





















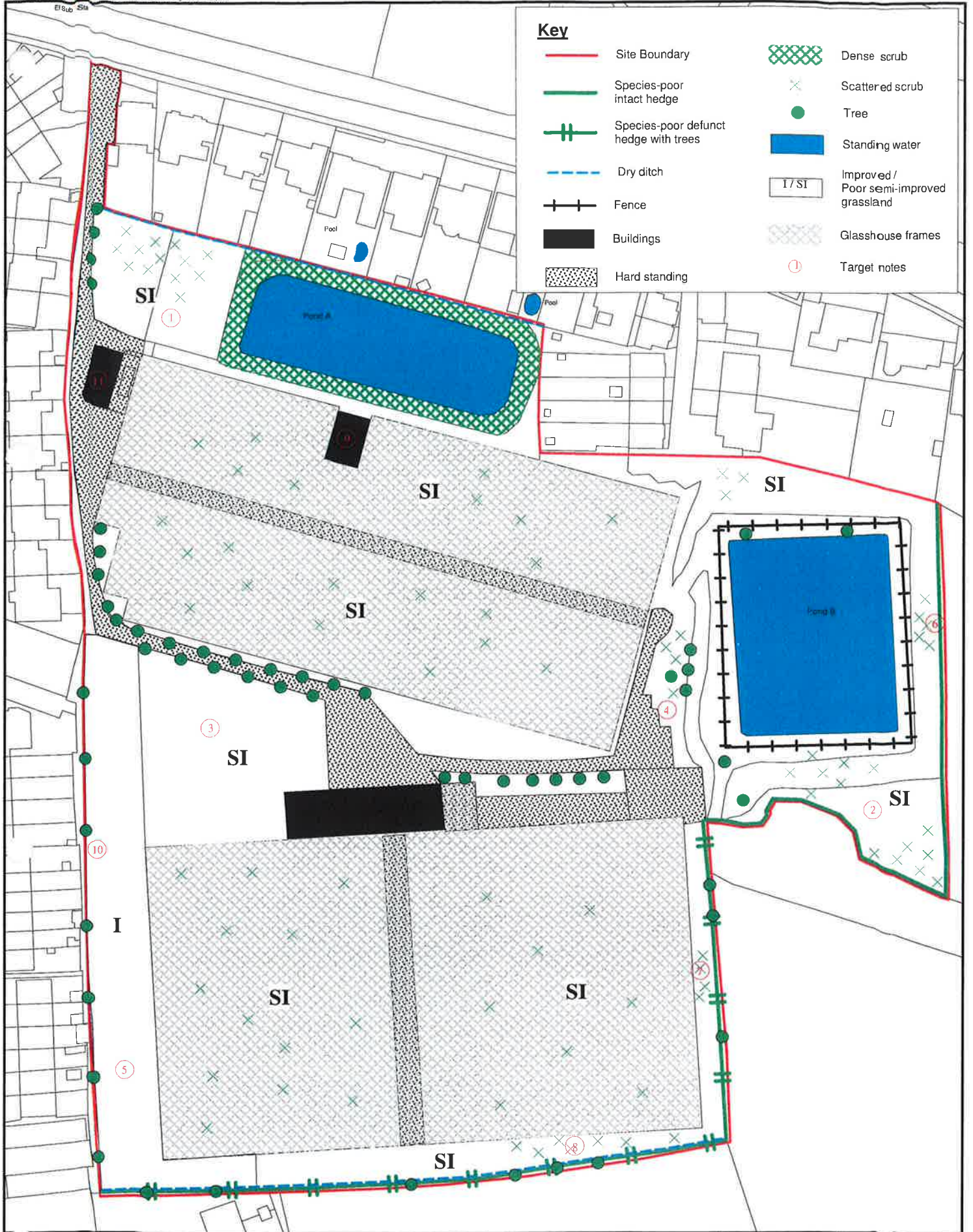
Samares Nurseries Ecological Enquiry

To be paired with Samares Nurseries GIS PDF.

KEY:	
	Contaminated Land
	Designated Ecological Site of Special Interest (SSI)
	Designated Geological Site of Special Interest (SSI)
	Species Action Plan Plants
	Common toad (<i>Bufo bufo</i>) Ponds
	Swallows (<i>Hirundo rustica</i>)/Martins (<i>Delichon urbica</i>)
	Thread-leaved Water-crowfoot (<i>Ranunculus trichophyllus</i>)
	Loose-flowered Orchid (<i>Anacamptis laxiflora</i>)
	Southern Marsh-orchid (<i>Dactylorhiza praetermissa</i>)
	Common Spotted-orchid (<i>Dactylorhiza fuchsii</i>)
	Loose-flowered Orchid (<i>Anacamptis laxiflora</i>)
	Autumn Lady's-tresses (<i>Spiranthes spiralis</i>)
	Barn Owls (<i>Tyto alba</i>)
	Bat Roost: Grey long-eared (<i>Plecotus austriacus</i>), Common pipistrelle (<i>Pipistrellus pipistrellus</i> , <i>Pipistrellus pygmaeus</i>) and Nathusius' pipistrelle (<i>Pipistrellus nathusii</i>).
	Invasive Gypsy Moth (<i>Lymantria dispar</i>)
	Invasive Gypsy Moth (<i>Lymantria dispar</i>)
	Grass Snake (<i>Natrix natrix</i>) records from 2006
	Red Squirrel (<i>Sciurus vulgaris</i>) Sightings
	Red Squirrel (<i>Sciurus vulgaris</i>) Road Traffic Accidents
	RAMSAR site

Capabilities on project:
Environment

Figure 5: Extended Phase 1 Habitat Plan



Key	
	Site Boundary
	Species-poor intact hedge
	Species-poor defunct hedge with trees
	Dry ditch
	Fence
	Buildings
	Hard standing
	Dense scrub
	Scattered scrub
	Tree
	Standing water
	Improved / Poor semi-improved grassland
	Glasshouse frames
	Target notes

MS PLANNING

Title: **FIGURE 5**
PHASE 1 HABITAT SURVEY PLAN

AECOM

Design: Betsabe Sanchez Mapinfo: Betsabe Sanchez

Chk'd: Pamela Hudson App'd: Pamela Hudson

Date: December 2009 Scale: Not to scale

Project: Samares Nurseries:
Ecology Extended Phase 1 Survey

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APPENDIX 7

Phase 1 Geotechnical and Geo-environmental Desk Study Report

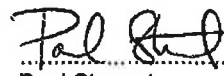
Samares Nursery
MS Planning
November 2009



Prepared by:


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Regional Director

Phase 1 Geotechnical and Geo-environmental Desk Study Report

Rev No	Comments	Checked by	Approved by	Date
A	First Issue			04/12/09

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Figure 1 Site Layout Plan

Executive Summary

On the instructions of MS Planning, AECOM Ltd has carried out a Phase 1 Study of the site known as Samares Nurseries, St Clement, Jersey. The project was commissioned in order to obtain and collate information on the geotechnical and environmental characteristics of the site and thence to assess the potential geo-environmental risk issues and provide recommendations for the proposed development.

