The Landings, Ford Airfield

Phase RM1 (North)

Drainage Technical Note
RM1_05.A
August 2024

Vistry Group

ARUN DISTRICT COUNCIL F/1624/REE

ARDENT
CONSULTING ENGINEERS
AN EMPLOYEE OWNED COMPANY

VISTRY HOMES LIMITED

THE LANDINGS, LAND AT FORD AIRFIELD, FORD

RM1 (North) Drainage Technical Note

REPORT REF.
2205771-R17-C

September 2024

[redacted]

Email: enquiries@ardent-ce.co.uk

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Document Control Sheet

REV	ISSUE PURPOSE	AUTHOR	CHECKED	APPROVED	DATE
-	DRAFT	VL	AD	MR	08/08/2024
A	FINAL	VL	AD	MR	16/08/2024
B	FINAL	VL	AD	MR	22/08/2024
C	FINAL	TKH	TKH	MR	06/09/2024

Distribution

1. Introduction

1.1. Ardent Consulting Engineers (ACE) has been appointed by Vistry Homes Limited to advise on the Flood Risk and Drainage aspects of the proposals for a residential-led mixed-use development on Land at Ford Airfield, Ford.

1.2. Outline (all matters reserved except access) permission (ref F/4/20/OUT) was granted in July 2023 for

"the development of up to 1,500 dwellings (Use Class C3), 60-bed care home (Use Class C2), up to 9,000 sqm of employment floorspace (Use Classes B1), local centre of up to 2,350 sqm including up to 900 sqm retail / commercial (Use Classes A1-A5) and 1,450 sqm community / leisure floorspace (Use Classes D1-D2), land for a two-form entry primary school (Use Class D1), public open space, allotments, new sports pitches and associated facilities, drainage, parking and associated access, infrastructure, landscape, ancillary and site preparation works, including demolition of existing buildings and part removal of existing runway hardstanding"

1.3. The development will be brought forward via a number of reserved matters applications. This Drainage Technical Note (TTN) covers the Reserved Matter 1 (RM1) application, which consists of

Approval of reserved matters (layout, scale, appearance and landscaping) following outline consent F/4/20/OUT for phase RM1 (North), for the erection of 340 no. residential dwellings plus associated roads, infrastructure, parking, landscaping, open space & play areas, and associated works.

1.4. This DTN outlines the foul and surface water design for the RM1N Phase. A separate DRN (Report Ref. 2205771-R16) has been produced to cover the foul and surface drainage strategy for the Infrastructure Reserved Matters (IRM) application, which focuses on the enabling infrastructure, including the strategic foul and surface water drainage networks and SuDS features for the wider development site.

1.5. A site-wide drainage strategy was produced by JNP Group as part of the outline planning application and has been used as the basis for the IRM detailed drainage design. The IRM drainage design has been updated to incorporate further findings of ground investigations as well as pre-application discussions with West Sussex County Council as the LLFA. A response to comments made by the LLFA as part of pre-

application discussions is included in Ardent's letter response in **Appendix B** (Ref. MCE/2205771).

Phase RM1 location and site layout

1.6. The approximate RM1 (North) site boundary relative to the wider development area are shown in Figure 1-1 below. A site layout is shown in Figure 1-2, and included in **Appendix A**.

Figure 1-1: Site Boundaries and Surrounding Area

Figure 1-2: Site Layout

2. Surface Water Drainage

Technical Standards

2.1. The proposed surface water drainage strategy for the development is in accordance with the following technical standards and best practice guidance:

- West Sussex County Council (WCCC) Sustainable Drainage Systems Design Guidance;
- CIRIA SuDS Manual (C753);
- Non-statutory technical standards for sustainable drainage systems. A Best Practice Guidance was published by the Local Authority SuDS Officer Organisation (LASOO) in July 2015 to accompany this document;
- The National Planning Policy Framework.

RM1 Drainage Design

2.2. Surface Water Drainage drawings are included in **Appendix D**. It should be noted that the Indicative Sitewide Drainage Strategy plan (drawing no. 2205771 - D020) has been provided for context only. The drainage design for this RM application is shown on drawings 2205771 – D140 (Sheet 1 of 2) and 2205771 - D141 (Sheet 2 of 2) in **Appendix D**. Detention basins and outfall arrangements form part of the strategic drainage network which is covered in a separate Infrastructure Reserved Matters application, and described in Ardent's Drainage Technical Note Ref. 2205771-R16.

Drainage Discharge Hierarchy

2.3. In line with CIRIA C753's discharge hierarchy, drainage strategies must aim to use a method of discharge as high up the following hierarchy as possible:

1. Store water for later use
2. Discharge to the ground via infiltration
3. Discharge to a surface water body
4. Discharge to a surface water sewer

5. Discharge to a combined sewer

2.4. It is proposed to include water butts across the site for water re-use. However, the benefits of rainwater harvesting on a specific design storm event cannot be quantified, due to the variable availability of storage within the structure. As such, these cannot be included in the drainage strategy calculations.

2.5. The surface water drainage strategy approved at outline stage included a series of infiltration basins draining this area of the site. However, subsequent ground investigations including winter groundwater monitoring were undertaken by Omnia Ltd between December and April 2024 (refer to **Appendix C**). Within the RM1N boundary, the investigations recorded groundwater levels as shallow as 0.99 m bgl. As a result, infiltration systems have been discarded as a method of disposal of surface water.

2.6. In line with the drainage discharge hierarchy outlined above, it is proposed to attenuate flows from RM1N within an attenuation basin prior to discharging surface water into an ordinary watercourse located to the north of the site.

Proposed discharge rates

2.7. Based on the natural topography of the site, surface water runoff from the RM1 plot is conveyed via a piped drainage network into a strategic detention basin, prior to discharging at the equivalent mean greenfield runoff rate (Qbar). Flows will be controlled by a vortex flow controls. It should be noted that the detention basin and outfall arrangements form part of the strategic drainage network which is covered in a separate Infrastructure Reserved Matters application, and described in Ardent's Drainage Technical Note Ref. 2205771-R16.

2.8. A Qbar rate of 2.42 l/s/ha has been calculated for the site using the FEH method. The proposed maximum allowable discharge rate for the site is based on the gross development area and including a 10% allowance for urban creep.

Surface Water Drainage Calculations

2.9. Causeway Flow Modelling results for the wider site are included in **Appendix E**. FEH 2022 data has been used in the calculations. The results demonstrate there is not flooding onsite for all rainfall events up to the 1 in 100 year +40%CC, and there is no surcharging in the network during the 1 in 2 year event.

2.10. Following discussions with the LLFA, a sensitivity check has been carried out using a Volumetric Run-off Coefficient (CV) value of 1. The results demonstrate that the additional runoff is stored within the available freeboard of the detention basins.

2.11. All outfalls have been modelled as fully surcharged up to the flood levels (assumed as top of bank levels) in a 1 in 100 years + 40% CC event.

