

University of Southampton

Wide Lane Sports Centre

Geotechnical and Geo-Environmental Desk Study

Reference: 293368-ARUP-ZZ-XX-RP-CG-001

Issue | 23 March 2023



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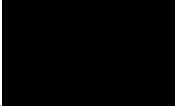
Job number 293368

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Document Verification

Project title Wide Lane Sports Centre
Document title Geotechnical and Geo-Environmental Desk Study
Job number 293368
Document ref 293368-ARUP-ZZ-XX-RP-CG-001
File reference 4-70

Revision	Date	Filename	293368-ARUP-ZZ-XX-RP-CG-001		
Issue	23/03/2023	Description			
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		Description			
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		Filename			
		Description			
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Issue Document Verification with Document ☒

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Executive Summary

Site Information	The site which forms the University of Southampton sports facility is centred around National Grid Reference SU 44691 17308, covers an area of approximately 23 hectares, and comprises grassed and artificial sports pitches, pavilion buildings and car parking areas. The western site boundary is defined by the Monks Brook and flood plain, to the north by Doncaster Drove and the Lakeside Country Park, to the east by Wide Lane (A355) beyond which is the South West Main line (rail), Southampton Parkway station and Southampton Airport, and to the south the site is bound by the A355, beyond which is another sports pitch and the M27 motorway junction. The site has been used as the university sports ground since the 1970s and prior to this was agricultural land comprising fields and is therefore considered to be effectively greenfield.
Development Proposals	The proposed development is for two new artificial pitches to be constructed in the centre of the site in the location of two existing grassed pitches. The proposed build up for the artificial pitches comprises 50-60mm of artificial turf overlying 65mm of porous asphalt and the perimeter of the pitches will be concrete. At present the intention is to use the existing positive drainage system of the grassed pitches but this may change during later design stages subject to requirements of the pitch supplier. Based on the available development proposals, it is anticipated the construction depth will be between 0.5m and 1.0m below existing ground levels.
Expected Ground Conditions	The published geology for the site comprises River Terrace Deposits (sands and gravel) overlying the London Clay Formation (predominantly silty, accompanied sometimes by silt and sand). Along the western boundary, Alluvium (predominantly soft clays and silts) are mapped to overlie the River Terrace Deposits. Due to the site history localised made ground is anticipated to be encountered on site associated with the construction of the onsite pavilion buildings, existing artificial pitches and paths. Made ground deposits may be encountered beneath the existing grassed pitches in the location of the new proposed pitches relating to the existing a positive drainage system. Review of available BGS boreholes indicate that the expected ground conditions within the construction depth will comprise topsoil overlying sandy clayey gravel of the River Terrace Deposits. Groundwater is not anticipated to be encountered during construction as previous boreholes encountered groundwater between 1.6m and 4.7m below ground level, however this may be subject to seasonal change.
Geotechnical Considerations	Foundations – Due to the presence of sands and gravel on site, shallow footings are expected to be appropriate for lightly loaded buildings at the site. Excavation – Excavation in the site soils will be readily achievable using typical hydraulic plant such as excavators or backhoe loaders. It is anticipated that dry batter slopes up to 1v:2h should be achievable. Groundwater level at the site has not yet been proven by a site-specific ground investigation, and accordingly excavations near to or below the groundwater table will be susceptible to collapse unless shored or battered. Surface Water Infiltration – The granular nature of the soils at the site will be suitable for infiltration of collected surface water. The permeability of site soils should be confirmed through site specific permeability testing. UXO – The site is located within a moderate risk area for UXO due to the proximity to strategic targets such as Southampton Airport (a Luftwaffe target during WW2) and a known UXO find. Buried Utilities – There is potential to encounter buried private utilities such as the existing drainage system during the construction of the proposed development.
Geo-environmental Considerations	Plausible Contaminant Linkages – No significant sources of contamination have been identified on site and there are no plausible contaminant linkages identified aside from the exposure of construction workers to onsite made ground (where present) during the construction of the proposed development. Material Reuse – There is not anticipated to be any scope for the re-use of excavated soils within the site and therefore the excavated soils will require offsite disposal. The excavated materials are not anticipated to be contaminated and therefore are considered likely to be suitable for inert disposal. Ground investigation is recommended to obtain soil samples for waste assessment to identify the appropriate disposal options.
Recommendations	A detailed UXO desk study and risk assessment is recommended to be completed to assess the risk posed by the development proposals.

	A non-intrusive utility survey for the entire site is recommended, to identify private utilities and the existing positive drainage system for the artificial pitches to inform the drainage design for the proposed development and future design constraints. Is it recommended that a targeted ground investigation is completed to understand on site ground conditions and inform the detailed design. A watching brief is recommended to be undertaken during the intrusive works for the proposed development to identify any unexpected contamination.
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1. Introduction

1.1 Background

Ove Arup and Partners Limited ('Arup') have been commissioned by University of Southampton (the Client) to undertake multidisciplinary engineering services in relation to the proposed development of new sports pitches within the existing University of Southampton, Wide Lane sports facility site.

The advisory services that Arup have been commissioned to undertake include a Phase 1 geotechnical and geo-environmental desk study, in order to characterise the nature of potential ground-related constraints associated with the proposed development. The specific objectives relating to this are outlined in Section 1.3.

1.2 Proposed Development

The proposed development on site is for the construction of two new artificial pitches in place of two existing grass pitches within the Wide Lane sports facility. The development does not include any built development and no significant change in use. Information regarding the proposed development has been gathered from the Arup 2023 RIBA Stage 1 Feasibility Study Report (293368-ARUP-ZZ-XX-RP-V-001_P02) [1] and the development proposals are enclosed within Appendix A.

Details of the builds ups for the artificial pitches are as follows:

- 65mm depth of porous macadam (to be confirmed by civil engineer/specialist contractor);
- 50mm or 60mm depth of artificial turf installed on porous macadam base;
- Concrete edging around the perimeter of pitch;
- Potential reuse of the drainage installed for the existing grass pitches; this will be explored in more detail at the next design stage;
- An assumed construction depth for the new pitches is between 0.5m and 1.0m below existing ground level, subject to the drainage design.

1.3 Objectives

The primary objectives of this report are as follows:

- Review available information and obtain sufficient additional information to determine the nature of any potential ground constraints (geotechnical and geo-environmental) that may pose a risk to the development.
- In the context of potential risks posed by land contamination, identify a list of all potential contaminant linkages on site (source-pathway-receptor) and evaluate the significance of the pollutant linkages.
- Provide initial commentary of geotechnical and geo-environmental constraints and risks to the proposed development and provide recommendations from the report findings.
- Determine the requirements for site investigations to further define or mitigate any risks identified.

1.4 Sources of Information

The following sources of information have been used to inform the findings of this report. Note that the published guidance and/or standards are not listed below and are referred to where relevant in the report.

- Envirocheck Report (Appendix A), which was purchased as part of this commission. This includes 1:1,250, 1:2,500, 1:10,000 and 1:10,560 scale Ordnance Survey (OS) maps from 1881 to the present day. Appendix A also includes environmental sensitivity and permitting information, as well as geological sensitivity information (from Envirocheck).

