Contaminated Land
Air Quality
Environmental Audit

SMITH GRANT Environmental Consultancy LLP

Partnership No: OC 300776

THE DELL, PRESTATYN

REMEDIATION STRATEGY

For: Denbighshire County Council

March 2018

R2485-R02-v1

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1. Introduction

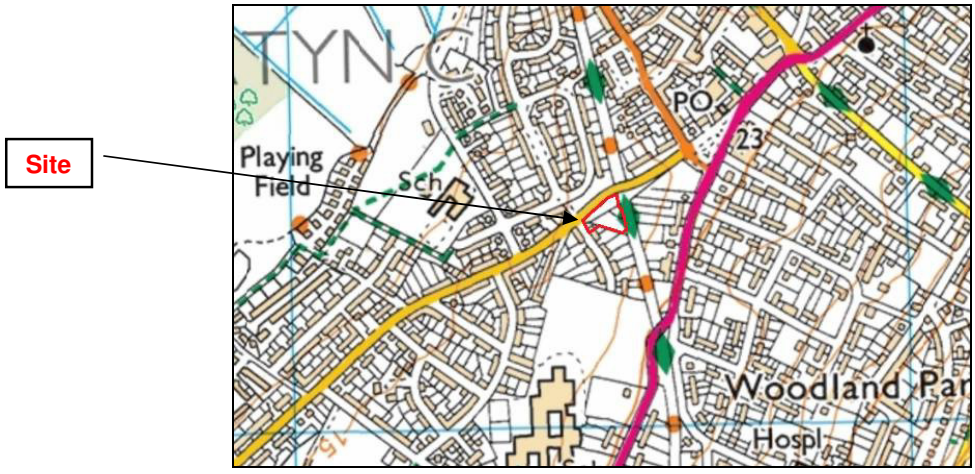
1.1. Smith Grant LLP (SGP) has produced a Stage 1 & 2 Contaminated Land Assessment (R2485-R01-v1), a Supplementary Soil Sampling Report (R2485-L01) and a Ground Gas Risk Assessment (R2485-L20180308) for a parcel of land off The Dell, Prestatyn. SGP understands that the site is being considered for a residential land use (apartments) and that a Remediation Strategy is required to address ground contamination issues and prepare the site for redevelopment.

1.2. The site comprises a parcel of land located directly to the south of Ffordd Isa and to the east of The Dell in Prestatyn, Denbighshire. The majority of the site presently exists as vacant open land occupied by a footpath used by the general public, however a single unoccupied residential property is present in the westernmost part of the site. Site details are:

Table 1.1: Site details

Address	Land at The Dell, off Ford Isa, Prestatyn, Denbighshire, LL19 8SS.
National Grid Reference	306517 382345
Local Authority	Denbighshire County Council
Site Area	~0.2 ha
Current Use	The site comprises a single residential property (No.1 The Dell) to the west with the rest of the site bisected in two by a public footpath. The north of the site is a vegetated embankment extending onto Ffordd Isa and the south is an area of cleared scrubland.
Site Access	Access is either via the road The Dell directly to the west of the site or from the footpath to the east, the nearest access point to which is off Banastre Avenue approximately 350m to the north.
Proposed Use	Residential housing – 3-storey apartment block

Figure 1.1: Site Location



1.3. The assessment methodology follows the framework described in the EA / DEFRA Contaminated Land Report 11: 'Model Procedures for the Management of Land Contamination' 2004, comprising an options appraisal to evaluate and identify feasible remediation options, specification of appropriate techniques, and an implementation programme and verification plan.

1.4. The site has been subject to a Desk Study, Ground Investigations and a Ground Gas Risk Assessment undertaken by SGP which has characterised the contamination status of the site. There is considered to be sufficient information available to develop a Remediation Strategy to address any contamination that has been identified and whatever might be reasonably anticipated. It is intended that this Remediation Strategy will be submitted to support a future planning application of the site and will require regulatory approval to confirm the proposed remedial works.

1.5. SGP understands that that the site is to be redeveloped for residential use comprising a 3-storey apartment block with areas of landscaping, car parking and access road. The proposed development layout is provided in Drawing AL(0)110 E. It is understood that whilst located within the site boundary, land to the immediate north of the footpath will remain as a vegetated embankment and is outside the managed landscape area associated with the proposed development.

1.6. A programme of works to physically prepare the site for development will also be required; assessment of the geotechnical properties of the ground, its' stability and related impacts on foundation and infrastructure design lie outside the scope of this report which relates to risks from contamination only.

2. Information Sources

2.1. Summaries of the previous combined Stage 1 (desk study) and Stage 2 (ground investigation) report, Supplementary Soil Sampling Report and Ground Gas Risk Assessment produced by SGP are provided in the table below:

Table 2.1: Primary Information Source

Report	Content
Smith Grant LLP The Dell, Prestatyn: Stage 1 & 2 Contaminated Land and Geotechnical Assessment. Ref. R2485-R01-v1 January 2018	Combined Stage 1 (Desk Study) and Stage 2 (Ground Investigation and Geotechnical Assessment) report comprising historical review, site setting, site description, geology, hydrogeology and risk assessment. Intrusive works consisted of the excavation of 6 machine dug trial-pits to a maximum depth of 3.3m bgl and the drilling of 6 cable percussive boreholes to a maximum depth of 6.45m bgl, 3 of which were completed with groundwater/gas monitoring installations. Five soil samples were collected from both made ground and natural soils which were submitted for a range of chemical analysis including asbestos, metals/metalloids, PAHs, hydrocarbons (TPHCWG), BTEX, pH and soluble sulphate. Geotechnical samples were also collected from natural soils for classification testing including: Atterberg limits, moisture content, particle size distribution and California Bearing Ratio compaction testing. One groundwater sample was collected from the single monitoring well which was submitted for pH, metals, PAH and hydrocarbon analysis. A preliminary round of ground gas monitoring was also undertaken. The report contained a quantitative risk assessment and compared results of soil testing and gas monitoring to contemporaneous screening criteria. Elevated concentrations of cadmium, lead and zinc were recorded within the site soils with recommendations made for further sampling.
Smith Grant LLP The Dell, Prestatyn: Supplementary Soil Sampling Report. Ref. R2485-L01 February 2018	Supplementary Soil Sampling Report detailing the high frequency soil sampling exercise undertaken to confirm whether the high heavy metal concentrations previously reported in the Stage 1 & 2 Assessment are representative of the site wide shallow soils, and if not, to delineate the hotspot area. The was also recommended to inform the potential for retention of shallow soils onsite or to confirm a suitable route of disposal, and to confirm the appropriate Remediation Strategy. Works included the collection of twenty samples on an approximate 10m grid from depths of between 0.0m and 0.6m bgl. Samples were scheduled for lead, cadmium and zinc analysis; the results of the soil testing were then compared to generic screening criteria for a residential setting. Exceedances of cadmium (7), lead (10) and zinc (3) were recorded across the site although exceedances were mostly limited to the north and eastern part of the site.

Smith Grant LLP The Dell, Prestatyn: Ground Gas Risk Assessment Ref. R2485-L20180308 March 2018	Ground Gas Risk Assessment utilising the results of a six-week monitoring programme carried out on the three cable percussion boreholes installed with monitoring wells during the intrusive ground investigation. This was undertaken to inform the necessary ground gas protection measures that should be provided for any future buildings on the site. Site classified as CIRIA Characteristic Situation 2 (CS2) – 'low risk' due to moderately elevated carbon dioxide and methane concentrations; ground gas protection measures compliant to a CIRIA Characteristic Situation 2 were therefore recommended for all future buildings on site.

2.2. Use of Information in Strategy Development

2.2.1. This report contains a brief summary of the findings of the previous investigations and other available information, and the risk assessment carried out, and then uses the conclusions of the previous risk assessments to define clear remediation objectives which must be met to allow the site to be developed without significant risk to human health or the wider environment. The various options for achieving these objectives are explored and a preferred strategy is arrived at and presented.

3. Site Characterisation

3.1. Historical Development and Use

3.1.1. The earliest historical mapping indicates that the site existed as parcels of open land slightly encroaching onto an adjacent railway line to the northeast with an embankment shown to be present along the northwest boundary. Between 1915 and 1938 the west of the site was partially developed for residential housing; this was shown on later mapping to comprise a single dwelling occupying the southwest corner of the site, which remains today but is left vacant. By 1979, the railway to the east was mapped as disused. The only development that has occurred since has been the construction of a pathway that crosses the site from east to west which appears to have occurred between 1993 and 2000.

3.1.2. The former railway extended south to Dyserth and served the Talargoch Lead Mine, 2.3km to the south. Further lead mines were located in the limestone escarpment 650m to the east of the site.

3.2. Geology

3.2.1. Ground conditions encountered during the intrusive investigation were generally consistent across the site typically comprising a thin veneer of topsoil overlying glacial till deposits with some areas of made ground also reported.

3.2.2. Topsoil was described within 8 of the 12 test locations from ground level to depths of between 0.3m and 0.5m bgl and was described as a dark brown slightly clayey silty sand with roots and rootlets. It is suspected that this material may have been historically imported to site.

3.2.3. Made ground was described within 4 of the 12 test locations and consisted of either a blackish dark grey slightly clayey gravelly sand with roots, wood and concrete (sleepers in TP6 only) or reworked slightly gravelly slightly sandy clay. The made ground was encountered from ground level down to depths of between 1.3m and 3m bgl.

3.2.4. Glacial till was encountered within all entries comprising varying proportions of sand and clay including firm to very stiff reddish brown slightly sandy slightly gravelly clays with lenses and partings of sand and reddish brown slightly gravelly slightly clayey sands with lenses of clay. The Glacial Till deposits were encountered from between 0.3m and 3m to a maximum proven depth of 10m bgl.

3.2.5. Bedrock was not proved during the site investigation.

3.3. Hydrogeology and Hydrology

3.3.1. The underlying superficial deposits are classified by the EA as Unproductive Strata and the underlying Pennine Coal Measures are designated as a Secondary A aquifer meaning it has permeable layers capable of supporting water supplies at a local scale and can be an important source of base flow to rivers.

3.3.2. The site is not located within a Source Protection Zone (SPZ) but is classed as being within a Groundwater Vulnerability area of high for the minor aquifer and a Nitrate Vulnerable Zone.

3.3.3. Groundwater inflow / seepage was recorded in all trial pits between the depths 2.1m and 3.2m bgl. Groundwater levels between the depths of 0.69m to 1.7m bgl were recorded during the subsequent groundwater / gas monitoring and soakaway testing.