Designing for Exceedance

2.12. Drainage exceedance may occur if the rate of surface water runoff exceeds the capacity of the drainage system, the receiving water or piped system becomes overloaded or blocked, or when the outfall becomes restricted due to flood levels in the receiving watercourse.

2.13. Exceedance routes have been identified in drawing no. 2205771- D020 in **Appendix D.** As mentioned above, all outfalls have been modelled as fully surcharged up to the flood levels (top of bank levels) in a 1 in 100 years + 40% CC event.

Future Maintenance

2.14. The drainage elements covered within the IRM application (the sewer network, swales and basins) will be offered for adoption by a New Appointments and Variations (NAV) company company under a S104 agreement.

2.15. The connecting pipework will be maintained by a private company.

2.16. A Maintenance and Management Plan for all drainage features is provided within **Appendix F**, detailing the operational requirements for each drainage element for the lifetime of the development.

3. Foul Water Drainage

3.1. Details of the strategic foul drainage infrastructure for the wider site have been submitted as part of the IRM application, and are described below for information. The foul drainage network to be approved under this application is shown in the drainage drawings in **Appendix D**.

3.2. The foul drainage strategy has been designed to convey foul flows to 3no. proposed adoptable pumping stations (Pump Stations 1, 2 and 3), which will in turn discharge into a fourth pump station (Terminal Pump Station 4). Foul Pump Station 4 will pump flows to Ford wastewater treatment works to the east of the site.

3.3. All pumping stations will be fitted with a telemetry system and emergency storage to adoptable standards.

3.4. Refer to Table 3-1 below for pumping station catchment details.

Table 3-1 Foul drainage catchments

Station Reference	Type	Catchment
Pump Station 1	Satellite	132 Dwellings plus 12l/s design flow from an adjacent development
Pump Station 2	Satellite	717 Dwellings
Pump Station 3	Satellite	437 Dwellings
Pump Station 4	Terminal	98 Dwellings, 60 bed care home, 2 form entry primary school, 2320m2 local centre plus pumped flows from Pump Stations 1,2 and 3

3.5. Total foul flows from Terminal Pump Station 4 have been calculated as 87.51 l/s. Desing flows for each pumping station are set out in Table 3-2 below.

Table 3-2 Foul drainage design flows

Pump Station	Design Flow (l/s)
1	18.22
2	33.19
3	20.23
4* (*Total site flows, including flows from PS 1, 2 and 3)	87.51

4. Summary and Conclusion

4.1. Ardent Consulting Engineers (ACE) has been appointed by Vistry Homes Limited to advise on the Drainage and flood risk aspects of the proposals for a residential-led mixed-use development on Land at Ford Airfield, Ford.

4.2. The development will be brought forward via a number of reserved matters applications. This DTN outlines the foul and surface water design for the RM1N Phase. A separate DTN (Report Ref. 2205771-R16) has been produced to cover the foul and surface drainage strategy for an Infrastructure Reserved Matters (IRM) application, which focuses on the enabling infrastructure, including the strategic foul and surface water drainage networks and SuDS features for the wider development site.

4.3. The Local Planning Authority (LPA) is Arun District Council (ADC) and the Lead Local Flood Authority (LLFA) is West Sussex County Council (WSCC). Pre-application discussions with the LLFA have taken place and have informed the drainage design for the RM design phase.

4.4. The surface water drainage strategy for the RM1N phase proposes to attenuate flows within an attenuation basing before discharging into an ordinary watercourse located to the north of the site at a rate restricted to the equivalent mean greenfield runoff rate (Qbar). It should be noted that the detention basin forms part of the strategic drainage network which is covered within a separate Infrastructure Reserved Matters application.

4.5. Causeway Flow results demonstrate there is not flooding onsite for all rainfall events up to the 1 in 100 year +40%CC, and there is no surcharging in the network during the 1 in 2 year event.

4.6. All outfalls have been modelled as fully surcharged up to the flood levels (assumed as top of bank levels) in a 1 in 100 years + 40% CC event.

4.7. Details of the strategic foul drainage infrastructure for the wider site have been submitted as part of as separate IRM application, and included in this technical note for information.

4.8. A Maintenance and Management Plan for all drainage elements of the wider site is included in **Appendix F** of this DTN.

Appendix A

The Landings - Reserved Matters Phase 1

Vistry Homes Limited

0 25 50 m

Proposed Site Layout and Roof Plan

180641-TOR-RMN1-MP-P003 Rev:

Scale @ A0:1:500 FOR PLANNING

08/2024

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tor &co

Appendix B

ARDENT
CONSULTING ENGINEERS
AN EMPLOYEE OWNED COMPANY

Our Ref: MCE/2205771-DRAFT

Eleanor Read
West Sussex County Council
Ground Floor
Northleigh
County Hall
Chichester
PO19 1RH

22/08/2024

Dear Elanor,

Thank you for your pre-application comments following the second meeting and a review of the documents for the proposed development at Ford Airfield. We are continuing to work on the proposals and taking on board your comments.

Following your comments, please find our response in blue:

1. In the outline planning application, the Qbar rate was calculated to be 1.14 l/s/ha. The proposed discharge rates do not match Qbar. It is noted this is a very low rate, however, if discharging at over greenfield runoff rate, flood risk could increase elsewhere, which is against policy.

Ardent CE Response
As part of the planning application, JNP Group initially specified the QMed value manually as 1.0, which resulted in a Qbar rate calculation of 1.14 l/s/ha. However, we have recalculated the greenfield runoff rate using the FEH method, utilising point data from the FEH Web Service. This approach provides more accurate results, and the Qbar rate has been recalculated as 2.42 l/s/ha. Specifically, we used a BFIHOST value of 0.63, obtained from the FEH Web Service.

We believe that the point data from the FEH Web Service provides a more precise estimate, and therefore, we have used the Qbar rate of 2.42 l/s/ha for the proposed drainage calculations to support our planning application. A summary of the greenfield runoff estimation results is enclosed along with our response.

2. As stated on previous pre-app comments, a Cv value of 1 must be used for summer and winter events. The rainfall being used isn't consistent currently. FEH 2022 rainfall is required (we are aware some software has issues with FEH 2022).

Ardent CE Response
The design has been updated and FEH 2022 rainfall data has been used for all hydraulic calculations and networks have been modelled with a surcharged outfall based on surface water flood levels obtained from EA Flood Zone map. Outfall 1 and 3 have been designed to have surcharged levels up to the top of bank levels as the EA map shows the flood risk between 'Medium' & 'High risk'. However, as the surface water flood levels deemed as 'low risk' – surface water flood depth below 300mm, Outfall 2 has been designed with 300mm surcharged depth. The proposed basins have been designed with 300mm freeboard based on default CV values (0.75 for summer & 0.84 wintar events).

A sensitivity check has been carried out with CV values of 1 and the additional volume of surface water runoff is attenuated within the available freeboard. Therefore, there will not be an increase in off-site flooding within the development.

