From:	Sam Dumbrell
To:	Christopher Herbert [redacted].
Cc:	Rebecca Sprules; CCD Planning Enforcement
Subject:	WSCC/104/13/SR - Condition 10
Date:	30 September 2015 16:43:00
Attachments:	Hydrogeological Risk Assessment (Conditions 10 & 11).pdf
Importance:	High

Chris,

I write further to your submission received 31/07/15 to discharge condition 10, which reads:

Hydrogeological Risk Assessment

10. The development hereby permitted shall not take place until a Hydrogeological Risk Assessment (HRA) has been submitted to and approved in advance and in writing by the County Planning Authority. Thereafter, the development shall be implemented in accordance with the recommendations and mitigation measures identified in the approved HRA throughout the operation of the development hereby permitted.

Reason: To accord with paragraphs 103, 109, 120 and 121 of the NPPF (2012) to ensure the protection of water quality and water resources and prevent flood risk.

The Environment Agency advise as follows:

We can recommend the discharge of this condition. The overall qualitative assessment provides a good understanding of the risks associated with developing an inert landfill at this location. The HRA provides information that supports appropriate technical precautions so that the proposed scheme presents a low risk of future pollution to the water environment. The use of low permeable land fill will raise groundwater levels once the pumps are turned off in due course (40m AO). This aspect and implications for surface water management and flood risk should be assessed when consider the details relating to condition 9.

(We are in discussions with Firth about the waste acceptance criteria and other aspects relating to the environmental permit requirements.)

I can confirm that your submitted 'Hydrogeological Risk Assessment' (Frith Consultants report ref: fc37126; dated July 2015) has been approved and the pre-commencement element of this condition is discharged. In order to ensure ongoing compliance, the development shall be implemented in accordance with the recommendations and mitigation measures identified in the approved HRA throughout the operation of the development hereby permitted.

Regards, Sam

Sam Dumbrell | Senior Planner, County Planning, Residents' Services, West Sussex County Council |
Location: County Hall, Chichester, West Sussex, PO19 1RH
Internal: 26947 | External: 0330 222 6947 | E-mail: sam.dumbrell@westsussex.gov.uk

From:	Sam Dumbrell
To:	"Christopher Herbert"
Cc:	Kirstie May; Chris Foss [redacted]
Subject:	RE: WSCC/104/13/SR - Condition 11
Date:	09 May 2016 16:27:00
Attachments:	Hydrogeological Risk Assessment (Conditions 10 & 11).pdf [redacted]
Importance:	High

Chris,

Please see comments from EA to your submission 05/01/16 below:

"It is unfortunate that the applicant does not want undertake produce a dewatering Method Statement. However based on their information, we do not feel that there is requirement to keep asking for this information at this stage. We will continue to review the application and operations on site and if there is requirement to undertake works, we will engage with the operator at that time. It may mean that the operator will need to stop works until a method statement is produced and agreed in writing by the EA. (through Environmental Permitting)

The issue of the dewatering was to have a method statement in place if they ever needed to do it (contingency). It is unlikely that they will need to. This is conjunction with details for Condition 11. (therefore we agree the condition could be discharged)

This does not have a bearing on Condition 9 at present. However if dewatering is needed (but unlikely) then it depends on where they want to discharge it and if it is to surface water then it may impact on flooding risk."

The Extraction and Restoration Method Statement (according with the submitted and attached HRA) is approved. Please ensure that the approved details are implemented in full throughout the operation of the development hereby permitted within the agreed timetable.

Regards, Sam

Sam Dumbrell | Senior Planner, County Planning, Residents' Services, West Sussex County Council |
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firth consultants
environmental risk assessment

Hydrogeological Risk Assessment
Washington Sandpit
Storrington
West Sussex

Final Report

on behalf of

Britaniacrest Recycling Ltd

Report fc37126

July 2015

Firth Consultants Ltd
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EXECUTIVE SUMMARY

Firth Consultants has been commissioned by Britaniacrest Recycling Ltd to conduct a hydrogeological risk assessment for restoration infill of Washington Sandpit, Storrington, West Sussex (hereafter referred to as “the site”). The restoration will involve the re-use of clean material at the site and imported from elsewhere to create a development platform above the current and anticipated future groundwater level on which to construct an inert landfill. A 1m thick layer of material with a permeability of no more than 1 x 10^{-7} $m.s^{-1}$ will then be emplaced to form the base and sides of the inert landfill. Inert wastes will then be accepted over a 5 year period before emplacement of the cover layer. The landfill will be designed to create a gentle slope from the restored areas of the southern and eastern parts of the site down to a pond in the northwest of the site in accordance with that agreed in the planning permission reference WSCC/104/13/SR.

The site is located on the Folkestone Formation sandstone which is classified as a Principal aquifer. The sandstone has been quarried to form a sandpit approximately 30m deep at the site. This adjoins a larger sandstone quarry (operated by Cemex UK) to the west. A former sandpit and historic landfill, now developed for residential housing, is located to the east.

Bedrock dips to the south and results in the underlying Sandgate Formation aquitard outcropping to the north of the site. The Folkestone Formation aquifer becomes confined by the overlying Gault Clay to the south of the site. Information obtained from Cemex UK indicates that there is likely to be a minimum of 24 m thickness of Folkestone Formation sandstone remaining below the base of the quarry at the site.

Cemex UK currently abstract groundwater from ponds on the neighbouring site for mineral washing purposes. This water usually drains back to the quarry pond but is sometimes discharged to a small watercourse to the north of the site in order to de-water the quarry. This has resulted in a lowering of groundwater levels in the vicinity of the site. Historical borehole logs indicate that groundwater levels before quarrying began were approximately 9m higher than they are today.

A conceptual site model was developed in order to assess the risk that infilling poses to water resources. Potential sources considered were the clean infill for the sub grade and inert waste material imported to the site. The risks from off-site sources (historic landfill and road run-off discharging to the site) were also considered. Receptors considered were the Folkestone Formation Principal aquifer, groundwater abstractions and surface water. Pathways considered included leaching and dissolved phase migration of dissolved phase constituents in groundwater and the discharge of abstracted groundwater to surface water. The risk from the plausible pollutant linkages were assessed qualitatively and this showed the risks associated with infilling the site to be low. The possibility of contamination from the neighbouring historical landfill impacting

groundwater quality beneath the site was identified as a medium risk given the nature of the waste deposited.

The risk from groundwater flooding associated with the construction of the sub grade and the infilling at the site was also assessed. Material will be emplaced above the current water table but groundwater levels could rise by up to 9m when Cemex UK cease abstraction. If groundwater levels were to rise by 9m and the sandpit infilled with low permeability material (representing a worse case scenario) then this would reduce overall aquifer transmissivity with a theoretical potential of further increasing groundwater levels up hydraulic gradient of the site. However, calculations show that the use of low permeability infill material is unlikely to increase groundwater levels by more than 1m over and above the possible 9m rise when Cemex UK cease abstraction. The future increase in levels could theoretically result in increased water level in one of the ponds to the north of the residential development to the east of the site, but this is highly unlikely to cause surface flooding.

A groundwater and surface water monitoring programme has been recommended. This includes installation of four groundwater monitoring wells around the perimeter of the site and quarterly monitoring of groundwater levels and groundwater and surface water quality. It is recommended that at least two rounds of baseline monitoring are conducted prior to disposal of inert waste material within the landfill. The provision of baseline data will then enable control levels and compliance limits to be derived for comparison with water quality data collected during the operational phase of the landfill.

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1 INTRODUCTION

Upon the instructions of Ged Duckworth Ltd, acting on behalf of their client, Britaniacrest Recycling Ltd (Britaniacrest), Firth Consultants Ltd has been commissioned to conduct a hydrogeological risk assessment for restoration infill of Washington Sandpit, Storrington, West Sussex (hereafter referred to as “the site”).

1.1 Background

Britianacrest has planning permission (WSCC/104/13/SR) for continued mineral extraction over a two year period (ending September 2016) and for the importation of inert material over a five year period to enable the restoration of Washington Sandpit for the long term benefit of the Sandgate Country Park. The intention is to re-use clean material from the site and elsewhere to create a suitable working platform for importation of inert waste material. The inert waste material will then be covered with cover material and topsoil to create a natural slope from the restored final levels to a pond in the northwest of the site. The topsoil will then be seeded to create a heathland type habitat.

In their consultation response to the planning application (dated 11 December 2014) the Environment Agency proposed the following conditions:

- Submission and approval of a hydrogeological risk assessment; and
- Submission and approval of a construction method statement to include details of (a) the method of construction, (b) the method of controlling and discharging groundwater during construction and (c) pollution prevention control measures to protect groundwater and surface waters.

The Environment Agency also indicated that the following items will be required:

- An assessment of the risk of groundwater flooding arising from infill at the site and from the future reduction and eventual cessation of groundwater abstraction from the neighboring Cemex sandpit;
- An Environmental Permit under the Environmental Permitting Regulations 2010 including a Waste “Recovery” Plan, to cover the use of inert materials as part of the proposed development. (Note that a Recovery Plan was prepared and submitted. However, the proposed waste infilling is considered to be a “Disposal” operation, hence the Landfill Application that this HRA supports, as well as in discharging the above planning condition).

1.2 Objectives

The hydrogeological risk assessment (HRA) presented herein is intended to satisfy the relevant planning condition and to support the application for an Environmental Permit for use of clean materials at the site for construction of the subgrade and infilling using inert wastes. Specifically, the objectives of the HRA are to:

- Assess the risk to water resources quality associated with the restoration of the site;
- Assess the risk of groundwater flooding associated with the restoration of the site; and
- Provide recommendations for the implementation of a future groundwater monitoring programme.

1.3 Scope of Work

In order to meet the objectives outlined above the following work was undertaken:

- Review of all existing data relevant to the site including planning permissions, Ordnance Survey, geological and hydrogeological maps and available borehole logs;
- Requests for relevant information from third parties and review of data provided. Information requests were made to the Environment Agency, West Sussex County Council, Horsham District Council, Cemex UK and Hanson Aggregates;
- A visit to the site and surrounding area was conducted on 25 February 2012. This was followed by a meeting with Simon Deacon of the Environment Agency to discuss the infill proposals and Environment Agency requirements for the HRA. Note that in this meeting it was agreed that a qualitative assessment of risk was most appropriate for the site;
- Development of a conceptual site model (CSM) and qualitative assessment of risks;
- Recommendations for groundwater monitoring, establishment of groundwater control levels and compliance limits and mitigation measures should limits be exceeded;
- Reporting.

The assessment has been produced with reference to the Environment Agency's *"Horizontal guidance Note H1 - Annex J3. Additional guidance for hydrogeological risk assessments for landfills and the derivation of groundwater control levels and compliance limits, v2.1, December 2011"* (EA, 2011).