3.4. Soil Contamination

3.4.1. Elevated concentrations of lead, cadmium and zinc were detected within the shallow soils across the site with the highest concentrations typically detected in the northeast where the presence of made ground has been confirmed. It is noted, however, that the highest concentrations of all determinands were reported in a sample collected from the stratum of glacial till which underlies the topsoil/made ground at the site. Out of a total of 24 soil samples collected across the site during both the Stage 2 intrusive works and the Supplementary Soil Sampling exercise, 13 exceedances of the residential C4SL for lead (200mg/kg) were detected at concentrations ranging from 240-4,768mg/kg, 8 exceedances for cadmium at between 19.2-53.8mg/kg (criteria of 11 mg/kg) and 4 exceedances for zinc at between 4,300-9,584mg/kg (criteria of 3,700mg/kg).

3.4.2. The exceedance concentrations detected within the site soils are likely to be attributable to either made ground associated with the historic railway line directly to the east of the site that connected to the former Talargoch Lead Mine (which could potentially include mine spoil used as hardcore), and/or the presence of natural mineral deposits (vein erosion materials within the glacial till). The British Geological Survey (BGS) database records naturally elevated lead concentrations within soils in the locality.

3.4.3. Recorded concentrations are anticipated to be in excess of hazardous waste thresholds and so site soils requiring off-site disposal may be classified as hazardous waste.

3.5. Groundwater Contamination

3.5.1. Within the single sample of groundwater collected exceedances of the stringent National Environmental Quality Standards for inland surface waters were reported for cadmium and zinc as well as a marginal exceedance for hexavalent chromium. The presence of these contaminants within the shallow groundwater is likely to be attributed to the migration / leaching of site soils.

3.5.2. Given the presence of a substantial depth of drift deposits over the Coal Measures bedrock, no significant risk exists to the underlying Secondary Aquifer within the bedrock. No significant risk is likely for surface watercourses given the small size of the site, and distance to any such features, and limited propensity for migration of metals through shallow drift deposits.

3.6. Ground Gas Contamination / Radon

3.6.1. No significant sources of ground gas such as peat or historical / active landfills have been identified on or in the vicinity of the site and the made ground underlying the site is of limited thickness / distribution and predominantly consists of largely inert material, but with timber fragments and tree roots.

3.6.2. Six rounds of gas monitoring were completed between the 13th December 2017 and 5th March 2018. Methane was recorded above detectable limits (0.1% v/v) within BH1 only with the highest reading reported at 8.6% v/v; the highest carbon dioxide recorded was also within BH1 at 10.3% v/v with lower concentrations detected within the other boreholes onsite. No sustained flows were recorded during the monitoring. These results may be attributable to the slow anaerobic decomposition of timber fragments or plant roots within the shallow soils / made ground.

3.6.3. The recorded ground gas concentrations in conjunction with the proposed redevelopment of the site to a 3-storey apartment block are sufficient to classify the site as CIRIA CS2 (Situation A) under CIRIA C665[1] guidance.

3.6.4. The site is located in an area where it is anticipated that between 10% and 30% of homes are affected by radon ingress.

3.7. Risk Assessment

3.7.1. Contamination has been identified during the previous investigations which could impose constraints on the proposed redevelopment of the site for residential use if not adequately addressed. This is limited to the upper soils on site containing elevated lead, cadmium and zinc, the localised onsite generation of ground gas (i.e. elevated methane and carbon dioxide), and the potential generation of radon gas from the underlying geology.

3.7.2. Concentrations of soil contaminants were compared to current assessment criteria derived for the protection of human health. The exceedances for metals indicate that shallow soils may have been contaminated via the interspersion of impacted made ground, although the elevated concentrations detected within the glacial till indicate that concentrations are also naturally high.

[1] Assessing risks posed by hazardous ground gases to buildings.

3.7.3. The above potential source is chiefly considered as posing a risk through long-term exposure to future residents within areas absent from permanent hardstanding cover such as soft landscaping (primarily exposure of young children via ingestion of surface soils and dust derived from such soils). No private gardens will be created and there is no likelihood that garden plants would be grown for future human consumption. The short-term exposure of workers engaged in construction or maintenance work make it unlikely to result in health impacts provided normal environmental, safety and occupational hygiene measures are implemented. These should include measures to prevent the release of dust or track-out from the site to avoid impacts to neighbours.

3.7.4. Areas to be covered by permanent hardstanding such as roadways, car park, drives and buildings will provide a full physical barrier to break the pollutant-receptor pathway meaning that any contaminated soils below such hardstanding do not require further mitigation measures to be implemented.

3.7.5. The six rounds of ground gas monitoring completed referenced with the proposed redevelopment of the site results in a site classification of CIRIA CS2 (low risk), meaning that gas protection measures are required. The site is also located in an area with a medium-high risk of radon ingress (10-30% of properties), therefore radon protection measures are also required.

3.7.6. An assessment of the ground conditions to determine their potential to impact concrete has been carried out with a recommended classification of Design Sulphate DS-1 and Aggressive Chemical Environments for Concrete of AC-1.

3.7.7. No specific risks relating to the potential tainting and toxification of water supply pipes have been identified, however, it is recommended that a water pipeline risk assessment is completed after completion of the site preparatory and remediation works.

3.7.8. The existing bungalow structure (No. 1 The Dell) has not been inspected by SGP for contamination but it is possible that due to its age it may contains asbestos construction materials. An asbestos survey will be required, and if asbestos is present this should be stripped prior to demolition and clearance. The building footprint will be crossed by the development access road hence any residual contamination within the building is unlikely to be significant for the redevelopment but will need to be checked following clearance and during preparatory earthworks / excavations for services and new road foundations.