Project Findings

<i>Current Usage</i>	The site is currently a disused greenhouse complex which consists of two large greenhouse structures and smaller outbuildings. Two reservoirs are also present on site. The vegetation on site is highly overgrown.
<i>Site Setting and Environs</i>	The site is located in the parish of St Clement, Jersey and bordered by residential properties and agricultural land. Potentially contaminative activities carried out on or near the site include: Historical Railway (1873 – 1929) Previous agricultural use with possible tanks Recent agricultural use with tank and boiler complex
<i>Site Reconnaissance</i>	The reconnaissance identified the following: Boilers Tanks Chimney/flue Storage tank, possibly containing oil Litter/dumped waste Electricity transformer station (just off site)
<i>Site History</i>	The site was initially undeveloped, located south of the main road into St Clement. The Eastern Jersey Railway was constructed across the centre of the site, operational from 1873 to 1929. A relic feature of the railway appears on maps up until 1998, representing a wooded linear feature. At sometime between 1942 to 1952, a greenhouse was constructed on the north western portion of the site. The southern portion remained undeveloped. Aerial photographs of 1974 show a small reservoir located in the north western corner of the site. Aerial photographs from 1997 show that the present day greenhouse in the north was constructed, as was the northern reservoir. The southern greenhouse and eastern reservoir are not shown on a map of 1998 and so have been constructed sometime after this. The complex has been redundant since 2002 and an enforcement notice was served on the owner in 2006 to remove the glass panes for safety reasons.

Geology

The drift geology of the site comprises Blown Sand to the north and Loess to the south with the boundary running east to west across the centre of the site. The solid geology comprises a plutonic complex of Diorite and Gabbro. There is also likely to be Made Ground. The drift deposits may hold shallow groundwater, as may the bedrock. The nearest water features are the two reservoirs located on site on the northern and eastern borders.

Project Conclusions

Ground Contamination

The study has identified the following possible sources of ground contamination on the site, including:

Contaminants in Made Ground – associated with former railway, infilling of reservoir, excavated material from two existing reservoirs

Ground gases generated from Made Ground/natural deposits

Pesticides/herbicides associated with crop production

Existing tanks and oil container

Existing boilers and chimney

Possible former oil tanks

Glass from current/previous greenhouses

Possible asbestos in sub soils

Litter/tipping

The most significant contamination issue associated with the site is considered to be the tanks which feed the boilers on site. The majority appear to be modified rail tank wagons and therefore may not be designed for the purpose they have been used for. One of the tanks is heavily damaged which may have compromised the structure. In addition, it is possible that pesticides/herbicides were used on site and so may be widespread in the underlying sub-soils and groundwater.

The preliminary findings suggest that the geo-environmental risks may be perceived as moderate.

Ground contamination is a material consideration under planning legislation. The site may be considered as Land Affected by Contamination and Phase 2 intrusive investigation works will be required in order to obtain the data for quantitative assessment of land contamination potential.

Remediation

The need for ground remediation cannot be assessed at this stage. A ground investigation and remedial options appraisal will be required to confirm the measures needed.

Geotechnical Hazards

The principal known hazards include the presence of Made Ground, highly compressible strata, shrinkable clay soils and a relatively high water table/perched groundwater.

Foundations

For low rise domestic properties the anticipated ground conditions may be suitable for lightly loaded shallow foundations, and potentially lightly loaded ground bearing floor slabs in the absence of made ground and/or infilled reservoirs. Shallow groundwater conditions are anticipated. Where low

permeability Loess soils are present soakaways may be unsuitable, where Blown Sand exists soakaway potential may be investigated, although high groundwater may preclude the use of soakaways. Also excavations may be unstable in the ground conditions identified at this stage. A ground investigation is required to establish site specific ground conditions and confirm foundation and drainage conditions.

Further Investigations

Phase 2 intrusive investigations are recommended.

1 Introduction

1 Introduction

1.1 Reason for the Report

On the instructions of MS Planning, AECOM Ltd (AECOM) has carried out a Phase 1 Geotechnical and Geo-environmental Desk Study of the site known as Samares Nurseries in St Clement, Jersey. The report was commissioned in order to obtain and collate preliminary information on the geotechnical and geo-environmental characteristics of the site and thence to assess the potential geo-environmental risks relating to the proposed development.

The scope of works have been carried out in accordance with AECOM fee proposal dated 29th October 2009, reference 'Samares Nurseries, St Clement, Methodology and Fees, Geo-Environmental and Geotechnical Services'.

The report has been produced on the assumption that the site will be redeveloped to create Category A housing, with between 100 and 150 residential properties.

This report presents a summary of readily available, published and unpublished information, which has been obtained and collated on the geotechnical and geo-environmental characteristics of the site. It records and discusses the desk study information and provides a qualitative assessment of specific site risks identified.

The report draws on information from, but not exclusive to the States of Jersey Island plan, historical island and town plans, historical Ordnance Survey plans, aerial photographs, geological and hydrogeological maps and a site walkover survey to establish potential ground related risks.

This draft issue desk study report will be updated with the findings from a geo-environmental questionnaire which has been sent to the site owner. Local knowledge of the site will enable further understanding of the recent history of the site and potentially contaminative land uses. The history of the site will also be updated with a number of photographs and maps ordered from the Jersey Archive.

1.2 Report Objectives

This report has been prepared to document the following:

- Review of readily available published and unpublished data which could provide information on the current status, ground conditions and site history;
- Findings of a site walkover survey undertaken on the 19th November 2009;
- Findings of the preliminary contaminated land risk assessment;
- Findings of a preliminary geotechnical risk assessment.

1.3 Sources of Information

This report has been prepared using information from the following sources:

- British Geological Survey, 1992. Hydrogeological Map of Jersey. Scale 1:25,000
- 'Digimap' website: www.digimap.je
- HR Wallingford, 2007. 'Climate Change, Jersey: Effects on Coastal Defences'.
- Information collected from Jersey Archive
- Information collected from Lord Coutanche Library
- Institute of Geological Sciences, 1982. Solid and Drift Geological Map. Channel Islands Sheet 2 "Jersey". Scale 1:25,000.
- Information regarding tanks taken from: <http://gallery6801.fotopic.net/>
- States of Jersey White Paper – Draft Island Plan Draft Housing Development Briefs.
- States of Jersey, 2009. States Corporate Digimap System website: <http://maps.digimap.je/islandplan/?cords=44028,64129,500>
- 'States of Jersey' website: <http://www.gov.je/>
- 'This is Jersey' website: <http://www.thisisjersey.com/community/history-heritage/railways/>

1.4 Limitations of the Report

This report is a desk study report, which has been prepared using readily available information in accordance with the project stage requirements, budget and timescales. The opinions expressed in this report and the comments and recommendations given are based on the information obtained from desk assessment and an initial site reconnaissance. This draft report will be updated with the findings from a geo-environmental questionnaire which has been sent to the site owner. The history of the site will also be updated with a number of photographs and maps ordered from the Jersey Archive.

At this stage intrusive investigations have yet to be undertaken at site to establish actual ground and groundwater conditions and provide data for assessment of the geo-environmental status of the site.

The information, views and conclusions drawn concerning the site are based, in part, on information supplied to AECOM by other parties. AECOM has proceeded in good faith on the assumption that this information is accurate. AECOM accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to AECOM from others.

The geo-environmental walkover survey consisted of a general external inspection of the site aimed at identifying any obvious signs of geotechnical hazards affecting the site and potential sources of ground contamination. An environmental compliance audit and/or detailed structural inspection of existing buildings were outside the project brief.

Any risks identified in this desk study are perceived risks, based on the information reviewed; actual risks can only be assessed following a physical investigation on site.

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2 Site Location and Description

2 Site Location and Description

2.1 Location

The site is known as Samares Nurseries and is located to the south of La Grande Route De St Clement, in St Clement, Jersey.

The site is centred on National Grid Reference 44028, 64129 and postcode JE2 6NW. A site layout plan is provided as Figure 1.