1.4 Information Reviewed

The following information has been reviewed for this assessment:

- BGS Solid and Drift geology maps sheets 317/332 and 318/333 (BGS, 1996 & 2006)
- Hydrogeological map of the South Downs and part of the Weald (IGS & SWA, 1978)
- BGS Geoindex boreholes database (http://mapapps2.bgs.ac.uk/geoindex/home.html)
- Relevant sections of Environmental Statement for planning application (WSCC/104/13/SR) (SLR, 2013)
- Desk study and hydrogeological risk assessment for residential development to east of site (Hydrock, 2009)

In addition, information requests for relevant hydrogeological information were made to the Environment Agency, West Sussex County Council, Horsham District Council, Cemex UK and Hanson Aggregates. The Environment Agency provided information about licensed groundwater abstractions within 2km of the site and the discharge consent for the neighbouring Cemex UK site. Cemex UK provided lithological logs and groundwater levels for five monitoring wells drilled within the vicinity of the site and information on abstraction and discharged water at the site. Horsham District Council provided Hydrock site reports for the residential development on the former RMC sand pit to the east of the site.

2 SITE SETTING AND GROUND CONDITIONS

2.1 Geography

The site is an active sand quarry located approximately 2 km east of Storrington, West Sussex on the A283, centred at National Grid Reference (NGR) 510700, 113850 (Figure 1). The site has an area of approximately 6.5 ha and is located immediately north-west of the South Downs National Park within the Wealden Greensand National Character Area (NCA). This area is generally undulating with shallow valleys and low hills with the original ground level at the site sloping from approximately 60 m above Ordnance Datum (mAOD) in the south-west of the site to 52 mAOD in the north-east. Sand extraction on site has given rise to a series of steps and steep slopes to the south, east and north of the site. There is a shallow pond in the north west of the site, where the quarry is deepest. This has a water elevation of approximately 30 mAOD.

The site adjoins a much larger extraction site known as Sandgate Park operated by Cemex UK (previously RMC Aggregates) to the west, the base of which is reported to be at 24 mAOD at its deepest point (R. Giddings, Cemex UK. *pers. comm*). At the time of writing Britaniacrest was in the process of forming a small bund to demarcate their site from the Cemex UK site and to allow for dewatering of their site so that material would not be placed directly into standing water.

The area to the north of the site comprises a strip of open fields with some wooded areas with residential properties beyond. A small watercourse flows east to west across this area following the northern boundary of the site. Topography rises to the north beyond the strip of open fields to a maximum elevation of approximately 90 mAOD at Longbury Hill (Heath Common), 1 km north of the site.

The site is bounded to the south by the A283 with fields and some residential properties and a farm beyond. Topography rises gently to the south and then steeply at the escarpment of the South Downs. This runs east-west and rises to over 200 mAOD in elevation, with the crest of the ridge approximately 1.5km to the south of the site.

The site is bounded to the east by Hampers Lane with a recent residential development on the site of the former RMC sandpit beyond. The sandpit was only partly infilled and so a depression remains in which the houses have been constructed. There are two ponds located to the north of the new houses that have elevations of 42.9 and 38.4 mAOD (Hydrock, 2013). Ground level of the lowest house in the former sandpit is approximately 46 mAOD.

2.2 Site History

The site has been an operational sandpit / sand quarry since approximately 1948 and as such there have been numerous planning applications / changes to the site over this period which are presented below:

- On the 5th July 1994, a consolidating planning permission was issued under reference SG/37/93 in response to a requirement under the Planning and Compensation Act 1991.
- In 1998 a Section 73 Application was made to extend the end-date of the 1994 permission to the 31st December 2008, and to vary the working scheme for the site.
- It is understood that sand extraction has continued intermittently at an extraction rate significantly less than was envisaged in the previous application.
- In 1999 the achievable reserve was calculated to be 224,000 tonnes in 1999.
- In 2008 it is understood that the reserve was estimated to be 150,000 tonnes which is dependent on the adjacent dewatering Sandgate Quarry operated by Cemex UK, and could in theory extend to 250,000 tonnes if the water table was lowered sufficiently to excavate down to the permitted level of 17m AOD (ref. condition 3 of Planning Permission) however this was dependent on the adjacent de-watering and lack of suitable discharge point.
- The former extension of life application by Hanson was to complete the extraction of all available reserves at the Site within a 10 year period (finishing 2018). However throughout the consultation period Hanson agreed to limit this period of time to only five years (2013) as at the time (pre 2008 recession) enquiries from potential customers were on the increase. Extraction throughout the last five years has unfortunately been extremely slow due to the economic down turn therefore there remains an estimated reserve of 100,000 tonnes of sand which would effectively be sterilised if an extension of time was not permitted.
- In 2013 Britaniacrest applied to extend the life of extraction activities at the sandpit by a further two years (application WSCC/086/13/SR) and to import inert waste over a five year period to restore the site. Planning was granted on 2 September 2014. This limits the depth of sand extraction to 30 mAOD.

There are a number of historical sandpits within the vicinity of the site that have subsequently been used for landfill. The Environment Agency website (EA, 2015) indicates the following landfills in the area (also shown on Figure 1):

- Two historic landfills known as “RMC Workshop” and “West of RMC Workshop” are located on the site of the former RMC sandpit to immediate east of the site. The Environment Agency website lists the type of waste deposited as unknown. Gas control measures are stated as having been used previously at the “West of RMC Workshop” landfill adjacent the site, suggesting biodegradable waste was deposited there.
- Historic landfill known as “Sandgate Park” located approximately 800m west of the site. This is reported to have accepted “inert” waste at that time (generally the waste type was not as tightly defined and controlled as it is today).
- Historic landfill known as “Thakeham Tiles” located approximately 900m north west of the site. This is reported to have accepted inert waste.
- Angells Sandpit landfill located 1 km west of the site. This is reported to have accepted non-biodegradeable wastes. The landfill is now closed and has recently been redeveloped as residential housing.

2.3 Hydrology

The site lies almost equidistant between the two classified water bodies in the area; the River Stor located approximately 1.6 km west of the site and Honeybridge Stream located approximately 1.4 km east of the site. Both water bodies originate from springs at the base of the chalk \ Upper Greensand escarpment at approximately 1km south-west and 700 m south of the site, respectively. The current ecological quality status (under the Water Framework Directive) of the River Stor and Honeybridge Stream is moderate and poor, respectively. Both have a predicted ecological quality status of moderate for 2015. Neither water body requires chemical assessment under the Water Framework Directive.

A small watercourse is located along the northern site boundary which flows northwest, eventually discharging to the River Stor. A small drain also enters the site along the southern boundary (see Figure A below) and currently flows into the pond on site. This originates from a drainage ditch on the southern side of the A283 and also receives run-off from the A283. Prior to quarrying activities this drainage ditch flowed north across the site and joined the watercourse to the north of the site.

There are no licensed surface water abstractions within 2 km of the site.

Figure A: Surface water entering site via drain on southern boundary

The site and surrounding area is within Flood Zone 1, the lowest risk category, where the chance of flooding from both rivers and sea has been assessed as less than 0.1% (1 in 1000) in any year. The site is also classified as being at very low risk of surface water flooding, however it should be noted that an area to the south of Washington Road and an area surrounding two ponds on the adjacent housing development (former landfill site) to the east of Hampers Lane are classified as being at a high risk of surface water flooding (EA, 2015).

Data from the nearest weather station (North Heath which is located approximately 24 km north-west of the site) indicates that the average annual rainfall for the area for the period 1981 to 2010 was 827 mm (Met Office, 2015).

2.4 Geology

The 1:50,000 Solid and Drift Geology map, Sheet 318 / 333, Brighton and Worthing (BGS, 2006) indicates that the site is located on the Folkestone Formation of the Lower Greensand Group. The Folkestone Formation is described as a yellow fine to medium grained sandstone with coarse interbeds with thin irregular iron-cemented veins and can be up to 60m thick in this area. Bedrock dips to the south and so the younger Gault Clay which overlies the Folkestone Formation outcrops to the south of the site (Figure 2). The Gault Clay is overlain by the Chalk which outcrops on the South Downs Escarpment.

The Folkestone Formation is underlain by approximately 20m thickness of the Sandgate Formation which consists of variable lithology including silts, clays and muddy sandstones. The Marehill Clay forms the upper part of the Sandgate Formation and is described as hard blue sandy clay. As a result of bedrock dipping to the south, the Folkestone Formation thins to the north. The Sandgate Formation outcrops 250m to the north-west of the site, but the higher elevations associated with Heath Common result in the Folkestone Formation outcropping further to the north in this area (Figure 2).

The Sandgate Formation is underlain by up to 30m thickness of the Hythe Formation which outcrops 1.5 km to the north of the site (Figure 2). This is described as yellow-brown sandstone and calcareous sandstone with glauconite. The Folkestone, Sandgate and Hythe Formations form the Lower Greensand Group.

The Lower Greensand Group is underlain by the Weald Clay Formation which outcrops 1.8 km to the north of the site.

No Superficial deposits are present at the site however the geological maps indicates the presence of Head deposits (clays, silts, sands and gravels) along the small watercourse to the north of the site.

Information on bedrock geology provided by Cemex UK (see Appendix 1) indicates that the base of the Folkestone Formation is likely to be approximately 20 mAOD at the northern extent of the site, -4 mAOD at the southern extent of the site and 6 mAOD beneath the pond in the north west of the site. This indicates that there is likely to be 24 m thickness of Folkestone Formation remaining below the deepest part of the site.

The geology at the site is summarised in Table A below and a schematic cross-section is shown in Figure 3.

Table A: Summary of Geology at the Site

Formation	Elevation of Base (mAOD)	Thickness (m)	Description
Folkstone Formation	-4 to 20	24 to 64	Yellow fine to medium grained sandstone with coarse interbeds with thin irregular iron-cemented veins
Sandgate Formation	-24 to 0	20	Silts, clays and muddy sandstones. Marehill Clay at top described as hard blue sandy clay
Hythe Formation	-64 to -40	40	Yellow-brown sandstone and calcareous sandstone with glauconite
Weald Clay Formation	< -160	120 to 275	Grey-brown mudstones with thin sandstones and limestone bands

2.5 Hydrogeology

2.5.1 Aquifer Units

The Lower Greensand Group is classified by the Environment Agency as a Principal Aquifer. It forms an east-west linear water bearing unit sandwiched between the non-aquifers of the Gault Clay to the south and the Weald Clay to the north. The Gault Clay separates the Lower Greensand and Chalk principal aquifers.

The Lower Greensand, although classified as one aquifer unit can generally be split into two distinct aquifers; the Folkestone Formation and the Hythe Formation. These two aquifers are separated by the clay and silt layers of the Sandgate Formation (EA & BGS, 1997). The Sandgate Formation is an important aquitard of generally poor permeability which impedes the circulation of groundwater between the Hythe and Folkestone Formations. However clay layers are rarely persistent allowing a degree of mixing between the two aquifers (EA & BGS, 1997).

