



CALA Homes (South Homes Counties) Limited

Former West End Nursery, Roundstone Lane, Angmering, BN16 4AX

Post Remediation Validation Report – Phase 2A (Formerly
referred to as Phase 3)

27621-R10 (00)

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RSK GENERAL NOTES

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1 INTRODUCTION

RSK Environment Limited (RSK) was commissioned by CALA Homes (South Home Counties) Limited, hereafter known as the client, to produce a post remediation validation report for Phase 2A (Plots 308 to 325) of the land at the former West End Nursery, Angmering, BN16 4AX.

This report is subject to the RSK service constraints given in **Appendix A**.

1.1 Background

This report details remedial and validation works carried out within the Phase 2A (formally known as Phase 3) development area, as well as across the wider site.

Validation of the soft landscaping and garden areas (Plots 308 to 325) within Phase 2A is still ongoing, the results of which will be reported to the National House Building Council (NHBC) and the Local Authority as plots/landscaped areas are completed.

Several preceding phases of site investigation and associated risk assessments have been completed for the site by RSK. These are outlined in the following reports:

- RSK, 2015a. Geo-environmental Site Investigation, report ref: 27621 R01 (02), May 2016;
- RSK, 2015b. Additional Geo-environmental Site Investigation and Remediation, report ref: 27621 R02 (00), June 2015;
- RSK, 2016a. Remedial Strategy, report ref: 27621 R03 (02), August 2017 (previous issue 01 dated January 2016);
- RSK, 2016b. Supplementary Geo-environmental Site Assessment, report ref: 27621 R04 (01), June 2016;
- RSK 2016c. Tank Validation, report ref: 27621 L01/ad, August 2016;
- RSK 2016d. Bund Validation Works, report ref: 27621 L02/JR, dated October 2016;
- RSK 2016e. Asbestos Delineation Works Phase 1A – Plots 1 to 19, report ref: 27621 L04/EH, dated October 2016;
- RSK 2017a. Phase 1A asbestos delineation works (Plots 18 and 20 - 64), report ref: 27621 L05/EH, February 2017;
- RSK 2017b. Phase 1B Asbestos Delineation Works (Plots 65 to 121) and Historic Boiler House Validation Works, report ref: 27621-L08-eh, July 2017;
- RSK 2017c. Downgrading of ground gas regime, report ref: 27621-L19-dbj, November 2017;
- RSK 2017d. Post-remediation validation report – Phase 1A, report ref: 27621 R06 (00), May 2017;
- RSK 2018a. Supplementary site investigation and remedial strategy – South east landscaped area, report ref. 27621 R08 (00), January 2018;
- RSK, 2018b. Post-remediation validation report – Phase 1B, report ref: 27621 R09 (00), April 2018;
- RSK, 2018c. Phase 3 Asbestos and Made Ground Delineation Works (northern and western areas), report ref: 27621 L25/EHP, April 2018; and

- RSK, 2018d. Phase 3 Supplementary Asbestos Delineation Works, report ref: 27621 L27/CMC, May 2018.

It is noted that the remedial strategy report (RSK 2016a) was updated and reissued to the client in August 2017 under reference 27621-R03 (02), to reflect changes in the topsoil to subsoil ratio agreed verbally with the Local Authority since issue of the preceding issue of the report in January 2016, following conveyance queries on this matter, (original reference 27621 – R03 (01), January 2016).

Further to the above, Keltbray Remediation, carried out the first phase of remedial works at the site in accordance with recommendations contained within the RSK remedial strategy (report ref: 27621-R03 (01), January 2016). RSK attended site on an ad hoc basis during Keltbray's first phase of works to provide advice on delineation, waste disposal and to carry out validation when required. The remedial works undertaken by Keltbray were documented in a Completion Report, (report ref: 6033.CR.LH.08072016V3, dated August 2016). It is understood that this report has been submitted to the Local Authority and therefore has not been appended to this report.

The salient findings of the aforementioned works relevant to Phase 2A are included within the following report. However, the report should be read in conjunction with the previous reports listed above, some of those that have direct relevance to Phase 2A are included in **Appendix B** for ease of reference.

1.2 Objectives

The objective of the remediation is to produce a site that is suitable for its intended purposes (residential end use with private gardens and communal soft landscaping), whilst providing a safe working environment with respect to site workers and adjacent users. This will involve the following measures:

- The placement of a suitable clean cover layer within any private gardens and proposed communal soft landscaped areas, locally deepened (to the requirements of the Landscape Architect) in the proximity of any proposed deep root-balled shrubs and/or trees in order to break potential contamination pathways with respect to the underlying made ground;
- Following decommissioning and demolition of the CHP building, nitric acid store, substations and above ground storage tanks (ASTs), in the event that any visually impacted materials are observed, an Environmental Engineer be contacted so that appropriate sampling can be implemented to determine any additional remedial and validation requirements;
- Regrading of bund materials (where required) to form site levels, in accordance with the approved development plan; and to facilitate placement of a 'clean' cover layer across the remaining bund materials. Where possible material won as part of the re-grading exercise will be re-used on site in accordance with a materials management plan following the CL:AIRE Code of Practice;
- Incorporation of gas protection measures within the proposed buildings: structural barrier comprising suspended or ground bearing floor slab with appropriate ventilation and a gas resistant membrane, sealed at all joints and penetrations (please note following further assessment as detailed in Section 1.5.2.2 gas protection measures are no longer required across the site); and

- Compliance with CAR 2012, through the adoption of safe working procedures with respect to the potential presence of asbestos containing materials (ACM) and notification to the HSE.

The objective of this report is to demonstrate that the remedial objectives listed above have been achieved for Phase 2A and that this area of the site is suitable for its intended purposes by:

- Providing a record of validation sampling undertaken post demolition/site clearance, confirming suitability of remaining materials in Phase 2A for the proposed end use (residential);
- Providing a record of validation sampling undertaken post demolition/site clearance, confirming suitability of remaining materials in Phase 2A with regards to soft landscaped areas (south western bunds); and
- Production of a post-remediation validation report recording all actions taken to implement the remedial works carried out to date: To confirm that remediation goals set out in the remedial strategy report (RSK ref: 27621 R03 (01), January 2016) have been achieved in Phase 2A and identify further works, if necessary.

1.3 Existing Conditions

The site is situated off Roundstone Lane, Angmering, BN16 4AX. The National Grid reference for the site is 507640, 103520 as shown on **Figure 1**. The site covers approximately 11 ha at an elevation of approximately 11 m above Ordnance Datum (AOD) with the exception that along the eastern and western boundaries, there are bunds that rise up above general site level.

The post remedial validation reports for development phases 1A and 1B have been approved by the Local Authority and properties in these areas are now occupied. The remainder of the site is currently an active construction site including the area known as Phase 2A (formerly known as Phase 3) containing Plots 308 to 325. All of the aforementioned plots have been founded and are currently being constructed.

Historically the site was arable land up until the construction of West End Nursery circa 1943. The nursery was extended during the 1970's towards the eastern part of the site with the construction of greenhouses.

Redevelopment of the site occurred from the 1990's, with the addition of smaller greenhouse's to the south. Also present from the 1990's were ASTs, a gas governor and laboratory in the south west of the site and a drainage pond in the south east. The laboratory was no longer present on mapping data between 2012 and 2014.

It is understood that the site as a whole is being redeveloped with 244 residential plots comprising a mixture of housing and flats, with private and communal gardens and some areas of communal soft landscaping. The phased development plan for the entire site and Phase 2A are shown within **Figures 2 and 3** respectively.

1.4 Regulatory Correspondence

As part of regulatory consultation process, the client forwarded all reports pertaining to the site to the relevant regulators for review and comment.

Subsequently the remedial strategies for the site have been agreed with the Environmental Health Officer(s) at Arun District Council (RSK 2016a and 2018a).

Since agreement of the remedial strategies the following items, which deviate from the agreed remedial strategies or, are additional to the remedial strategies have been discussed and agreed as specified with the Council:

- A cover layer validation sampling frequency of one sample per 250 m³ in public open space areas has been agreed rather than one sample per 50 m³;
- Topsoil thickness of 150 mm has been agreed as acceptable rather than 300 mm, subject to the overall capping layer thickness of subsoil and topsoil remaining 600 mm in higher risk areas and 450 mm in lower risk areas;
- Prevention of public access to south west bund B by fencing and planting of prickly vegetation to deter trespassers has been agreed. Photographic evidence confirming these measures have been incorporated shall be included in the verification report for this area of the site;
- Validation sampling in the vicinity of the hydrocarbon hotspots identified during the construction phase at Phase 2A;
- Validation sampling in the vicinity of the septic tanks identified during the construction phase at Phase 2A; and
- Following queries raised by the NHBC regarding the gas membrane design submitted for the site, further gas assessment has been undertaken, as detailed in Section 1.5.2.2. Based on the results of the further assessment, subject to no new sources of ground gas generating material being identified during the remaining works, it has been agreed with the Local Authority and NHBC that gas protection measures are no longer required.