- British Geological Survey (BGS), Sheet 315: Geological map of Southampton, Solid and Drift (1:50,000) - 1987. Reviewed for site geological information [2].
- British Geological Survey (BGS), GeoIndex Onshore online database. Reviewed for geological mapping, and digital historical borehole records for the regional area [3].
- Environment Agency Online Flood Map for Planning. Reviewed for flood risk on site [4].
- Historic England online Aerial Photo Explorer. Reviewed to understand whether there was any historical aerial imagery of interest, particularly around the Second World War to understand UXO risks [5].
- Department for Environment, Food & Rural Affairs (DEFRA), MAGIC online database. Reviewed for aquifer designations, and general environmental sensitivity information [6].
- UK Health Security Agency (UKHSA) UK Radon online risk map. Review for radon potential on site [7].
- Zetica UXO bomb risk maps. Reviewed for UXO risk (Appendix C).

1.5 Limitations

This report has been prepared for University of Southampton (the Client) and takes into consideration their particular instructions and requirements. It is not intended for, and should not be relied upon by, any third party and no responsibility is undertaken to any third party.

The interpretation of the ground conditions is based on the information obtained as part of this desk-based assessment, newly acquired third party information and available ground investigation information. Reasonable skill, care and diligence has been exercised in carrying out this report within the timescales and information available.

2. The Site

2.1 Site Location and Description

The site is colloquially known as the ‘Southampton University Sports Ground’, and comprises open land used for sports and recreation. The site is centred around National Grid Reference SU 44691 17308 and covers an area of approximately 23 hectares. Figure 1 presents the site boundary. The site is bounded as follows:

- To the East: Wide Lane, with Southampton Airport Parkway station and the South West Main (rail) Line, and Southampton Airport beyond;
- To the South: the A335 link road to Junction 5 of the M27;
- To the West: a tree lined boundary with floodplain and Monks Brook beyond;
- To the North: a tree lined boundary with Doncaster Drove and Lakeside Country Park beyond.

The site has a relatively uniform elevation at about +10mOD, as befitting land used for sports pitches.

2.2 Site History

A review of available historical Ordnance Survey (OS) maps and historical aerial imagery is presented in Table 1 below.

Table 1 - Site History

Source	On Site	Off Site (within 500m of site boundary)
1868 to 1897	The site appears to be divided into 5no agricultural fields with a narrow band of woodland along the western site boundary.	Wide Lane forms the eastern site boundary with the London and South Western Railway located circa 25m east of the site parallel to the site boundary. Doncaster Drove forms the northern site boundary. A gravel pit and ice house are labelled immediately north of the northwestern corner of the site along Doncaster Drove. A drainage ditch is present along the western site boundary with 3 sluices labelled. The Monks Brook flows north to south circa 50m from the western site boundary. Beyond the river are more agricultural fields, a Rectory and the North Stoneham Deer Park. Spring located circa 50m northwest of site.
1909 to 1911	No significant development or change on site.	Wide Lane crosses the railway line via a new bridge structure circa 200m south. A school is present circa 125m northwest of site beyond Monks Brook.
1931 to 1946	No significant development or change on site.	The Atlantic Park Hostel is present beyond the railway circa 50m southeast of the site. The development comprises several buildings and a sports ground. Land between Wide Lane and railway comprised allotments circa 25m east. Residential development circa 300m northeast of site.
1951 to 1963	Field boundaries in north of site no longer present.	Atlantic Park Hostel renamed Southampton (Eastleigh) Airport. New structures present 50m southeast of site Land to north of Doncaster Drove indicated to be raised above road.

Source	On Site	Off Site (within 500m of site boundary)
1971-1978	Site labelled as University of Southampton Sports Ground. Trees present along central field boundary.	Playing fields and football ground located beyond Monks Brook circa 50m to 150m southwest of site. Several buildings within Southampton Airport labelled as Warehouses, Engineering Works and Works. Southern site boundary defined by construction of new road, A335. Construction of new motorway and junction circa 240m southwest of site. Land to north of Doncaster Road, divided into fields and labelled as 'Nursery' (circa .10m north).
1986-1989	Present day Gym Pavilion building present on site along eastern site boundary.	Land to north of Doncaster Drove mapped as Lakeside Country Park and appears to be for recreation, crossed by paths through vegetation and around the lakes and amphitheatre. Slopes indicated around perimeter of site indicating the area has been excavated and it topographically lower than the surrounds. Southampton Airport Station (train) present 50m southwest of site.
1992-2000 OS maps and 1999 aerial imagery	No significant change on site. Site comprises 3no. grassed fields divided by tree lined boundaries. The gym pavilion building is present close to the east boundary with 2 areas of hardstanding to the north and south along the eastern site boundary.	Southampton Airport undergoing redevelopment. Works, engineering works and warehouse buildings no longer present and construction of new Terminal building and multistorey carparks. Southampton Airport Station redeveloped as Southampton Parkway Station with car park and station building constructed between railway and Wide Lane circa 20m southwest of site.
2005 aerial imagery	Construction of the existing sports pavilion building, carpark and existing artificial pitches and tennis courts in the centre of the site.	Development of land circa 160m and 320m north ongoing, comprising clearing of vegetation for development platform.
2007 to 2012 aerial imagery	Ongoing development of carpark to north and south of main pavilion building.	Construction of new multistorey carpark for Station circa 20m southeast of site beyond A355. Development of allotments circa 160m northeast and residential housing circa 320m north.
2014 to 2017	No significant change on site.	No significant change.
2018 to 2022	Redevelopment of artificial pitches in centre of site.	Ongoing development of land circa 160m to 320m northwest of site, comprising residential and school buildings of Stoneham Park Academy.

Review of the historical site use does not indicate any significant sources of potential contamination on site or in the immediate vicinity. The site is effectively greenfield, remaining undeveloped until the 1970s when it was developed as grassed pitches.

2.3 Geology and ground conditions

A review has been conducted of publicly available records held by the British Geological Society (BGS) near the Wide Lane site and is summarised in the following sections and presented in Figure 2.

2.3.1 Site Geology

Geology mapping indicates the following geological sequence of natural deposits at the site:

- Superficial geology comprising River Terrace Deposits (typically sand and gravel) with overlying Alluvium (predominantly soft clays and silts, accompanied sometimes by sand and gravel) along the western boundary;
- Bedrock geology comprising London Clay Formation (predominantly silty clay, accompanied sometimes by silt and sand)

Due to the site history, localised made ground is anticipated to be encountered on site associated with the construction of the onsite pavilion buildings, existing artificial pitches and paths. Made ground deposits may be encountered beneath the existing grassed pitches in the location of the new proposed pitches relating to the existing a positive drainage system.

2.3.2 Nearby borehole records

The eastern and southern boundaries of the site include historical boreholes, with 5no. borehole records in reasonable proximity of the proposed works. These are summarised in the following table.