2.5.2 Groundwater abstraction and discharge consents

The site does not lie within a groundwater Source Protection Zone (SPZ) however there are four licensed groundwater abstractions within 2 km of the site. These are listed in Table B below and their locations shown in Figure 1. Three of these relate to abstractions from the Folkestone Formation for the purposes of mineral washing: one at Chantry Lane approximately 1.2 km west of the site and two from the Cemex quarry to the immediate west of the site. The fourth licensed abstraction is located 1.5 km east of the site at Washington Garden Centre. This abstracts from the Hythe Formation for the purposes of spray irrigation. The Environment Agency also indicated that there is a private water abstraction for domestic supply located approximately 2km south west of the site which abstracts from the Chalk.

According to the Environment Agency, Cemex UK abstracted a total of 202,000 m^3 (approximately 81% of licensed maximum) in 2013 from Sandgate Pit. The water is abstracted by pumping from the base of the excavation and effectively drains back into the quarry.

Table B: Groundwater abstractions in the vicinity of the site

License No.	Name	Max Annual quantity (m^3)	Max daily quantity (m^3)	Aquifer	Use
25/084	Sandgate Pit (Point A)	250000	910	Lower Greensand (Folkestone)	Mineral Washing
	Sandgate Pit (Point B)				
10/41/415407	Sand Quarry at Chantry Lane	99000	660	Lower Greensand (Folkestone)	Mineral Washing
23/073	Washington Garden Centre	8000	40	Lower Greensand (Hythe)	Spray Irrigation
Private Supply	The Chantry	---	<20	Chalk	Domestic Supply

Cemex also have a permit to discharge excess water (up to 6480 $m^3.d^{-1}$) to the small watercourse to the north of the Cemex site, which they do periodically. The volumes discharged vary considerably from one month to the next depending on de-watering requirements and the amount of surface water entering the quarry (which can be significant during wet periods). Data provided by Cemex indicate that the annual volumes discharged were 88556 m^3 in 2012, 378100 m^3 in 2013 and 238941 m^3 in 2014. Over the long-term, the annual amount discharged appears similar to the amount of groundwater abstracted. Assuming that the amount discharged exceeds rainfall and surface water flow onto the quarry it can be assumed that there is net abstraction from the aquifer which will result in a depression in groundwater levels within the vicinity of the site.

2.5.3 Hydraulic Properties

The Folkestone Formation is regarded as one of the few UK aquifers that exhibits homogeneous, intergranular flow (EA & BGS, 1997). However, hard low permeability ironstone layers can act as aquitards therefore stratifying flow locally within the aquifer, although these are not laterally extensive. Reported transmissivities vary from 150 to 1200 $m^2.d^{-1}$ with a geometric mean of 260 $m^2.d^{-1}$. Hydraulic conductivity is reported to vary from 5 to 20 $m.d^{-1}$ with an average of 10 $m.d^{-1}$ (EA & BGS, 1997).

The Hythe Formation is more heterogeneous than the Folkestone Formation with both intergranular and fracture flow which is controlled by cementation of the sands and sandstones. Transmissivity values range from 150 to 3000 $m^2.d^{-1}$ but are usually around 1000 $m^2.d^{-1}$ (BGS & EA, 1997).

2.5.4 Groundwater Levels

Groundwater level monitoring data provided by Cemex UK for the period February 2005 to March 2015 indicates that groundwater level in the Folkestone Formation within the vicinity of the site ranged from approximately 22 to 33 mAOD (see Figure B below). The locations of the Cemex wells are indicated on Figure 4. The water level of the pond in the north west of the site is approximately 30 mAOD and likely represents groundwater level.

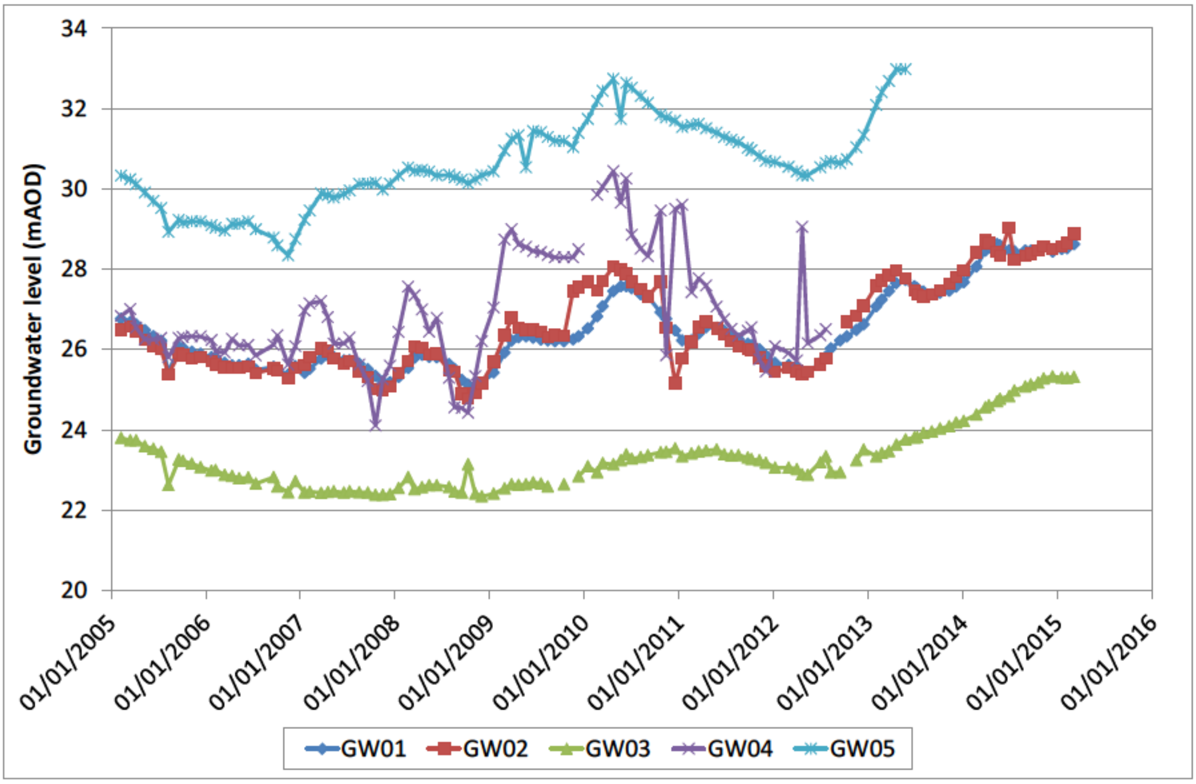


Figure B: Groundwater levels in Cemex wells

A number of groundwater monitoring wells have also been installed in the Folkestone Beds (and overlying made ground) at part of the re-development of the former sandpit to the east of the site. Groundwater level monitoring of these wells in April 2009 indicates that groundwater levels at that time ranged from 44.7 mAOD in the north of the site to 31.2 mAOD in the south of the site (Hyrdock 2009).

The groundwater levels on the 20th to 22nd April 2009 in both Cemex and Hydrock wells are shown on Figure 4. These monitored levels indicate that groundwater is likely to be flowing south from the topographic high of Heath Common and then swinging round to the west into the site and Cemex quarry, where it is ultimately abstracted (Figure 4).

Regionally, groundwater in the Folkestone Beds is likely to flow cross-dip (i.e. east or west) and groundwater that is not abstracted is ultimately likely to discharge to surface water that is in hydraulic continuity with the Folkestone Beds. This could be the River Stor to the west of the site or surface water further afield. The bed elevation of the River Stor is noted to be 30 to 40mAOD where it crosses the Folkestone Formation outcrop and is therefore unlikely to be a point of groundwater discharge from the Folkestone sandstone with current groundwater levels. Other possible discharge points include Honeybridge Stream to the east (although the bed level of this watercourse is also likely to be above current groundwater levels in the Folkestone Formation), Amberley Wild Brooks (flood plain of River Arun) 6km west of the site (which is at an elevation of 1 to 2 mAOD) or Wiston Pond 6km east of the site (which is at an elevation of 20 mAOD).

As a result of the general geological dip to the south, groundwater in the Folkestone Beds becomes confined by the Gault Clay south of the site. Regionally groundwater in the Folkestone Beds is unlikely to flow south as there is no point of discharge or abstractions within the confined zone. Likewise, groundwater flow to the north is likely to be limited due to the presence of the lower permeability Sandgate Formation, although, as discussed above, some leakage through the Sandgate Formation to the underlying Hythe Beds may occur.

Limited information could be found on baseline groundwater levels prior to quarrying activities. The BGS borehole database has logs for a number of boreholes in the vicinity that date back to the early 1900s. These have levels ranging from 38.4 to 56.4 mAOD (Figure 5). Groundwater levels in the vicinity of the site were 39 mAOD, approximately 9 m higher than current levels prior to quarrying activities in the area. The distribution of historical groundwater levels suggests that groundwater flowed south from the topographic high of Heath Common (as it does today), before turning west. It is possible that groundwater discharged to the River Stor at that time when groundwater levels were higher.

2.6 Baseline Groundwater Quality

No groundwater analytical data are available for the site. Also the Environment Agency does not have any information on groundwater quality for the Lower Greensand aquifer in the vicinity of the site. Information on the concentrations of major ions and some metals/metalloids in the Lower Greensand aquifer as a whole are presented in EA & BGS (1997). The 95th percentile concentrations of each constituent in the Lower Greensand are shown in Table C below. This table also shows freshwater environmental quality standards (EQSs) and drinking water standards (DWS) for comparison.

Groundwater analytical data are presented in the Hydrock report for the former RMC sandpit and landfill to the immediate east of the site (Hydrock, 2009). Hydrock report elevated[1] concentrations of PAHs and locally elevated concentrations of chromium, total cyanide, nitrate and cadmium within the Folkestone Formation sandstone. Hydrock concluded that the historic landfill had impacted groundwater quality in the Folkestone Formation but not to the extent that created a significant risk to water resources. As discussed in Section 2.5.4, it is possible that groundwater from the RMC site flows onto the Washington Sandpit site and thus groundwater beneath the Britaniacrest site may also be impacted. Table C indicates the maximum concentrations of selected contaminants in groundwater in the Folkestone Formation beneath the RMC site.