3. The amount of groundwater monitoring and infiltration testing is satisfactory for this site and demonstrates high groundwater levels and limited infiltration potential. The high groundwater levels will need to be considered in detailed design of the basins.

Ardent CE Response

[redacted]

Noted, suitable mitigation measures will be provided. Additional information will be submitted as part of the planning application including lining details and flotation calculations, as necessary.

4. Calculations to show 50% AEP rainfall event does not surcharge in the drainage network and 3.33% AEP rainfall event plus climate change does not flood outside the drainage network which is designed to hold water.

Ardent CE Response
Noted. Detailed drainage network calculations will be provided as part of planning submission.

5. Calculations for surcharged outfall to watercourses are required. This surcharge level must be the 1% AEP flood event of the receiving watercourse if known or bank full if not already hydraulically modelled.

Ardent CE Response
All outfalls have been modelled as fully surcharged up to the flood levels (top of bank levels) in 1 in 100 years + 40% CC event.

6. Basins should be designed using Ciria SuDS Manual. 1.8m is too deep for safety reasons. Fencing should be avoided as much as possible to enhance multifunctional benefits of SuDS.

Ardent CE Response
Basins have been designed varying side slopes with no steeper than 1:3 in line with SuDS manual guidance to provide safe access for maintenance works. Within the SuDS manual guidance Section 22.2 of Part D, it's stated that the maximum depth of water in the basin should be no more than 2m in the most extreme design events and this principle has been adhered to through the design of the proposals.

7. While I have reviewed the phasing plan, a phasing plan for the delivery of the drainage basins is required. We need to ensure the site is only discharging for the impermeable area that has been built. This will involve changing flow controls through the construction of the development but is essential to not increase flood risk elsewhere. –

Ardent CE Response
The attenuation basins and associated flow control chambers will be constructed prior to the construction of any impermeable area.

The southern section of the site (outfall 2 and 3) restricts flows to a combined rate of 15l/s, the equivalent greenfield Qbar rate is 68.4l/s. It is not necessary to change flow controls as the discharge rate is circa 20% of the Qbar rate.

Through the construction process, all runoff from the development site will be directed through the attenuation basins ensuring that all flows are continued to be restricted to greenfield. Where this is not possible then alternative measures will be put in place by the contractor to manage flood risk during construction. This will be managed through the Construction Management Plan (CMP) for the development.

8. Evidence of third party agreement for discharge into their land/system is required for the outfalls outside the red line boundary (these don't need to be submitted when the application is submitted, we just need to see them so that there is not issues later on).

Ardent CE Response
Noted. Third party agreement plans will be provided.

9. Easements 3m from top of bank of both sides of watercourses and the basins is required for maintenance access. Off road parking for maintenance vehicles is required.

Ardent CE Response
3m flat maintenance strips have been provided for all the basins. Visitor parking bays or on-street parking bay will

[redacted]

be located closer to the attenuation basins.

10. Water quality-is assessment of water quality being submitted as part of later applications?

Ardent CE Response
Yes, water quality will be assessed as part of each planning application.

11. As mentioned previously, open source, above ground SuDS should be prioritised in the design of the development, instead of reliance on underground pipes and end of pipe design, as source control means water is dealt with where it falls. Although swales are included in the indicative drainage layout, it is unclear how these will connect to the wider drainage system. Once the layout is set it is very difficult to make any changes to the drainage layout, therefore we require more detail on where source control SuDS will be used.

Ardent CE Response
Attenuation requirements are met by providing above ground SuDS (except the S278 roundabout to the North which utilises an attenuation tank). Providing attenuation adjacent to the outfall is the most effective strategy. Where feasible, additional at source SuDS components will be provided within the development parcel such as water butts.

A carrier drain will be laid beneath the swale which will connect into the adjacent piped network.

12. Urban creep-it is unclear whether 10% urban creep has been included in the volume of SuDS storage required.

Ardent CE Response
10% Urban creep has been included to the impermeable areas, please refer to the table on the Sitewide SuDs sketch.

13. Cross sections and long sections of the network and structures such as basins and swales will need to be submitted.

Ardent CE Response
Noted. Cross sections & long sections of the basins and swales will be provided as part of the planning submission.

We trust the above is satisfactory and we look forward to hearing back from you.

Yours sincerely,

[redacted]

Mehmet Cakir Ertay
Senior Engineer

[redacted]

Appendix C

Omnia
Suite 1 Pure Offices,
One Port Way,
Port Solent
PO6 4TY
[redacted]

28th March 2024

ref: A11918-3/240326/L1.1

Dan Chapman
Vistry Southeast
Linden House
Guards Avenue
Caterham
Surrey
CR3 5XL

[redacted]

Dear Dan,

RE: Ford Airfield, Arun, West Sussex BN17 5QZ – (Interim Report) Winter Groundwater Monitoring – Geo environmental Consultancy Support

Omnia were commissioned by Vistry South East to undertake winter groundwater monitoring within nineteen (19no.) previously installed wells and thirteen (13no.) further locations installed by Omnia across the site in order to provide detailed information on groundwater levels over the winter period between December and April 2024.

If you have any questions, please do not hesitate to contact us.

Yours Sincerely,
Omnia Consulting

[redacted]

Abbie Dodds
Geo Environmental Consultant

Olivia Maxwell
Principal Geo Environmental Consultant

Attachments:

Attachment I: Limitations

Attachment II: Drawings

Attachment III: Exploratory Hole Logs

Attachment IV: Photographs

Attachment V: Groundwater Monitoring Graphs

Attachment VI: A11918-3 Winter Monitoring Technical Note

Quality Assurance

Remarks	Draft
Date	March 2024
Prepared by	A. Dodds
Signature	[redacted]
Checked and authorised by	O. Maxwell
Signature	[redacted]
Project number	A11918-3
Comments	

www.omnia-consulting.co.uk

North Office
3 Fulwood,
3 Caxton Road,
Preston,
PR2 9ZZ

Midlands Office
Office 203,
St Nicholas House,
31 Park Row,
Nottingham,
NG1 6FQ

South Office
Suite 1, Pure Offices,
One Port Way,
Port Solent,
PO6 4TY

[redacted]

Site Details	
Site Name	Ford Airfield, Arun, West Sussex, BN17 5QZ
National Grid Reference	499156, 103169

1 Background

It is understood that Vistry South East are proposing to develop the former Ford Airfield, in Arun, West Sussex to comprise residential housing, local centre and open space, including attenuation basins.

A period of groundwater monitoring is required to provide detailed information on groundwater levels over the winter period, to assist with drainage design.

To date a series of reports have been prepared for the site including a Geo-Environmental and Geotechnical Site Assessment, a series of infiltration tests and limited winter spot monitoring, amongst other supporting reports. Post review, a technical summary has been produced, as detailed within the Omnia Winter Groundwater Monitoring Technical Note A11918-3/231220/L1 included within Attachment VI.