3.8. Conceptual Site Model

3.8.1. The conceptual site model is summarised below:

Table 3.1: Summary of Pollutant Linkages Under Residential Land Use

receptors	pathways	contaminant sources
human health (future residents) (transient risks to construction workers addressed under HSWA 1974 / COSSH)	consumption of contaminated vegetables	Elevated cadmium, lead and zinc reported in shallow soils; concentrations of the contaminants are not acceptable for landscape areas in new residential developments and may be sufficiently high to be classed as hazardous waste.
	soil and dust ingestion	
	inhalation of dust	
	dermal uptake	
	migration and accumulation of ground gas / radon in buildings	Elevated concentrations of carbon dioxide and methane have been detected which is attributed to natural sources. The site is also located in an area where between 10 and 30% of properties are anticipated to be impacted by radon ingress from the underlying geology.
	infiltration of water supply pipes	No risks identified to date, however the utility provider may require a water pipeline risk assessment to be completed.
buildings	migration and accumulation of explosive gas in buildings	Elevated concentrations of methane have been detected.
	contact with aggressive soil or groundwater	No risks identified.
plants	root uptake of phytotoxic metals	Elevated zinc in shallow soils.

4. Scope of Remediation

4.1. Remediation Objectives

4.1.1. The remediation strategy and implementation plan described below addresses the contamination identified to date. If additional contamination is encountered, and subsequent investigations/risk assessment indicates the requirement for any substantial revisions to the strategy, any such revisions should be submitted to the Planning and Regulatory Authorities for prior approval.

4.1.2. The key remediation objectives are to:

- break potentially significant future pollutant linkages resulting from the change in land use;
- remove/remediate significant pollution sources that pose a risk to man and/or the environment if identified during the works;
- respond appropriately to contingencies in particular the discovery of currently uncharacterised contamination;
- manage all emissions to air and water to protect local residents, surface waters and groundwater, and the atmosphere during the remediation works;
- allow appropriate additional protection measures to be implemented during construction, specifically the provision of landscaping soils of suitable quality / thickness and the installation of ground gas/radon protection measures.

4.1.3. The potential risks identified will be managed to break any potential pollution linkages and allow development of the site for its intended residential use without harm to human health, property and the environment. Each of the potential contaminant linkages identified in the site conceptual model and risk assessment will be addressed for the remediation strategy to be considered appropriate for the site and to allow construction to commence.

4.1.4. Gas protection measures are required across the site consistent with CIRIA CS2 requirements due to the detection of elevated carbon dioxide and methane concentrations. Such measures can also be designed to satisfy the level of protection required against Radon.

4.1.5. The risk assessment carried out does not indicate any requirement for remediation to protect controlled waters; risks to surface and groundwater appear to be minimal based on the available evidence and will be further mitigated by the preparation of the site for development.

4.1.6. The potential for exposure of concrete to aggressive ground conditions and water supply pipes to damaging substances is considered to be very low, however, a water pipeline risk assessment may be required by the utility provider.

4.1.7. Enabling works will also be required to physically prepare the site for any future development. These are expected to entail the demolition of the existing building, removal of hardstanding, stripping of shallow organic soils / tree roots and grubbing out of underground obstructions and relict foundations where these would affect the development, and a site regrade to provide a level development platform. A watching brief by supervisors and site operatives should be maintained during all the required preparatory earthworks and excavations for uncharacterised sources of contamination.

4.1.8. Should surplus soils require off-site disposal these may be classified as hazardous waste based on the recorded metal concentrations. If such spoil is destined for landfill disposal then Waste Acceptance Criteria (WAC) testing will be required and should be undertaken on stockpiled material by collection of representative samples.

4.2. Options Appraisal

Table 4.1: Remedial Options Outline

Method	Advantages	Disadvantages.	Feasibility
Do nothing	No cost	Potential health risks remain to future site users from exposure to contaminated soils within landscaped areas and ground gas / radon gas ingress into future built development.	Currently not acceptable due to the presence of potential harmful concentrations of lead, cadmium and zinc in the shallow soils and the potential for ground gas/ radon ingress into future built development.
Physical Barriers	Conventional and well-understood techniques.	Requirement to source, place and maintain cover layers, cost of removing contaminated soils to accommodate cover layer; cost of installing and verifying building gas protection measures.	Practical option for landscaped areas where direct exposure is a possibility; gas protection barriers in accordance with CIRIA CS2 are required in all future buildings to break the indoor migration pathway.
In-situ soil treatment and retention	Treat contamination at source, reducing disposal cost and waste generation.	Only suitable for organic contaminants which have not been identified and are not anticipated.	Not an effective / appropriate solution to address the contamination identified.
Ex-situ soil treatment and retention	Contaminated soils could be subject to cement stabilisation / solidification to reduce metal availability / leachability	Extent of roots would limit practicality and clean soil cover for landscaping would still be required.	Technique does not provide significant benefits except to possibly reduce disposal costs as hazardous waste for off-site disposal

Method	Advantages	Disadvantages.	Feasibility
Excavation and disposal	Conventional dig and dump technique; method reduces source volume and contaminant level and can be validated on short timescale. The contamination requiring mitigation is generally at shallow depth so readily accessible.	Costs associated with off-site disposal of soils, especially if a hazardous waste classification is arrived at; import soil costs	Anticipated costs for disposal of soils containing lead at potentially hazardous waste thresholds is considered disproportionate to the proposed development but may be required if retention of soils below clean cover following regrade is not feasible.