Table C: Summary of Background Chemical Data

Chemical	Units	DWS	EQS	EA & BGS, 2007	Hydrock, 2009
				95th percentile	Maximum
Arsenic	$ug.L^{-1}$	10	50	**14**	**13**
Barium	$ug.L^{-1}$	1000	-	200	200
Cadmium	$ug.L^{-1}$	5	0.25 [a]	<u>0.5</u>	<u>0.36</u>
Chromium	$ug.L^{-1}$	50	3.4, 4.7 [b]	<u>5</u>	<u>6</u>
Copper	$ug.L^{-1}$	2000	28 [a]	20	6.1
Mercury	$ug.L^{-1}$	1	0.05	-	0.02
Nickel	$ug.L^{-1}$	20	4	<u>10</u>	<u>14</u>
Lead	$ug.L^{-1}$	10	1.2	<u>5</u>	0.8
Selenium	$ug.L^{-1}$	10	-	-	6
Zinc	$ug.L^{-1}$	5000	125 [a]	100	44
Chloride	$mg.L^{-1}$	250	250	70	-
Fluoride	$mg.L^{-1}$	1.5	5 [a]	0.4	-
Sulphate	$mg.L^{-1}$	250	400	60	70
Nitrate	$mg.L^{-1}$	50	-	20	**77**
Ammonium (as N)	$mg.L^{-1}$	0.5	0.3 [e]	0.3	
Total cyanide	$ug.L^{-1}$	50	1	-	<u>3.3</u>
Naphthalene	$ug.L^{-1}$	-	2	-	<u>5.3</u>
Anthracene	$ug.L^{-1}$	-	0.1	-	<u>0.16</u>
Fluoranthene	$ug.L^{-1}$	-	0.0063	-	<u>5.6</u>
Benzo(a)pyrene	$ug.L^{-1}$	0.01	$1.7x10^{-4}$	-	<u>**1.8**</u>
PAHs [c]	$ug.L^{-1}$	0.1	-	-	**5.37**
Benzene	$ug.L^{-1}$	1	10	-	**11**
Toluene	$ug.L^{-1}$	700 [d]	50	-	<10
Ethylbenzene	$ug.L^{-1}$	300 [d]	20	-	<10
Xylenes	$ug.L^{-1}$	500 [d]	30	-	<10
pH	pH units	6.5 to 9.5	6 to 9	6.2 – 8	6.77 – 8.15

a. EQS assuming receiving water body has hardness > 250 $mg.L^{-1}$
b. EQSs for hexavalent and trivalent chromium
c. Sum of benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(123cd)pyrene & benzo(ghi)perylene
d. WHO drinking water guideline
e. 90th percentile concentration for "good" quality river
f. Values in **bold** exceeds DWS, values <u>underlined</u> exceed EQS

[1] Elevated with respect to freshwater environmental quality standards (EQS) and drinking water standards (DWS)

3 DEVELOPMENT PROPOSALS

The restoration plan for the site involves the partial infill of the sandpit to create gentle slopes from the restored area down to the pond in the north west of the site. This will be achieved in the following manner:

- Further excavation and export of sand. Brittaniacrest plan to extract a further 84000 tonnes of sand from the quarry for export. The sand will be excavated from above the current water table.
- Re-use of material (sand and overburden) from the site to infill the base of the sandpit from the edge of the pond.
- Where required, this will be supplemented with import of clean naturally occurring material from development sites brought in under the CL:AIRE Definition of Waste: Development Industry Code of Practice. The material will be used to form a working platform at 42 mAOD (2 to 3m above the anticipated future groundwater level) for construction of the inert landfill basal liner. This ensures that the inert landfill is above the water table. A gentle slope will be formed below this platform down to the current pond level of 30 mAOD in the north west of the site.
- Import of inert material with a permeability of less than 1×10^{-7} $m.s^{-1}$ to form a 1m thick layer above the working platform and up the sides of the sand pit. This will form the basal layer and sides of the proposed inert landfill.
- Import and disposal of inert waste material within the landfill.
- Importation of a cover layer. This will be seeded and planted to integrate with the surrounding area. The final restoration levels will be in accordance with the planning approval application WSCC/104/13/SR.

Leachate is not expected to accumulate in the landfill and so leachate control measures are not anticipated to be required.

A schematic cross-section illustrating the proposed plan is shown in Figure 6. Details of the restoration plan will be provided in the Construction Method Statement for the site. This will include a Materials Management Plan that will outline the testing regime for imported materials associated with the construction of the sub grade. It is proposed that material brought in under the CL:AIRE Code of Practice will be tested to ensure that contaminant concentrations in leachate are below drinking water standards. The importation of inert waste material will be subject to a strict Waste Acceptance Procedure (summarised in

Appendix 2) to ensure that it is suitable for disposal at the site and to ensure that “rogue” material is not incorrectly deposited within the landfill.

4 ASSESSMENT OF RISK TO WATER QUALITY

A conceptual site model (CSM) of risk has been developed for the proposed scheme. This identifies potential sources, pathways and controlled waters receptors and determines which combination of these are plausible pollutant linkages. Plausible pollutant linkages are then qualitatively assessed to determine whether the proposed scheme could pose an unacceptable risk to waters resources.

4.1 Sources

Potential sources of contamination are divided into on-site and off-site sources and are described below.

4.1.1 On-site

Potential on-site sources of contamination are considered below:

- **Existing on-site soils**. Folkestone Sand and overburden soils at the site will be re-used as infill material in the deepest parts of the quarry as part of the basal layer for construction of the inert landfill. This material will potentially be below the water table if groundwater levels rise in the future. However, given that the site was greenfield prior to quarrying, it has been assumed that this natural material is not a potential source of groundwater contamination and has therefore not been considered further.
- **Imported material under CL:AIRE Code of Practice**. As discussed in Section 3, prior to construction of the inert landfill, clean material will be imported to the site to raise ground levels to ensure the base of the landfill is above the anticipated future groundwater table. The suitability of this material will be assessed prior to import by reviewing existing test data and if necessary additional leachate testing and comparison of the results with drinking water standards. Material with leachate concentrations above drinking water standards will not be accepted. As shown in Table C, EQS are more stringent than drinking water standards for most contaminants and it is therefore possible that leachate from the imported material exceeds EQS. This material has therefore been considered as a potential source for consideration in the qualitative risk assessment.
- **Inert waste material**. Once constructed, the landfill will accept inert waste material. Only material that meets the WAC criteria for inert waste will be accepted. The leachate concentrations for WAC for inert waste are generally greater than drinking

water standards and EQS. This material has therefore been considered as a potential source for consideration in the qualitative risk assessment. As discussed in Section 3, the importation of inert waste will be subject to a strict Waste Acceptance Procedure (see Appendix 2) to ensure that "rogue" material is not incorrectly deposited at the site.

4.1.2 Off-site

Potential off-site sources of contamination that could impact groundwater quality beneath the site are:

- **Historic landfills to the immediate east of the site**. These are known to have impacted groundwater quality and are up-hydraulic gradient of the site. These are considered as a potential source for this assessment.
- **Road run-off**. Run-off from the A283 discharges into a culvert that discharges onto the site on the southern boundary. There is the potential for this run-off to contain trace concentrations of hydrocarbons from vehicle emissions. The surface water currently drains into the pond at the base of the sandpit and is ultimately abstracted by Cemex UK and discharged to the brook to the north of the site (which the drain used to connect to prior to quarrying activities at the site). In the future, when Cemex cease abstraction, this surface water will become a source of recharge to the Folkestone Formation aquifer. Given that the surface water could contain trace concentrations of hydrocarbons it has been considered as a potential source.

4.2 Receptors

Potential waters resources receptors are described below:

- **Groundwater**. The Folkestone Formation that underlies the site is classified as Principal Aquifer. The Folkestone aquifer is therefore considered to be a sensitive receptor of contamination from the site.
- **Groundwater abstractions**. There are four licensed abstractions within 2km of the site (Section 2.5.2). Three of these are licensed for mineral washing and are not considered sensitive receptors and are not considered further for this assessment. The fourth is licensed for spray irrigation and abstracts from the Hythe Beds. There is also a small private abstraction 2km south west of the site which abstracts from the Chalk. Both these abstractions are considered further as potential receptors in the qualitative risk assessment.

- **Surface water**. The main surface water bodies in the area are the River Stor located approximately 1.6 km west and Honeybridge Stream located approximately 1.4 km east of the site. As discussed in Section 2.5.4, the current groundwater levels in the Folkestone Formation are likely to be below the bed levels of these rivers and therefore groundwater is more likely to discharge to surface water further afield, such as Amberley Wild Brooks or Wiston Pond, both of which are 6km from the site. When Cemex cease abstraction groundwater levels are expected to rise and this could allow groundwater at the site to discharge to the River Stor or Honeybridge Stream. These surface water bodies are therefore considered potential receptors.

  The watercourse to the north of the site is also considered a potential receptor. Although this watercourse is not in hydraulic continuity with groundwater in the Folkestone Formation, groundwater abstracted by Cemex from the pond in the base of the quarry is ultimately discharged to this watercourse.

4.3 Pathways

Possible pathways linking the potential on-site sources to the identified receptors are:

- **Leaching of contaminants to groundwater**. Potential contamination in the imported infill could partition to the dissolved phase and leach into the underlying Folkestone Formation sandstone aquifer. All imported material will be placed above the current water table but some of this could become below the water table if groundwater levels rise following cessation of abstraction by Cemex.
- **Dissolved phase migration in groundwater**. Groundwater in the Folkestone Formation beneath the site likely flows towards and discharges to the pond in the north west of the site or adjoining ponds on the neighbouring Cemex site. Once abstraction ceases on the neighbouring site, groundwater is likely to flow to the west and could possibly discharge to the River Stor.
- **Discharge of abstracted groundwater to surface water.** Whilst Cemex continue to abstract groundwater from the ponds and discharge to surface water there is a potential for any groundwater contamination that enters the ponds to be discharged to the watercourse to the north of the site and migrate with surface water flow to the River Stor.
- **Direct entry to groundwater.** Surface water that enters the site via the drain at the southern boundary flows into the pond in the north west of the site and is ultimately abstracted by Cemex and discharged to the watercourse to the north of the site.

When Cemex cease abstraction, surface water entering the pond will likely become a source of recharge to the aquifer.

4.4 Plausible Pollutant Linkages

Table D lists the possible source-pathway-receptor combinations and makes a qualitative assessment of the risk from each. Pollutant linkages rated with a risk of “low” are considered highly unlikely to create an unacceptable risk and do not require further consideration. Pollutant linkages rated with a risk of “medium” or “high” require further assessment or risk mitigation.