During the first phase of works completed by Omnia, eleven (11no.) continuous data loggers were deployed within existing wells on the 21st of December 2023, as specified by the client and detailed with the technical note. An additional twelve (12no.) monitoring wells were advanced using Window Samplers by Omnia on 18th-19th January 2024 as well as a further seven (7no.) loggers deployed within existing wells on the 17th of January 2024.

Following this installation, Ardent confirmed that deeper wells were required, as due to ground conditions during the installation, and UXO readings, some wells were not installed to the full 5m depth required. Following confirmation from Vistry South East, ten (10no.) monitoring wells were re-drilled, with the logger re-deployed to supplement the existing data set between the 19th to 22nd of February 2024. The positions were re-drilled with a larger cable percussive rig. The locations redrilled were WS401, WS402, WS403, WS404, WS405, WS408, WS410, WS411 and WS412.

One (1no.) additional logger was deployed within the new well (WS413) on the 22nd of February 2024. Due to wet conditions on site hindering drilling equipment, one (1no.) monitoring well was installed as within the position (CP502) on the 22nd of February 2024, as WS402 could not be reached to re-drill the location.

The winter monitoring period will continue until the 17th of April 2024 however Vistry South East require an interim report with all the data acquired so far as well as information on the previous monitoring periods prior to 2023/2024 included from the Technical note.

The change of logger positioning is detailed within the same graphs to reduce confusion, as shown within Attachment V.

Site Description

The area of investigation is located between the villages of Ford and Yapton in West Sussex, with the wider site boundary approximately 90 hectares in size. The southern parcel of land is 32.43 ha, and the northern parcel 30.63 ha.

The land is predominantly used for agricultural purposes, however commercial premises are also located on the site, including the haulage yard within the northern parcel of land and fuel storage/former runway within the southern parcel.

The site is bordered by a mixture of residential to the south and west and commercial/open fields to the south, east and north.

Scope of works

From the previous phases of works and more recent advancements of monitoring wells completed by Omnia on site, thirty-two (32no.) window sampler and cable percussive boreholes were utilised (P16, BH1, P21, P24, BH5, WS6, P12, BH3, BH2, DS22Z, WS2, WS8, BH6, P1, DS6Z, P4, DS7Z, BH4, WS401, WS402, WS403, WS404, WS405, WS406, WS407, WS408, WS409, WS410, WS411, WS412, WS413 and CP205) for winter groundwater monitoring. The maximum depth of the monitoring borehole installations across the site was 10.49m bgl within BH2.

Dataloggers were placed within all thirty-two (32no.) monitoring wells across the site, allowing the collection of a continuous dataset with groundwater measurements taken at one-hour intervals depending on the location. Continuous monitoring data was downloaded at monthly intervals at which point each well was manually dipped with an electronic dip-tape to confirm that the dataloggers were operating within the expected parameters.

Winter groundwater monitoring was commenced for eleven (11no.) positions on the 21st of December 2023, seven (7no.) positions on the 17th of January 2024, twelve (12no.) positions on 18-19th January 2024 and two (2no.) positions on 22nd of February 2024. The monitoring period at the time of writing this report is ongoing and will end on the 17th of April 2024, however this report will provide all the groundwater monitoring data up to the 20th to 21st of March 2024.

Site Topography

A review of topographic maps, EA LiDAR and on-site observations indicated that the site was generally flat. There were slight inclines or declines around field and road edges as well as a stockpile in the northwest of the site.

2 Geology & Hydrogeology

The British Geological Survey (BGS) map for the site (Chichester and Bognor, Solid and Drift, Sheet 317/332 at a scale of 1: 50,000, 1996) indicates that the site is underlain by the geological sequence summarised in Table 2.1:

Table 2.1 - Geological Succession

Geological Unit	Classification	Description	Aquifer Classification
Superficial	Brickearth	Silts and Gravels	Secondary A
Superficial	River Terrace Deposits	Sands and gravels	

Bedrock	Lewes Nodular Chalk, Seaford chalk, Newhaven Chalk, Culver chalk and Portsdown Chalk	Chalk	Principal

The intrusive site investigation undertaken by Omnia in January 2024 found the geology present on site to generally correspond with that highlighted within BGS mapping as well as deposits found within previous investigations. The findings are outlined below.

Made Ground was encountered within one (1no.) location (WS404) to a depth of 1.00m bgl. The base of the Made Ground was proven. It typically comprised grass over soft brown or orangeish brown sandy CLAY with rare gravel. Sand is fine and medium. Gravel is subangular medium clinker.

Topsoil was encountered within the remaining twelve (12no.) intrusive locations (WS401-WS403, WS405-WS412) to a maximum depth of 1.20m bgl within WS401. The base of the Topsoil was proven in all locations. It typically comprised grass over soft or very soft orangeish brown sandy CLAY. Sand is fine to coarse. Rare cobbles of subangular flint within WS405. Rare gravel of flint within WS407.

River Terrace Deposits were encountered within all locations (WS401-WS412) beneath the Topsoil and Made Ground. The base of the River Terrace Deposits was confirmed within WS402, WS404, WS405, WS406, WS407, WS409 and WS411. It was found to a maximum depth of 5.00m bgl (WS401) within this phase of investigation. These were typically recovered as:

- Soft grey mottled orange or yellowish or orangeish brown slightly gravelly sandy CLAY or sandy CLAY. Gravel is subangular to subrounded fine flint. Sand is fine to coarse.
- Yellowish orange mottled grey or orangeish brown clayey gravelly fine to coarse SAND. Gravel is subangular to subrounded fine to coarse flint.
- Orangeish brown slightly clayey very sandy angular to subrounded fine to coarse GRAVEL of flint and chalk.

The Lewes Nodular Chalk, Seaford chalk, Newhaven Chalk, Culver chalk and Portsdown Chalk identified as Undifferentiated Chalk were found directly beneath the River Deposits within WS402, WS404, WS405, WS406, WS407, WS409 and WS411 to a maximum drilled depth of 5.00m bgl. The base of the Undifferentiated chalk was not proven. These were typically recovered as:

- Orangeish brown slightly sandy slightly gravelly CLAY mottled with structureless CHALK composed of slightly sandy gravelly SILT. Sand is fine. Gravel is subangular to subrounded fine and medium flint and medium density CHALK. (Weathered Differentiated chalk)
- Recovered as structureless CHALK composed of cream sandy gravelly SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine and medium low or medium density weak chalk with black specks. Presumed Grade Dm.

Groundwater Conditions

During the drilling of the holes for the monitoring installations groundwater strikes were encountered these are summarised below in Table 2. During return groundwater monitoring visits, groundwater was encountered at 0.00 – 4.58m bgl.

