



Homes &
Communities
Agency

Guidance on dereliction, demolition and remediation costs

March 2015

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Note:

This report was prepared 4th Quarter 2014, and the pricing data included herein is on a current day firm price basis as of 4th quarter 2014.

1. The Homes and Communities Agency (HCA)

The Homes and Communities Agency is the national housing and regeneration agency for England, with a capital investment budget of around £4bn for the period 2012-15. We contribute to economic growth by helping communities to realise their aspirations for prosperity and to deliver high quality housing that people can afford.

We provide investment for new affordable housing and to improve existing social housing, as well as for regenerating land. Our staff have a range of skills and expertise and can provide support and advice to partners to enable them to tailor their plans to the needs of their different communities.

We are also the regulator for social housing providers in England. The focus of our regulatory activity is on governance, financial viability and financial value for money as the basis for robust economic regulation. We set consumer standards but will only intervene in cases of serious detriment that have caused, or are likely to cause, harm.

We operate throughout England, including as regulator in London. However, responsibility for housing and regeneration activity in London lies with the Greater London Authority.

2. The purpose of the guide

Brownfield land (often interchangeably called Previously Developed Land, PDL) has an important role in delivering housing and supporting economic growth. Given the potential that brownfield land holds it is important that central and local Government (and their agencies), developers and landowners work together to overcome potential obstacles to delivery.

Estimating the cost of preparing a brownfield site for reuse can be a complex exercise and one that often has uncertainties. Current and comprehensive information is essential to reduce the uncertainty and risk of underestimating the costs of remediation. In this respect nothing can compete with a recent and well executed site investigation that has been designed with full regard for the land use history and setting of a site. Appropriate surveys (such as for asbestos and other hazardous substances and structural/building form) can assist to understand demolition techniques and hence reduce costs.

The guide was initially developed in 2005 to assist the Homes and Communities Agency (formerly English Partnerships) project managers and development partners form, at an early stage, an opinion as to the costs of the remediation of the contamination and demolition of buildings, for inclusion in a project appraisal, possibly even prior to the appointment of consultants and the provision of site-specific advice. This revised edition presents an update on cost estimates for the remediation of land affected by contamination based on 2014 prices. Regional weightings for the costs have also been provided for guidance. This 2014 revision provides an update of the 2008 publication which is now superseded. The HCA wishes to offer profound thanks to those involved in supporting the preparation of this guide, as outlined in Annex A.

The revised edition of the guide includes additional guidance on pre-acquisition site investigations, as part of 'due diligence', and expands the remediation costs to include problems associated with demolition. This includes, for instance, having to deal with the above and below ground structures, together with the abandonment and removal of redundant services. Land that has been subjected to works of this nature often requires excavated voids to be backfilled, with site won material and/or the import of clean fill material, consolidation and grading/levelling to form development platforms.

This guide has been prepared by the Homes and Communities Agency and its consultants. The information and opinions contained in this guide are for general information purposes only. The guide is not intended to constitute professional advice. However, it may prove useful for organisations outside the Homes and Communities Agency, for example, consultants, contractors, developers, landowners, local authorities and surveyors.

The information in this guide should not be relied on or treated as a substitute for specific advice relevant to particular circumstances. The ranges of costs identified within the guide are for guidance purposes only and should not be relied upon, on their own, for the purposes of commissioning remediation works. However, costs derived from the guide may be helpful at later stages of a project appraisal, for example to provide a comparison with unit costs estimated by a specialist consultant, or to query unit costs which fall significantly outside the relevant ranges set out in this guide.

3. Contamination policy, regulation & procedural context

Land contamination is regulated under several different legislative regimes, including environmental protection, permitting, waste management, planning and development control and health and safety. Annex F provides an overview of some of the key regulations and guidance related to land contamination.

The planning system should contribute to and enhance the natural and local environment by remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate. The local authority will typically require a developer to deal with the legacy of contamination at that time.

Contamination is typically dealt with when a site is developed and it is the developer's responsibility to provide a new development that is suitable for use

The potential presence of ground contamination at a site could result in:

1. Construction-related issues, including:
 - health and safety (both on site and off site);
 - increased costs compared to uncontaminated sites, particularly for waste disposal and remediation;
 - possible delays and cost increases caused by unexpected contamination encountered during construction;
 - the requirements for permits to undertake certain site activities; and
 - the need for verification and discharge of planning consent conditions.