4.2.1. The potential risks to future site users from direct exposure to shallow soils in landscaped areas is due to the presence of elevated lead, cadmium and zinc. The most appropriate development requirement to prevent risks to human health presented by heavy metals (lead, cadmium and zinc) within the shallow soils will be to provide clean soil cover in soft landscaped areas outside areas of hardstanding / buildings. This will form a suitable physical barrier between the elevated concentrations of contaminants within the soils and future receptors. A basal geotextile / barrier layer should be placed at the base of the soil cover system.

4.2.2. In landscaped areas, a 600mm clean, validated soil cover system should be provided as a physical barrier to any underlying residual contamination which should include a minimum 150mm topsoil cover as a suitable growing medium. Due to the high concentrations of heavy metals reported, a high visibility basal geotextile should be placed at the base of the placed cover system.

4.2.3. Given the generally immobile nature of the contaminants recorded, physically suitable soils stripped from future landscaped areas could be retained under areas of permanent hardstanding (car parks/roads/driveways) or structures, providing there is a requirement for fill materials. It is noted that the extensive shallow root / organic topsoil layer is unlikely to be suitable for re-use and will need to be removed from the site during the surface strip.

4.2.4. Ground gas data indicates that gas protection measures are required in the proposed apartment block compliant to a CIRIA CS2 (Situation A) classification and should be installed in accordance with the guidance contained within BS8485:2007[2] and Ciria C735[3]. This will also provide suitable protection from the potential ingress of radon gas into future built development.

[2] Code of design of protective measures for methane and carbon dioxide ground gases for new buildings.
[3] Good practice on the testing and verification of protection systems for buildings against hazardous ground gases

4.2.5. No suspected asbestos containing material (ACM) has been identified across the site surface or was detected in site soils that were tested as part of the Stage 1 and 2 Contamination Assessment, however, the potential for ACM to be present within the fabric of the vacant building exists. It is understood that the building is to be demolished as part of the redevelopment of the site and it is therefore recommended that an asbestos survey and removal (if necessary) is carried out by a specialist contractor prior to its demolition to reduce the potential for asbestos fibre dispersal.

4.2.6. The preferred option for managing the contamination identified onsite involves elements of all the previously described techniques. This will entail:

- removal of any surface wastes and fly tipped materials (where present);
- asbestos survey and strip (if required) of the existing building prior to demolition which will include the break out / removal of hardstanding and subsurface structures;
- removal and disposal of impacted soils should uncharacterised contamination be identified during preparatory works including the collection of verification samples;
- stripping of shallow soils from future landscaped areas down to 600mm below finished levels. Stripped soils may either be suitable for retention below permanent hardstanding or may require to be disposed off-site as Controlled Wastes;
- placement of high visibility geotextile and 600mm of clean validated soils across future landscape areas; and
- installation of gas protection measures to CIRIA CS2 requirements (Situation A);

4.3. Contamination Hotspots/Unexpected Contamination

4.3.1. It is not considered likely that previously uncharacterised materials or contamination sources (i.e. buried wastes / tanks etc.) will be identified during the works, however if this were to occur, a decision must be made as to whether these can be dealt with using the techniques selected to manage the contamination characterised to date. Materials must be inspected by an appropriately qualified and experienced person and, if appropriate, samples collected and analysed. The Local Authority will be immediately informed in writing following any such discovery.

4.4. Materials Management

4.4.1. Earthworks will be carried out using methods/controls to ensure that contaminated materials, runoff or discharge, or dust, does not affect surroundings.

4.4.2. If materials are removed from the site, then these will be waste materials requiring disposal at a suitably permitted facility for which transfer documentation should be retained; removed soils may be classed as hazardous waste. WAC testing should be carried out where landfill disposal is required; this should be undertaken on stockpiled material with representative sampling to properly characterise the waste.

4.4.3. Excavation arisings from service trenches and foundations may be contaminated and should be either removed from the site or replaced below cover layers. Alternatively, if tested and found to be uncontaminated, these materials could be suitable for use as clean subsoil within the landscaping cover layer.

4.5. Construction materials

4.5.1. It is considered unlikely that protected water mains will be required, however, following completion of preparatory earthworks and prior to the installation of services, consultation with the water utilities provider is recommended regarding submission of a pipeline risk assessment, utilising post-remediation data as necessary.

4.5.2. An assessment of the ground conditions to determine their potential to impact concrete has been carried out with a recommended classification of Design Sulphate DS-1 and Aggressive Chemical Environments for Concrete of AC-1.

5. Health, Safety and Environmental Management

5.1. Health and Safety Roles / Responsibilities

5.1.1. The Principal Contractor under the Construction Design and Management Regulations 2015 (CDM2015) will be responsible for managing health and safety during the remediation / preparation works and for producing any risk assessments and method statements required.

5.1.2. SGP's responsibilities as 'Designer' under CDM 2015 are to eliminate, reduce or control foreseeable risks that may arise during construction, maintenance or use, and to provide information to other members of the project team to assist them in fulfilling their duties. The recommendations in this report should be considered by the 'Client' and/or 'Principal Designer', and Principal Contractor, as defined within the regulations, and included in the Health and Safety File for the site.

5.1.3. Protection of site workers, local-residents and visitors during the remediation works can be achieved by the adoption of appropriate health and safety practices, environmental management and site security. All site workers should be given a comprehensive health and safety induction and required to use appropriate personal protective equipment.