Table D Assessment of pollutant linkages

Source	Pathway	Receptor	Risk	Justification
Material imported under CL:AIRE Code of Practice	Leaching	Folkestone Formation Aquifer	Low	All imported material will be placed above the current water table but some of this could become below the water table if groundwater levels rise following cessation of abstraction by Cemex. However, all this material will have been tested to ensure that the leachate concentrations are below drinking water standard. This material therefore poses negligible risk to the aquifer.
	Leaching and dissolved phase migration	Groundwater abstractions	Low	The groundwater abstraction licensed for spray irrigation abstracts from the Hythe Formation. The presence of the Sandgate Formation aquitard means that there is no plausible pathway to this receptor. Likewise the private abstraction abstracts from the Chalk and the presence of the Gault Clay aquiclude means there is no plausible pathway to this receptor.
		Surface Water	Low	Groundwater from beneath the site is currently likely to be abstracted by Cemex and so does not discharge directly to surface water. There is the possibility that groundwater levels will rise in the future once Cemex stop abstracting allowing groundwater from the site to discharge to the River Stor or Honeywell Stream. However, given that the leachate concentrations generated from the imported material will be low (below drinking water standards), and the potential for further reduction of concentrations along the groundwater flow pathway due to natural attenuation, the risk to surface water is considered low.
	Discharge of abstracted water to surface water	Surface Water	Low	Groundwater from beneath the site is currently likely to be abstracted by Cemex and is ultimately discharged to the watercourse to the north of the site. Impacted groundwater beneath the site could therefore be discharged to surface water and impact surface water quality. However, given that the leachate concentrations generated from the imported material will be low (below drinking water standards), and the fact that groundwater from the site will be diluted with groundwater from elsewhere in the abstracted water, the risk to surface water is considered low.
Inert waste material	Leaching	Folkestone Formation Aquifer	Low	The leachate concentrations of the waste material are expected to be low. Additionally, the presence of an engineered layer below the waste and unsaturated zone will allow natural attenuation of contaminants prior to entering groundwater. Dilution at the groundwater table will further reduce concentrations. The risk posed by the inert waste to the aquifer is therefore considered low.
	Leaching and dissolved phase migration	Groundwater abstractions	Low	As for material imported under CL:AIRE Code of Practice
		Surface Water	Low	As for material imported under CL:AIRE Code of Practice
	Discharge of abstracted water to surface water	Surface Water	Low	As for material imported under CL:AIRE Code of Practice

Source	Pathway	Receptor	Risk	Justification
Rogue waste material	Leaching + dissolved phase migration	Folkestone Formation Aquifer, groundwater abstractions and Surface Water	Low	Strict Waste Acceptance Procedures (Appendix 2) will be adopted to ensure that non-compliant waste material is not incorrectly deposited at the site. The risk from rogue waste is therefore considered low.
Off-site historic landfills	Leaching	Folkestone Formation Aquifer	**Med**	There is evidence that the historic landfills to the east of the site have impacted groundwater quality. Various contaminants have been detected in groundwater within the Folkestone Formation at concentrations in excess of EQS and drinking water standards, in particular PAHs. It is possible that contamination from these landfills impacts groundwater quality at the site. This contamination is therefore considered to pose medium risk to the aquifer beneath the site.
	Leaching and dissolved phase migration	Groundwater abstractions	Low	As for material imported under CL:AIRE Code of Practice
		Surface Water	Low	As for material imported under CL:AIRE Code of Practice
	Discharge of abstracted water to surface water	Surface Water	Low	As for material imported under CL:AIRE Code of Practice
Road run-off	Direct entry to groundwater	Folkestone Formation Aquifer	Low	Although there is the potential for run-off to contain hydrocarbons from vehicle emissions, the concentrations are likely to be very low. As a result, even if this surface water were to recharge groundwater it would be unlikely to cause a significant impact to groundwater quality
	Discharge of abstracted water to surface water	Surface Water	Low	Although there is the potential for run-off to contain hydrocarbons from vehicle emissions, the concentrations are likely to be very low and will be further diluted by the abstracted groundwater. This potential source is therefore unlikely to cause an impact to surface water.

4.5 Risk Evaluation

All of the identified pollutant linkages, bar one, are considered to pose low risk to receptors. One pollutant linkage was assessed as having a medium risk: the migration of impacted groundwater from the off-site historic landfill to the east of the site. It is possible that contamination from this landfill impacts groundwater quality beneath the site. The hard covered areas and formal drainage associated with the recent residential development will mean that infiltration will be reduced, compared to the situation prior to development and hence the impact may be reduced. This potential impact is discussed further in Section 6.2.

5 ASSESSMENT OF GROUNDWATER FLOOD RISK

As discussed in Section 1.2, the Environment Agency requires the risk of groundwater flooding to be assessed for the proposed restorationat the site. This should account for the potential rise in groundwater level as and when Cemex cease abstraction and for the reduction in aquifer transmissivity caused by use of lower permeability material as infill - relative to that of the Folkestone Formation.

As discussed in Section 2.5.4, historic groundwater levels at the site prior to quarrying activities in the area are estimated to be 39 mAOD, 9m higher than current levels. It is therefore possible that groundwater levels will recover to 39 mAOD when abstraction ceases. Given that the aquifer is unconfined beneath the site, the storage capacity within the aquifer is likely to be significant and therefore it could take many years for groundwater levels to re-stabilise once abstraction ceases.

The proposed inert landfill will be designed to sit above the water table, but material imported under the CL:AIRE Code of Practice could be present below the water table. This material is likely to be of lower permeability than the Folkestone Formation sands (which are relatively permeable) and could theoretically reduce the overall transmissivity of the aquifer.

As discussed in Section 2.4, there is estimated to be a minimum of 24 m of Folkestone Formation sands below the base of the sandpit. If groundwater levels rise by 9m, and this 9m is filled with low permeability material (rather than Folkestone Formation sand), the maximum reduction in transmissivity will be 27% (9m / 33m). According to Darcy's Law, the hydraulic gradient at the site is equal to the groundwater flow rate through the site ($m^3.d^{-1}$), divided by transmissivity ($m^2.d^{-1}$) and width of the site (m). Infilling the sandpit with low permeability material could reduce the transmissivity by 24% but will have no effect on groundwater flow rate or site width. Thus, the maximum increase in hydraulic gradient would be 32% (1 – 1/0.76).

Based on the recent groundwater levels presented in Figure 4 and assuming that the level of the pond in the north west of the site of approximately 30m represents groundwater level, the difference in groundwater levels across the site is approximately 2m (32m in the east to 30m in the west). Should the use of low permeability infill material result in an increase in hydraulic gradient by 32%, the maximum rise in groundwater levels on the up-hydraulic gradient end of the site is predicted to be 0.64m.

Accounting for both cessation of abstraction and use of low permeability material as infill, the maximum rise in groundwater level is predicted to be 9.64 m, bringing groundwater levels at the site to approximately 40 mAOD. Other than the quarry ponds on the site and neighbouring Cemex quarry, the lowest lying land within the vicinity of the site is the two ponds in the former RMC sandpit to the east of the site which have elevations of 42.9 and 38.4 mAOD. The latter is below the predicted groundwater level and it is possible that the water level in this pond would rise. The lowest house in the new development to the east of the site is 46 mAOD. This is 6m above the worst case predicted rise in groundwater levels and indicates that groundwater flooding of these new properties is highly unlikely to occur.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The following conclusions can be drawn from this work:

- The proposed scheme is unlikely to cause a significant risk to water resources;
- The historic landfill to the east of the site has impacted the quality of groundwater in the Folkestone Formation and could be impacting groundwater quality beneath the site; and
- The proposed scheme could cause a slight increase in groundwater levels but this will be minor relative to the predicted increase in groundwater levels resulting from the cessation of abstraction from the Cemex site. The combined effect of the cessation of abstraction and material placement could cause up to 10m rise in groundwater levels locally to the site. This could result in an increase in water levels in the ponds in the former RMC sandpit to the east of the site, but is highly unlikely to cause surface flooding.

6.2 Recommendations

In order to ensure that the proposed scheme poses no significant risk to water resources a programme of groundwater monitoring at the site is recommended. This is discussed below:

6.2.1 Installation of monitoring wells

It is proposed that four monitoring wells are installed around the boundaries of the site as shown in Figure 7. Note that the exact locations may vary depending on access restrictions. The wells should be drilled to a depth corresponding to 25 mAOD, with screened sections from 25 mAOD to 40 mAOD. Following installation, the wells would be developed and surveyed in. The exact installation requirements should be discussed and agreed with the Agency prior to commencement of the works.

6.2.2 Baseline monitoring

There is a strong possibility that groundwater beneath the site is impacted with contamination from the historic landfill to the east. Baseline groundwater quality monitoring will be required to help determine groundwater control levels and compliance limits for monitoring during and after landfill operation. It is recommended that at least two rounds of baseline monitoring (three months apart) be conducted prior to disposal of inert waste in the landfill. Baseline monitoring will consist of purging each of the four monitoring wells, recording field parameters (including pH, conductivity, dissolved oxygen, redox potential and groundwater level) and obtaining groundwater samples for laboratory analysis. Surface water samples of the drain entering the southern site boundary and pond in the north west of the site should also be taken for laboratory analysis.

6.2.3 Operational monitoring

It is proposed that surface water and groundwater quality monitoring (including field parameters) be conducted on a quarterly basis during landfill operation and for one year after closure. This monitoring should be conducted on the same locations as the baseline monitoring.

6.2.4 Analytical Schedule

It is proposed that surface water and groundwater samples be analysed for the following determinands:

- Arsenic
- Barium
- Cadmium
- Chromium
- Copper
- Mercury
- Nickel
- Lead
- Selenium
- Zinc
- Chloride
- pH
- Fluoride
- Sulphate
- Nitrate
- Ammoniacal nitrogen
- Total cyanide
- Naphthalene
- PAHs
- Benzene
- Toluene
- Ethylbenzene
- Xylenes

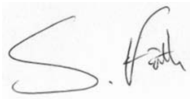
6.2.5 Control Levels and Compliance Limits

Control levels and compliance limits are dependent on baseline groundwater quality and will therefore be derived following the collection of baseline monitoring data and presented in a Site Monitoring Plan.

6.2.6 Contingency Actions

Should a compliance limit be exceeded contingency measures will be required. This will initially be repeat sampling and if this confirms the initial result then investigative action will be taken to identify the cause of the breach of compliance limit. Should the breach be caused by infill material at the site then action will be taken to limit the discharge of contaminants to groundwater. For example, this could involve testing and excavation of suspect material for off-site disposal. Details of contingency plans will be provided in the Site Monitoring Plan.

Report prepared by:



Simon Firth

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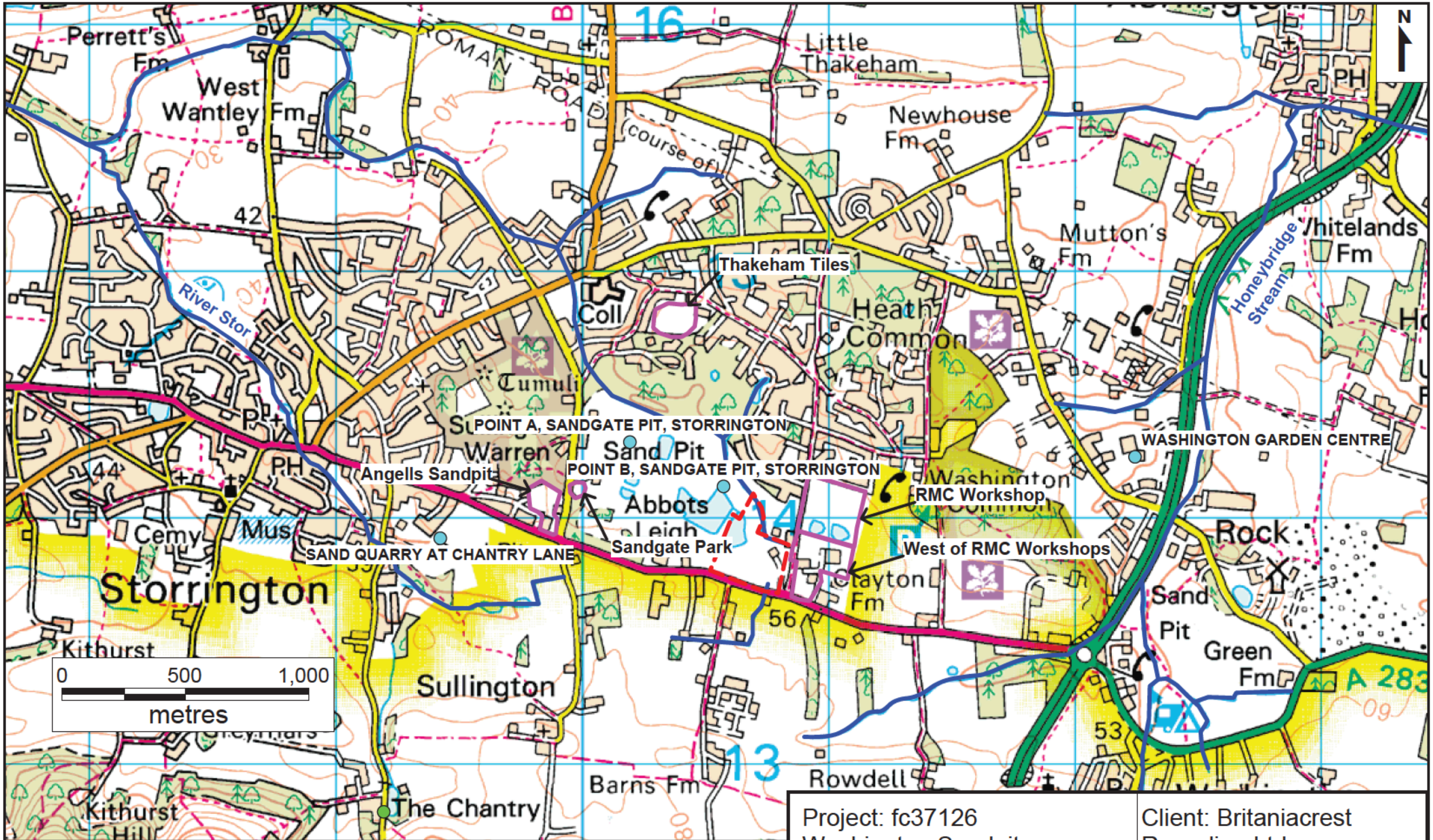
FIGURES



- Site boundary
- Licensed groundwater abstraction
- Private groundwater abstraction
- Watercourse
- Landfill

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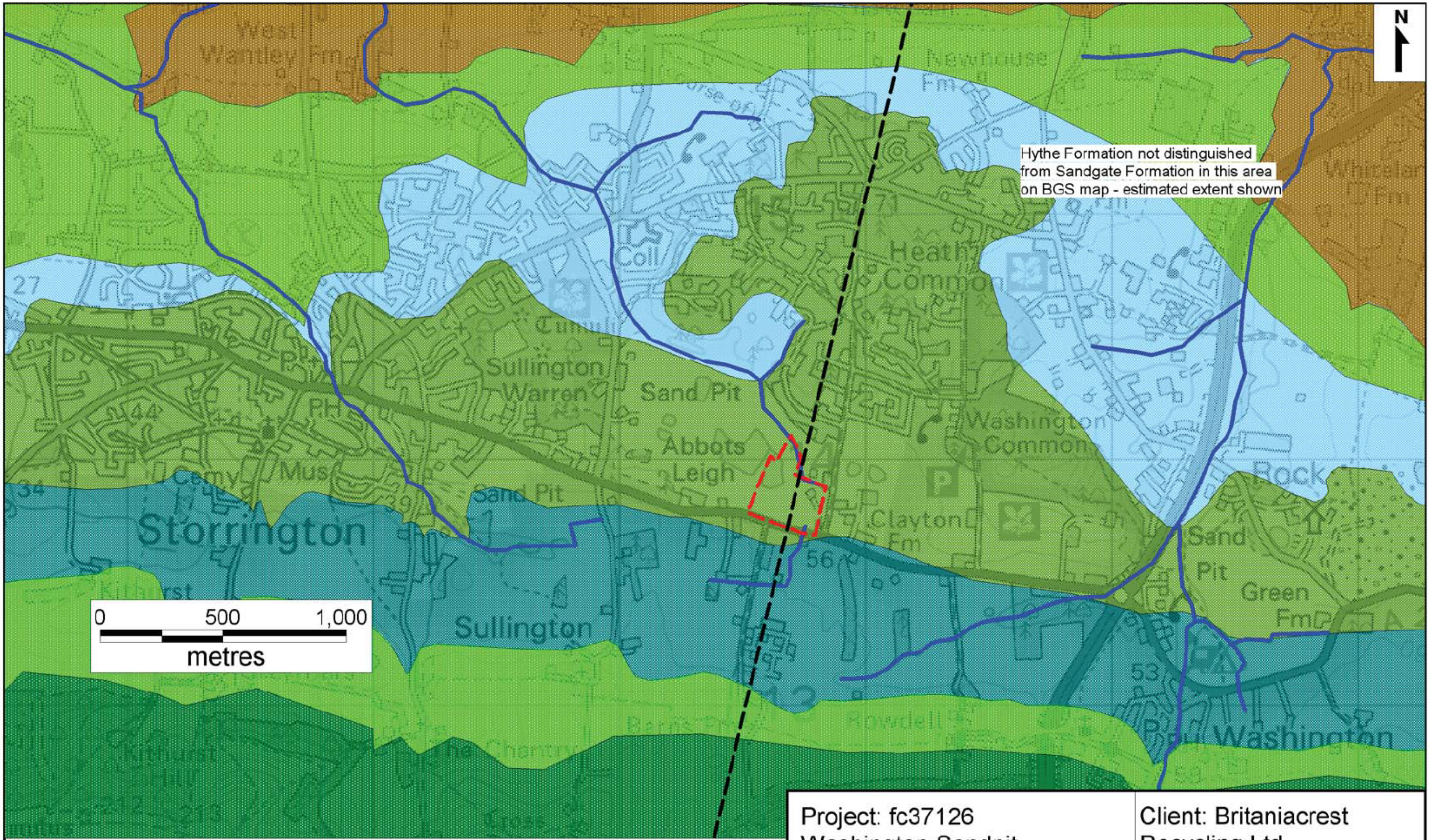
Figure 1 Scale: 1:20000 (A4) Date: 23/2/15	Site location



Site boundary	Sandgate Formation
Chalk Group	Hythe Formation
Upper Greensand	Weald Formation
Gault Formation	Line of Figure 3 cross-section
Folkestone Formation	

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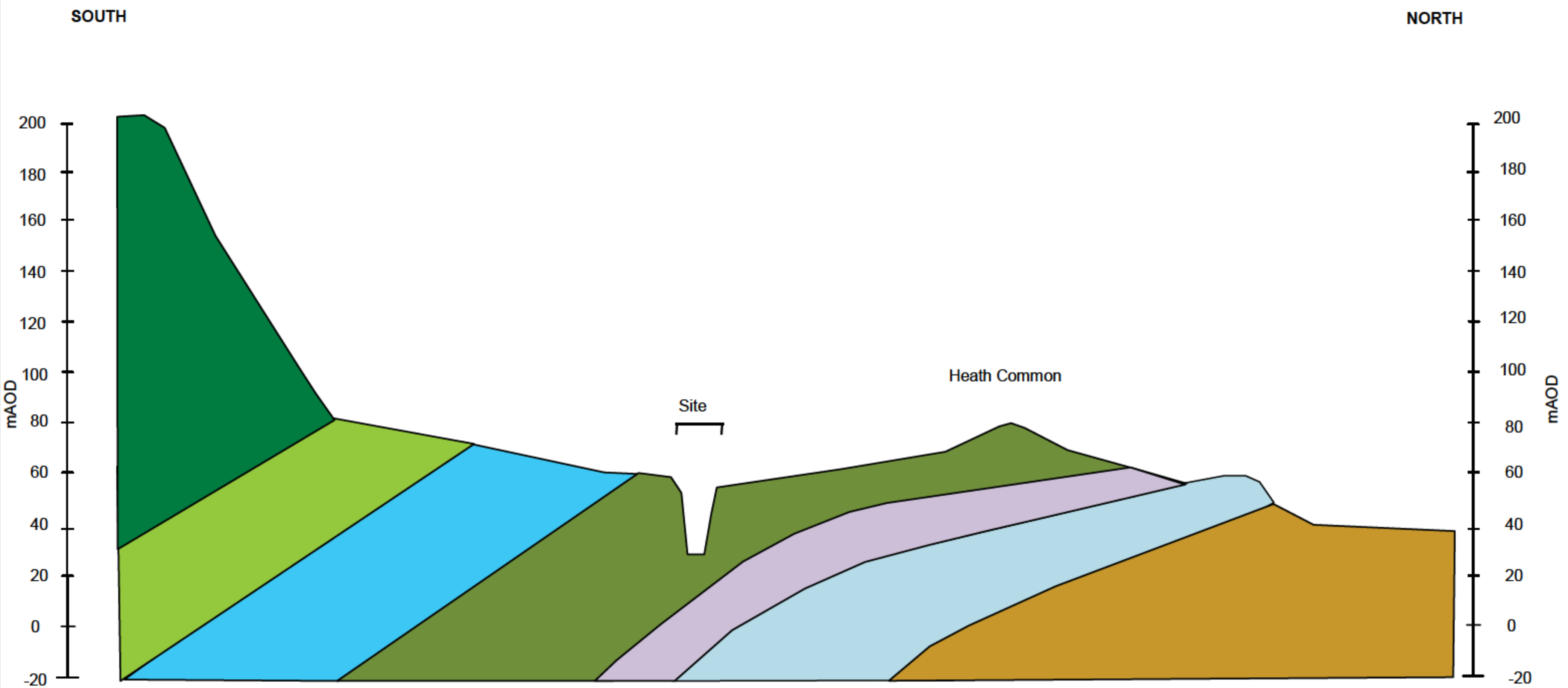
Figure 2

Bedrock Geology

Scale: 1:20000 (A4)