Table 2-Summary of Groundwater Conditions

Location	Depth (m bgl)	Strata	Type of Water Strike
Omnia site works (Jan and Feb 2024)			
WS401	1.00	River Terrace Deposits	Water Strike
CP501*	2.50	River Terrace Deposits	Water Strike
WS402	0.80	River Terrace Deposits	Water Strike
WS403	3.63	River Terrace Deposits	Water Strike
WS404	1.20	River Terrace Deposits	Water Strike
WS405	1.80	River Terrace Deposits	Water Strike
WS406	1.33	River Terrace Deposits	Water Strike
WS407	2.65	River Terrace Deposits	Water Strike
WS411	1.10	River Terrace Deposits	Water Strike
RSK Investigation (Aug and Sept 2018)			
WS1	3.20	River Terrace Deposits	Water Strike
BH1	7.00	Undifferentiated Chalk	Water Strike
BH3	6.10	Undifferentiated Chalk	Water Strike
BH4	5.50	Undifferentiated Chalk	Water Strike
BH5	4.00	Undifferentiated Chalk	Water Strike
BH6	6.10	Undifferentiated Chalk	Water Strike

*Please note CP501 was a cable percussive hole drilled within 5m of WS401.

3 Groundwater Monitoring Results- Previous investigations

A summary of winter groundwater monitoring at the above-mentioned site has been provided within the Omnia Winter Groundwater Monitoring Technical Note (Ref: A11918-3/231220/L1), this has been provided within Attachment VI if further details are required. The summary of data collated by previous groundwater monitoring is as follows (References remain the same as within the Technical Note):

Intrusive works undertaken by RSK, where groundwater monitoring was undertaken over August and September 2018 within seven (7no.) locations. Their monitoring results are summarised below in Table 2-1

Table 2-1 Summary of RSK groundwater monitoring

Location	Groundwater Strike depth during SI	Groundwater level (29/8/18) in m bgl	Groundwater level (5/9/18) in m bgl	Groundwater level (13/9/18) in m bgl
WS1	3.2	1.73	1.88	1.93
BH1	7.0	2.15	2.29	2.37
BH2	N/A	3.13	3.26	3.31
BH3	6.1	4.218	4.42	4.57
BH4	5.5	4.592	4.74	4.95
BH5	4.0	4.78	4.85	4.81
BH6	6.1	5.368	5.41	5.52

A summary of the shallowest and deepest groundwater levels recorded from the previous RSK investigation is provided within Table 2-2 below.

Table 2-2 Summary of Shallowest and Deepest Recorded Groundwater Level

Location	Shallowest recorded GW (m bgl)	Date	Deepest recorded GW (m bgl)	Date
North of site				

Location	Shallowest recorded GW (m bgl)	Date	Deepest recorded GW (m bgl)	Date
BH3	1.30	Feb 2020	4.62	12/10/2018
BH5	4.11	Feb 2020	4.86	13/09/2018
BH6	2.96	Feb 2020	5.52	13/09/2018
DS5Z	4.00	Feb 2020	4.75	Jan 2020
DS6Z	3.23	Feb 2020	4.14	Jan 2020
DS3Z	1.54	Feb 2020	1.99	Jan 2020
DS7Z	3.015	Feb 2020	3.69	Jan 2020
DS11Z	3.17	Feb 2020	4.01	Jan 2020
DS13Z	2.28	Feb 2020	3.48	Jan 2020
DS8Z	2.41	Feb 2020	3.24	Jan 2020
DS9Z	2.23	Feb 2020	3.21	Jan 2020
DS12Z	1.89	Feb 2020	2.96	Jan 2020
South of site				
WS1	0.15	13/12/2019	1.93	13/09/2018
BH1	0.335	Feb 2020	2.41	12/10/2018
BH2	0.893	Dec 2019	3.36	12/10/2018
BH4	2.195	Feb 2020	4.95	13/09/2018 & 12/10/2018
DS14Z	1.26	Feb 2020	2.24	Jan 2020
DS16Z	1.02	Dec 2019	1.39	Jan 2020
DS22Z	0.58	Dec 2019	1.26	Jan 2020
P21	1.83	Dec 2019	1.93	Jan 2020
DS23Z	0.923	Dec 2019	1.525	Jan 2020

The shallowest groundwater recorded within the north of the site ranged from 1.30 – 4.11m bgl. The shallowest groundwater recorded within the south of the site ranged from 0.15 – 2.195m bgl.

Omnia attended site on 7th December to investigate whether the existing wells were still present on-site and serviceable. Omnia identified eighteen (18no.) wells, the co-ordinates for each identified well are displayed below and a summary of the recorded groundwater is provided within Table 3-3 below.

Table 3-3 Summary of Groundwater Levels - 07/12/2023

Location	Coordinates	Depth to base of well (m bgl)	Depth to GW (m bgl)
North of site			
BH3	499048,103009	10.19	2.05
BH5	499727,103379	9.3	3.47
BH6	498830,103554	9.52	3.52
WS6	499313,103302	2.35	DRY
WS8	498938,103256	2.79	DRY
DS6Z	498929,103604	4.76	3.62
DS7Z	499217,102488	4.97	3.27
P1	498915,103855	1.96	DRY
P4	499245,103550	1.97	DRY
P12	499096,103172	1.97	0.88
South of site			
DS22Z	499217,102488	3.23	0.75
BH1	499503,102349	7.73	0.53
BH2	499087,102527	10.69	1.17
BH4	499358,103009	10.47	2.35
P16	499037,102646	1.94	1.15
P21	499447,102588	1.99	1.71
P24	499498,102433	1.98	1.08
WS2	499156,102574	3.49	1.52

4 Groundwater Monitoring Results- Omnia investigation

Spot Monitoring

Results of the groundwater spot monitoring undertaken between 21/12/2024 to 20-21/03/2024 for all available monitoring wells has been summarised and included in Table 3.1 below. Please note that this is an interim report, and that the final data collection will be completed on the 17/04/2024 and subsequent full data will be reported after this.

Table 3.1 – Groundwater monitoring results

Location	Date	Depth to Groundwater (m bgl)	Depth to base (m bgl)
BH1	21/12/2024	0.42	7.71
	17/01/2024	0.70	7.71
	20/02/2024	0.27	7.71
	20/03/2024	0.51	7.71
BH2	21/12/2024	0.94	10.47
	17/01/2024	1.82	10.42
	21/02/2024	0.77	10.49
	20/03/2024	1.07	10.47
BH3	21/12/2024	1.94	10.16
	17/01/2024	2.47	10.14
	21/02/2024	1.85	10.15
	20/03/2024	2.09	10.15
BH4*	17/01/2024	2.66	10.46
	21/02/2024	2.16	10.46
	20/03/2024	2.40	10.47
BH5	17/01/2024	3.57	9.28
	21/02/2024	3.31	9.30
	20/03/2024	3.36	9.29
BH6	21/12/2024	3.30	9.44
	17/01/2024	3.59	9.44
	21/02/2024	3.42	9.38
	20/03/2024	3.36	9.45
CP502	23/02/2024	0.61	4.85
	20/03/2024	0.44	4.80
DS6Z	17/01/2024	3.78	4.77**
	21/02/2024	3.54	4.56
	20/03/2024	3.59	4.57
DS7Z	21/12/2024	3.15	4.97
	17/01/2024	3.41	4.98
	21/02/2024	3.18	4.96
	20/03/2024	3.19	4.95
DS22Z	17/01/2024	1.23	3.25
	21/02/2024	0.56	3.25
	20/03/2024	0.87	3.24
P1	21/12/2024	Dry	2.02
	17/01/2024	Dry	2.02
	21/02/2024	Dry	2.00
	20/03/2024	Dry	2.01
P4	17/01/2024	Dry	1.95
	21/02/2024	Dry	3.80
	20/03/2024	Dry	2.04