2.2 Description and Geographic Setting

The site, which covers approximately 9.8 acres, is located within a residential setting within the parish of St Clement. At its closest point the site is 330m from the coastline. Residential houses are located on the northern and western boundaries as well as to the south west, whilst agricultural fields are located to the south and east.

The site is currently disused but was formerly used for tomato production. On site are two large greenhouses. The glass planes have been removed for safety reasons so that only the steel frame work remains. The ground cover within the greenhouses is softcover and the vegetation is very overgrown.

Two reservoirs are present on site, one to the north and one to the east. The northern reservoir is approximately 1500m² whilst the eastern reservoir is approximately 2000m².

The topography of the site is approximately 5 to 10m AOD. The majority of the site is relatively level however the eastern reservoir is separated from the site by a 2m high bank, whilst the northern reservoir has a 1m bank surrounding it. The site boundary on the south and west is demarked by a small bank of earth and fill.

The site boundaries are as follows:

North -	Residential properties along La Grande Route De St Clement
South -	A tree border and small earth bank separate the site from agricultural fields and a residential estate to the west
East -	Agricultural fields beyond the tree line
West -	Residential houses along Manor Close to the north and La Blanche Pierre close to the south

2.3 Site Walkover Survey

The site was visited on 19th November 2009. The geo-environmental reconnaissance survey consisted of an external inspection of the site. No entry was made into the greenhouses due to the unsafe structure. The aim of the survey was to identify the range of activities carried out on the site and any obvious potential sources of ground contamination. Photographs taken during the site walkover are presented in Appendix A.

The site is currently disused but it is understood that it was formerly used for tomato production. The site is accessed from the main road to the north which is not secured. On site are two large greenhouses; one to the north and one to the south. The glass planes have been removed for safety reasons so that only the steel frame work remains. The structure does not appear to be particularly stable. The walkover was carried out during strong winds and loose parts of the structure were observed.

Two further concrete buildings are present on site in addition to a small control room within the southern greenhouse. The larger concrete building to the north west appeared to be in fairly good condition and was boarded up. The second building to the north had a corrugated roof which was not weather proof and appeared to be in a quite poor state of repair. A general storage container is also present to the north west which appears to have been vandalised as the glass window has been smashed.

The northern boundary of the site is adjoined by residential housing, separated by heras fencing on the eastern side. The western boundary is separated from residential housing by walls or fences of back gardens. A small earth bank is also present comprising earth, vegetation and general waste. The southern boundary is backed onto by a housing estate on the western side and agricultural fields to the east. Again an earth bank is present. The eastern boundary is marked by a line of mature trees backing onto agricultural fields.

The site is estimated to comprise 20% hardcover and 80% softcover. Hardcover is found on the entrance road into the site which leads round to the east between the two greenhouses. The remainder of the site is softcover including the ground cover within the greenhouse structures. The vegetation within the greenhouses is very overgrown and reaches the roof of the structure in places. Vegetation consists of long grass, brambles, wild flowers and reeds, amongst other species. Trees are located along the entrance road through the site and along all site boundaries. The abundance of vegetation does not indicate any obvious signs of environmental stress.

The majority of the site is relatively level apart from the land surrounding the reservoirs. The northern reservoir could not be accessed as a thick border of brambles were present around the structure, however it appeared to be surrounded by a 1m sloped bank. The eastern reservoir was surrounded by a 2m bank that was steep in places but could be accessed in one location. Fencing is present around this reservoir. The internal banks of the reservoir slope gently and consist of soil and vegetation. A black liner was observed on the eastern side. Two drains were observed high up on the southern bank.

A boiler complex is associated with each greenhouse. The northern greenhouse is thought to be of older construction. Two boilers were noted inside the concrete building to the north. These were noted to be rusted and the main boiler doors were open. Two orange tanks were located to the south of the building but could not be accessed as these were inside the greenhouse structure. A further upright tank was noted immediately to the east of the building.

A second much larger boiler and tank complex is located to the north of the southern greenhouse. Two large boilers are located within the greenhouse structure connected to a large chimney. Gauges on the boilers appear to indicate that they may not be empty.

These boilers are fed by five tanks to the east. At least four of these tanks appear to be modified BRT Tank Wagons (British Rail) which are connected by metal pipes. The wagons have been taken off their rollers but are still sitting on their metal frames. The tanks are located on an area of hardstanding. One of the tanks appears to have been damaged and is misshapen. This is likely to have compromised its structure and so leaks may have occurred. The fifth tank is raised off the ground on concrete footings within a bunded area. All of the tanks are rusted and stained. The staining looks to be the result of both weathering and petroleum staining. It should be noted that these tanks are not featured on the site layout plan (Figure 1).

A standalone green plastic tank is located in the centre of the site on a wheeled trailer. Its contents are unknown but the tank appears to be an oil tank, perhaps once used to re-fuel the larger tanks.

A concrete plinth was observed to the east of the building in the north western portion of the site which may have once supported a tank. The site plan (Figure 1) details a rectangular object in this location which further indicates a former structure in this location.

Areas of stockpiled material and waste dumping were noticed on site. Construction rubble was noted on the eastern border in two discrete locations comprising slate, tile and brick and concrete and building stone respectively. Stockpiles of PVC drains were found in two locations to the east and west. Some discarded machinery was also observed. Other general windblown litter and dumped waste was observed around the site. Broken glass was also observed around the site.

Evidence of underground services was noted including drain pipes, drain covers and gullies. A small electricity transformer site was located at the top of the entrance road called '201 Samares Manor'. Disconnected electricity cables were noted loose on site.

The boundary wall on the western side was noted to have a large structural crack. The structures on site (not including greenhouses) showed evidence of some minor cracks.

A plan showing the main features of the site is included as Figure 2.

2.4 Information from Statutory Authorities

Information from the States of Jersey Island Plan website details some of the land use around the site. Features in the area include a waste management site located 300m to the south, areas classified as 'green zones' to the south and east and areas of 'protected open space'; the closest of which is located 80m to the south west shown to be a recreation ground.

2.5 Sensitive Land Uses

Archaeological sites are known to exist in the vicinity of the site and this has been highlighted in the Draft Island Plan. The closest area of archaeological interest is thought to be 100m from La Rue de la Bliinerie to the north known as 'Le Dolmen Du Mount Ube.'

The site is located 330m from a Ramsar site on the south east coast of Jersey. The Ramsar site extends from the port of St Helier on the south coast, to Gorey Harbour on the east coast, encompassing the south-east corner of the Island. The site comprises various habitats which provide important winter habitat for nationally important populations of waders and wildfowl.

2.6 Unexploded Ordnance

Jersey is not covered by UXO risk maps provided by the Zetica website and so a risk rating is not available for the site. Jersey was under German occupation during WWII and therefore there may be the risk of encountering UXO.

It is recommended that the Client commission a specialist UXO report in advance of any future intrusive site works or development.

2.7 Radon

Radon is a naturally occurring radioactive colourless and odourless gas formed by radioactive uranium, which is found in small quantities in all soils and rocks. Areas particularly at risk are those underlain by granite complexes. The site is underlain by a larger granite complex which occurs in the south east of the island; however the site is thought to be underlain by subordinate Diorite and Gabbro thereby reducing the risk of high radon levels.

However, due to the lack of data for the area, the risk should not be overlooked.

3 Development History

3 Development History

3.1 Sources of Information

A review of the history of the site and adjacent area has been undertaken using historical maps dated between 1896 and 1998 (Table 3.1). The maps were obtained through archive and library searches.