Email correspondence between RSK and Arun District Council in regard to the bullet points listed above are presented in **Appendix C**.

1.5 Method Statement for Remediation of Contaminated Ground

Remedial strategy 27621 R03 (02) (RSK 2016a, August 2017) was based upon previous site investigations findings. Previous investigations found evidence for ACM and/or asbestos fibres in trial pits TP1 to TP9 (all excavated through the bund materials) and within boreholes BH1, BH4, BH12, BH15 and BHE during the initial ground investigations (RSK 2015a, RSK 2015b and RSK 2016b). Elevated concentrations of hydrocarbons and metals were also identified within the bund materials. On this basis, a potentially complete pollutant linkage was identified to human health (construction workers and future residents) from asbestos in soil and elevated concentrations of hydrocarbons and metals.

The second remedial strategy 27621 R08 (00) prepared for the south east landscaped area (RSK 2018a, January 2018) was completed following the discovery of suspected ACM in the bund surrounding the pond in the south east of the site during tree clearance works. Following this discovery, works were ceased in this area and potential risks to construction workers and neighbouring residents mitigated in the short term by damping down and covering with a geo-membrane to prevent potential release of asbestos fibres. RSK subsequently undertook further investigation works in the south eastern portion of the site as reported in RSK 27621 R08 (00) (2018a, January 2018). The investigation found evidence for ACM and/or asbestos fibres in trial pits TP202, TP206-TP208, TP220, TP221 and TP224. Suspected ACM was also encountered in TP212 and TP222, although bulk ID testing was not conducted on materials from these locations. On this basis, a potentially complete pollutant linkage was identified to human health (construction workers and future residents) from asbestos in soils that required supplementary

remediation to that specified in preceding remedial strategy 27621 R03 (02), (2016a, August 2017).

1.5.1 Implementation

The remedial strategies for the site (RSK report ref: 27621 R03 (02) and 27621 R08 (00)) were divided into the enabling and demolition phases, i.e. those works required to produce a suitable development platform, and the subsequent construction phase.

The sequence of works required under both phases is outlined in the following bullet points relating to the proposed demolition sequence and the subsequent construction works.

- Before commencing demolition works of the remaining buildings, an asbestos survey suitable for demolition purposes should be undertaken to confirm the presence or absence of ACM within all structures. Where ACM is encountered removal by an appropriately licensed contractor should be undertaken before commencing demolition works. The demolition works (with exception to one building used as a site office) were the responsibility of the vendor prior to handover of the site to our client. As such, no further details are available in regard to whether or not this was completed prior to demolition of the buildings.
- Before commencing demolition of the final building used as a site office an asbestos survey suitable for demolition purposes was conducted by Envirochem in April 2018. None of the samples collected during the survey were found to contain asbestos. A copy of this report is included in **Appendix B**.
- With regards to the removal of the ASTs and substation, live services to these features would need to be isolated/disconnected before removal. In addition the contents of any ASTs and associated pipework should be purged of their liquid contents. The liquid shall be tankered off-site for appropriate disposal by a licensed waste disposal contractor.
- The existing ASTs, substation and associated pipework, underlying concrete and brick, should be removed under the supervision of a suitably qualified geo-environmental engineer and disposed off-site. Validation of the soils underlying these features, in relation to potential contamination, should be completed at the discretion of the geo-environmental engineer. Validation of the underlying soils is likely to include some or all of the following:
 - Logging of the underlying materials to BS5930 (2015);
 - In-situ screening by a photo-ionisation device;
 - Any materials suspected to be contaminated based on visual/olfactory observations and/or in-situ screening should be stockpiled in areas of impermeable surfacing (hard-standing/on impermeable geo-membrane material). Soil sample(s) should be collected from the stockpiled material and submitted for laboratory analysis to verify its suitability for re-use on-site or off-site disposal; and
 - Any remaining drains or service ducts associated with these features, which have the potential to provide a pathway for contaminant migration should be removed or sealed.
- In accordance with the proposed development plan, sections of the bunds were proposed to be regraded with the removal of the top 1.30 m (approximately). Following agreement from the Local Authority, the excavated materials were to be re-used beneath a clean capping layer in the central public open space (POS) area.

- In the central and south eastern POSs and across the regraded bunds a capping layer to be a minimum depth of 600 mm was subsequently required. The capping materials were proposed to be sourced from natural subsoil won from the central and south eastern POS areas and imported topsoil, underlain by a geo-marker layer.
- Following agreement with the Local Authority, excavated materials from the bunds surrounding the former pond (where required), made ground from the cleared wooded area and other made ground excavated during the development works from across the site (suitable for re-use at depth), were to be re-used beneath a clean capping layer in the south eastern public open space area.
- It was recommended that material movements across the site be controlled through the implementation of a CL:AIRE Code of Practice Material Management Plan (MMP) to demonstrate compliance of the four factors set out therein.

1.5.2 Construction Phase

1.5.2.1 *Placement of clean cover soils*

In order to break the identified pollutant linkages in Section 1.5, within the proposed areas of private gardens and communal soft landscaping areas within Phase 2A the placement of a suitable clean cover layer will be required. To address potential risks posed from the impacts identified in a sustainable manner, the minimum thickness of the clean cover layer is required to be 600 mm in all private gardens and areas of communal soft landscaping, with exception to the southern soft landscaped area across which a 450 mm clean capping layer is considered suitable following further validation works in the vicinity of the historic AST and nitric acid store. The 600 mm cover layer should comprise 150 mm of topsoil and 450 mm of subsoil with a geo-membrane marker layer at the base. The 450 mm cover layer should comprise 150 mm topsoil underlain by a 300 mm of subsoil. Throughout the development of the entire site, a 600 mm capping layer has been placed in areas of high risk. These higher risk areas were defined by:

- Areas of identified impact (remaining bund materials, pesticide hotspot, made ground containing asbestos), un-investigated areas considered to potentially impacted (i.e. made ground extending to the south of the sites buildings considered to potentially contain asbestos and soils in the vicinity of the fuel tanks and nitric acid store), and the central and south eastern POS landscaped areas containing asbestos impacted materials reused at depth.

The capping layer requirements across Phase 2A are presented on **Figure 4**.

1.5.2.2 *Installation of gas protection membranes*

It was recommended in the remedial strategy for the site (RSK, 2016a) that a detailed gas membrane installation design and implementation plan be completed in accordance with the recent updates in UK guidance (BS8485:2015).

Following queries raised by the NHBC regarding the gas membrane design submitted for the site, further validation gas assessment in the form of void monitoring was undertaken at the site. RSK initially completed void monitoring for Plots 10, 20, 28, 30, 44, 48 and 50. These plots were chosen due to their proximity to the principal borehole of concern (BH1), other observed sources of potential ground gas generation from the site investigation and to provide suitable coverage of the Phase 1A development area.

Additional void monitoring in Plots 53, 63 and, to a lesser extent, Plot 51 took place to provide an added level of comfort for plots that were due to be occupied as Plots 44, 48 and 50 located in the southern half of Phase 1A were not yet ready for the void monitoring to take place at that time.

The original classification of Amber 1/CS2 was also a belt and braces precautionary approach due to the site history and encountered ground conditions. Whilst not the original purpose of the void monitoring, it quickly became clear that the collection of primary data from beneath existing properties on site was demonstrating that the ground gas regime on the site was presenting itself as a Green/CS1.

Based on the new lines of evidence of significant void monitoring data and further widespread excavation of the development site not encountering significant organic material, RSK considered there was sufficient data to downgrade the site from Amber 1/CS2 to Green/CS1. This has been subsequently agreed by the Local Authority and the NHBC and therefore ground gas protective measures are not required at the site unless any new sources of ground gas generation are discovered during the remaining stages of the development, which is considered to be very low. Supporting correspondence in regard to this is presented in **Appendix C**.

1.5.3 Verification

1.5.3.1 Validation of clean cover soils

In accordance with the remedial strategy reports, validation is required in regard to the thickness and chemical quality of the clean capping layer placed in gardens and areas of communal soft landscaping.

To verify the thickness of the cover layer, it will be necessary to dig through the cover layer at selected locations to verify the required thickness of topsoil, subsoil and presence of the marker layer where required.

In addition, validation samples are to be collected on a 1 in 50 m³ frequency for garden areas and a 1 in 250 m³ frequency in areas of communal soft landscaping as agreed with the Local Authority. All chemical testing for validation purposes is required to be carried out by an MCERTS and UKAS accredited laboratory and the results compared to the relevant validation assessment criteria as set out in the remedial strategy reports (RSK report ref: 27621 R03 (02), August 2017 and 27621 R08 (00), January 2018) and **Table 1**. Should lower SOM be present, the RSK Generic Assessment Criteria (GAC) within **Appendix D** provides alternative criteria for 1 % and 2 % SOM.