Location	Date	Depth to Groundwater (m bgl)	Depth to base (m bgl)
P12	17/01/2024	1.54	2.00
	20/02/2024	0.74	1.95
	20/03/2024	1.04	1.96
P16	21/12/2024	1.08	1.86
	17/01/2024	1.63	1.88
	21/02/2024	0.88	1.89
	20/03/2024	1.37	1.86
P21	21/12/2024	1.08	1.86
	17/01/2024	Dry	1.94
	21/02/2024	1.45	1.68
	20/03/2024	Dry	1.63
P24	17/01/2024	1.21	1.91
	21/02/2024	1.00	1.91
	20/03/2024	1.09	1.92
WS2	21/12/2024	1.37	3.30
	17/01/2024	1.65	3.29
	21/02/2024	1.11	3.31
	20/03/2024	1.45	3.31
WS6	21/12/2024	Dry	2.37
	17/01/2024	Dry	2.32
	21/02/2024	Dry	2.37
	20/03/2024	Dry	2.38
WS8	21/12/2024	2.64	2.78
	17/01/2024	Dry	2.78
	21/02/2024	Dry	2.77
	20/03/2024	Dry	2.78
WS401	18/01/2024	0.56	4.00
	21/02/2024	0.19	4.01
	21/02/2024+	0.16	4.75
	20/03/2024	0.52	4.76
WS402	18/01/2024	0.49	2.13
	21/02/2024	GL	2.06**
	21/03/2024	GL	1.95
WS403	19/01/2024	3.40	3.75
	20/02/2024	2.93	3.60
	20/02/2024+	2.60	4.62
	20/03/2024	2.92	4.94
WS404	19/01/2024	Dry	1.35
	21/02/2024	1.00	1.46
	21/02/2024+	0.99	4.81
	20/03/2024	1.04	4.66
WS405	18/01/2024	1.51	3.65
	21/02/2024	0.80	3.77
	21/02/2024+	0.61	4.87
	21/03/2024	0.97	4.97
WS406	18/01/2024	1.22	3.97
	21/02/2024	1.21	3.99
	21/03/2024	1.31	3.99
WS407	18/01/2024	2.45	3.60
	21/02/2024	1.32	3.52**

Location	Date	Depth to Groundwater (m bgl)	Depth to base (m bgl)
	21/03/2024	1.83	3.48**
WS408	19/01/2024	Dry	2.37
	21/02/2024	Dry	2.37
	22/02/2024+	Dry	4.92
	21/03/2024	3.29	4.92
WS409	18/01/2024	Dry	3.98
	21/02/2024	Dry	3.97
	20/03/2024	Dry	3.94
WS410	18/01/2024	Dry	2.35
	20/02/2024	1.53	2.30
	20/02/2024+	2.70	4.70
	20/03/2024	4.58	4.70
WS411	18/01/2024	0.97	2.89
	20/02/2024	1.53	2.61
	01/03/2024+	0.71	4.75
	21/03/2024	0.85	4.73
WS412	19/01/2024	Dry	1.92
	20/02/2024	0.99	1.95
	23/02/2024+	1.47	4.83
	21/03/2024	2.27	4.80
WS413	23/02/2024	3.26	4.81
	21/03/2024	3.33	4.79

**Depths varies due to the hole having increasing amounts of silt over the groundwater monitoring period.

+The data is repeated, with a change in base depth, on these return dates due to the borehole having been re-drilled as specified within the scope of works.

Continuous Monitoring

Continuous groundwater monitoring is to be undertaken for a period of four (4no.) months utilising LevelScout and Solinst Level Loggers. The pressure transducers within the Level Loggers measure total pressure (water column pressure & atmospheric pressure), and in order to measure changes in water level only, fluctuations in atmospheric pressure need to be compensated for, with a Barologger barometric pressure logger that was placed securely on site for both LevelScout and Solinst loggers to facilitate this.

Monitoring was commenced on the 21st of December 2023 (BH1, BH2, BH3, BH6, DS7Z, P1, P16, P21, WS2, WS6, WS8), 17th of January 2024 (BH4, BH5, DS6Z, DS22Z, P4, P12, P24), 18-19th of January 2024 (WS401, WS402, WS403, WS404, Ws405, WS406, WS407, WS408, WS209, WS410, WS411 and WS412 and 23rd of February 2024 (CP502 and WS413) with monitoring set at one-hour intervals for both the groundwater and for atmospheric pressure.

The depths at which the Level Loggers were installed are summarised in Table 4.1 below:

Table 4.1 - Datalogger Deployment Depths

Location	Level Logger Depth (m bgl)	After Re-deployment
BH1	4.76	-

BH2	3.80	-
BH3	4.05	-
BH4	10.15	-
BH5	8.95	-
BH6	7.79	-
CP502	4.85	-
DS6Z	4.71	-
DS7Z	4.62	-
DS22Z	2.15	-
P1	1.81	-
P4	2.55	-
P12	2.29	-
P16	1.76	-
P21**	1.92	-
P24	1.81	-
WS2	2.79	-
WS6**	2.12	-
WS8	2.69	-
WS401	3.90	4.38
WS402	1.60	-
WS403	3.64	4.53
WS404	1.25	4.50
WS405	3.55	4.69
WS406	3.83	3.41*
WS407	3.90	3.01*
WS408	2.26	3.90
WS409**	3.89	-
WS410	2.26	2.28
WS411**	2.44	4.51
WS412	1.80	4.75
WS413	4.70	-

*Logger depth was changed as it was silty at the bottom which can affect the compensation results, not because it was redeployed.

**Please note that these loggers are missing some information, which is further explained below.

Variations of scope

On return to site on the 21st of February 2024 it was found that the logger was removed from within BH4. Therefore, no data of groundwater was recovered between the period of 04/02/2024 at 12.45am to 21/02/2024 at 09.45am. The logger was placed properly within the hole at the latter date and had no further issues.

On return to site on the 20th of February 2024 it was found that the headworks for P21 had been knocked over and the logger moved within the hole during the incident. It was not apparent from the groundwater data when this occurred, so no adjustments were made to the data. On the return to site on the 20th of March 2024 the logger string was found to be cut, luckily the logger was able to be retrieved from the hole, but once again the incident was not apparent from data. The data within this time period has been denoted with a dotted line on the graph, as complete surety to the data set cannot be given, given the movement of the logger.