Table 2 - BGS Borehole Records

Reference	Year	Elevation	Depth	Soil descriptions	Groundwater
SU41NW363	1972	+10.71m OD	7.2m	0.0-0.6m – TOPSOIL then GRAVEL with soft sandy clay 0.6-6.4m – Medium dense GRAVEL grading very dense with depth. Localised sandy clay bands up to 0.2m thick. 6.4-7.2 – Very dense SAND with layers of sandy clay.	4.70m bgl (+6.01m OD)
SU41NW364	1972	+10.78m OD	4.45m	0.0-1.2m – TOPSOIL then interbedded mixtures of GRAVEL and Sandy CLAY. 1.2-3.7m – Medium dense GRAVEL over Sandy GRAVEL. 3.7-4.45m – Very dense fine SAND.	3.70m bgl (+7.08m OD)
SU41NW365	1972	+10.49m OD	12.45m	0.0-0.3m – Productive soil with gravel 0.3-1.65m – Loose GRAVEL with brown sandy clay. 1.65-2.90m – Dense black rounded GRAVEL with some brown sandy clay. 2.90-3.50m – Dense SAND and black rounded GRAVEL 3.50-12.45m – Very dense pale brown fine and medium SAND with traces of brown silty clay	3.00m bgl (+7.49m OD)
SU41NW236	1968	+9.48m OD	4.55m	0.0-1.50m – Made ground: mainly clay, bricks and stones. 1.50-3.35m – SAND and GRAVEL with traces of clay. 3.35-4.55m – Stiff brown sandy CLAY	2.45m bgl (+7.03m OD)
SU41NW235	1968	+7.8m OD	10.65m	0-0.45m – TOPSOIL. 0.45-2.9m – Firm becoming soft grey/brown mottled organic silty CLAY, finely fissured at upper levels. 2.9-4.25m – Flint GRAVEL with some sand 4.25-10.65m – Stiff grey silty sandy CLAY with partings and pockets of silt and fine sand becoming fissured at lower levels.	Struck at 2.75m bgl Water level at 1.67m (+6.13m OD)

2.3.3 Natural Ground Stability Hazards

The Envirocheck report (Appendix B) indicates the following in relation to natural ground stability hazards:

- The potential for **Collapsible deposits** is listed as having a hazard potential from ‘very low’ to ‘no hazard’ on site.
- The potential for **Compressible deposits** on site is listed as having a hazard potential of ‘moderate’ to ‘no hazard’. The moderate hazard potential is anticipated to be associated with the Alluvium deposits which are present to the west of the site and are not considered to be present beneath the wider site.

- The potential for **Ground Dissolution hazards** on site is listed as having a hazard potential of ‘no hazard’.
- The potential for **Landslides** on site is listed as having a hazard potential of ‘very low’.
- The potential for **Running Sands deposits** on site is listed as having a hazard potential of ‘low’ to ‘very low’.
- The potential for **Shrinking or Swelling Clay deposits** on site is listed as having a hazard potential of ‘low’ to ‘no hazard’. The low hazard potential is anticipated to be associated with the Alluvium deposits present to the west of the site which are not considered to be present beneath the wider site.
- The **Radon Potential** for the site indicates the site is in an ‘intermediate’ probability radon area where 3 to 5% of homes are estimated to be at or above the Action Level. The UK radon map was updated in December 2022 and supersedes the results within the Envirocheck report [7]. Basic radon protective measures are necessary for new dwellings or extensions at the site however, the proposed development does not include the construction of buildings and therefore is considered to be unaffected by radon protective measures.

2.4 Hydrogeology

Aquifer designations for relevant geological units within the site are provided in the table flow. Aquifer designation have been obtained from the DEFRA online MAGIC database and corroborated by the Envirocheck report (Appendix B).

Table 3 - Aquifer Designations

Geological Unit	Aquifer Designation	Description
River Terrace Deposits	Secondary A	‘Permeable layers that are capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.’
London Clay Formation	Unproductive	‘Areas comprised of rocks that have negligible significance for water supply or baseflow to rivers, lakes, and wetlands. They consist of bedrock or superficial deposits with a low permeability that naturally offer protection to any aquifers that may be present beneath.’

The site is designated as having a medium groundwater vulnerability which is defined as ‘areas that offer some groundwater protection. Intermediate between high and low vulnerability’.

Review of the available BGS borehole records within the vicinity of the site encountered groundwater was at depths between 4.70m and 1.67m below ground level (+6.01m to +7.49m OD). It is therefore anticipated that groundwater is present beneath the site at shallow depth and will vary seasonally.

Based on the topography of the site and surrounding area and the nearby surface water features it is anticipated that the groundwater flow direction on site is to the southwest and south of the site, towards the Monks Brook and River Itchen.

2.5 Hydrology

2.5.1 Surface water features

The nearest surface water feature is Monks Brook which, at its closest point, is within 30m of the site boundary and flows along the western boundary southwards before it joins the River Itchen. A large man-made lake is present immediately to the north of the site within Lakeside Country Park.

The River Itchen is just over 1km from the eastern site boundary, which flows to the south before changing course to begin flowing south-west to the south of the site boundary.

2.5.2 Flooding

The published flood risk map for planning indicates that the majority of the site is within Flood Zone 1 and the area along the western site boundary is within Flood Zone 2. Flood Zone 1 has a low probability of flooding meaning in any year it has less than 0.1% chance of flooding from rivers or the sea whereas Flood Zone 2 has a medium probability of flooding meaning in any year land has between 1% and 0.1% chance of flooding from rivers and 0.5% and 0.1% chance of flooding from the sea.

The BGS groundwater flood risk map within the Envirocheck Report (Appendix B) indicates that the entirety of the site has potential for groundwater flooding to occur at surface.

2.6 Environmental Setting

2.6.1 Waste and Landfill Facilities

There are 4No. registered landfill sites within 1km of the site, however the license for each of these is recorded as lapsed/cancelled/defunct or surrendered. These are summarised below:

- 7m to the north belonging to Sir Alfred McAlpine and Son Limited authorised for excavated natural materials and household waste. The first input date is the 19th January 1983. There is no recorded last input date, however the licence status is recorded as lapsed/cancelled/defunct;
- 166m to the north-east belonging to H T Hughes & Sons (Transport) Ltd authorised for sand, chalk, gravel and naturally occurring earth spoils. The licence is dated 1st May 1994 and its status is recorded as surrendered.
- 197m to the south belonging to A E Farr Ltd authorised for builders' rubble and earth spoils excluding by-pass. The license is dated 1st January 1988 and the status is recorded as lapsed/cancelled/defunct.
- 321m to the south belonging to Shellabear Price Ltd authorised for excavated waste. The license is dated 19th September 1985 and the status is recorded as lapsed/cancelled/defunct.

There are 10No. registered historical landfill sites located within 1km of the site. The landfills located within 250m of the site boundary are summarised below:

- 7m to the north belonging to Sir Alfred McAlpine and Son Limited authorised for Deposited Waste including Inert and Household Waste and unauthorised waste included biodegradable/putrescible waste. The first input date is the 19th January 1983. There is no recorded last input date.
- 8m to the north-east belonging to H T Hughes and Sons (Transport) Limited authorised for Deposited Waste including Inert Waste. There is no recorded first or last input date.
- 143m to the south belonging to A E Farr Limited authorised for Deposited Waste including Inert Waste. There is no recorded first or last input date.