5.2. Environmental Management Issues

5.2.1. The scope of remediation works is unlikely to have a significant impact upon the nearby residents and housing and the wider environment provided that due care is taken to control dust, noise and vibration, and to prevent surface runoff/trackout onto roads and into drains. Noise emissions should be managed through the observation of approved working hours and use of appropriate plant.

5.2.2. Dust and trackout of mud should be routinely monitored visually, and if unacceptable emissions beyond the site boundaries are noted then the element of the works contributing to this should be halted until appropriate mitigation (damping down, road sweeper, etc) can be deployed.

5.2.3. No discharges of dewatering or surface runoff to surface waters is permitted, however uncontaminated or marginally contaminated water may be discharged to foul sewer in agreement with the utility provider.

5.2.4. Plant fuel and lubricant storage should take place using suitable containers, bunds and secured filling points. An oil spill kit and adsorbent materials to manage any accidental release of liquid pollutants should be provided. Suitable sealed skips and containers should be used for the temporary storage of small quantities of asbestos or other hazardous wastes, if encountered.

6. Inspection and Verification

6.1. Additional Investigation / Monitoring

6.1.1. A watching brief by supervisors and site operatives should be maintained during the preparatory earthworks for uncharacterised sources of contamination.

6.1.2. If any unexpected ground conditions are encountered during the remediation earthworks that include visual or olfactory contamination indicators, then works in that area should cease until specialist advice can be sought. Samples of suspect materials will then be collected and analysed to enable assessment of the risks to the future site use, and to determine the suitability of the materials for retention within the site. Any such additional risk assessment would be submitted to the DCC for approval.

6.2. Building Gas Protection

6.2.1. The site is classified as CIRIA CS2 (low risk) and the proposed development 'Situation A' under CIRIA C665 guidance, meaning that basic specific precautions against ground gas (elevated carbon dioxide and methane) are required within the future built development. This should be designed in accordance with guidance contained within BS8485:201 to achieve a gas protection score of 3.5.

6.2.2. Validation of installed gas protection measures should be verified in accordance with CIRIA C735 and is dependent on the slab type (reinforced or not) and presence of a venting void. It is understood that slab design details are yet to be finalised and these should be provided to determine the level of verification required, however assuming the use of a reinforced slab with sub-floor void the suggested level of verification is as follows:

Table 6.1 Extract of Table A2 from CIRIA C735 (Risk based decision structure for verification of gas protection systems in buildings)

Installer Experience	Suggested Level of Verification
General builder / groundworker/ landfill operative (no relevant qualification[1])	Verifier (consultant[2] or qualified and experienced installer[1]) to conduct thorough verification (visual) inspection prior to all concrete pours. Contractor to supply sign off sheets (verification evidence) including sub grade acceptance forms and photographs to independent verifier.
Qualified[1] and experienced installer (minimum one operative to hold qualification)	Verifier (consultant[2] or third party qualified and experienced installer1) to conduct thorough verification (visual) inspection prior to 25 per cent concrete pours (minimum two visits), including venting void, subgrade etc. Installer to supply sign off sheets (verification evidence) including sub grade acceptance forms, photographs to independent verifier for all other pours.

[1] Relevant qualification NVQ Level 2 in gas protection installations
[2] Verification consultant should be competent, experienced and suitably trained. A statement detailing their qualifications and should be included in the verification plan

6.2.3. Building gas protection proposals will be submitted by the Developer to the Local Authority for approval prior to the commencement of construction.

6.3. Landscaping Soils

6.3.1. Due to the presence of elevated heavy metals (lead, cadmium and zinc) a 600mm soil cover system and basal geotextile is required in all landscape areas regardless of whether a site strip has been completed due to the presence of elevated concentrations within the underlying natural glacial till.

6.3.2. The developer will be responsible for managing soil stockpiles and completed areas of soil cover to avoid cross-contamination of clean materials.

6.3.3. The general requirement will be as follows, subject to Local Authority approval:

- high visibility geotextile at interface between retained soils and base of soil cover system;
- provision of 600mm of clean soil cover over made ground materials within landscape areas, typically comprising 450mm of subsoil, and 150mm of imported topsoil;
- materials to be used as the landscape soils must be suitable for use and validated;
- potential cross-contamination of cover soils due to secondary excavations for foundations construction or trenching must be avoided, with appropriate replacement or disposal of contaminated arisings.

6.4. Site Cover System Validation

6.4.1. There are no site soils consistently found to be suitable for reuse within the soil cover system due to elevated metals, imported soil will therefore be required by the developer. It is possible that some subsoil might be encountered that is uncontaminated and suitable for use within the clean cover system in landscaping areas, however further testing would be required in order to confirm this.

6.4.2. Imported soils for use within landscaping areas should be subject to chemical testing to determine their suitability. Sampling of imported soils should be completed in accordance with WLGA[4] requirements with a minimum of 4 samples collected per 250m^3.