Reference to historical plans and Ordnance Survey (OS) maps provides invaluable information regarding the land use history of a site. However, it should be noted that historical evidence will be incomplete for the period pre-dating the first edition and between successive maps.

3.2 Historical Mapping

The site was initially undeveloped, located south of the main road into St Clement, originally known as 'St Clement's Road'. The Eastern Jersey Railway was constructed across the centre of the site, aligned east to west connecting Samares Station in the east with Grev D'Azette in the west. The railway was operational from 1873 to 1929. A relict feature of the railway appears on maps up until 1998, which was identified in aerial photographs to consist of a linear wooded tract. Information from a local heritage website states that the Eastern Jersey Railway was rebuilt during the German Occupation.

Some time from 1942 to 1952 a greenhouse was constructed on the north western portion of the site. This building was rectangular and approximately half the size of the current northern greenhouses. Aerial photographs from 1960 show that the greenhouse was made up of six individual rows and included the two outbuildings, which are present today. The southern portion of the site remains undeveloped. Aerial photographs of 1974 show a small reservoir located in the north western corner of the site and indicate that a further row had been added to the greenhouse structure. Information from the current site owner indicates that the greenhouse was extended to its present day configuration in 1976.

It is known from the Draft Island Plan that in 1997 approval was granted for a large greenhouse complex for tomato production. An aerial photograph from 1997 shows that the existing greenhouse in the north had been extended with the addition of the present day northern reservoir. The previous smaller reservoir located in the far north west was infilled with soil sometime in the 1970's. The southern greenhouse and eastern reservoir are not shown on a map of 1998 and so have been constructed sometime after this.

The complex has been redundant since 2002 and an enforcement notice was served on the owner in 2006 to remove the glass panes for safety reasons.

Further details are provided in the following table.

Table 3.1: Summary of Historical Mapping

Year [scale]	Features on-site	Features off site
Jersey Place Names (1986)	This composite map shows the track of the Jersey Eastern Railway crossing the site north west to south east across the central portion of the site. The railway is dated 1873 – 1929.	Area appears relatively undeveloped apart from the main road into St Clement.
Road Map of Jersey 1896	The railway is again marked as crossing the site.	The road to the north is known as 'St Clements Road' there are a number of quarries in the area including one to the north by Longueville Manor, to the north of Grouville Road and to the North West near the town of St Helier.
OS map 1914	It is difficult to locate the site exactly; however there is very little development in the surrounding area. A number of small residential buildings are located next to La Grande Route De St Clement. The railway is still shown.	A marsh is located to the south, close to the coast. A canal is located to the north, aligned east to west leading to Samares Manor.
The Royal Road	The railway is not shown. No other significant	No significant changes

Year [scale]	Features on-site	Features off site
Map of Jersey (1930)	development has taken place	
OS map 1936	No significant changes.	No significant changes.
1942 (unknown map)	No further development, railway is not shown nor is any relict feature.	No significant changes.
1952 (unknown map)	A greenhouse has been constructed on the north western portion of the site which is rectangular in shape .A linear feature crosses the site, east to west, which is thought to represent the former railway.	No significant changes.
1962 Island Plan	This plan shows the site in more detail and shows that in addition to the greenhouse are two small outbuildings, one to the east and one to the west. The site itself is not marked as part of the island plan.	The surrounding area is shown to be residential, with properties along La Grande Route De St Clement and the estate to the west. The areas to the west and south west are earmarked for a new secondary school and residential homes. An area of industry is marked to the north, just east of Bagot Vineries whilst a further building known as 'L'Industrie' is marked to the south east.
Aerial photo 1960	The aerial photograph shows the northern greenhouse and smaller outbuildings. There does not appear to be a reservoir on site at this time. Two tracks are thought to cross the site to the north of the greenhouse.	No significant changes.
Aerial photo 1974	The aerial photograph shows the relict railway as a linear, wooded feature. There are pale upright features shown which may be a fence. There is a circular feature to the south of the greenhouse which could be a tank. A small reservoir is shown located in the far north western corner of the site.	No significant changes.
OS map 1987	The northern greenhouse has been extended to its present day configuration. The smaller reservoir has been infilled and the larger, present day reservoir is shown on site. the southern portrion of the site remains undeveloped.	No significant changes.
Aerial photo 1997 (digimap)	The present day northern greenhouse and reservoir are shown on site. Some possible structures are shown on the north western corner of the site where the old reservoir was once located. Some activity is shown on the eastern reservoir site which may be the initial construction of the reservoir or alternatively may be associated with agricultural activity. The smaller outbuildings have been constructed. The linear feature is shown to consist of an area of vegetation with two dirt paths either side.	No significant changes.
1998 (unknown map)	No significant changes	No significant changes

4 Geology, Hydrogeology and Hydrology

4 Geology, Hydrogeology and Hydrology

4.1 Geology

4.1.1 Geological Information from Published Information and Maps

The published 1:25,000 scale geological map of the area produced by the Institute of Geological Sciences (Channel Islands Sheet 2, "Jersey", 1982) indicates the site is underlain by the following geological succession:

Table 4.1 Geological succession from Published Mapping

Group	Geology
Recent	Blown Sand
	Loess
Late Precambrian or lower Palaeozoic	Diorite and Gabbro

Blown Sand comprises sand located in a coastal strip less than 500m wide. The deposit is generally up to 15m thick. The sand comprises of quartz-feldspar sand with few structures and contains shell debris at St Clement's Bay derived from the shell-sand of the beach

Loess comprises wind-blown glacial orange-yellow to pale brown clay and silts. The deposit thickens eastward across the island and may be up to 4m thick on site. Most of the deposit is decalcified and has a banded appearance as a result. A few sections are calcareous at the base and calcareous concretions can occur.

There is a boundary between the superficial deposits trending east to west across the centre of the site. Blown Sand is found to the north of this boundary whilst Loess is found to the south.

The **Diorite and Gabbro** is part of a plutonic rock complex with associated granites which have undergone alteration during intrusion. Diorites are generally coarsely crystalline, intermediate plutonic igneous rocks, medium grey in colour with a speckled appearance produced by black hornblende and/or augite crystals and white to pale feldspars. Quartz may form up to 10% of the rock. Gabbro is a dark grey to black, coarsely crystalline, plutonic, basic igneous rock. Clear distinction cannot be easily made between diorite and gabbro as some of the diorites have relict textures and mineralogy indicative of gabbros. Some of the diorites appear brecciated or to contain xenoliths of gabbro where coarsely crystalline diorite veins have intruded them. The rocks generally exhibit a layered sequence. Dip angles of the complex at Le Nez on the coast are 70° or more to the north east.

The existing topography and history of development of the site suggests that, in addition to these natural strata, Made Ground may be present on the site, particularly from the railway construction and demolition, excavation and infilling of the historical reservoir and excavation of the two current reservoirs on site.

4.2 Hydrogeology

4.2.1 General Characteristics

The hydrogeology of the site is likely to be characterised by the presence of an unconfined shallow aquifer comprising superficial deposits of Blown Sand and/or Loess.

The Blown Sand aquifer is present to the north of the site. This aquifer is used for public supply elsewhere on the island and can have a maximum saturated thickness of 8m. The Loess forms a fine grained weakly permeable cover and is generally above the water table.

The Diorite and Gabbro bedrock may also store water through shallow granular weathering and dilation of joints, faults and other dislocations.

Borehole data from 50 monitoring wells, collected by the BGS, is published on the States of Jersey website.