There is 1No. registered waste treatment or disposal site within 1km of the site located 682m to the west belonging to J Remington authorised for silt dredged from North Stoneham Lake.

The historical and registered landfills located to the north of the site extend over the Lakeside Country Park comprising a large lake (approximately 270m by 200m), recreational open space and allotment gardens to the northeast. The lake and recreational use of the Lakeside Country Park was first mapped in 1986 and the first input date of the landfill covering the area was 1983. Similarly, the allotment gardens mapped beneath the H T Hughes and Sons landfill was licensed from 1994. These landfills are not anticipated to impact the site due to the subsequent development of the landfilled areas and the nature of the proposed onsite development.

2.6.2 Industrial Land Use

There are 27No. current industrial activities within 500m of the site boundary. The nearest activities, within 250m of the site boundary, include:

- Railways – 2No. in total including steam and miniature with status recorded as inactive;

- 1No. site with electrical engineers, windmills and windpower equipment and air conditioning equipment and systems, recorded as active;
- 2No. entries for airports belonging to Southampton Airport, recorded as inactive;
- 1No. car dealer at the site of Southampton Airport recorded as active;
- 2No. entries for cargo handling services and freight forwarders at the site of Southampton Airport recorded as inactive;

Based on the anticipated groundwater flow direction being towards the south and southwest of the site, these industrial land uses are not considered to have impacted the subsurface on site.

2.6.3 Licensed Discharges to Controlled Waters

There are 4No. discharge consents located on the site, and a further 40No. discharge consents within 500m of the site boundary. The discharge consents located on site are summarised below:

- University of Southampton as operator, with final/treated effluent discharged into land/soakaway with groundwater as the receiving water via infiltration system, issued in 2017;
- University of Southampton as operator, with sewage discharged onto land with groundwater as the receiving water via a soakaway, issued in 2005 and revoked in 2017;
- University of Southampton as operator, with sewage discharged onto land with groundwater as the receiving water via a soakaway, issued in 2005 and revoked in 2017;
- University of Southampton as operator, with sewage discharged onto land with underground strata as the receiving water, issued in 2003 and revoked in 2005.

These discharges indicate that the onsite drainage system is via a permitted infiltration system. The development proposals include scope for infiltration to ground.

2.6.4 Pollution Incidents

There is 1No. pollution incident to controlled waters within 500m of the site boundary, located 114m to the north at the Concorde Club in 1996 with septic tank effluent as the pollutant and resulted in sewage entering a brook. This was a Category 3 – Minor Incident. There is unlikely to be any impact from this incident on this site.

A further substantiated pollution incident was recorded within 30m of the site boundary to the north-west in 2012, with a Category 2 – Significant Incident to water. There is unlikely to be any long term impact from this incident on site.

2.6.5 Environmental Designations

This section of the report has been informed by a review of the DEFRA online MAGIC database and corroborated by the Envirocheck report (Appendix B).

- The site is located within a Nitrate Vulnerable Zone. Zone 3 named Hamble Estuary Eutrophic NVZ (TraC).
- This site is not located within any source protection zones (SPZ) and there are no SPZ within 1km of the site.
- There is 1No. Site of Special Scientific Interest (SSSI) and a Special Area of Conservation within 1km of the site boundary located 732m to the south-east for the River Itchen.

2.7 Unexploded Ordnance

Available Zetica UXO risk mapping indicates that the site is located within an area deemed to be Moderate risk of UXO [8]. A Zetica UXO bomb risk map was obtained for the site and is enclosed within Appendix C. The Zetica risk mapping identified 2no. Luftwaffe targets approximately 300m to 500m southeast of the site

associated with Southampton Airport, 1no. UXO find approximately 1km northwest of the site, and a strategic target relating to industry approximately 1km to the north.

Based on the above, it is recommended that a detailed UXO desk study and risk assessment is undertaken for the site to assess the risk for the proposed works. This should take into account the largely surficial nature of the proposed works.

2.8 Planning Applications

Eastleigh Borough Council online planning portal was accessed to identify relevant planning applications registered to the site. While several planning applications were identified, the applications did not concern development on site, instead concerning felling and maintenance of onsite trees, siting of portacabins on site, and the hosting of community events on site.

3. Preliminary Geo-Environmental Risk Assessment

3.1 Conceptual Site Model

A conceptual site model (CSM) describes the scenario in which the risks to human health and the environment (posed by contaminated land) are assessed. It describes the ground and surface conditions, the proposed ground works, and the final form of the development. In particular the CSM identifies and describes the sources of the potential contamination, the behaviour of the contamination in the environmental media such as soil and groundwater, surface water and air. It also identifies and characterises potential human health and environmental receptors, and plausible pathways.

The potential risks to human health and the environment have been considered in the context of a source - pathway-receptor (SPR) model of the site, identifying:

- The principal contaminant hazards associated with the site (the sources).
- The principal receptors at risk from the identified hazards.
- The existence, or absence, of plausible pathways which may exist between the identified hazards and receptor.

For risks to be present at the site, all three elements (source-pathway-receptor) of a plausible contaminant linkage must be present. Potential S-P-R linkages are described below based on the currently proposed site end-use.

3.1.1 Potential Contamination Sources

Limited sources of potential contamination have been identified on site due to the limited history of development at the site. The potential sources of contamination comprise the following:

- The only source of potential contamination on site is the presence of made ground associated with the built development which is concentrated in the east and south of the site away from the proposed development. Any made ground in the vicinity of the pitches is likely to comprise granular fill as part of the positive drainage system and is considered unlikely to be contaminated.
- The only other potential source of contamination relevant to the site is the presence of historical landfills to the north of Doncaster Drove which accepted inert and household wastes. The license details for the landfill states that no biodegradable or putrescible waste was permitted. Consequently, the historical landfills are not anticipated to be a substantial source of ground gas on site. However, there is potential that leachable contamination from the landfills has migrated in the subsurface beneath the site as the landfills are considered to be hydraulically upgradient of the site and the River Terrace Deposits are anticipated to be transmissive.

3.1.2 Receptors

- Construction workers
- Site End Users and Maintenance workers
- Secondary A aquifer (River Terrace Deposits)
- Offsite surface water (Monks Brook)

3.1.3 Pathways

- **Dermal contact and ingestion of soils:** During construction of the artificial pitches, construction workers are likely to be exposed to on site made ground (where present) via dermal contact and ingestion pathways. On completion of the development, there is considered to be no exposure for site end users or maintenance workers via dermal contact or ingestion as the artificial pitch build up (50-60mm of artificial turf over 65mm of porous asphalt) and concrete around the pitch perimeters will be sufficient to break the pathway.