6.4.3. Soil concentrations will be compared to assessment criteria based on a residential land use as detailed in table 6.1 below:

[4] Welsh Land Contamination Working Group – Requirements for the Chemical Testing of Imported Materials for Various End Uses and Validation of Cover Systems

Table 6.1 Landscaping soil screening criteria (residential use)

Contaminant	Residential Use Screening criteria (mg/kg unless stated)
Asbestos	**<0.001%** by mass (LOD)
Arsenic	**37** LQM/CIEH S4UL
Cadmium	**11** LQM/CIEH S4UL
Chromium (total)	**910** LQM/CIEH S4UL
Hexavalent Chromium	**6** LQM/CIEH S4UL
Copper	**2,400** LQM/CIEH S4UL
Lead	**200** (C4SL)
Mercury	**40** LQM/CIEH S4UL
Nickel	**180** LQM/CIEH S4UL
Zinc	**3700** LQM/CIEH S4UL
Naphthalene	**2.3** LQM/CIEH S4UL
Acenaphthylene	**170** LQM/CIEH S4UL
Acenaphthene	**210** LQM/CIEH S4UL
Fluorene	**170** LQM/CIEH S4UL
Phenanthrene	**95** LQM/CIEH S4UL
Fluoranthene	**2400** LQM/CIEH S4UL
Anthracene	**280** LQM/CIEH S4UL
Pyrene	**620** LQM/CIEH S4UL
Benzo(a)anthracene	**7.2** LQM/CIEH S4UL
Chrysene	**15** LQM/CIEH S4UL
Benzo(b)fluoranthene	**2.6** LQM/CIEH S4UL
Benzo(k)fluoranthene	**77** LQM/CIEH S4UL
Benzo(a)pyrene	**2.2** LQM/CIEH S4UL
Indeno(123cd)pyrene	**27** LQM/CIEH S4UL
Dibenzo(ah)anthracene	**0.24** LQM/CIEH S4UL
Benzo(ghi)perylene	**320** LQM/CIEH S4UL
Aliphatic C5-C6	**42** LQM / CIEH S4UL
Aliphatic C6-C8	**100** LQM / CIEH S4UL
Aliphatic C8-C10	**27**LQM / CIEH S4UL
Aliphatic C10-C12	**130**LQM / CIEH S4UL
Aliphatic C12-C16	**1100** LQM / CIEH S4UL
Aliphatic C16-C21	**65000** LQM / CIEH S4UL
Aliphatic C21-C35	**65000** LQM / CIEH S4UL
Aromatic C5-C6	**70** LQM / CIEH S4UL
Aromatic C6-C8	**130** LQM / CIEH S4UL
Aromatic C8-C10	**34** LQM / CIEH S4UL
Aromatic C10-C12	**74** LQM / CIEH S4UL
Aromatic C12-C16	**140** LQM / CIEH S4UL
Aromatic C16-C21	**260** LQM / CIEH S4UL
Aromatic C21-C35	**1100** LQM / CIEH S4UL
Benzene	**0.08** LQM / CIEH S4UL
Toluene	**130** LQM / CIEH S4UL
Ethyl-benzene	**47** LQM / CIEH S4UL
m/p-xylene	**56** LQM / CIEH S4UL
o-xylene	**60** LQM / CIEH S4UL

S4UL: Generic assessment criteria published by Chartered Institute of Environmental Health and Land Quality Management Ltd S4UL, residential land use scenario; COPYRIGHT Land Quality Management Limited reproduced with permission; publication number UL3102. All Rights Reserved
C4SL: Category 4 Screening Levels published by CL: AIRE 'residential land use with plant uptake'

6.4.4. Quality criteria for the cover system soils will be set down in the table above. Soils will be tested at an MCERTS or UKAS accredited environmental laboratory. Sampling for quality and depth should validation should be undertaken by an independent consultant.

6.4.5. Depth validation will be carried out at a frequency of 1 test pit per 25m^2 area or a minimum of 3 pits. Test pits will be measured and photographed in accordance with WLGA validation requirements.

6.5. Remediation / Preparatory Earthworks Completion Reporting

6.5.1. A report detailing the works carried out and the results of any validation / verification testing undertaken will be prepared by the Environmental Consultant and submitted to the Local Authority for approval upon completion. The report will include validation and verification of the installed gas protection measures and landscape cover soils, details of any waste removed including surplus soils and imported materials.

6.5.2. The proposed management and remediation, and implementation and reporting of the verification/validation testing regime will demonstrate that the proposed remedial works have been carried out and the site made suitable for the proposed development, subject to the execution of any additional requirements on the developer during the construction stage of the regeneration programme for the phase.