The closest borehole, J100, is located to the north. Whilst not thought to be located within the same solid geology the groundwater level recorded gives an indication of the groundwater level in the area which is estimated to be in the region of 2.0 - 2.5m bgl.

The site is shown to be outside the region of sea water intrusion.

The regional direction of groundwater flow is generally thought to be to the south, towards the coast. It is possible that localised perched water may also be present in any Made Ground on site.

4.2.2 Water Abstraction

Approximately 90% of the population receive their water from the public water supply which is replenished from surface water. However a percentage of the population receive water from private boreholes and wells. The quantity of water pumped from the Island's groundwater is presently not known however abstractions are currently undergoing registration as part of 'The Water Resources (Jersey) Law (2007)'. To date, over 2700 registrations have been received. It is unknown whether one of these abstraction is located close to the site.

The groundwater resource of Jersey is particularly vulnerable to pollution because the groundwater is at shallow depth in fractured rock, protected only by thin and permeable soils.

Historically high nitrate levels have been detected in the Island's groundwater. Pesticides and their breakdown products have also been found, however, breaches of EC maximum admissible concentrations are uncommon.

In terms of aquifer protection, Groundwater resources on Jersey are not subject to the same protection as in the UK. Source Protection Zones or similar designations are not available for Jersey.

4.3 Hydrology

4.3.1 Surface Water Courses and Drainage

There are two reservoirs located on site, one to the north and one to the east. Information received from the current site owner indicates that the reservoirs were used to store water from the glasshouse roofs and were constructed of soil with a rubber lining. No other water courses are present on site.

4.3.2 Flooding

The site is not thought to be at risk from fluvial flooding as there are no water courses on or adjacent to the site. Although not observed it is considered likely that overflow mechanisms exist for the water storage reservoirs on site.

Historical coastal flooding in St Clement is known to have taken place however, since that time a sea wall defence was constructed.

There is likely to be an increase in high tide levels around Jersey of 500mm by 2080 as a result of climate change as reported by HR Wallingford (2007). This increase will have a significant effect on the performance of the existing coastal defences, particularly where overtopping already occurs. Major areas of concern were noted in a feasibility study of Jersey's coastal defences. St Clements Bay was not highlighted as an area of concern. The closest area under consideration is the Green Island slipway to Le Nez point which is considered as a low priority only, where it is planned to construct a sheet pile and concrete toe to enforce the existing sea wall.

It is recommended that a flood risk assessment be undertaken for the site in accordance with planning guidance PPS25. [Note – requirement for FRA if site area >1 hectare.]

4.4 Quarrying and Landfilling

An attempt has been made to identify any quarrying and landfilling operations, past and present that have taken place in the vicinity of the site. The sources of information referenced in this element of the desk study include:

- Old Ordnance Survey maps and plans
- Geological maps
- States of Jersey Website

The States of Jersey website identifies operational quarries on the island, none of which are located within the vicinity of the site. They are mostly concentrated in the north west of the island. Some historical quarries have been identified in the surrounding area but none have been identified on site.

However, with reference to the historical data there have clearly been some demolition and excavation activities on site and therefore the presence of Made Ground should not be overlooked.

4.5 Proposed Ground Model

Based on the review of published geological information, a Preliminary Ground Model for the site has been prepared and is presented in Table 4.2.

Table 4.2 Preliminary Ground Model

Stratum	Typical Description	Anticipated Thickness (m)
Geology		
Blown Sand	Quartz-feldspar sand with few structures and contains shell debris	8-9m
Loess	Wind-blown glacial orange-yellow to pale brown clay and silts. Most of the deposit is decalcified and has a banded appearance as a result. A few sections are calcareous at the base and calcareous concretions can occur.	≥4m
Diorite and Gabbro	Plutonic rock complex with associated granites which have undergone alteration during intrusion. Diorites are generally coarsely crystalline, intermediate plutonic igneous rocks, medium grey in colour with a speckled appearance. Gabbro is a dark grey to black, coarsely crystalline, plutonic, basic igneous rock. Clear distinction cannot be easily made between diorite and gabbro	>1km taking into account dip angles
Groundwater		
Blown sand	Shallow groundwater table anticipated	
Loess		

5 Review of Geo-environmental Risk

5 Review of Geo-environmental Risk

5.1 Introduction

This section is aimed at identifying possible risks, if any, arising from substances used or deposited on-site, or from other sources of land contamination. Both past and current potentially contaminative land uses have been considered.

The legislative framework for this risk assessment and the principles of pollutant linkage on which it is based are described in Appendix C.

The review of geo-environmental risks given within this report is based on information reviewed as part of the desk study.

5.2 Potential Sources of Contamination

5.2.1 Historical Usage

The site is thought to have been undeveloped prior to the construction of a railway which crossed the central portion of site and operated from 1873 to 1929. It is thought the railway may have been rebuilt during the German Occupation. A relict feature is shown on many historical plans up to 1998.

After the closure of the railway the next phase of development on site occurred sometime between 1942 and 1952 when a greenhouse on the northern portion of the site was constructed. A small reservoir was also present sometime from the mid 1970's which has subsequently been infilled. The southern portion of the site is not shown to have been developed during this period. The site is thought to have been redeveloped into its current configuration sometime after 1997.

Possible releases of contamination may therefore have historically taken place on the site associated with the past agricultural use and railway use.

With reference to the DoE Industry Profile for Railway Land the following list indicates the potential contaminants that may be associated with the existing land use.

Organic:	Hydrocarbons: diesel, lubricating oils, paraffin.
	Polychlorinated biphenyls (PCBs)
	Polycyclic aromatic hydrocarbons (PAHs)
	Solvents
	Ethylene glycol
	Creosote
	Herbicides
Metals:	Ferrous residues
	Metal fines
Other:	Asbestos
	Ash and fill (possibly containing metals, phenols, sulphates and PAHs) Sulphates

Other potential contaminants associated with past agricultural use include:

- Pesticides/herbicides
- Hydrocarbons
- Glass
- Unknown Made Ground associated with infilling of the reservoir

5.2.2 Recent and Current Usage

The current site use is that of a derelict greenhouse complex which was used for tomato production. Two boiler complexes are present on site fed by a number of tanks. These tanks are likely to have held fuel to heat the greenhouses.

Several of the tanks are thought to be old BRT Tank Wagons which were originally built and used by companies for rail transportation of liquid and gaseous chemicals. The wagons have individual reference numbers. Further research into these tanks shows that one of the tank wagons was hired to Murco for petroleum transportation in the UK and was in use in 1992. This indicates that the tank wagon reached the site after the tank wagon was decommissioned by Murco and was probably in use at the site when the southern greenhouse was constructed sometime after 1998. Production of the tank is thought to be from 1969, indicating that the tank is over 40 years old. The tanks have been modified and were not designed for the purpose they have been used for and may hold a different product than originally intended. Information from the current site owner indicates that the tanks were used on site to store hot water, presumably to heat the greenhouses.

One of the tanks is heavily damaged and appears to have been crushed. Therefore, leaks and spillages may have taken place as a result of the structure having been compromised. A number of other, smaller tanks are also present. The current site owner has indicated that there are at least two oil tanks on site, one at the old boiler house in the north and one at the newer boiler house in the south. Both are thought to have been run down to a low level. A portable green plastic tank was also observed which may contain oil, perhaps used for refuelling. This looked relatively new and did not show signs of leaks or damage.