Date: 23/2/15



Legend

Chalk Group	Sandgate
Upper Greensand	Hythe
Gault	Weald Clay
Folkestone	

Approximate horizontal scale: 1: 20000
Approximate Vertical Exaggeration: x 10

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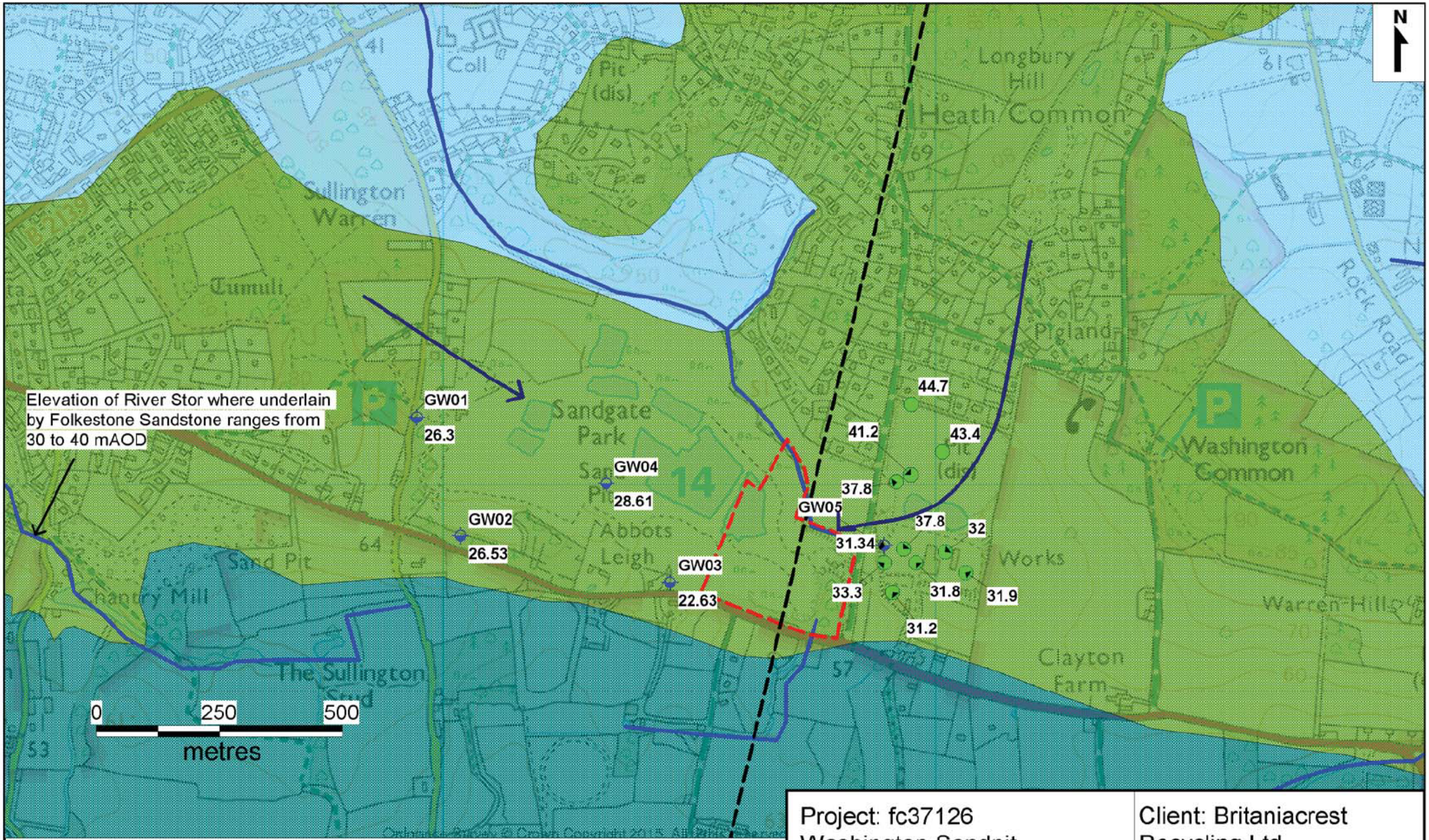
Figure 3

Scale: see key

Date: 24/2/15

Geological cross-section through the site



- Site boundary
- Gault Formation
- Folkestone Formation
- Sandgate Formation
- Interpreted groundwater flow direction
- Hydrock well showing groundwater level on 20 April 2009
- Cemex well showing groundwater level on 22 April 2009

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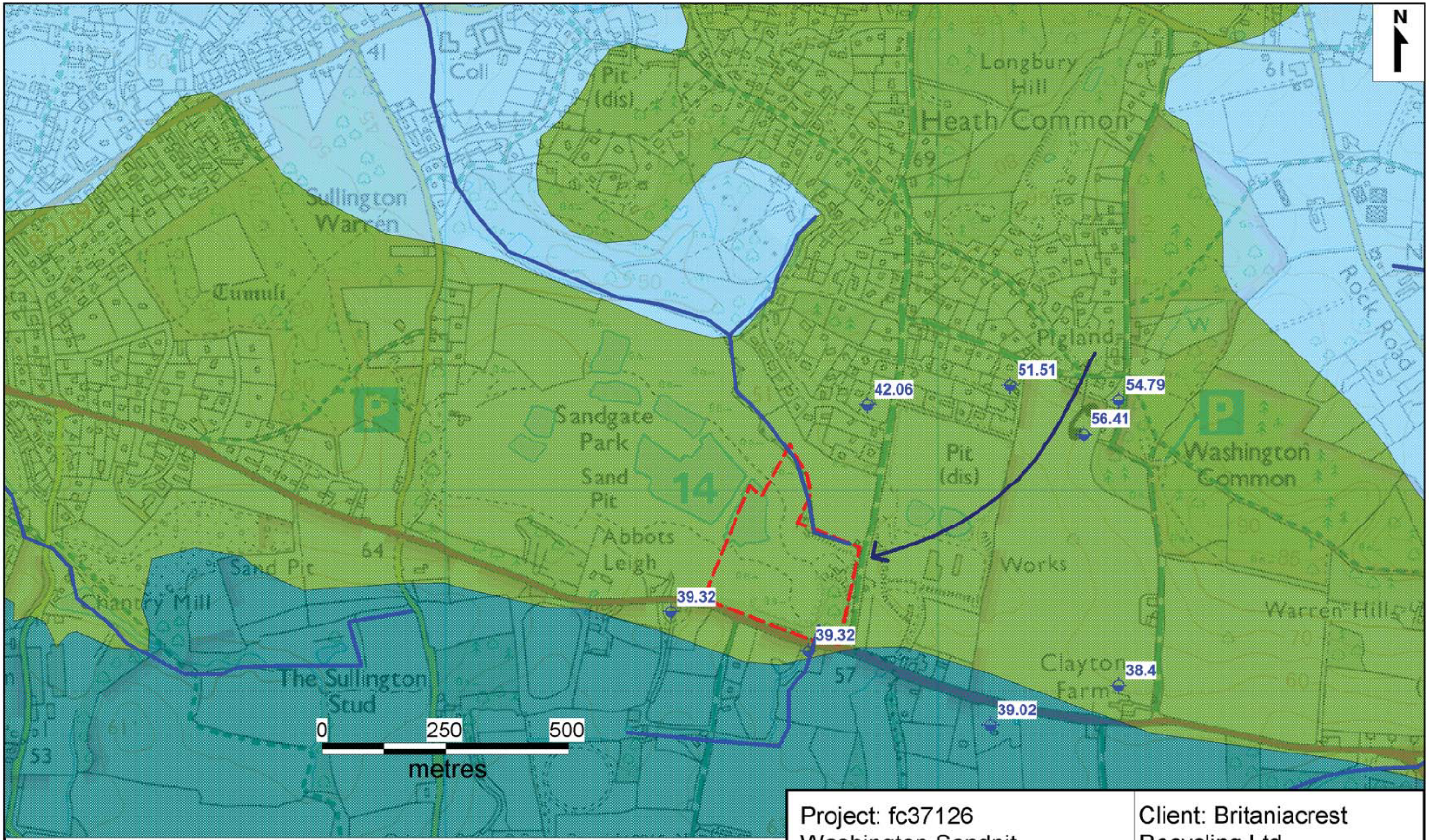
Figure 4	Current groundwater levels and interpreted flow in Folkestone Formation
Scale: 1:10000 (A4)	
Date: 25/3/15	



Site boundary

Gault Formation

Folkestone Formation

Sandgate Formation

Interpreted groundwater flow direction

Historical well on BGS borehole database with standing water level shown in mAOD

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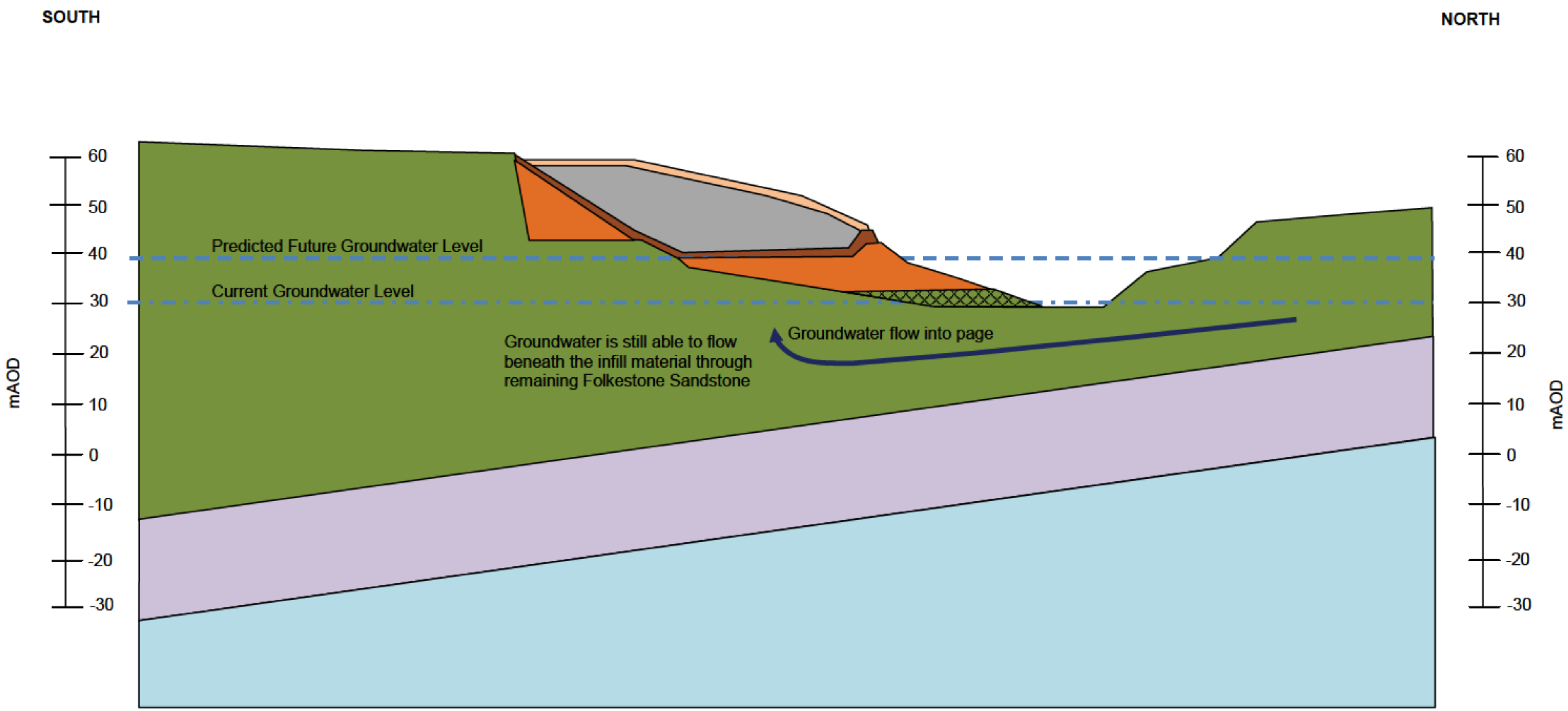
Figure 5	Historical groundwater levels and interpreted groundwater flow direction in Folkestone Formation
Scale: 1:10000 (A4)	
Date: 25/3/15	