Table 1: Validation assessment criteria

Compound	Generic Assessment Criteria (GAC) 6% SOM (mg/kg)
Metals	
Arsenic	37
Cadmium	30
Chromium (III) - oxide	910
Chromium (VI)	21
Copper	2,500

Compound	Generic Assessment Criteria (GAC) 6% SOM (mg/kg)
Lead	200
Elemental Mercury (Hg ₀)	1.2
Inorganic Mercury (Hg ₂₊)	39
Methyl Mercury (Hg ₄₊)	10
Nickel	180
Selenium	258
Zinc	3,900
BTEX Compounds	
Benzene	0.87
Toluene	680
Ethylbenzene	260
Xylene - m	327
Xylene - o	332
Xylene - p	310
Total xylene	310
Polycyclic Aromatic Hydrocarbons (PAHs)	
Acenaphthene	1,170
Acenaphthylene	970
Anthracene	10,900
Benzo(a)anthracene	13
Benzo(b)fluoranthene	3.7
Benzo(g,h,i)perylene	350
Benzo(k)fluoranthene	100
Chrysene	27
Dibenzo(a,h)anthracene	0.30
Fluoranthene	900
Fluorene	880
Indeno(1,2,3-cd)pyrene	41
Phenanthrene	440
Pyrene	2,040
Benzo(a)pyrene	5
Naphthalene	71
Total Petroleum Hydrocarbons	
Aliphatic hydrocarbons EC ₅ –EC ₆	160
Aliphatic hydrocarbons >EC ₆ –EC ₈	530
Aliphatic hydrocarbons >EC ₈ –EC ₁₀	154
Aliphatic hydrocarbons >EC ₁₀ –EC ₁₂	7,50
Aliphatic hydrocarbons >EC ₁₂ –EC ₁₆	3,500
Aliphatic hydrocarbons >EC ₁₆ –EC ₃₅	79,000

Compound	Generic Assessment Criteria (GAC) 6% SOM (mg/kg)
Aromatic hydrocarbons >EC ₈ –EC ₉	56
Aromatic hydrocarbons >EC ₉ –EC ₁₀	189
Aromatic hydrocarbons >EC ₁₀ –EC ₁₂	367
Aromatic hydrocarbons >EC ₁₂ –EC ₁₆	600
Aromatic hydrocarbons >EC ₁₆ –EC ₂₁	800
Aromatic hydrocarbons >EC ₂₁ –EC ₃₅	1,200
Other	
Asbestos	Not observed in asbestos in soil with ID analysis
Note: if heavy PAH compounds exceed the GAC, benzo(a)pyrene will be used as a surrogate depending upon the heavy PAH compound composition	

2 REMEDIAL WORKS WITHIN PHASE 2A

The remedial works have been carried out in a phased approach as development has progressed at the site.

The following validation and verification requirements were identified as needing to be completed across Phase 2A, prior to this area being deemed suitable for the proposed residential end use:

- Validation sampling following removal of the hydrocarbon hotspots identified during the construction phase;
- Validation sampling following removal of the septic tanks identified during the construction phase;
- Validation sampling in the vicinity of the south western bund A;
- Validation that in the vicinity of the south western bund B, prickly vegetation has been planted and the area fenced off;
- Further delineation and validation sampling of oil impact observed adjacent to the historic tank ASTs and hydrocarbon source removal (if required);
- Garden and soft landscaping validation sampling and reporting; and
- Post remediation validation reporting for all of the above.

Although not required to be completed in accordance with the agreed remedial strategies for the site to provide the Principal Contractor with further information in regard to asbestos impacts and the occurrence of made ground across Phase 2A supplementary site works were completed as detailed in Sections 2.1.1 and 2.1.2.

2.1 Verification Works

Throughout the remedial and construction phase RSK attended site on an ad hoc basis to verify the works carried out. During ground works undertaken in Phase 2A RSK maintained a site presence on a full time to part time basis (2 – 3 days per week), to undertake a watching brief and conduct validation works as and when required. Photographs documenting the remedial and validation works discussed in this report are presented in **Appendix G**.

Further to RSK's presence onsite Economic Insulations (Portsmouth) Ltd. were employed by the Principal Contractor to undertake a watching brief for asbestos during ground works within Phase 2A (including removal of the eastern most portion of the SW Bund B as shown on **Figure 6**) and re-use of made ground suitable for use in the south eastern borrow pit.

2.1.1 Asbestos Delineation Works across Phase 2A (February 2018)

Since completion of the initial site investigation conducted by RSK, buildings and infrastructure have been demolished within Phase 2A. Following site clearance, evidence of suspected cement-bound asbestos was identified sporadically at the ground surface across much of this area.

RSK carried out supplementary intrusive investigation works on 5th and 12th February 2018 (RSK, 2018b). The objective of the works was to characterise made ground and further delineate asbestos impacts in Phase 2A (formerly referred to as Phase 3).

A copy of the letter report (ref. 27621 L25/EPH) dated April 2018, documenting this work is presented in **Appendix B**. However, a summary of pertinent information is presented below.

A total of 11 trial pits were excavated, numbered TP301 to TP311, in the northern and western areas of Phase 2A, as shown on **Figure 3** in letter report ref. 27621 L25/EPH) presented in **Appendix B**.

A total of 37 representative soil samples were collected during the works. Of these, 13 samples were scheduled for an asbestos screen to confirm the presence or absence of asbestos fibres and/or ACM. In the event that asbestos was detected, quantification analysis was undertaken. No visual or olfactory signs of organic contamination were observed during the works and in-situ volatile screening using a photo ionisation detector (PID) reported concentrations of <1.5 ppmV.

It was originally intended that further asbestos delineation works be conducted in the southern and eastern areas of Phase 2A in the vicinity of the proposed residential dwellings, however following discussions with the client in accordance with previous findings, it was agreed that a 600 mm clean capping layer be placed in all residential front and back gardens within this area.

The exploratory holes revealed that the northern and western area of Phase 2A is underlain by a variable thickness of made ground and reworked River Terrace Deposits, followed by River Terrace Deposits. Made ground encountered during the intrusive investigation varied greatly; from 0.35 to 3.20 m bgl.

Fragments of suspected ACM cement were noted throughout made ground soils in TP302, TP304, TP307 and TP310. These fragments ranged from 100 mm to 220 mm in size. 8 of the 13 soil samples submitted for analysis returned negative asbestos screens with the exception of those detailed in Table 2.

Table 2: Samples returning positive asbestos screen

Samples of soil where asbestos was identified					
Exploratory Hole	Depth Range	Stratum	Asbestos Type	Presenting As	Quantification Result
TP301	0.30	Made ground	Chrysotile	Loose Fibres	<0.001 %
TP304	1.20	Made ground	Chrysotile	Loose Fibres	0.003 %
TP307	1.20 to 1.50	Made ground	Chrysotile	Loose Fibres	<0.001 %
TP310	0.50 to 0.60	Made ground	Chrysotile	Loose Fibres	<0.001 %
TP311	0.10	Made ground	Chrysotile	Cement and Loose Fibres	0.004 %
Suspected asbestos cement sample results					
Exploratory Hole	Depth Range	Stratum	Asbestos Type	Presenting As	Quantification Result
TP302	1.00	Made ground	Chrysotile	Cement	15 %

In a total of 6 trial pits, made ground were either found to contain fragments of suspected ACM cement, laboratory-confirmed ACM cement, or laboratory-identified asbestos fibres in soil. All 5 soil samples returning positive laboratory identification of asbestos were submitted for asbestos quantification analysis. The quantification results for asbestos fibres in soil ranged from <0.001 % to 0.004 %. A representative suspected asbestos cement sample collected from TP302 tested positive for chrysotile cement, with a bulk asbestos fibre content of 15 %.

2.1.2 Supplementary asbestos delineation works – Phase 2A (May 2018)

On the 10th April 2018, a small localised bundle of suspected ACM insulation was observed during a walkover of Phase 2A. The suspected ACM insulation was collected by the RSK engineer for laboratory analysis. The laboratory results confirmed the material to contain loose insulation comprising amosite fibres and quantification results indicated asbestos fibres at 14.87 % by weight, as detailed in laboratory certificate 18-02669-4 presented in **Appendix E**.

Following the positive identification of localised loose amosite insulation as described above, the Principal Groundworks Contractor's (Blaze) asbestos consultant (Economic Insulations) requested supplementary site investigation works be conducted within Phase 3 in the vicinity of Plots 324 and 325, to further inform and delineate asbestos impacts in this area of the site. RSK subsequently carried out intrusive investigation works on 20th, 23rd and 24th April 2018. The Principal Groundworks Contractor's asbestos consultant (Economic Insulations) were present during the works.

A copy of the letter report produced (ref. 27621 L27/CMC dated May 2018), documenting this work is presented in **Appendix B**. However, a summary of pertinent information is presented below.