Contamination may have arisen through leaks and spills of fuels and oils around storage areas where bunding has not been provided or through residual contamination from the tank wagons brought to site. Some staining is evident on the tanks, thought to be a combination of both weathering and fuel staining.

It is possible that the site would have used pesticides/herbicides in the production of the crop; therefore the presence of residual chemicals in the sub-soils and groundwater is a possibility. However information from the current site owner indicates that the site was farmed using a 'natural Choice' program and so the use of pesticides/herbicides may have been limited. There is evidence of stockpiling materials and of windblown litter. As the majority of the site is soft cover there is an increased risk that contamination may have infiltrated through permeable shallow soils.

It is known that a historical water storage reservoir in the north western corner was once present and is now infilled. The material used to infill the reservoir is unknown and may be potentially contaminated. It is thought that the railway on site was no longer in use after the German occupation; however a relict feature was present on site up to at least 1997. From the site walkover this area has now been levelled and paved over. Therefore it is possible that this material has been relocated to other areas of the site.

On the basis of the reconnaissance survey, it is considered that there is a medium probability of releases on the site, and potentially could have been of a significant nature.

In addition to the schedule given above, soil gases and/or other mobile contaminants may also potentially be present.

5.2.3 Off Site Sources of Contamination

No significant off-site sources of contamination have been identified.

5.2.4 Summary

The potential sources of contamination can be summarised as follows:

- Contaminants in Made Ground – associated with former railway, infilling of reservoir, excavated material from two existing reservoirs
- Ground gases generated from Made Ground/natural deposits

- Pesticides/herbicides associated with crop production
- Existing tanks and oil container
- Existing boilers and chimney/flue
- Possible former oil tanks
- Glass from current/previous greenhouses
- Possible asbestos in sub soils
- Litter/tipping

5.3 Pathway for Migration

For the purpose of this assessment, the principal pathways for contaminant migration are considered to be as follows:

- Dermal contact / Ingestion / Inhalation with / of soils, dusts or liquids;
- Migration of aqueous phase contamination via Made Ground and permeable natural strata;
- Migration of aqueous phase contamination via the underlying groundwater;
- Migration of gaseous phase contamination via Made Ground and soils;
- Inhalation of hazardous gases in confined spaces;
- Plant uptake of bio-available contamination in soils.

5.4 Potential Receptors

For the purpose of this assessment, the principal receptors are considered to be as follows:

- Humans – current site users;
- Humans – demolition, construction and maintenance workers;
- Humans – adjacent site users;
- Humans – future site users of the building;
- Groundwater;
- Surface water - reservoirs
- Landscaping and open space;
- Building structures and services;
- Air.

5.5 Assessment of Plausible Pollutant Linkages

A conceptual model of plausible pollutant linkages has been formulated for this site, in line with the new risk assessment approach applied to contaminated land assessment. The conceptual model illustrating the pollutant linkages is presented in Appendix D. The accompanying pollutant linkage table is presented in Appendix D.

5.6 Summary of the Qualitative Risk Assessment

The information reviewed and considered in pollutant linkage table has been assessed and a summary of the risk assessment process is included in Table 5.1.

Table 5.1: Summary of Geo-environmental Risks

	Risk Rating	Justification / Comments
Contamination Potential		
Potential for Significant On Site Contamination	Moderate	Likely sources of contamination identified on site including historical railway and tanks, existing tanks, boilers and probable Made Ground. Also potential for pesticides/herbicides having been used on site.
Potential for Contaminants to Migrate On to Site	Very Low	No significant sources identified in close proximity to site
Potential for Contaminants to Migrate Off Site	Moderate / Low	Likely sources of contamination identified on site and potential pollutant linkage to off site receptors through shallow groundwater.
Environmental Risks		
Risk of Harm to Human Health - Existing Conditions	Moderate	Likely sources of contamination identified on site and potential pollutant linkage to receptors.
Risk to Construction Workers	Moderate	Likely sources of contamination identified on site. Special health & safety precautions may be required.
Risk of Pollution of Controlled Water	Moderate / Low	Likely sources of contamination identified on site and potential pollutant linkage to shallow Aquifer and Surface Water
Hazards to Flora and Fauna	Low	Potential phytotoxic effects would not appear to be significant - based on current apparent good health of vegetation
Hazards to Building Structures and Services - Excluding Ground Gas	Moderate / Low	Potential sources of elevated concentrations of petroleum hydrocarbons
Liabilities		
Likelihood of designation as Contaminated Land under Part IIA EPA 1990	Low	Some potential for contamination identified - but likely to be addressed under the planning regime (see planning guidance PPS23)
Liability issues for owner	Low	No significant liability issues identified
Development Implications		
Possible Requirement for Remediation of Soil	Moderate	Minor remedial works could be required. Provisionally assume some removal of contamination from hot-spots and nominal cover system.
Possible Requirement for Remediation of Groundwater	Moderate	No groundwater remediation anticipated at this stage. Some limited remedial action on soils should not be discounted.
Possible Requirement for Gas Protection Measures	Low	No special precautions anticipated however if areas of deep made ground encountered this may need to be re-assessed.
Special Requirements for Water Supply Pipes	Moderate	Likely requirement for specialist pipe materials to be specified.
Potential Limitations on Foundation Design	Low	No special precautions
Risk of Encountering Materials classified as Hazardous Waste	Moderate	Potential sources of contamination have been identified. Ground investigation required to clarify potential risks.

Should the proposed end use be significantly altered from that as described in Section 1 or it is considered that the assumptions employed are not representative of the proposed development then the contamination assessment is likely to require revision. Currently, the principal assumptions are:

- the desk study evidence reviewed is representative and accurate;
- the site's current use will remain unchanged until development begins;
- the proposal is for 100 to 150 residential homes, as outlined in the Draft Island Plan;
- appropriate health and safety practices will be adopted during site clearance, preparation, earthworks and construction, and appropriate environmental protection / mitigation measures will be employed;
- the proposed development will not introduce contaminative substances into the ground.

The risk assessment is based on evidence from literature sources and a site walkover. Whilst these have suggested that potential sources of contamination may exist on the site, no confirmation of contamination being present has been obtained. The risk assessment is therefore partially based on conjecture from available information.

6 Review of Geotechnical Risk Assessment and Foundation Options

6 Review of Geotechnical Risk Assessment and Foundation Options

6.1 Details of the Proposed Development

It is understood that the development is likely to comprise 100 to 150 residential properties.

The development of the site is anticipated to require the following stages:

- Demolition of the existing buildings on the site
- Draining, clearance and infilling of reservoirs
- Decommissioning checks and clearance of existing tanks and plant on the site
- Clearance of landscaping areas, stockpiling and testing of topsoil for later external works
- Site earthworks including breaking out of hardstanding areas, excavation, levelling
- Installation of new site roads, services and drainage
- Construction of the new buildings

6.2 Geotechnical Hazards

Anticipated ground conditions beneath the site are discussed in Section 4. A summary of commonly occurring ground related hazards, excluding ground contamination, is given in Table 6.1. The hazards identified as being potentially present on site have potential implications on foundation design.