Legend

- Folkestone
- Sandgate
- Hythe
- Re-used Folkestone sand/ overburden from site
- Material brought in under CL:AIRE CoP
- Material with K of <1x10^{-7} m.s^{-1} (brought in under CoP)
- Inert waste material
- Cover material

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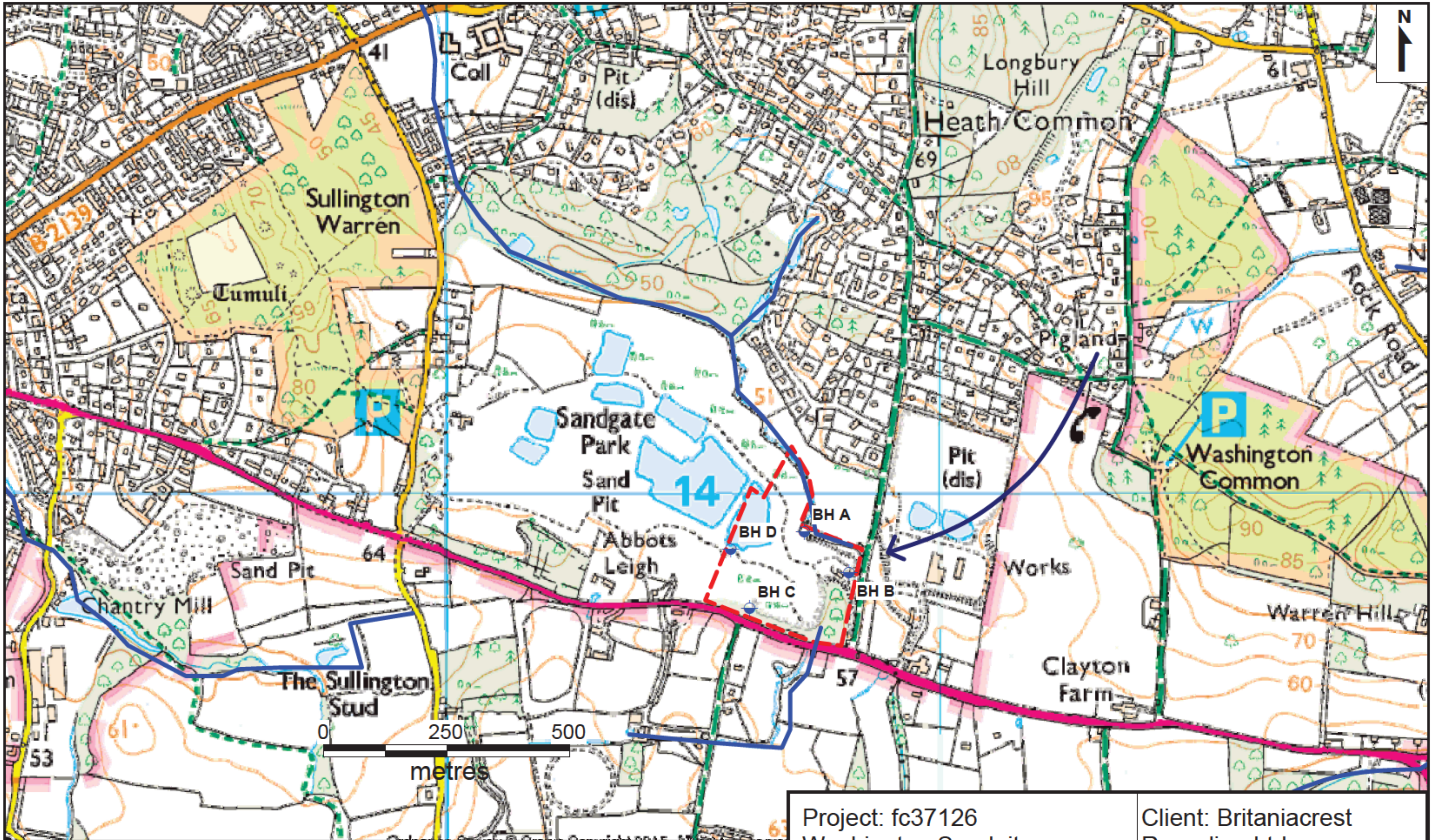
Figure 6 Scale: schematic Date: 28/4/15	Schematic cross-section showing proposed infill



Site boundary

Proposed monitoring well location

Interpreted groundwater flow direction

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Figure 7	Proposed monitoring well locations
Scale: 1:10000 (A4)	
Date: 25/3/15	

APPENDIX 1
Estimated base of Folkestone Formation

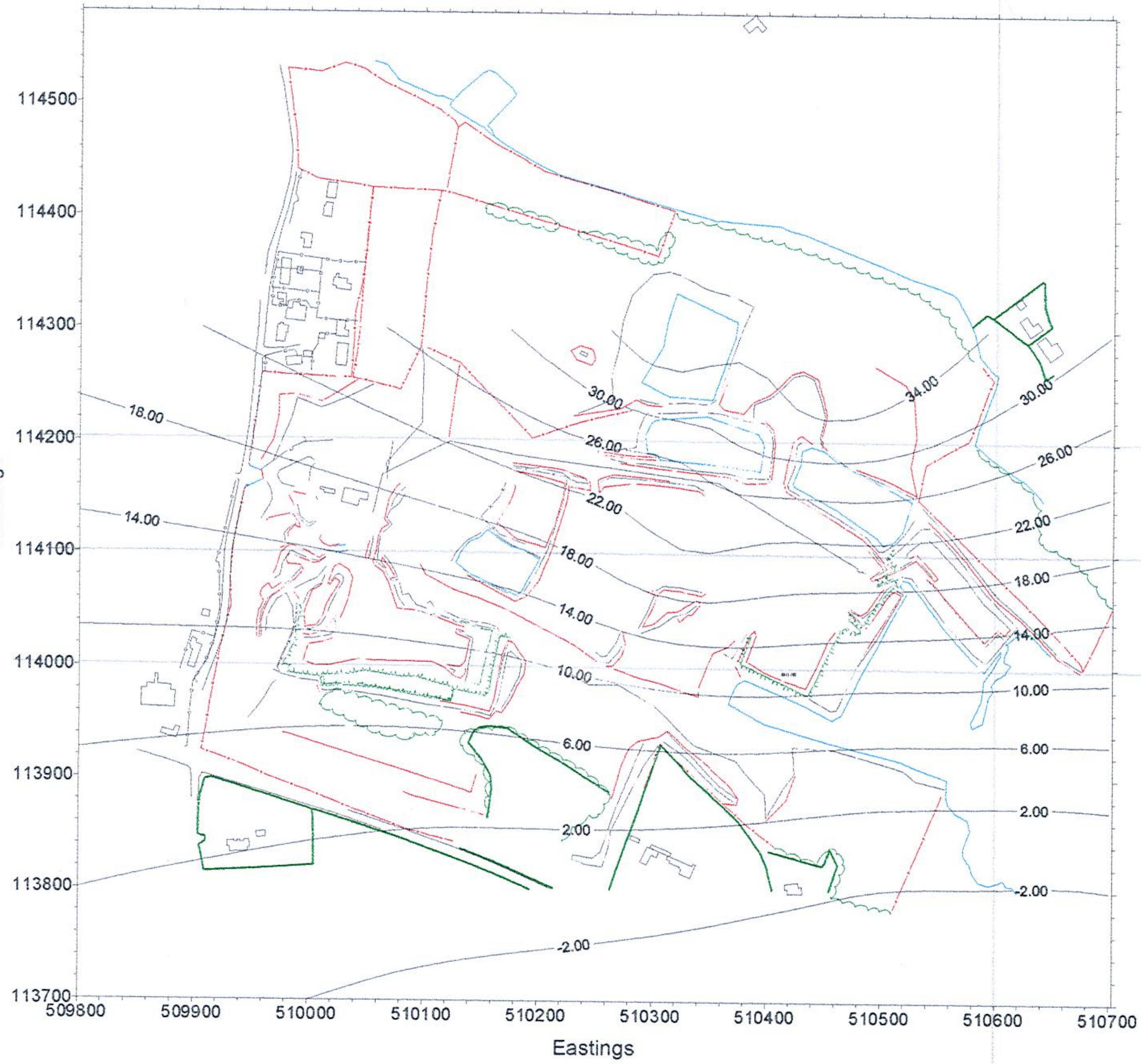

FIGURE 2 – CONTOURS ON THE BASE OF THE FOLKESTONE BEDS

APPENDIX 2
Summary of proposed
Waste Acceptance Procedure

Appendix 2: Summary of Proposed Waste Acceptance Procedure

The following waste acceptance procedure will be applied to the importation of material at the site:

1. Pre-acceptance checks will be made, as well as, at receipt of the waste to ensure the right waste types are received.
2. A waste characterisation analysis will be requested of the waste producer to demonstrate it is inert waste.
3. Only hauliers that have been given permission to deposit materials on the site will be allowed to do so. Those without permission will be turned away. This is a significant deterrent to the haulage industry as lorry operators cannot afford to waste time and fuel travelling to a site that will not allow them to deposit their loads.
4. Hauliers must have an approved credit account with the site operator before they are allowed to enter the site. No hauliers are allowed to arrive and pay at the gate on a cash or credit card basis. This means that all hauliers will have been subject to a vetting routine and a proper contractual and invoicing system.
5. Details of the origins of every load that is brought into the site are to be recorded. The records of the loads will be retained on site and can be checked at any time.
6. Only suppliers that have a contract with Britainiacreast will be allowed to deliver waste to the site i.e. on spec loads arriving at the site will be rejected.
7. Deliveries will only be permitted by Registered Waste Carriers and in accordance with Duty of Care Regulations.
8. On receipt on-site, the material will be further visually inspected to verify that it conforms to the characterisation provided.
9. Conformance checks will comprise the following:
    - all loads will be inspected on arrival at the site entrance
    - all loads will be supervised during off-loading
    - any loads that appear not to conform to the original characterization based on visual and olfactory inspection (e.g. hydrocarbon odours, hydrocarbon staining, unusual discolouration, potentially biodegradable material, asbestos containing materials) will be rejected at the gate or if unloaded set aside close to the point of offloading for confirmatory analysis and / or the supplier required to remove the material from site.
10. All proposed waste materials will be handled and placed in solid form. No liquid wastes will be received or used at the site.

11. Any supplier delivering loads that are not acceptable will be informed and asked that their procedures tighten up. Any supplier who persistently delivers unacceptable waste will be prevented from using the facility.
12. Any unacceptable materials will be segregated and either returned to the supplier or taken to an appropriately authorised facility. It will be stored in a quarantine area in the interim
13. Should a compliance limit be exceeded contingency measures will be required. This will initially be repeat sampling and if this confirms the initial result then investigative action will be taken to identify the cause of the breach of compliance limit. Should the breach be caused by infill material at the site then action will be taken to limit the discharge of contaminants to groundwater. For example, this could involve testing and excavation of suspect material for off-site disposal. Details of contingency plans will be provided in the Site Monitoring Plan.