A total of 5 trial pits were excavated, numbered TPP3-401 to TPP3-405 in the vicinity of the localised loose amosite insulation identified at the ground surface in the vicinity of Plot 325's rear garden. In addition two hand pits were excavated, numbered TPP3-406 and TPP3-407, in the proposed front driveways of Plots 316 and 317. A total of four soil samples (SP3-1 to SP3-2) were also collected from a temporary made ground stockpile. The stockpile was formed in accordance with preparation of the development formation level across Phase 2A.

A total of 24 representative samples were collected during the works. Of these, 12 soil samples were scheduled for an asbestos in soils screen, and 1 suspected ACM sample was scheduled for bulk asbestos identification, to confirm the presence or absence of asbestos fibres in soil and/or fragments of ACM. In the event that asbestos was detected, quantification analysis was undertaken.

The exploratory holes revealed that a variable thickness of made ground, underlain by River Terrace Deposits and the Lewes Nodular Chalk Formation. The thickness of made ground encountered during the intrusive investigation varied greatly from 0.35 m to 2.7 m bgl. Fragments of suspected ACM cement were noted throughout made ground soils in TPP3-402 (0.0 m to 0.5 m), TPP3-405 (0.7 m to 2.7 m) and stockpile sampling location SP3-2 (0.05 m to 0.10 m). These fragments ranged between 30 mm and 150 mm in size. Fragments of fibrous ACM were noted in the made ground within TPP3-403 (0.0 m to 0.35 m bgl), this material was sampled within one of the two soil samples collected from made ground in this location and was subsequently confirmed by visual inspection at the laboratory as amosite ACM.

Based in the results received 6 out of 8 soil samples collected from the exploratory hole locations and all stockpile samples returned negative asbestos screens. The positive results are detailed in **Table 5** along with occurrence of visual onsite ACM identification. In addition the fragment of suspected ACM tile fragment collected from TPP3-403 returned a negative asbestos result.

Table 5: Summary of additional asbestos analysis results

Samples of soil where asbestos was identified					
Exploratory Hole	Depth Range	Stratum	Asbestos Type	Presenting As	Quantification Result
TPP3-403	0.0 - 0.3	Made ground	Amosite	Loose Fibres	2.292
TPP3-405	1.1 - 1.4	Made ground	Amosite	Loose Fibres	0.002
Suspected asbestos cement based on visual on-site identification by RSK and Economic Insulations					
Exploratory Hole	Depth Range	Stratum	Asbestos Type	Presenting As	Quantification Result
TPP3-402	0.0 – 0.5	Made ground	Chrysotile	Cement	N/A
TPP3-405	0.7 to 2.7	Made ground	Chrysotile	Cement	N/A
SP3-2	0.05 to 0.1	Made ground	Chrysotile	Cement	N/A

The letter report documenting the supplementary asbestos delineation works (RSK 2018d) was subsequently circulated to relevant parties.

Please note following discovery of the amosite ACM in the vicinity of Plot 325, groundworks were ceased in this area until such time that the supplementary asbestos delineation works were complete and Economic Insulations had completed localised removal as documented in Section 2.1.3.

2.1.3 Removal and off-site disposal of localised loose amosite insulation

Following review of the results from the supplementary asbestos delineation works detailed in Section 2.1.2, Economic Insulations deemed removal of the localised amosite asbestos impacted area (vicinity of TPP3-403 as shown on **Figure 6**) as notifiable non-licensed works (short duration).

On the 8th May 2018 a total of 17 bags (170 kg) of asbestos impacted made ground was removed and disposed of off-site by Economic Insulations. Prior to the works Economic Insulations submitted a notification of works to the Health and Safety Executive (HSE). A copy of the ASB>NNLW1 notification is presented in **Appendix L**. Waste disposal tickets for this material are provided in **Appendix I**.

Throughout the works background air monitoring was completed by Envirochem within 3 m from the perimeter of the excavation area to the south east, north east, north west and south west, and also within the work area. The air monitoring results were all found

to be below the reportable method detection limit of <0.01 fibres per ml. The Envirochem fibre counting report for the 8th May 2018 is presented in **Appendix K**.

2.1.4 Hydrocarbon hotspots identified during the construction phase

During the construction phase possible hydrocarbon hotspots were discovered within Phase 2A comprising; oily deposits at the ground surface within the vicinity of Plot 325 following heavy rainfall and black staining / cobble sized fragments of bitumen within the vicinity of Plot 317.

2.1.4.1 Plot 325 hotspot

The oily deposits observed at the ground surface in the north western portion of Plot 325 were discovered on the 29th March 2018. Two validation samples named P3-A1 and P3-A2 were collected from the visually impacted surface soils, as shown on **Figure 6**. These samples were collected to determine whether the affected material could remain in-situ or whether further assessment and/or remediation may be required. In situ screening of the two validation samples indicated low levels of volatiles to be present (maximum 7.70 pppV). Whilst awaiting the laboratory analysis results the area was covered over with impermeable geo-membrane and cordoned off using herras fencing.

Laboratory analysis subsequently indicated that primarily heavy end hydrocarbons were present with all measured concentrations below the human health GAC detailed in **Appendix D**. The laboratory results can be found in **Appendix E**, laboratory certificate ref: 18-02433-1. Based on the results it was agreed with Arun District Council that this material could remain in-situ beneath the cover layer and/or buildings/hardstanding. It was also agreed that any material in this area required to be removed, would need to be segregated and stockpiled on hardstanding/impermeable membrane and covered by impermeable membrane, prior to off-site disposal.

However, further hydrocarbon impacts comprising free phase product and fragments of rusted corroded metal (suspected to be the remains of historic oil drums), were discovered at Plot 325 on the 10th May 2018 during footing excavations. The groundworks in the area were ceased upon the discovery, a sample of the free phase product resting in the footing collected, and the EHO for Arun District Council (Matthew Kennett) informed. The laboratory product ID test results are presented in **Appendix E**, which indicate the product to comprise hydrocarbons in the range C12 to C44 (laboratory certificate ref: 18-03643-1).

Following discussions with the EHO, on the 17th May 2018 hydrocarbon hotspot removal works were undertaken in the vicinity of Plot 325. A suitably qualified geo-environmental engineer supervised removal of all materials visually or olfactory impacted by hydrocarbons and subsequently collected validation samples from the sides and base of the excavation (HC hotspot Plot 325 base, HC hotspot Plot 325 N side, HC hotspot Plot 325 E side, HC hotspot Plot 325 S side and HC hotspot Plot 325 W side). Sample descriptions and in-situ volatile screening results (maximum recorded 1.2 ppmV) for each validation sample are presented in **Appendix F**.

The validation samples were submitted for laboratory analysis for total petroleum hydrocarbons (TPH CWG), benzene, toluene, ethylbenzene and xylenes (BTEX) and asbestos. The results were all found to be below the applicable RSK GAC for residential end use presented in **Appendix D**, demonstrating that the extent of the hydrocarbon

hotspot had been removed. The laboratory analysis results are presented in **Appendix E**, laboratory certificate ref: 18-03945-1.

Photographs taken during the works are presented in **Appendix G**.

2.1.4.2 *Plot 317 hotspot*

On the 3rd and 9th April 2018, during service excavations in the vicinity of Plot 317's parking area, black staining and cobble sized fragments of bitumen were observed. Hydrocarbon odours were noted throughout the visually impacted materials. A suitably qualified geo-environmental engineer supervised the service excavation works and subsequently collected samples from the southern face of the Plot 317 service trench excavation (samples A to D). Sample descriptions and in-situ volatile screening results for each validation sample are presented in **Appendix F**.

Volatiles were screened in each sample collected using a PID. Volatiles concentrations recorded in samples C and D (collected from the central portion of the southern excavation face) were 82.5 ppmV and 51.4 ppmV respectively. Volatiles concentrations in samples A and B were much lower at 1.2 ppmV and 3.1 ppmV respectively. Subsequently, samples C and D were submitted for laboratory analysis for total petroleum hydrocarbons (TPH CWG), BTEX and asbestos. The laboratory analysis results are presented in **Appendix E**, laboratory certificate ref: 18-02669-4.

The results were all below the applicable RSK GAC for residential end use presented in **Appendix D**, with the exception of sample D, which contained chrysotile asbestos fibres at <0.001 % by weight asbestos and aromatic (>C12-C16) concentrations of 159 mg/kg, which exceeds the RSK GAC for >C12-C16 of 140 mg/kg. No obvious source of the black staining and bitumen cobble impacts was observed during the service excavation works, therefore further delineation, localised source removal and validation works were conducted in this area on the 2nd July 2018.

The works on the 2nd July 2017 involved a suitably qualified geo-environmental engineer supervising the removal of soils containing black staining and cobble sized fragments of bitumen. The engineer subsequently collected validation samples from the sides and base of the excavation (base, north, east, south and west), as shown on **Figure 6**, which were submitted for laboratory analysis for TPH CWG, BTEX and asbestos. The results were all below the applicable RSK GAC for residential end use presented in **Appendix D**, demonstrating that the extent of the hydrocarbon hotspot had been removed. The laboratory analysis results are presented in **Appendix E**, laboratory certificate ref: 18-05463-1.