Table 6.1: Summary of Potential Geotechnical Hazards

Geotechnical Hazard category (excluding contamination issues)	Probability	Engineering Implications
Lateral changes in ground conditions	High Likelihood	There are two different drift deposits at the surface on site. Potential to affect ground engineering and foundation design and construction.
Existing sub-structures (e.g. foundations and adjacent sub-structures)	High Likelihood	Any sub-structures related to current buildings on site will need to be considered.
Filled and Made Ground	High Likelihood	Possibly present derived from construction of railway, reservoirs and various stages of development on the site. Infilled reservoir area in north west corner of the site
Shrinkable clay soils	Likely	Foundations are to be designed to mitigate risk of shrinkage/swelling
Highly compressible / collapsible / low bearing capacity soils, (including peat / soft clay)	Likely	Silty Loess Deposits may collapse on wetting, cohesive Loess Deposits may have high moisture contents. Infill to reservoir area in north west unknown may be subject to settlement
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)	Likely	Buried concrete to be designed accordingly to mitigate against this potential risk
High groundwater table / and/or flooding (including waterlogged ground)	Likely	Potentially in cohesive drift deposits
Ground subject to or at risk from landslides	Low Likelihood	The site is relatively level. Only the reservoir banks could be subject to possible small landslides.
Ground subject to or at risk from coastal or river erosion	Low Likelihood	Historical flooding but sea defence now constructed along coast.
Underground mining	Negligible	
Karstic dissolution features (including 'swallow holes' in Chalk terrain)	Negligible	
Evaporite dissolution features and/or subsidence	Negligible	
Ground subject to periglacial valley cambering with gulls possibly present	Negligible	

6.3 Foundations and Ground Engineering

6.3.1 Foundations

For light to moderate loads, the ground conditions may be suitable for the use of traditional spread foundations founded within the Loess Deposits. If near surface soils are found to be loose or saturated deeper piled foundations may need to be considered, particularly for more heavily loaded structures.

Footings should be taken deeper than 0.70m in the presence of Made Ground and at least 0.10m into the underlying natural stratum.

Similarly, footings should be taken deeper than any specified minimum depth where structures are located within cohesive drift deposits and within the influencing distance of any existing or future trees or significant vegetation. In these circumstances reference should be made to NHBC Chapter 4.2 for guidance.

Foundation obstructions and low bearing capacity materials may exist within the existing infilled reservoir, and settlement could be an issue. This area should be investigated to establish the nature and engineering state of infilled material and potentially may need to be preceded by dredging and /or drainage. The infilled reservoir may also present a risk of obstructions. For existing unfilled reservoirs engineering fill may be required and need specification, dependent on the future development proposals for these areas.

6.3.2 Ground Floor Slabs

In the absence of significant Made Ground deposits ground bearing floor slabs may be suitable but will be dependent on the thickness and consistency of the superficial deposits and the floor loading. The potential use of ground bearing floor slabs can be determined following the ground investigation.

6.3.3 Excavations

Excavations will be required to remove existing foundations and hardstanding and for construction of new foundations and service trenches. Deep excavations for basements structures are not expected given the proposed residential land use. For excavations it is noted that unstable soils, potentially subject to collapse in either a dry or wet state; and shallow groundwater may be present at the site. Further information on the groundwater regime will be available following the ground investigation and subsequent monitoring.

Excavation of unsuitable materials may be required if, for example contaminated materials or low bearing capacity soils, are identified by the ground investigation in areas where it is not suitable to remain. This can be assessed following the ground investigation.

Dependant on the thickness of drift deposits, which could be five metres or more, and the excavation depth solid geology comprising igneous rocks could be encountered. Whilst it is possible that the upper metre may be weathered, bedrock will be difficult and slow to excavate and special plant required. If following the investigation works it is anticipated that excavations may extend below bedrock careful consideration of the excavation proposals is recommended.

6.3.4 Soakaways

The ground conditions are likely to be marginally suitable for the use of shallow soakaways, and a high groundwater table (<2m below ground level) is anticipated. Areas underlain by Loess may not be suitable due to clay content. Areas underlain by Blown Sand may be suitable for testing to identify the infiltration characteristics. If any areas are identified as suitable from the investigation works approval from the statutory authority is likely to be required.

7 Recommendations for Further Work

7 Recommendations for Further Work

Based on the findings of the geo-environmental and geotechnical assessments, set out in Sections 5 and 6 respectively, it is recommended that it is necessary to carry out further Phase 2 Ground Investigation and appraisal work on this site. It is considered that the scope of this further work should comprise the following tasks:-

- An intrusive ground investigation consisting of the following items:-
 - Boreholes formed by cable percussive and/or rotary methods sunk to intercept the solid geology and groundwater, distributed at suitable locations within the site boundary in order to confirm or amend the ground model;
 - Boreholes are to facilitate the retrieval of soil samples for laboratory testing and to determine the groundwater level beneath the site.
 - Window samples sunk around the tank areas to target shallow soils to investigate whether they have been impacted by contamination;
 - Standpipes and piezometers to be installed to monitor gas and groundwater levels;
 - Trial pits to investigate if soakaways would be suitable for the development.

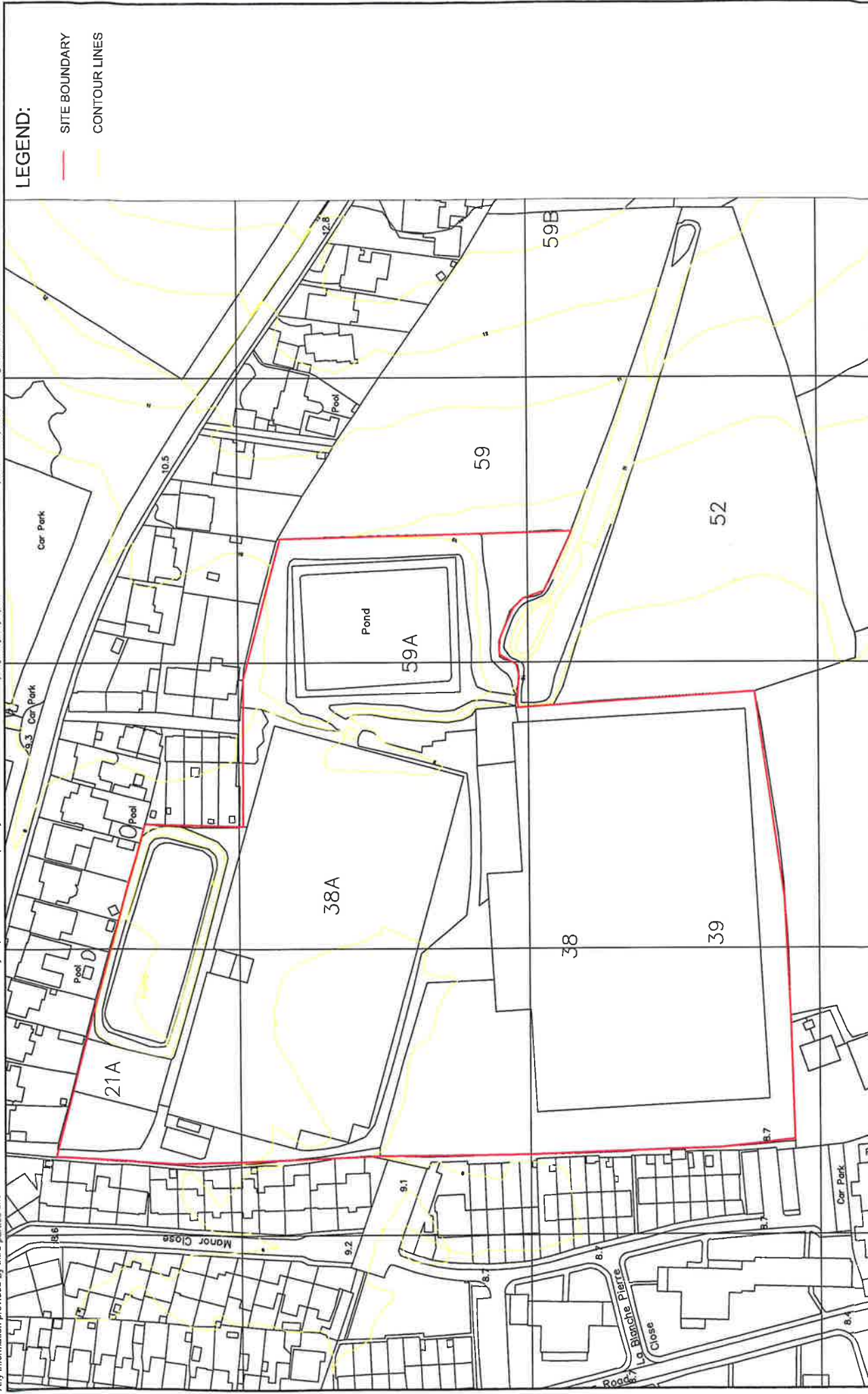
By undertaking a Phase 2 intrusive ground investigation, an assessment of the ground and groundwater profiles may be carried out and the geotechnical and geo-environmental risks quantitatively assessed for the site. The ground investigation will allow a quantitative assessment as to whether any of the potential risks identified in this study are present and are of material concern to the development.