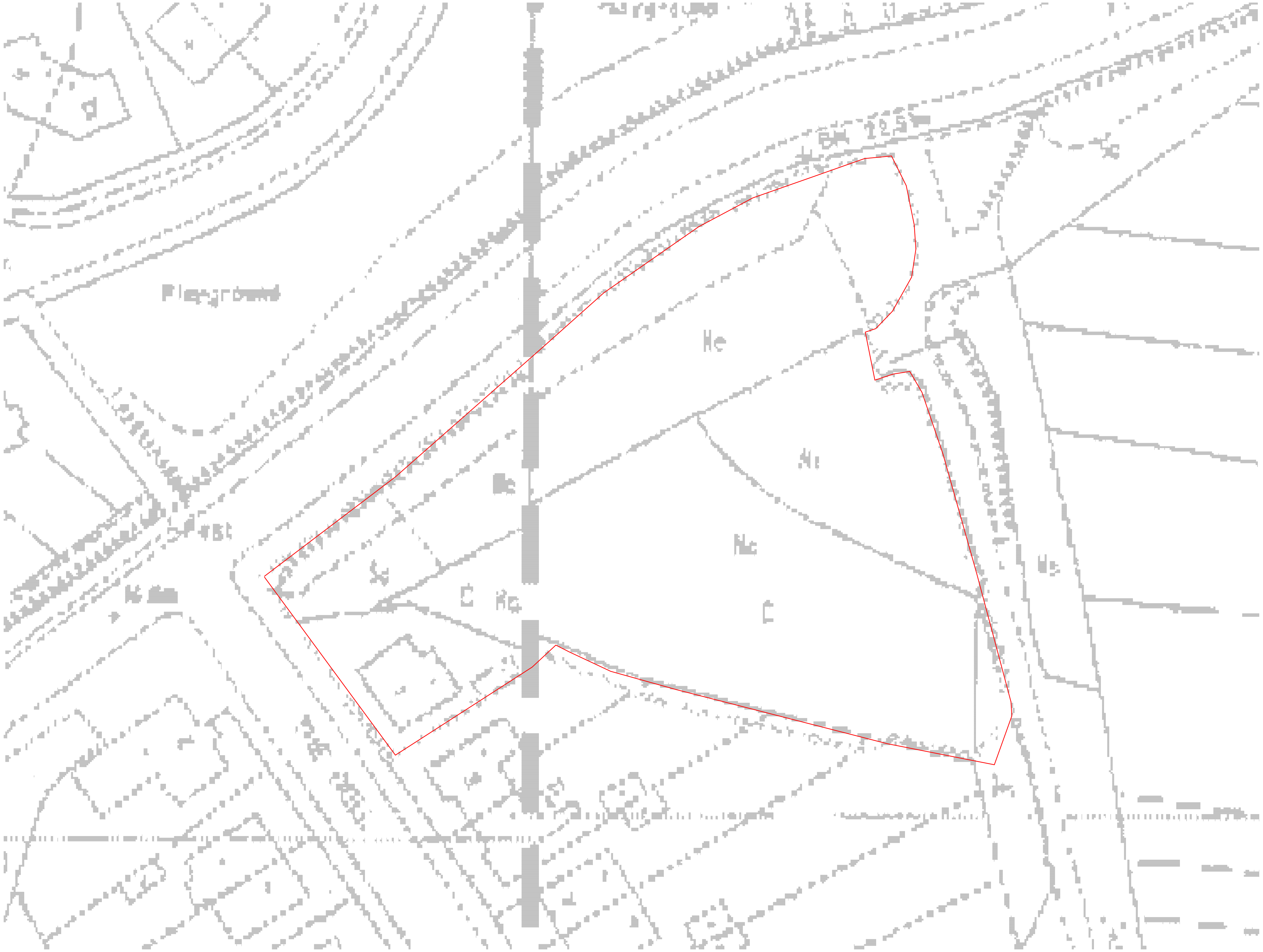
6.5.3. With the adoption of the above normal practices for Brownfield development, and on the information available to it, SGP considers that the site can be safely and economically redeveloped, and the existing environmental liabilities managed.

6.6. Limitations

6.6.1. This report has been prepared by SGP for the sole and exclusive use of Denbighshire County Council. Reasonable skill, care and diligence has been exercised within the budget available, and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet undetected may exist. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context.

6.6.2. SGP reserves the right to alter any of the foregoing information in the event of new information being disclosed or provided and in the light of changes to legislation, guidelines and responses by the statutory and regulatory authorities.

DRAWING



N

Site Boundary

SMITH GRANT
Environmental Consultancy
LLP

Station House
Station Road, Ruabon
Wrexham, LL14 6DL
Tel: 01978 822367
Fax: 01978 824718

www.smithgrant.co.uk
email: info@smithgrant.co.uk

Project: The Dell, Prestatyn	
Drawing: Site Boundary	
Drawn: SM	Checked: DW
Date: 28.03.18	Scale: 1:500 @ A3
Job No: R2485	Drg No: D01

Schedule of Accommodation

15No Units : Comprising of : (approx. areas)

2No 2 Bed CAT 3 - Wheelchair User Apartments	80-88m2*
3No 1 Bed CAT 3 - Wheelchair User Apartments	62-70m2*
4No 2 Bed CAT 2 - Accessible & Adaptable Apartments	80-95m2*
6No 1 Bed CAT 2 - Accessible & Adaptable Apartments	62-70 m2*

* All apartments feature covered external 'private' space/ balcony 6-8m2

Scooter storage points (exact location TBA)

External Bin Store (exact location TBA)

On site Parking

5No Disabled Bays 3600 x 6000mm

13No standard parking bays 2400 x 4800mm

Land transfer to adjoining property (3, The Dell) subject to agreement- Exact details TBA

Party fence wall boundary treatment, exact details TBA- subject to agreement

Access for adjacent property 7 & 9 The Dell exact details TBA- subject to agreement

A	18:10:17	Schedule of Accommodation omitted	
B	14:12:17	Schedule of Accommodation added	
C	29:01:18	Location of Building Footprint Amended	
D	07:02:18	Drainage Omitted	
		Notes added regarding boundary etc	
E	26:02:18	Levels	
		Existing & Proposed added	

Cyngor sir ddinbych denbighshire County Council

Cyfleusterau, Asedau a Tai
Facilities, Assets & Housing

Project_Name :

The Dell, Prestatyn.

Project_Number :

P7_17_706

Drawing Stage: RIBA STAGE 3

Drawn By:

Reviewed By:

Date: 16:10:17

Scale: 1:200 @A1

Drawing Name: Proposed Site Plan.

Drawing Number: AL(0)110

Revision: E