Sample descriptions and in-situ volatile screening results for each validation sample are presented in **Appendix F** and photographs taken during the works are presented in **Appendix G**.

2.1.4.3 *Stockpiling and off-site disposal of hydrocarbon impacted materials*

Materials removed during the hydrocarbon hotspot works at Plots 325 and 317, as shown on **Figure 6**, were segregated and temporarily stockpiled on and covered by impermeable membrane prior to off-site disposal. Two samples were collected from the stockpiled hydrocarbon impacted materials for waste acceptance criteria (WAC) analysis, as presented in **Appendix E**, laboratory certificate ref: 18-03945-2. Sample descriptions and in-situ volatile screening results (maximum recorded 78.7 ppmV) for each WAC sample

are presented in **Appendix F**. The results indicated that the materials comprised stable non-reactive hazardous waste. The results were forwarded to the chosen landfill site by the Principal Contractor and the materials subsequently disposed off-site in accordance with best practice.

The total amount of hydrocarbon impacted materials subsequently removed from site was approximately 171.6 tonnes. Waste disposal tickets for this material are provided in **Appendix I**. Photographs of the stockpiled materials prior to offsite disposal are presented in **Appendix G**.

2.1.5 Septic tank hotspots identified during the construction phase

2.1.5.1 Plots 320 – 323 hotspot

On the 17th April 2018 historic septic tanks were uncovered in the vicinity of Plots 320 – 323. Following removal of the tanks, visual and olfactory evidence of sewage impacts was observed in the surrounding soils adjacent to the southern of the two tanks. As such, 3 samples were taken from the base, east wall and west wall of the excavation (as shown on **Figure 6**), to determine whether the impacted materials required off-site disposal or were suitable for re-use on site. The samples were submitted for laboratory analysis of ammonium, nitrogen, total organic carbon, coliforms, E.coli and asbestos screen. The excavation was backfilled following sample collection awaiting the laboratory analysis results.

The sampling results are presented in **Appendix E**, in laboratory certificate 18-02971-1. Measured concentrations of total coliforms in two of the three samples and ammonium in all three of the samples were measured at least two orders of magnitude greater than their respective laboratory limits of detection (LMDL), with maximum concentrations of total coliforms and ammonium recorded at 1600 cfy/g and 231 mg/kg respectively. Asbestos fibres were not detected in the three samples collected.

There are no readily available GAC to demonstrate that the measured concentrations of the compounds associated with the septic tank impacts do not pose a risk to human health or controlled waters. Therefore, following consultation with the EHO at Arun District Council, it was agreed that localised removal of visual and olfactory evidence of septic tank impacted soils and validation works be completed in this area. Email correspondence dated 15th May 2018 presented in **Appendix C** documents the agreed scope of works.

The backfill material at Plots 320 – 323 was excavated on 12th July 2018 in accordance with the agreed scope of works. Following excavation of the backfill materials, the original extent of the septic tank excavation was extended to remove soils containing visual and olfactory evidence of septic tank impacts, as shown on **Figure 6**. A total of 5 No. validation samples were collected from the base and sides of the final septic tank hotspot excavation for Plots 320-323, as shown on **Figure 6**. A photographic log of the validation works is presented in **Appendix G** and sample descriptions are contained in **Appendix F**.

The validation samples were submitted for laboratory analysis of ammonium, nitrogen, total organic carbon, coliforms, E.coli and asbestos screen. The results are reported in laboratory certificate 18-05665-1, contained in **Appendix E**.

The results for total coliforms and E.coli, the two key microbiological contaminants of concern in relation to septic tank impacts, were all below the LMDL. Low level concentrations of ammonium (reported as NH₄) were recorded in the validation samples

at between <LMDL and 1.03 mg/kg. Asbestos fibres were also not detected in any of the validation samples collected.

Although low residual concentrations of ammonium remain present in soils, the extent of the septic tank hotspots was considered to have been removed and it was concluded that further remediation was not necessary in relation to the historic septic tanks beneath Plots 320-323 based on the following lines of evidence:

- The tanks were present at depth, with potentially impacted areas (i.e. base and sides) at a depth beyond which there is likely to be any contact by future site users;
- Total coliforms and E.coli have been reported below LMDL in the validation samples collected, indicating that the septic tank has not previously leaked extensively as following localised removal of visually and olfactory impacted soils there is no remaining microbiological impact; and
- Background concentrations of ammonia (NH₃) in the US are comparable to the residual concentrations reported i.e. typical US soils range between 1 to 5 mg/kg (ATSDR, (2004). Toxicological profile for Ammonia). Please note, no background data for UK soils has been identified.

The above conclusion was agreed with the EHO at Arun District Council, as documented in email correspondence dated 24th September 2018 presented in **Appendix C**.

Sample descriptions and in-situ volatile screening results for each validation sample are presented in **Appendix F** and photographs taken during the works are presented in **Appendix G**.

2.1.5.2 Plot 319 hotspot

During the excavation of footings for Plot 319 on 20th June 2018, an unexpected historic septic tank and a flint gravel soakaway feature in a state of disrepair were discovered. Given that the impacts observed were consistent to those associated with the Plot 320-323 septic tank hotspot, the scope of remedial and validation works agreed with the Council for the Plots 320-323 was adopted for this area.

Excavation works to delineate and remove the historic septic tank, flint gravel soakaway, and surrounding soils containing visual and olfactory evidence of septic tank impacts was undertaken in stages between 20th June 2018 and 17th July 2018. The excavation extent spread across the entire footprint of Plot 319 (as shown on **Figure 6**), to a maximum depth of 6.00 m bgl. A total of 5 No. validation samples were collected from the base and sides of the excavation of the septic tank area.

The validation samples were submitted for laboratory analysis of ammonium, nitrogen, total organic carbon, total coliforms, E.coli and asbestos screen. The results are reported in laboratory certificate ref: 18-05769-3, presented in **Appendix E**.

The results for total coliforms and E.coli, the two key microbiological contaminants of concern in relation to septic tank impacts, were all below the LMDL. Low level concentrations of ammonium (reported as NH₄) were recorded in the validation samples at between <LMDL and 11.1 mg/kg. Asbestos fibres were also not detected in any of the validation samples collected.

Although low residual concentrations of ammonium remain present in soils, the extent of the septic tank hotspot was considered to have been removed and it was concluded, and

agreed with the Arun District Council EHO, that further remediation was not necessary in relation to the historic septic tank at Plot 319, based on the same lines of evidence as outlined in Section 2.1.5.1.

Sample descriptions and in-situ volatile screening results for each validation sample are presented in **Appendix F** and photographs taken during the works are presented in **Appendix G**.

2.1.5.3 *Stockpiling and off-site disposal of septic tank impacted materials*

The arisings from both septic tank hotspots were stockpiled separately on polythene sheeting to prohibit any potential septic tank impacts leaching to ground, prior to off-site disposal. Two representative samples were taken from the stockpile of impacted material excavated from the Plot 319 septic tank hotspot. The samples were analysed for WAC, ammonium, nitrogen, total organic carbon, coliforms, E.coli and asbestos screen (laboratory certificate ref: 18-04950-1). The WAC analysis results were below the inert landfill waste acceptance criteria limits.

The stockpile results along with the initial test results associated with the septic tank impacts identified at Plots 320-323 (laboratory certificate ref: 18-02971-1) were forwarded to the chosen landfill site by the Principal Contractor and the materials subsequently disposed off-site in accordance with best practice.

The total amount of septic tank impacted materials subsequently removed from site was approximately 40 tonnes. Waste disposal tickets for this material are provided in **Appendix I**. Photographs of the stockpiled materials prior to offsite disposal are presented in **Appendix G**.

2.1.6 **South west bund A validation works**

RSK attended site on the 23rd June 2016 to undertake 4 hand dug pits (SWBV1 – SWBV4) in south west bund A to allow inspection of the subsoil component of the capping layer prior to Keltbray's site works concluding, as reported in RSK letter report 27621 L02, dated 24th October 2016. Four representative subsoil samples were collected during the south west bund A validation works in 2016. All of these were scheduled for metals, asbestos screen, PAHs and TPH CWG. All measured concentrations were below the human health GAC detailed in **Appendix D**, the laboratory results can be found in **Appendix E**, laboratory certificate ref: 16-03957-1.

In accordance with site level changes south west bund A was re-graded by the Principal Groundworks Contractor in May 2018. Prior to regrading of the bund the 'clean' subsoil was stripped and stockpiled separately. This material was re-used to regrade the bund below the level of the final capping layer. The south eastern portion of the bund was removed entirely, as shown on **Figure 6**, and the southern and western portions of the bund regraded.