On return on the 20th of March 2024 the logger and logger string within WS6 was not present in the monitoring location or it's vicinity. It is suspected that the logger was stolen as the string was burnt off. Therefore, there is no continuous monitoring data between 21/02/2024 to 20/03/2024. A replacement logger was deployed within the hole on the 23rd of March 2024 to gather data for the remaining monitoring period.

Data from WS409 is missing due to a system error in data recovery. After the error was discovered, the logger was changed and re-deployed on the 1st of March 2024. Data is missing between the 16/02/2024 and the 01/03/2024.

The data from WS411 is incomplete as the logger had a technical fault, such that limited data has been recorded between 19/01/24 – 01/03/24. A replacement logger was redeployed on the 01/03/24 and data was recovered between the 01/03/2024 until the 21/03/2024.

Locations of the groundwater monitoring installations have been denoted on Figure 3.0 appended to this report.

The minimum and maximum groundwater levels recorded have been summarised in Table 4-2 below:

Table 4.2 – Summary of Minimum and Maximum Winter Groundwater Levels – 2023/2024 period

Location	Shallowest Groundwater Level (m bgl)	Deepest Groundwater Level (m bgl)	Date of Shallowest Groundwater Level
BH1	0.02	0.91	8/02/2024, 18/02/2024
BH2	0.45	1.82	18/02/2024
BH3	0.86	3.25	02/03/2024
BH4	1.34	3.20	02/03/2024
BH5	2.72	4.13	02/03/2024 and 03/03/2024
BH6	2.06	4.41	02/03/2024 and 03/03/2024
CP502	0.32	0.61	02/03/2024 and 03/03/2024
DS6Z	1.86	4.62	02/03/2024
DS7Z	2.27	4.02	02/03/2024 and 03/03/2024
DS22Z	0.09	1.53	18/02/2024
P1	0.99	Dry	02/03/2024
P4	1.42	Dry	02/03/2024
P12	0.12	1.91	25/02/2024, 26/02/2024 and 02/03/2024
P16	0.26	1.78	02/03/2024
P21	1.62	Dry	04/01/2024, 05/01/2024, 22/02/2024, 25/02/2024, 26/02/2024 and 02/03/2024
P24	0.95	1.62	18/02/2024
WS2	0.48	1.81	02/03/2024
WS6	2.03	Dry	05/01/2024
WS8	1.27	Dry	02/03/2024 and 03/03/2024
WS401	GL	0.99	25/02/2024, 26/02/2024 and 02/03/2024
WS402	GL	0.71	18/02/2024, 19/02/2024 and 21/02/2024-08/03/2024 and 10/03/2024-21/03/2024
WS403	1.44	3.93	02/03/2024 and 03/03/2024
WS404	0.69	Dry	02/03/2024

WS405	0.11	1.70	26/02/2024
WS406	1.01	1.50	18/02/2024
WS407	1.10	3.47	02/03/2024
WS408	0.95	2.47	02/03/2024 and 03/03/2024
WS409	3.05	Dry	02/03/2024 and 03/03/2024
WS410	0.56	2.45	18/02/2024
WS411	0.24	1.16	02/03/2024
WS412	0.51	2.28	02/03/2024 and 03/03/2024
WS413	2.36	3.38	02/03/2024 and 03/03/2024

A review of groundwater levels across the thirty-two (32no.) locations shows groundwater has been recorded between 4.62m bgl (DS6Z) at its deepest (where dry boreholes have been discounted) and ground level (WS401 and WS402) is at the shallowest.

Fluctuations within the groundwater recorded within all thirty-two (32no.) boreholes are observed, which correlates with rainfall data (ref: https://meteostat.net/en/place/gb/littlehampton?s=03876&t=2023-12-21/2024-02-05 [Accessed on the 25.03.2024 – Shoreham Airport] for the site's location.

Further review of the data indicates that the groundwater across the site fluctuates similarly responding to the groundwater and has been shown to be at the shallowest points at similar dates within some anomalies, the most common dates are 18/02/2024, 02/03/2024, 03/03/2024, 25/02/2024 and 26/02/2024.

WS402 showed extended periods of high groundwater between 21/02/2024-08/03/2024 and 10/03/2024-21/03/2024, from topography on site and anecdotal evidence this has been known to be an area where high levels of groundwater and surface water have been found, as it is at the sites lowest point.

5 Discussion

As this is an interim report, it is important to note that the data represented is only partial, there is still one month of data collection before the winter period is completed in April 2024.

From a review of the data presented above, it can be seen that the shallowest groundwater levels at all locations followed a similar pattern in the 2023/2024 winter groundwater monitoring period. The data for all thirty-two (32no.) boreholes positively correlates with rainfall records within the location of the site. Therefore, consideration should be given to the presence of groundwater across the site during the design of foundations and drainage solutions for the site.

Attachment I

Limitations

1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between OEC and the Client as indicated in Section 1.0.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information, it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination, which are enforced, by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.

7. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials this is for indicative purposes only and do not constitute or replace full and proper surveys.

8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

9. OEC cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by OEC is owned by them and no such plans or documents may be reproduced, published, or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by OEC in this connection without their explicit written agreement there to by OEC.

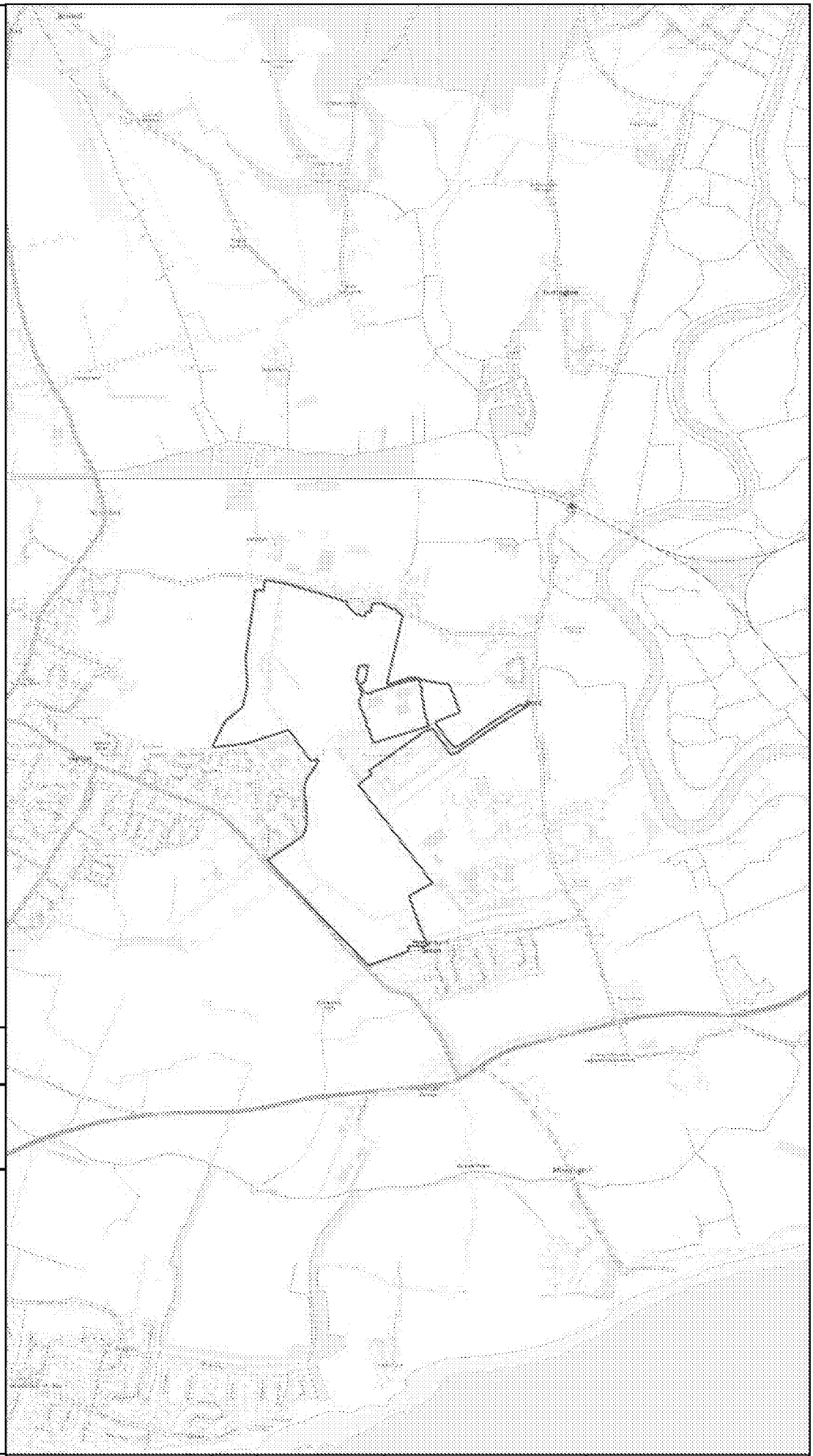
10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