- **Inhalation of Ground Gas:** No significant sources of ground gas have been identified on site or in the vicinity and there are no enclosed spaces proposed therefore there is no pathway for the inhalation of ground gases.
- **Dermal contact and ingestion of potentially contaminated groundwater:** During construction of the artificial pitches, groundwater is not anticipated to be encountered. Historical on site BGS boreholes encountered groundwater between 1.67m and 4.70m bgl and based on the build ups presented within the RIBA Stage 1 report, excavations for the new pitches are likely to be between 0.5m to 1.0m bgl. Therefore, there is no plausible pathway for construction workers to be exposed to contaminated groundwater during the construction works and likewise, on completion of the development there is no pathway for the site end users to be exposed potentially contaminated groundwater originating from the offsite historical landfills.

3.1.4 **Plausible Contaminant Linkages (PCLs)**

Based on the preliminary conceptual site model presented in the previous sections, one plausible pollutant linkage has been identified relating to the proposed development and is detailed below.

- **PCL1: Construction workers exposure to onsite Made Ground** – During construction of the new pitches, construction workers may be exposed to onsite made ground (where present) via dermal contact and ingestion of soil. The onsite made ground is not anticipated to be contaminated and exposure will be short term only, so the risk is considered to be low.

4. Preliminary Considerations & Recommendations

4.1 Geotechnical Considerations

4.1.1 Foundation design

Due to the presence of sands and gravel on site, shallow footings are expected to be appropriate for lightly loaded buildings at the site.

The foundation soils should be exposed and inspected for soft spots, potentially with discrete probing to confirm that pockets of compressible alluvium are not included within the gravels and sands within the footing's stress bulb (ie. a depth of 1.5-2.0 times breadth).

4.1.2 Excavations

Excavation in the site soils will be readily achievable using typical hydraulic plant such as excavators or backhoe loaders. It is anticipated that dry batter slopes up to 1v:2h should be achievable.

Groundwater level at the site has not yet been proven by a site-specific ground investigation, and accordingly excavations near to or below the groundwater table will be susceptible to collapse unless shored or battered.

4.1.3 Suitability for infiltration

The granular nature of the soils at the site will be suitable for infiltration of collected surface water. A permeability of $1 \times 10^{-3} \text{m/s}$ could be suitable for preliminary design purposes, however this should be confirmed through site specific permeability testing (such as either BRE style soakaway pits or variable head borehole infiltration tests).

4.1.4 Buried Utilities

According to the Arup Civil Engineering Technical Note [11], the existing artificial pitches to the south of the proposed new pitches have a positively drained storm drainage system and electrical supply to the flood lights but further information such as their route, location and depth are unknown. A linesearch check did not identify any known public utilities within the grassed pitches. Three of the pitches to the north of the artificial pitches have had a system of land drainage installed. The technical note recommended a non-intrusive utility survey for the entire site to identify private utilities and the existing positive drainage system for the artificial pitches to inform the drainage design for the proposed development and future design constraints.

4.1.5 UXO

The Zetica UXO bomb risk mapping identifies the site as being within a moderate risk area. In addition, a number of strategic targets and Luftwaffe targets and a known UXO find were identified within 1km of the site. Based on the above it is recommended that a detailed UXO desk study and risk assessment is undertaken for the site in the context of the proposed works.

4.2 Geo-Environmental Considerations

Based on review of the information presented within this desk study, there are limited geo-environmental constraints identified relating to the site and the proposed development. The identified features and constraints surrounding the site are presented in Figure 3.

4.2.1 PCL1: Construction workers exposed to onsite Made Ground.

During construction of the new pitches, construction workers may be exposed to onsite made ground (where present) via dermal contact and ingestion of soil. The onsite made ground is not anticipated to be contaminated and exposure will be short term, so the risk is considered to be low. However, without ground investigation information the level of risk posed to construction workers is unknown and as such the

contractor should undertake their own assessment to confirm the appropriate PPE and health and safety procedures.

4.2.2 Surface water infiltration

Based on information provided within the RIBA stage 1 report [1] and the Envirocheck report (Appendix B), the existing grassed pitch drainage system discharges to groundwater via soakaway/infiltration. It is therefore considered likely that surface water run-off from the new artificial pitches discharging to groundwater using the existing drainage systems on site will be acceptable provided the materials used in the construction of the artificial pitches are not a source of leachable contamination.

4.2.3 Materials Re-use

There is not anticipated to be any scope for the re-use of excavated soils within the site and therefore the excavated soils will require offsite disposal. Ground investigation is recommended to obtain soil samples for waste assessment to identify the appropriate disposal options. Excavated materials are anticipated to comprise topsoil, subsoil and made ground associated with the drainage system for the existing pitches. The excavated materials are not anticipated to be contaminated and therefore are considered likely to be suitable for inert disposal. The topsoil and subsoil may also be suitable for reuse on other sites, subject to confirmation through chemical analysis of soil samples.

4.3 Recommendations

4.3.1 Ground Investigation

Based on the above findings, it is recommended that a targeted ground investigation is completed to understand on site ground conditions and inform the detailed design. The ground investigation may include the following:

- Boreholes and or trial pits to confirm ground conditions, groundwater level, complete infiltration testing and collect soil samples for laboratory analysis. These ground investigation proposals will be finalised once the design criteria for the artificial pitches is understood from the supply chain;
- Dry weight and waste acceptance criteria (WAC) of soil samples to inform disposal options;
- Laboratory analysis of topsoil and subsoil to inform potential for reuse on other sites.
- If encountered, made ground soils should be sampled and sent for laboratory analysis to confirm risk to construction workers.

4.3.2 UXO

A detailed UXO desk study and risk assessment is recommended to be completed by a specialist practitioner to assess the potential UXO hazard in the context of the proposed development.

4.3.3 Buried Utilities

A non-intrusive utility survey for the entire site is recommended to identify private utilities and the existing positive drainage system for the artificial pitches, to inform the drainage design for the proposed development and future design constraints.