Made ground removed during this process was re-used at depth in the south eastern POS area in accordance with remedial strategy reference 27621 R08 (00), dated January 2018. During the material movement, as well as dust mitigation measures being maintained in accordance with the remedial strategy, reassurance air monitoring was conducted at the site (the results of which are presented in **Appendix K**) and Economic Insulations maintained a site presence to provide advice on ACM as required.

In June 2018 RSK observed the placement of geo-marker membrane and a clean capping subsoil layer across the entirety of the remaining south west bund A. Subsequently, RSK attended site to undertake an additional No. 2 hand dug pits (SWBV1 18 – SWBV2 18) to revalidate the clean capping layer across the western portion of south west bund A following topsoil placement.

The validation works conducted on the 1st November 2018 found that the capping layer comprised at least 600 mm of soil, with the general succession comprising 0.25 m to 0.30 m of topsoil above 0.30 m to 0.55 m of subsoil, underlain by an orange geo-marker membrane. The above is in line with capping layer requirements detailed in RSK report ref: 27621 R03 (02). The descriptions of the strata encountered, samples taken and field observations are included on the exploratory hole records in **Appendix F**. A photographic log is presented within **Appendix G**.

A total of 3 representative soil samples were collected during the validation works on the 1st November 2018. All samples were scheduled for metals, asbestos screen, PAHs and TPH CWG. All measured concentrations were below the human health GAC detailed in **Appendix D**, the laboratory results can be found in **Appendix E**, laboratory certificate ref: 18-09273-1.

The approximate area of south west bund A following the regrading works is 902 m². Therefore, it is considered that an appropriate number of samples have been obtained (3 No. samples), given the required capping layer thickness of 600 mm and the testing strategy of 1 sample per 250 m³.

However, revalidation of the southern portion of the bund has not yet been completed, as construction materials for Phase 2A are currently being stored in this area, as shown on **Figure 5**. Following removal of the construction materials and completion of the clean capping layer, RSK shall reattend site to complete validation inspection pits in this area and report under separate cover. In the interim this area has been cordoned off using herras fencing to prevent access by future residents. Photographic evidence of the above is presented within **Appendix G**.

2.1.7 Validation of the south west bund B

Given the limited access and danger due to overhead cables in the vicinity of south west bund B, investigation of this area has not been conducted. It was agreed with the EHO at Arun District Council that additional investigation was not required in this area and instead, secure fencing would be placed surrounding the bund and prickly vegetation planted across the bund to prevent public access. Emails dating from the 27th and 28th February 2017 documenting this are presented in **Appendix C**.

On the 20th November 2018 RSK attended site and confirmed that appropriate prickly vegetation and secure fencing had been placed in the vicinity of south west bund B, which is in line with remedial requirements agreed with the EHO.

Photographic evidence of the above is presented within **Appendix G** and the approximate location of the fence line is presented on **Figure 6**.

2.1.8 Supplementary tank validation works

On 25th January and 8th March 2016 RSK carried out validation works in the vicinity of the former above ground fuel storage tanks located in the southern portion of Phase 2A,

details of the investigation can be found within RSK report ref. 27621L01/ad presented in **Appendix B**.

The tank validation works in 2016 found evidence of localised oil seepage at validation location V2, at a depth of around 0.3 m bgl. No other positions showed signs of oil seepage. It was recommended that the vicinity of V2 be further investigated by a suitably qualified geo-environmental consultant to identify the extent of oil contamination in this area of the site, with a view to excavating visually impacted soils from this location under the supervision of a suitably qualified geo-environmental engineer, for disposal as hazardous waste or treatment and re-use on site.

In spite of the visual evidence for localised oil seepage in location V2 the soil sample collected from this location at 0.3 m, along with all other nine samples collected in relation to this feature (V1, V3- V10) were not in excess of the RSK GAC presented in **Appendix D**.

Following removal of the former tanks concrete base and other historic surface infrastructure in this area, it is understood that levels in this area of the site were raised by approximately 0.6 m to 0.8 m using clean site won subsoil from the south eastern POS area and imported topsoil. Therefore, the original sampling location would be expected to be around 0.9 m to 1.1 m below current ground levels.

On the 7th February 2019 RSK carried out additional validation works within the vicinity of V2, which comprised supervising the excavation of a 3 by 3 m² trial pit, as shown on **Figure 6**. The trial pit was positioned in relation to validation location V2 using a GPS.

The exploratory hole revealed that this area is underlain by 0.15 m of topsoil followed by reworked River Terrace Deposits to a depth of 0.5 m bgl, which comprise the clean capping layer. Beyond made ground comprised of slightly sandy gravelly clay with fragments of brick, plastic, wood and concrete was encountered to 1.8 m bgl, underlain by natural soils of the River Terrace Deposits to the maximum excavation depth of 2.0 m bgl. No visual or olfactory signs of hydrocarbon contamination were observed during the excavation. Sample descriptions are contained within **Appendix F**. A photographic log is presented within **Appendix G**.

It is noted that the different materials types were excavated and placed in separate stockpiles during the works to prevent cross contamination between the clean capping materials with the underlying made ground. Materials were subsequently replaced in the order of excavation.

A total of 11 validation soil samples were taken for in-situ volatile screening using a PID, 2 from the excavation faces, 2 from the excavated material at 1.00 m to 1.10 m bgl and 1 from the final base depth of the excavation at 2.00 m bgl, as shown on **Figure 6**. The in-situ screening results of the validation samples indicated low levels of volatiles between <0.1ppmV and 0.1 ppmV. It should be noted that free phase product/oil seepage was not noted during the excavation works.

Of the 11 validation soils samples collected 6 of the samples were submitted for laboratory analysis (one from each side of the excavation, one in the approximate original location of V2 (base 1) and one from the base (base 3) of the excavation for laboratory analysis of TPH CWG, BTEX and asbestos screen.

All measured concentrations were below the human health GAC detailed in **Appendix D**, laboratory results can be found in **Appendix E**, laboratory certificate ref: 19-01308-1.

No visual or olfactory signs of hydrocarbon contamination have been observed in the vicinity of V2 since the original localised oil observed in the 2016. Further to this all validation samples (including V2) are below the RSK GAC for residential gardens. Therefore, no further validation or remedial works are deemed necessary in relation to the historic ASTs.

2.1.9 Clean cover layer placement

Following completion of the groundworks within Phase 2A and in accordance with the remedial strategy, RSK are to validate the placement of a geo-marker membrane covered by a 600 mm thick clean capping layer across all gardens (front and back) in Phase 2A and south west bund A. The soil components of the 600 mm clean capping layer are to comprise a minimum of 150 mm of topsoil underlain by 450 mm of subsoil. Following validation works conducted in the vicinity of the historic ASTs and nitric acid store, the soft landscaped area in the south of Phase 2A (as shown on **Figure 4**), is considered to require the placement of a 450 mm thick capping layer comprising 150 mm of topsoil underlain by 300 mm subsoil.

‘Clean’ subsoil is to be taken from the clean stockpile resulting from the Keltbray central POS works or the ‘clean’ stockpile from the Blaze south eastern POS works. To date no such capping layer has been placed within Phase 2A gardens. Upon the placement of topsoil at individual plots, RSK shall undertake formal validation works to confirm the suitable chemical status and thickness in accordance with the remedial strategy, and the works documented in letter reports for submission to the National House Builders Council (NHBC) and Local Authority.

2.1.10 Health and Safety regarding asbestos within Phase 2A

In accordance with the RSK remedial strategy reports (refs. 27621 R03 (02) and 27621 R08 (00)) the Principal Contractor (Blaze) prepared health and safety risk assessment and method statement documentation (presented in **Appendix J**), pertaining to how potential risks from asbestos in accordance with the control of asbestos regulations (2012) would be managed on site.

The following health and safety methods were put in place onsite to reduce associated health risks and prevent cross contamination between clean and dirty designated areas:

- RSK maintaining a presence to conduct watching brief validation works as and when required;
- Fencing erected between clean and dirty designated areas during works in Phase 2A. Fencing remained erected for the entire works, a duration of approximately seven weeks, during which the majority of Phase 2A groundworks were completed. After completion of the majority of the ground works the Principal Contractor reviewed their health and safety requirements in agreement with Economic Insulations, (Blaze revised risk assessment and method statement revision 3, presented in **Appendix J**);
- Economic Insulations (asbestos contractor) present during excavations on a full-time basis until the end of September 2018. A copy of Economic Insulations plan of work and risk assessment is presented in **Appendix J**;
- Clean and dirty access routes to Phase 2A for plant established;

- Materials locally excavated and tracked across adopted “dirty” route directly to the south eastern borrow pit area;
- “Dirty” excavator and transporter used. Plant not to be removed from designated dirty area unless jet washed;
- All operatives to be inducted in the health and safety method statement;
- All operatives to have received asbestos awareness training;
- Exposed stockpiles to be dampened down and covered with terram to prevent asbestos fibres becoming airborne; and
- Reassurance air monitoring conducted throughout works undertaken between 16/04/2018 – 20/07/2018, air monitoring results are presented in **Appendix K**.