Figures

Figures

Figure 1 Site Layout Plan

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LEGEND:

- SITE BOUNDARY
- CONTOUR LINES

Client:	MS PLANNING		Title:		SITING PLAN		AECOM		Design: LC	CAD: LC	UC
	SAMARES NURSERIES, JERSEY								Chkd: PS	App'd: PS	
Project:									Date: 24/11/09	Scale: NTS	
<p>No. 60143070/FIGURE 1</p> <p>Rev: A</p>											
<p>AECOM House 63-77 Victoria Street, St Albans, Hertfordshire, AL1 3ER</p> <p>Tel: +44 (0) 1727 535000 Fax: +44 (0) 1727 535099 www.aecom.com</p>											

Appendices

Appendix A Site Walkover Photographs

Site Walkover Photographs

(taken 19th November 2009)



Stockpiled rubble on eastern side of site



Tank area by southern greenhouse. shows tank within a concrete bunded structure.



Eastern reservoir, looking north east



Modified tank wagon with metal pipes connecting tanks.



Two boilers within southern greenhouse structure



View of misshapen tank in foreground, looking south

Site Walkover Photographs

(taken 19th November 2009)



Looking west at tank area, showing misshapen tank wagon on right



View of southern greenhouse facing south west



Chimney/flue attached to boiler



View of entrance road, looking north



Green plastic tank on trailer – thought to contain oil



View of southern boundary, looking east

Site Walkover Photographs

(taken 19th November 2009)



Boarded up concrete building to the north west



View looking west along northern site boundary with residential properties to the right



Derelict interior of northern greenhouse with upright tank to right



Drain covers fed by pipes from the boiler complex

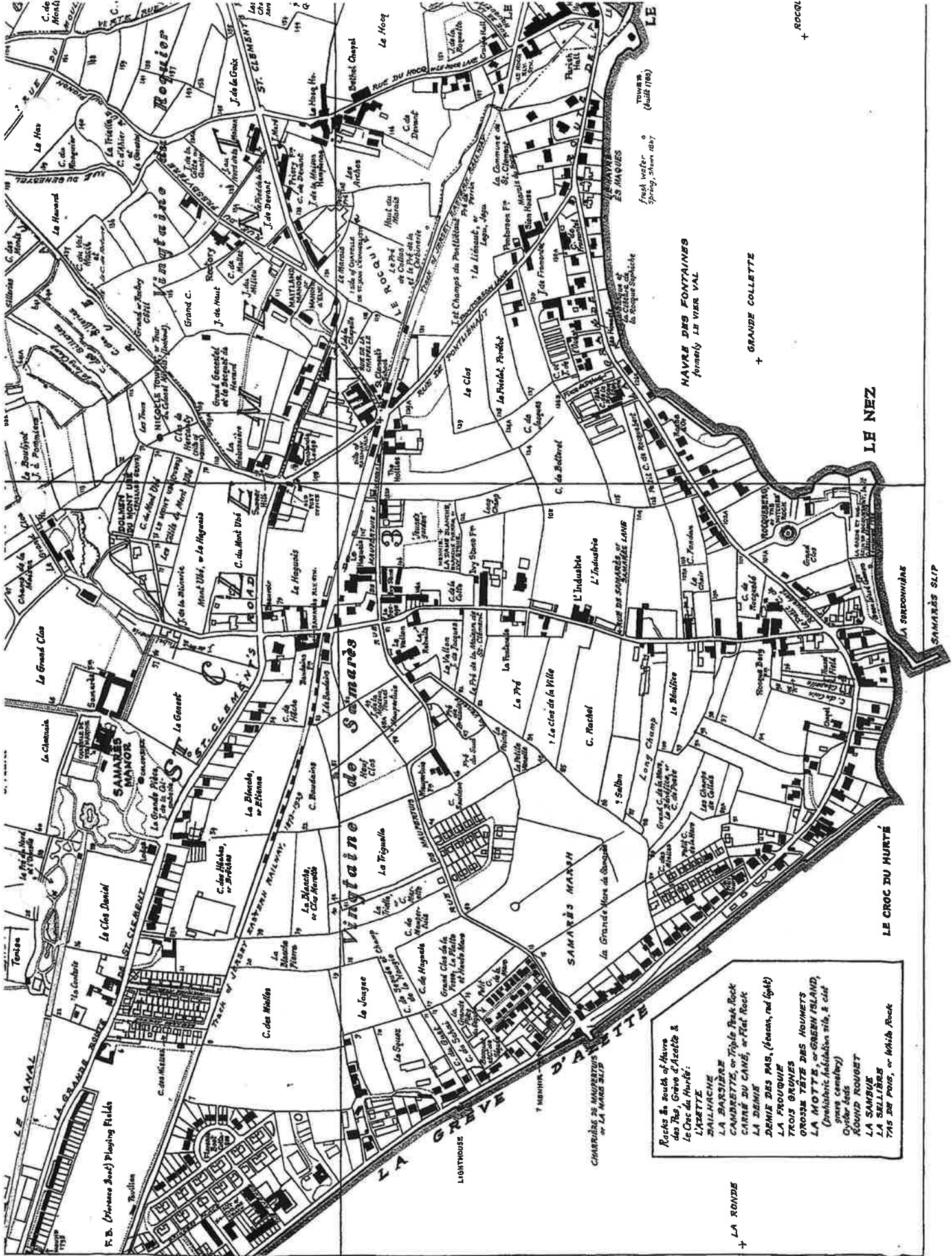


Concrete building by northern greenhouse with two boilers inside.



View of southern greenhouse, looking east.

Appendix B Historical Maps and Aerial Photographs



Rocks to south of Havre
 des Rues, Grève d'Arlette &
 Le Croc du Murte:
 LA ZETTE
 MAILHACHE
 LA BARRIÈRE
 CARRIÈRE, or Triple Peak Rock
 CARRÉ DU CANÉ, or Flat Rock
 LA DEMISE
 DEMISE DES PAS, (stone, red light)
 LA FROUQUE
 TROIS BRUNES
 GROSSE TÊTE, or GREEN ISLAND,
 (prohibitive habitation site, & cist
 very common)
 OYSTER ISLAND
 ROUND ROBERT
 LA SAMURE
 LA SELLIERE
 THIS BE PONS, or White Rock

LA RONDE