4.3.4 Unexpected Contamination

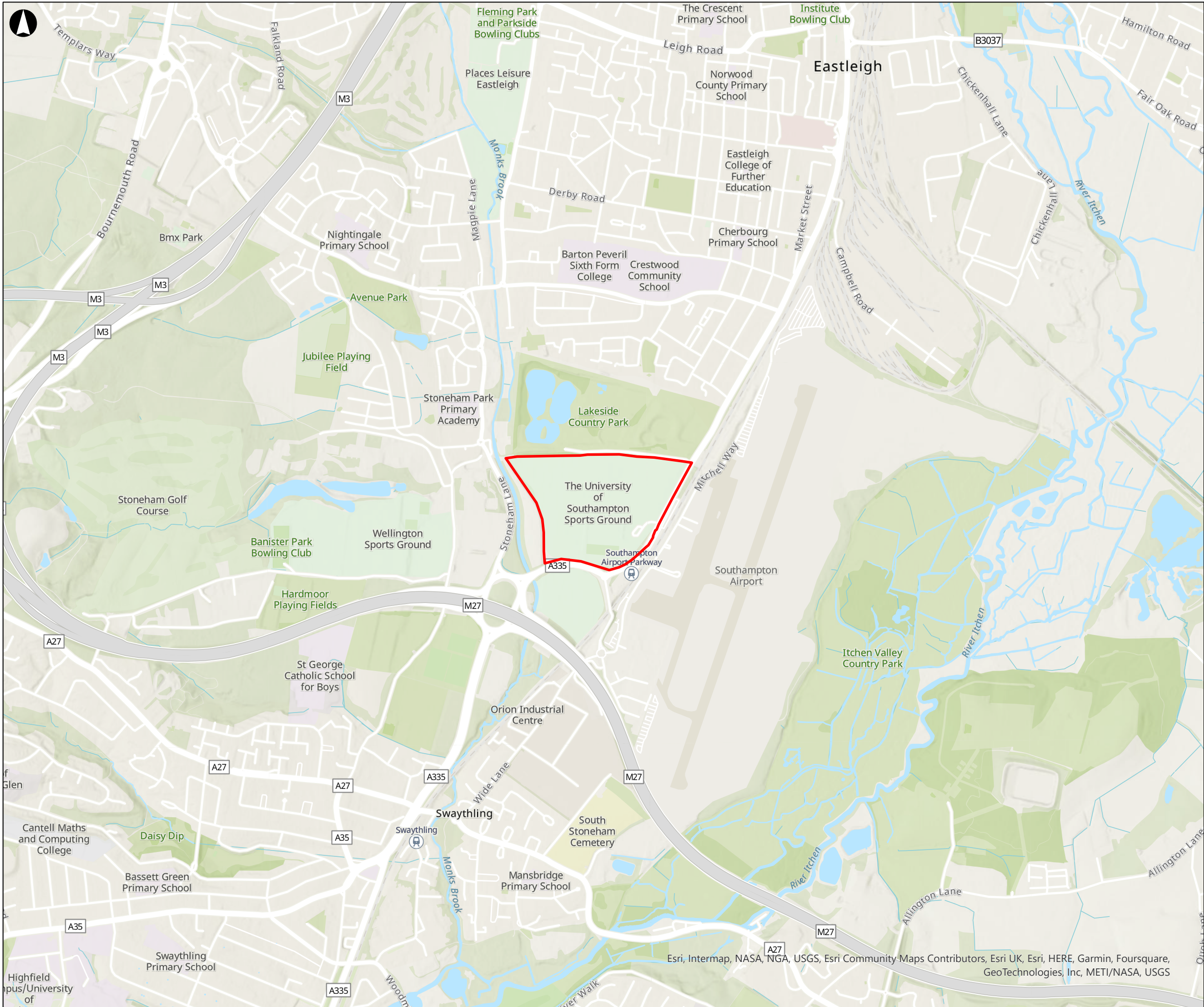
The information presented within this report does not identify any anticipated sources of contamination within the location of the proposed development and no plausible contaminant linkages have been identified aside from short term exposure of construction workers. A watching brief is recommended to be undertaken during the intrusive works for the proposed development to identify any unexpected contamination.

References

- [1] Arup, “Wide Lane Sports Centre: RIBA Stage 1 - Feasibility Study Report (293368-ARUP-ZZ-XX-RP-V-001_P02),” 2023.
- [2] BGS, “Geological Survey of England and Wales 1:63,360/1:50,000 geological map series, New Series,” [Online]. Available: <https://webapps.bgs.ac.uk/data/maps/Maps.cfc?method=listResults&series=E50k&scale=&origID=&getLatest=Y&pageSize=100&MapName=cardiff>. [Accessed 05 12 2022].
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- [7] UKHSA, “UK maps of Radon,” UK Health Security Agency, December 2022. [Online]. Available: <https://www.ukradon.org/information/ukmaps>. [Accessed March 2023].
- [8] Zetica, “Zetica Online Risk Maps,” [Online]. Available: <https://zeticauxo.com/downloads-and-resources/risk-maps/>. [Accessed February 2023].
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- [10] Google, “Google Earth Pro,” [Online]. Available: <https://earth.google.com/web/>. [Accessed 2023].
- [11] CIRIA, “Contaminated Land Risk Assessment: A Guide to Good Practice (C552),” Construction Industry Research and Information Association, London, 2001.
- [12] Environment Agency, “Land Contamination Risk Management (LCRM),” Environment Agency, 2021.

Figures

Figure 1 - Site Location Plan



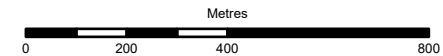
 Red Line Boundary

A3

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Coordinate System: British National Grid

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University of Southampton

Project Name

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Drawing Title

Figure 1 - Site Location Plan

Scale at A3

1:15,000

Role

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Suitability

Issue

Project Number

293368

Drawing Number

001

Rev

01

Esri, Intermap, NASA, NGA, USGS, Esri Community-Maps Contributors, Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS

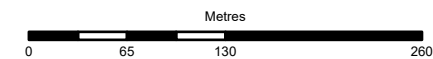
Figure 2 - Published Geology Plan



Red Line Boundary

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Coordinate System: British National Grid



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Figure 1 - Site Location Plan

Scale at A3
1:5,000

Role

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Suitability

Issue

Project Number
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Drawing Number
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Rev
01

Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS

Figure 3 - Features and Constraints Plan



- Legend**
- Red Line Boundary
 - Local Authority Pollution Prevention and Control (LAPPC)
 - Pollution Incident
 - Substantiated Pollution Incident
 - Registered Landfill
 - EA Historical Landfill

Coordinate System: British National Grid

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0 65 130 260

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Figure 3 - Features and Constraints Plan