3 VALIDATION RESULTS SUMMARY WITHIN PHASE 2A

Remedial works at the site are being carried out in a phased approach as the proposed development progresses. The following is applicable to the Phase 2A part of the site as shown on **Figures 2 and 3**.

3.1 Validation within Phase 2A

Investigation works prior to remediation of the site identified asbestos across Phase 2A (as detailed within Sections 1.1 and 2.1.1). Further to this during validation and enabling works at Phase 2A the following contamination was observed:

- Localised amosite insulation in the vicinity of TPP3-403 as shown on **Figure 6** and detailed in Sections 2.1.2 and 2.1.3;
- Hotpots of hydrocarbon impact in the vicinity of the Plots 317 and 325, as detailed within Section 2.1.4;
- 2 no. septic tanks in the vicinity of Plots 319 and 320 – 323, as detailed within Section 2.1.5; and
- Localised oil observed in validation sampling location V2 in 2016, as detailed in Section 2.1.8.

The following remediation and validation works have been undertaken within Phase 2A:

- Removal and off-site disposal of localised loose amosite insulation as detailed in Section 2.1.3;
- Hydrocarbon hotspot delineation works and localised impact removal for off-site disposal as detailed in Section 2.1.4;
- Septic tank delineation works localised impact removal for off-site disposal as detailed in Section 2.1.5;
- Validation sampling in the vicinity of the western part of the south western bund A (as detailed in Section 2.1.6);
- Validation of the south western bund B (as detailed in Section 2.1.7); and
- Supplementary validation works in the vicinity of the of localised oil impact observed in 2016, in relation to the historic ASTs, as detailed in Section 2.1.8.

On the basis of the results discussed within Section 2.1.1, a decision was made by the client to place a uniform 600 mm of clean capping layer, underlain by a geo-marker membrane across all residential gardens (front and back) in Phase 2A. A 600 mm clean capping layer underlain by a geo-marker membrane is also required across south west bund A, the southern portion of which is yet to be validated (as shown on **Figure 5**). A 450 mm thick clean cover layer is also required in the communal soft landscaped area in the south of Phase 2A. The capping layer thickness requirements for the entirety of Phase 2A are summarised on **Figure 4**.



No further remediation or validation works are deemed necessary in Phase 2A, other than the application of the capping layer requirements detailed above.

All garden validation testing data will then be submitted to the NHBC for approval prior to release of any CML's. Once complete the south west bund B and southern landscaped area validation results shall be submitted to the Local Authority.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Based upon the remedial works carried out to date within the Phase 2A, it is considered that the area is suitable for the proposed residential end use, subject to the results of the garden/soft landscaping validation works (including the southern portion of the south western bund A).

RSK are satisfied that the remedial works carried out to date at the site by CALA Homes and Keltbray, have been carried out in accordance with the agreed remedial strategies. In accordance with the agreed phased approach further remediation and validation within Phase 2B, the central and south eastern POS's and the north eastern bund are ongoing at the site.

4.2 Recommendations - Phase 2A

The following validation and verification requirements need to be completed across Phase 2A prior to this area of the site being deemed suitable for the proposed residential end use:

- Garden (Plots 308 to 325) validation sampling and reporting; and
- Soft landscaping validation sampling in the vicinity of the southern portion of the south western bund A and soft landscaping in the south of Phase 2A.

4.3 Recommendations – Phase 2B/POS/north east bund

The following validation and verification requirements need to be completed across Phase 2B, the central and south eastern POS's and the north eastern bund, prior to these areas of the site being deemed suitable for the proposed residential and public open space end uses:

- Re-validation of the central POS area capping materials following placement of further 'clean' site won subsoil to raise levels in this area and imported topsoil;
- Validation of the south eastern POS area capping materials following placement of further 'clean' site won subsoil and imported topsoil;
- Re-validation of the north east bund clean capping layer following installation of cut throughs in accordance with design layout changes (Phase 2B);
- Garden and soft landscaping validation sampling and reporting Phase 2B; and
- Post remediation validation reporting for all of the above in relation to Phase 2B.

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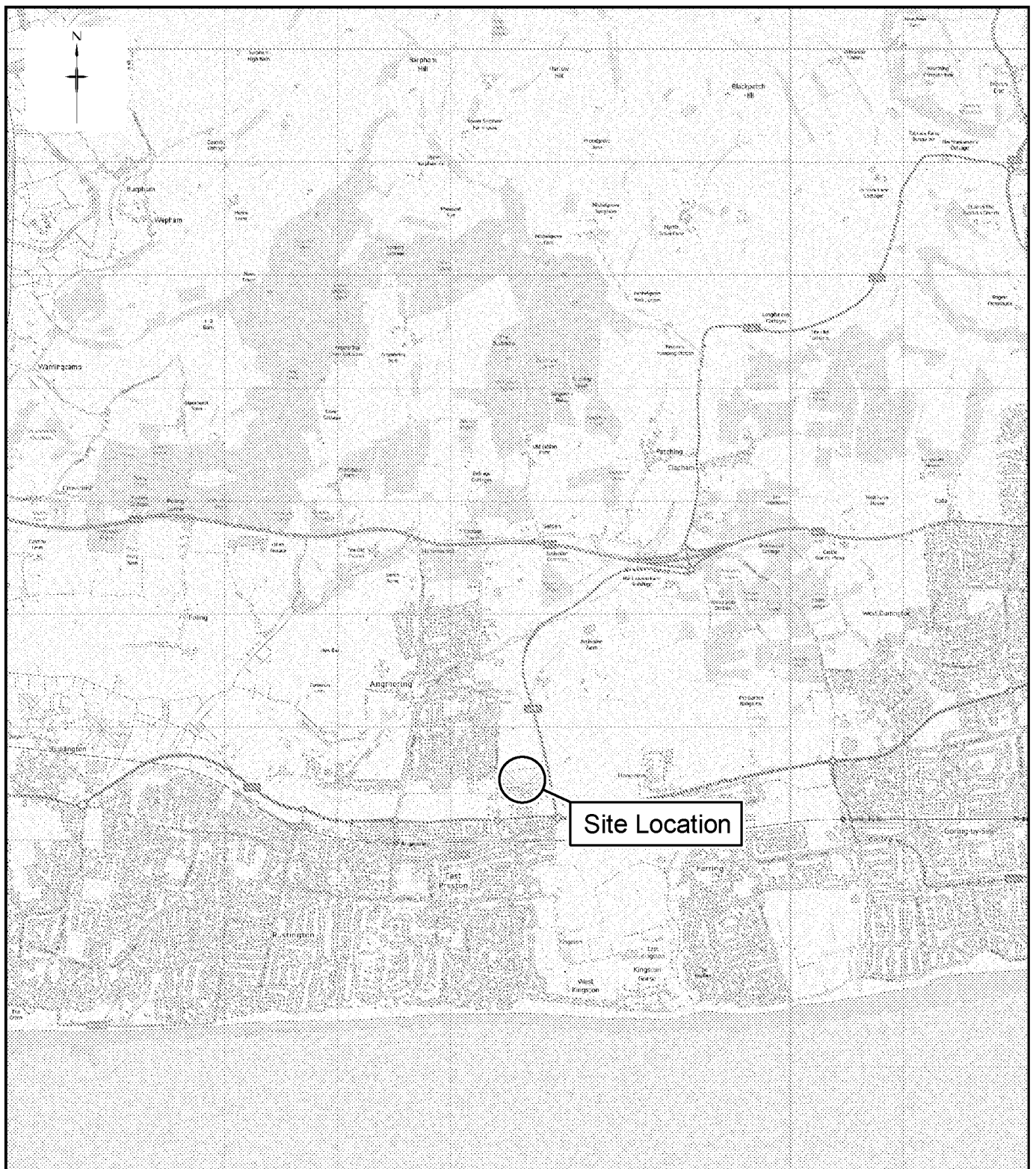
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FIGURES