Attachment II

Drawings

Key

Whole Site Boundary



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Omnia Consulting,
Suite 1 Pure Offices
One Port Way
Port Solent
Portsmouth
PO6 4TY
T: (01489) 808 088
E: info@omnia-consulting.co.uk
W: www.omnia-consulting.co.uk

OMNIA

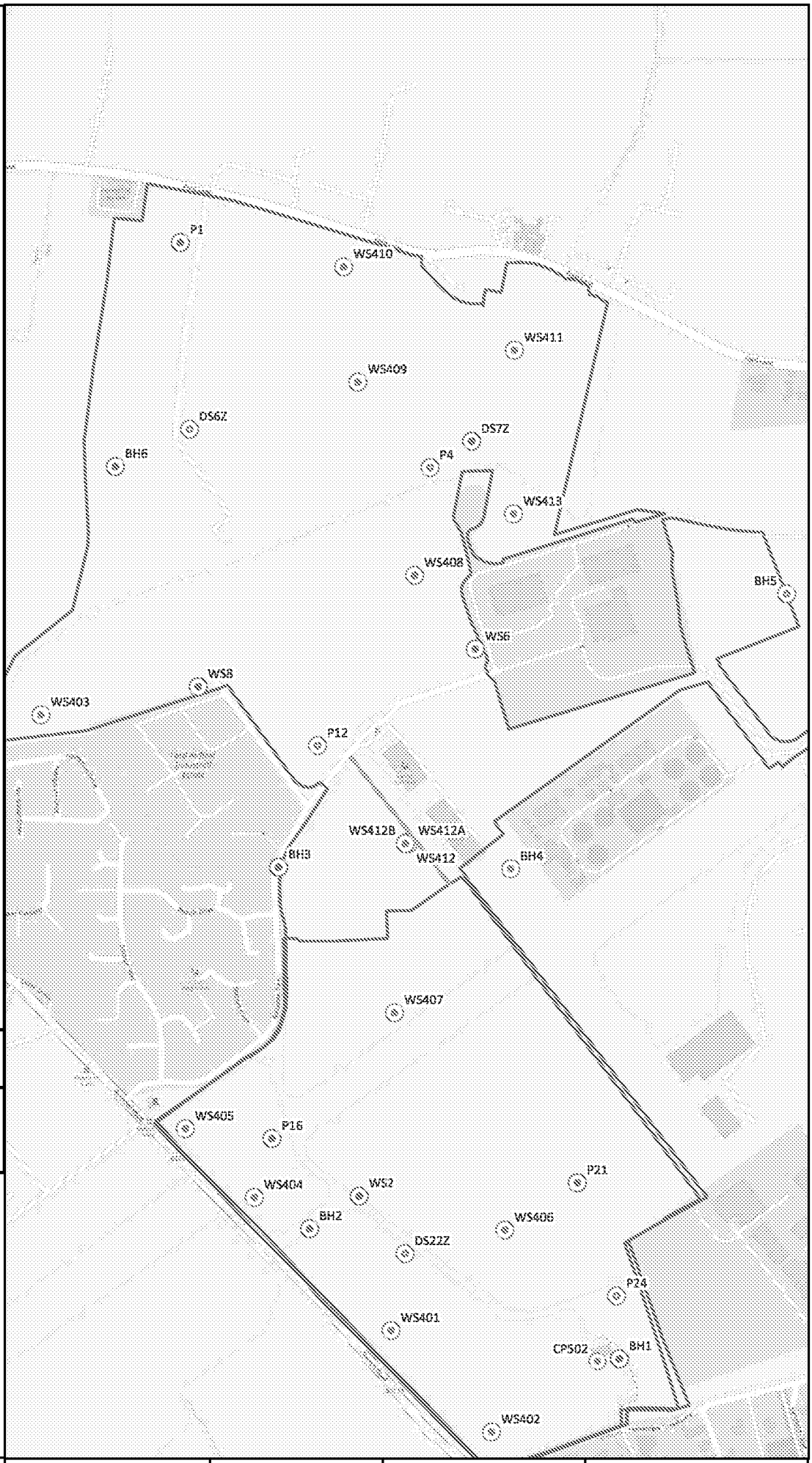
Project Number: A11918-3	Client: Vistry Housebuilding South East	Drawn By: L. Burnett	Drawing Title:
Job Title: Ford Airfield	Date: 07/11/2023	Authorised By: O. Maxwell	Figure 1.0 Site Location Map

ARUN DISTRICT COUNCIL F/15/24/RES

Key

Monitoring Locations

Whole Site Boundary



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Omnia Consulting,
3-6 The Quarterdeck,
Port Solent,
Portsmouth,
Hampshire,
PO6 4TP
T: (01489) 808 088
E: info@omnia-consulting.co.uk
W: www.omnia-consulting.co.uk

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Project Number: A11918-3	Client: Vistry Housebuilding South East	Drawn By: A. Dodds	Drawing Title: Figure 3.0 Groundwater Monitoring Locations
Job Title: Ford Airfield	Date: 26/03/2024	Authorised By: O. Maxwell	