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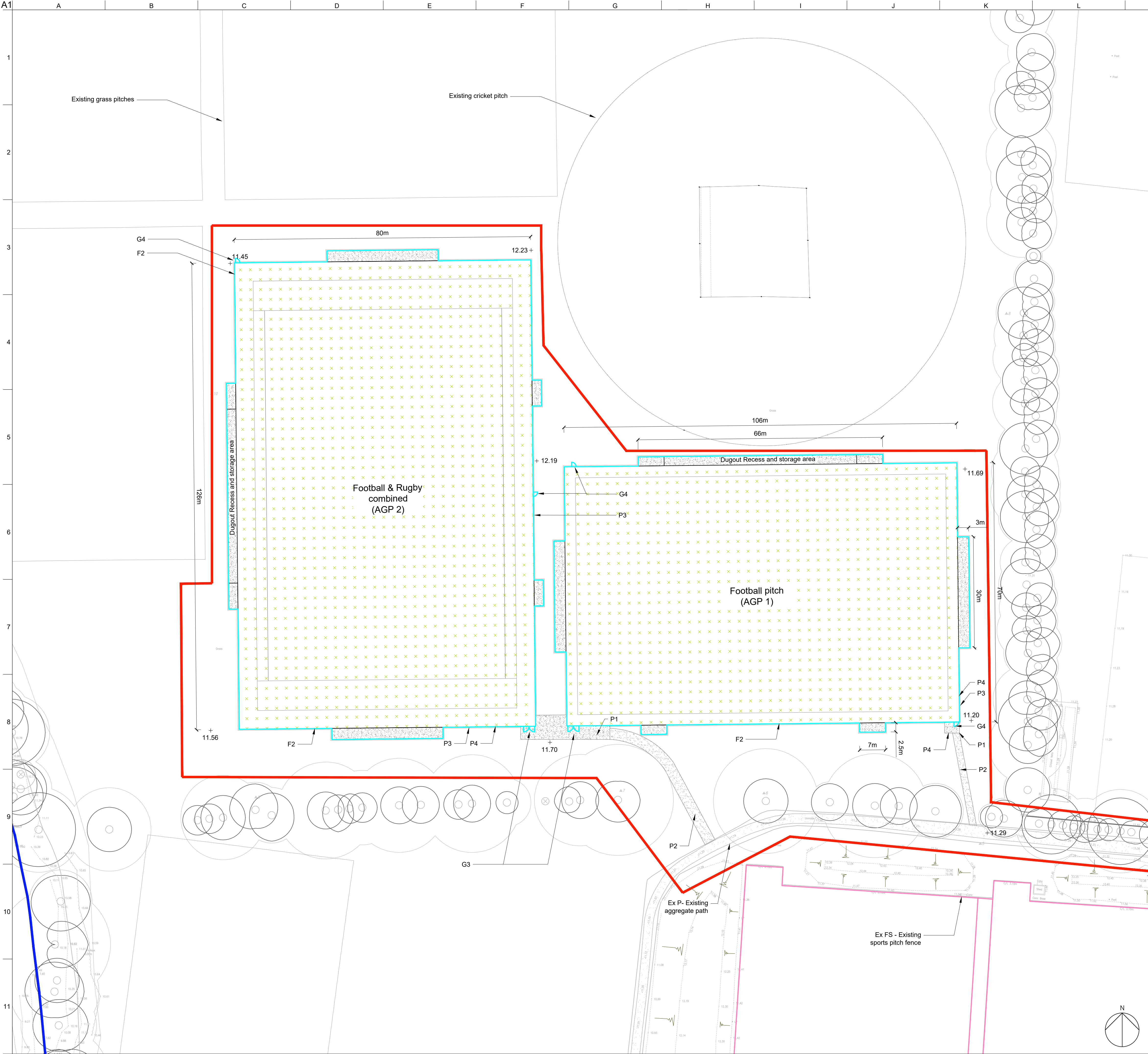
Role
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Suitability
Issue

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Drawing Number 003	

Appendix A

Development Proposals



- Artificial Grass Pitch 1 (AGP 1)
'Football Pitch'
106 x 70 m
- Outline specification notes:
- Principal playing area: 100 x 64m
 - Principal playing area plus run offs: 106 x 70m (does not include the goal recesses and dug-out areas)
 - Goal recess areas and dug-outs (2.5 / 3m deep) as shown on the layout.
 - Space in recesses to accommodate the following size goals:
2 x 11-aside [24ft x 8ft / 7.32m x 2.44m]
4 x 9-aside [16ft x 7ft / 4.88m x 2.13m]
8 x 5-aside [16ft x 4ft / 4.88m x 1.22m]
 - Sports pitch to include over markings (to be determined at detailed design)
 - For excavation depths, build ups, formation and drainage refer to Civil Engineer / Specialist Contractor information (to be developed at detailed design).
 - Ensure single plane gradient not exceeding 1%
 - 65mm depth of porous asphalt (tbc Specialist Contractor details)
 - 50mm or 60mm artificial turf installation on porous asphalt base. 'Football only' 3G turf system - 'LigaTurf RS+R 260 18/4' by *Polytan* or equivalent and approved to meet current NGB performance requirements.
 - 'Super Rebound 8' double wire mesh fencing (5.08m high) with integrated rebound mesh by *Zaun* or equivalent and approved. Fence to be RAL 6005 - Moss Green. *Additional ball stop netting by Zaun or equivalent and approved behind the goals at either end (height tbc detailed design).*
 - Single pedestrian gate (min. 1.2m wide) and double vehicle gates (3m wide) incorporated to match adjacent fence. Gate access control / requirements tbc detailed design.
 - PC concrete edging to perimeter of pitch
 - PC concrete slab mowing strip to the outside of the perimeter fence line (300mm)
 - Boot wash area (with water supply and local drainage) to the main point of entry.
 - Column floodlighting system to Specialist contractor / MEP information.
 - Pitch line marking layout to be approved by Client and to meet NGB requirements at the detailed design stage.
 - Space for storage container to be located in 'dugout and storage' recess area (tbc detailed design)

- Artificial Grass Pitch 2 (AGP 2)
'Football and Rugby Pitch combined'
126 x 80 m
- Outline specification notes:
- Principal playing area: 100 x 70m
 - Principal playing area plus run off and in-goal area: 126 x 80m (does not include the goal recesses and dug-out areas)
 - Goal recess areas and dug-outs (2.5m / 3m deep) as shown on the layout
 - Space in recesses would accommodate the following size goals:
2 x 11-aside [24ft x 8ft / 7.32m x 2.44m]
4 x 9-aside [16ft x 7ft / 4.88m x 2.13m]
8 x 5-aside [16ft x 4ft / 4.88m x 1.22m]
 - Sports pitch to include over markings for (to be determined at detailed design)
 - For excavation depths, build ups, formation and drainage refer to Civil Engineer / Specialist Contractor information (to be developed at detailed design).
 - Ensure single plane gradient not exceeding 1%
 - 65mm depth of porous asphalt (tbc Specialist Contractor details)
 - 50mm artificial turf (dual yarn) installation on in situ shock pad (25mm). 'Football and Rugby combined' 3G turf system - 'LigaTurf Cross R 250 13/8' by *Polytan* or equivalent and approved to meet current NGB performance requirements.
 - 'Super Rebound 8' double wire mesh fencing (5.08m high) with integrated rebound mesh by *Zaun* or equivalent and approved. Fence to be RAL 6005 - Moss Green. *Additional ball stop netting by Zaun or equivalent and approved behind the goals at either end (height tbc detailed design).*
 - Single pedestrian gate (min. 1.2m wide) and double vehicle gates (3m wide) incorporated to match adjacent fence. Gate access control / requirements tbc detailed design.
 - PC concrete edging to perimeter of pitch
 - PC concrete slab mowing strip to the outside of the perimeter fence line (300mm)
 - Boot wash area (with water supply and local drainage) to the main point of entry of proposed pitches.
 - Column floodlighting system to Specialist contractor / MEP information.
 - Pitch line marking layout to be approved by Client and to meet NGB requirements at the detailed design stage.
 - Space for storage container to be located in 'dugout and storage' recess area (tbc detailed design)

Legend

- Site ownership boundary
- Site boundary
- Existing buildings
- External existing levels

Boundaries / Fences

- Ex F - Existing fence
- Ex FS - Existing sports fence to be retained
- F1 - Proposed security fence
- G1 - Proposed security gate (vehicular)
- G2 - Proposed security gate (pedestrian)
- F2 - Proposed sports pitch fence (5m)
- G3 - Proposed sports pitch gate (vehicular) to match adjacent fence
- G4 - Proposed sports pitch gate (pedestrian) to match adjacent fence