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Project Title

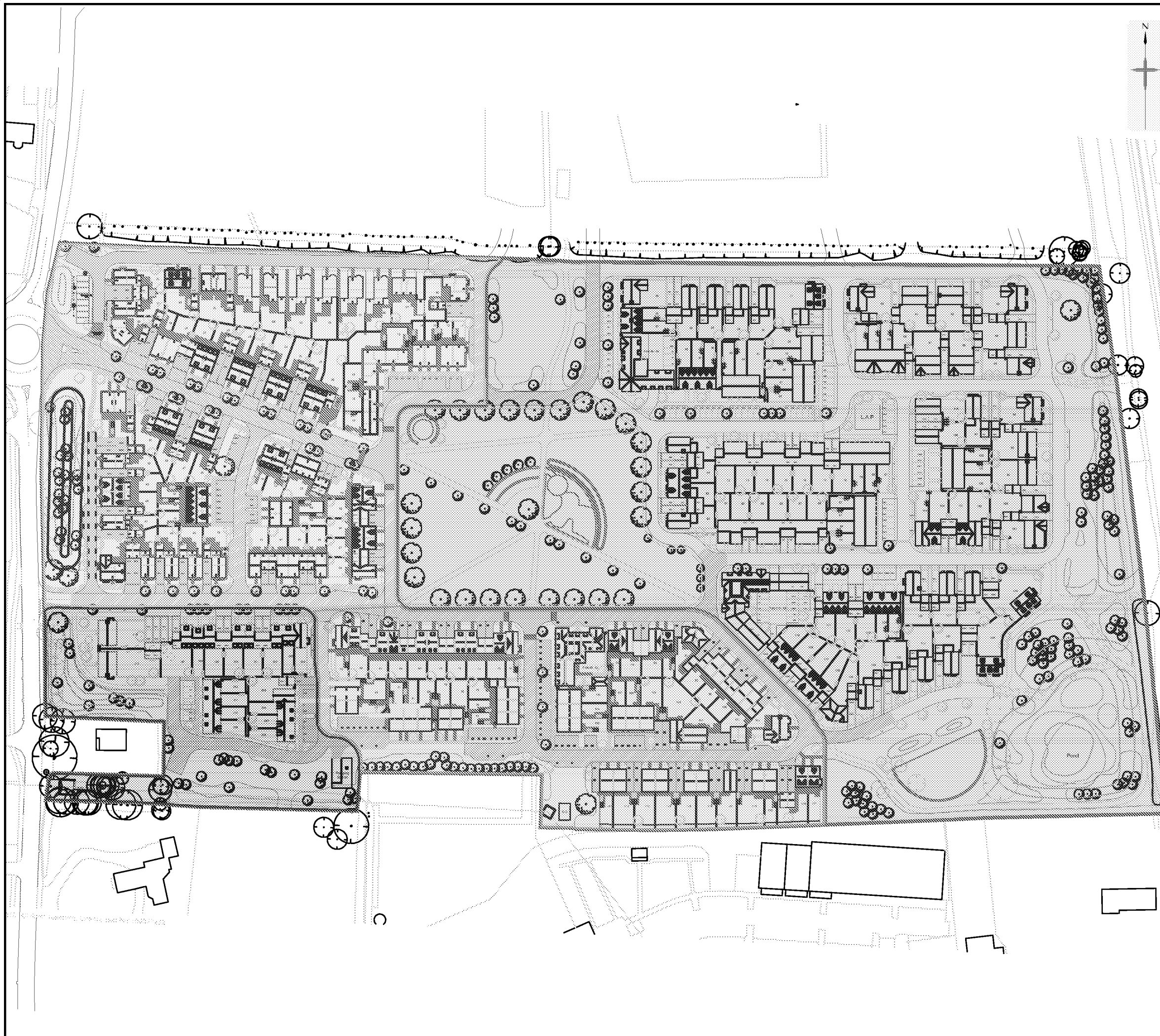
**FORMER WEST END NURSERY,
ANGMERING**

Drawing Title

SITE LOCATION MAP

Rev	Drawn	Date	Checked	Date	Approved	Date
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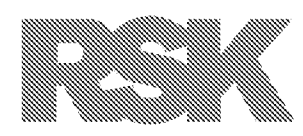
Project Number	Drawing File	Drawing Number
27621 - R10 (00)	27621 - SLP.dwg	FIGURE 1



LEGEND

- Site Boundary
- Phase 1A
- Phase 1B
- Phase 2A
- Phase 2B

Rev.	Date	Amendment	Drawn	Chkd.	Appd.



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Project Title
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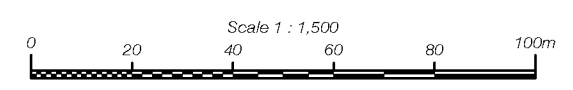
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PROPOSED DEVELOPMENT PLAN

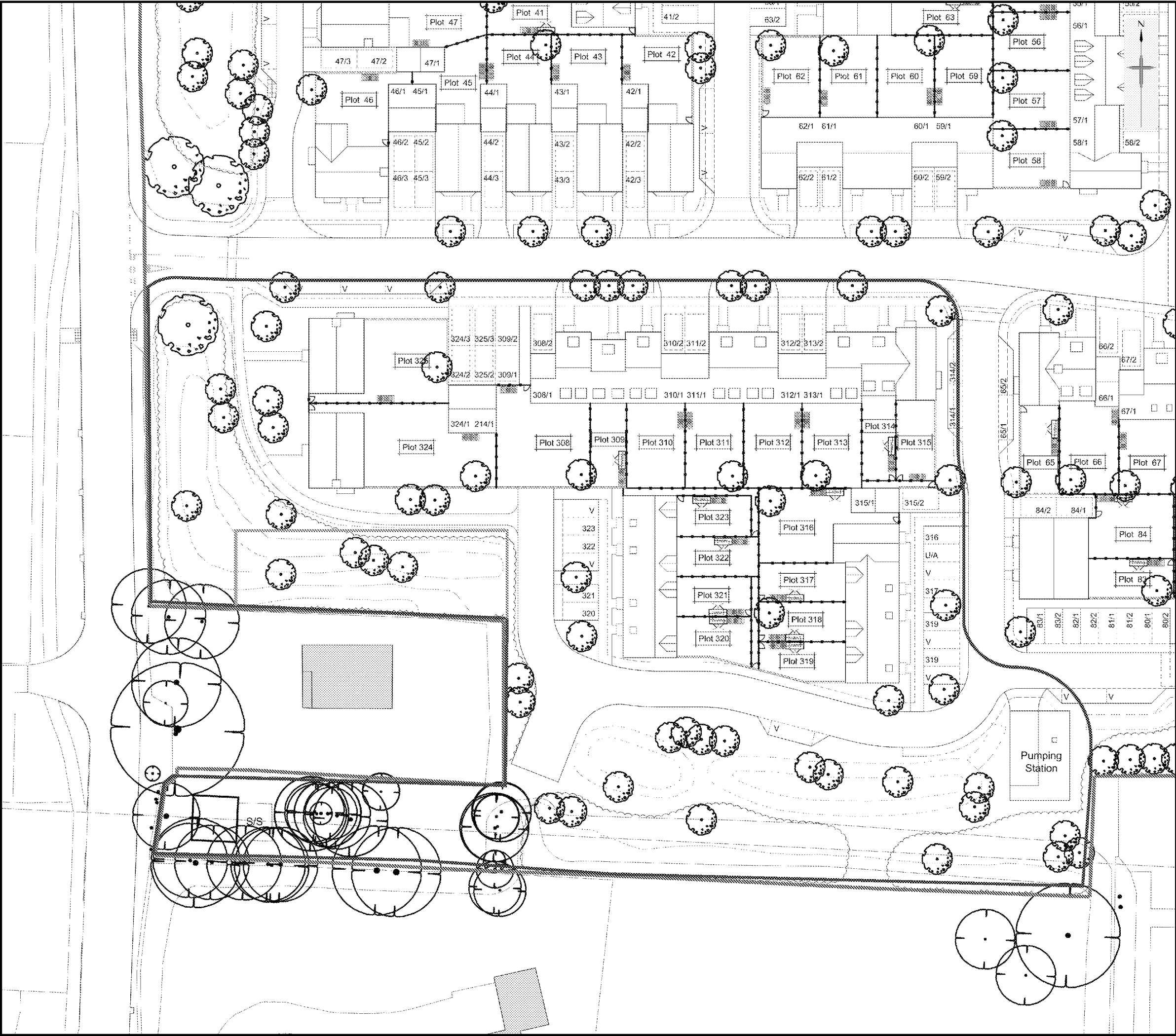
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ASC	05.12.18	JL	05.12.18	CC	05.12.18

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1:1500	A3	m

Project No.	Drawing File
27621 - R10 (00)	27621 (R10-00) Fig 2

Drawing No.	Rev.
FIGURE 2	P1





LEGEND

- Site Boundary
- Phase 2A Boundary
- Fenced Off Area

Notes:

Temporary fencing in place until such time that construction materials stored here are removed & revalidation of the SW bund A capping layer can be completed.

P1	05.12.18	First Issue.	ASC	JL	CC
Rev.	Date	Amendment	Drawn	Chkd.	Appd.



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Project Title
LAND AT WEST END NURSERY, ANGMERING

Drawing Title
PHASE 2A LAYOUT PLAN

Drawn ACS	Date 05.12.18	Checked JL	Date 05.12.18	Approved CC	Date 05.12.18
Scale 1:500	Orig Size A3	Dimensions m	Project No. 27621 - R10 (00)	Drawing File 27621 (R10-00) Fig 3.dwg	
Drawing No. FIGURE 3					Rev. P1