Surfaces and Paving

- AGP 1 - Artificial Grass Pitch area (Football only)
- AGP 2 - Artificial Grass Pitch area (Football and Rugby combined)
- P1 - Porous asphalt
- P2 - Proposed aggregate path (to match existing)
- P3 - PC paving (min. 300mm) mowing strip to perimeter of AGP
- P4 - PC Edging (50mm)
- Ex P- Existing aggregate paths

Soft Landscape

- Existing trees
- Tree root protection areas

- Notes:
- To be read in conjunction with Tree Condition Survey & Report, document ref: EAS-026-WL-01
 - To be read in conjunction with New Sports Pitches and Security Fence DAS.
 - To be read in conjunction with Typical fencing detail drawing: 293368-ARUP-ZZ-XX-DR-L-0600 and 293368-ARUP-ZZ-XX-DR-L-0601

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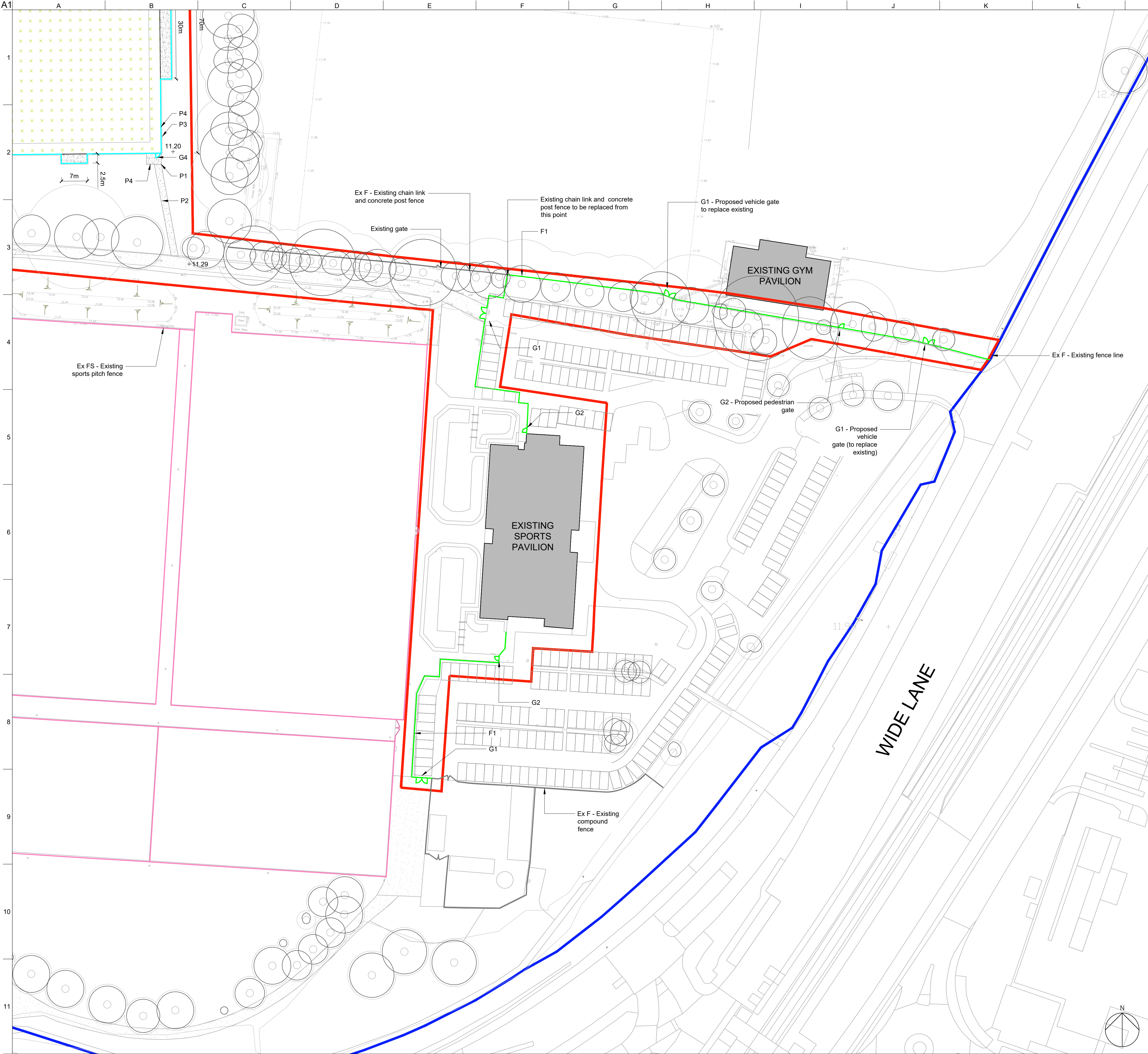
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Proposed General Arrangement Plan
Sheet 1 of 2

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Discipline Landscape Architect

Job No 293368
Drawing Status S1

Drawing No 293368-ARUP-ZZ-XX-DR-L-0200
Issue P01



New Security Fence

Outline specification notes:

1. "Duo 8 SR1" perimeter security fencing (2.03m high) by Zaun or equivalent and approved.
2. To be read in conjunction with Typical fencing detail: 293368-ARUP-ZZ-XX-DR-L-0600 and 293368-ARUP-ZZ-XX-DR-L-0601
3. Security fence and gates to be RAL 9005 - Jet black (tbc detailed design)
4. Single pedestrian gate (min. 1.2m wide) and double vehicle gate (min. 3.1m wide) incorporated to match adjacent fence. Gate access control / requirements tbc detailed design.

Legend

- Site ownership boundary
- Site boundary
- Existing buildings
- External existing levels

Boundaries / Fences

- Ex F - Existing fence
- Ex FS - Existing sports fence to be retained
- F1 - Proposed security fence
- G1 - Proposed security gate (vehicular)
- G2 - Proposed security gate (pedestrian)
- F2 - Proposed sports pitch fence (5m)
- G3 - Proposed sports pitch gate (vehicular) to match adjacent fence
- G4 - Proposed sports pitch gate (pedestrian) to match adjacent fence

Surfaces and Paving

- AGP 1 - Artificial Grass Pitch area (Football only)
- AGP 2 - Artificial Grass Pitch area (Football and Rugby combined)
- P1 - Porous asphalt
- P2 - Proposed aggregate path (to match existing)
- P3 - PC paving (min. 300mm) mowing strip to perimeter of AGP
- P4 - PC Edging (50mm)
- Ex P - Existing aggregate paths

Soft Landscape

- Existing trees
- Tree root protection areas

Notes:

1. To be read in conjunction with Tree Condition Survey & Report, document ref: EAS-026-WL-01
2. To be read in conjunction with New Sports Pitches and Security Fence DAS.
3. To be read in conjunction with Typical fencing detail drawing: 293368-ARUP-ZZ-XX-DR-L-0600 and 293368-ARUP-ZZ-XX-DR-L-0601

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