2. Design issues, including:

- ground investigations, risk assessment and remediation;
- ground gas and vapour protection measures;
- suitability of earthworks materials as cut and fill;
- drainage strategy and the feasibility of sustainable drainage measures;
- aggressive ground conditions and materials used for buildings and services (particularly potable water supply); and
- long term operation, maintenance or monitoring requirements in some circumstances.

National policy and guidance on contaminated land is provided by the National Planning Policy Framework¹ (NPPF) and associated Planning Practice Guidance². The NPPF states the planning system should contribute to and enhance the natural and local environment by preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely effected by unacceptable levels of soil, air, water or noise pollution or land instability. It should also contribute to remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate. At the heart of the NPPF is a presumption in favour of sustainable development and decisions should ensure that “the site is suitable for its new use taking account of ground conditions and land instability”. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

The term “safe” in this context was not intended to imply a scientific toxicological benchmark (such a minimal risk) rather was intended in an holistic planning sense

1. DCLG, 2012, National Planning Policy Framework

2. NPPG: Land affected by contamination: <http://planningguidance.planningportal.gov.uk/blog/guidance/land-affected-by-contamination/land-affected-by-contamination-guidance/>

Environment Agency guidance³ for the management and protection of groundwater (GP3) allows for a proportionate, risk-based approach reflecting the government's sustainable growth agenda while ensuring that the environment is protected. The Environment Agency⁴ encourages voluntary remediation or remediation under the planning regime. Where this is not possible they may require remediation using anti-pollution works notices or a remediation notice. The Environment Agency state in GP3 that "suitable for use" may also be applicable to new contamination via spills and accidents although most current regulation aims to ensure that activities cause "no deterioration" in soil or water quality.

Protecting surface water and groundwater may mean carrying out work over and above that required to make the land suitable for the proposed development and to protect human health. The Environment Agency may recommend the refusal of a planning application where they judge the risk of groundwater pollution is too high or it has been inadequately assessed.

In GP3 the Environment Agency state they support a proportionate, risk-based approach, but may object if they judge the risk of water pollution is too high or not properly assessed

The presence of contamination can have significant implications as to the cost of disposing of surplus excavated material which may be waste. A waste is any substance or object which the holder discards or intends or is required to discard. 'Discard' in this context has a special meaning which is not necessarily the same as its dictionary meaning. Defra has published guidance for businesses and other organizations setting out a practical guide about whether something is or is not waste. Controls apply from the point of its production, to its movement, management, and recovery or disposal. While the assessment of land contamination is risk-based the classification of whether a waste soil is hazardous waste or not is instead based on fixed national thresholds (i.e. hazard-based). If a development site intends to produce hazardous waste (i.e. send off-site for disposal) then the premises must be registered with the Environment Agency before undertaking such activity and specific procedures apply. Extensive guidance on waste classification, management, treatment, recovery and disposal is provided on www.gov.uk.

When contamination is being considered for a site that is not proposed to be developed, or if the work done during redevelopment is or was not done to a sufficient standard, then legislation provides a means of direct intervention (the Part 2A regime). The Statutory Guidance⁴ defines a risk based approach to the management of risks arising out of land contamination. It describes the risk assessment methodology in terms of significant contamination and 'contaminant linkages' (also referred to as 'pollutant linkages' in older guidance) within a 'source-pathway-receptor' model of the site. All three elements of a significant contaminant linkage must be present.

The Statutory Guidance defines four 'categories' of land to assist in determining whether a site might be "Contaminated Land" with respect to

3. Environment Agency, 2013, Groundwater protection: principles and practice (GP3) 4. Defra, 2012, Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance.

4. Defra (2012) Guidance on the legal definition of waste and its application, A practical guide for businesses and other organisations www.gov.uk

the potential for significant harm to human health under Part 2A. Category 1 and 2 would indicate that the site would be determined whereas in the case of both 3 and 4 it would not. Land that has been developed which is assessed to be within category 4 should be acceptable with respect to human health under planning. Defra, DCLG and the Welsh Government have confirmed that category 4 screening levels (C4SL), could be used under the planning regime (in England and Wales). It states that C4SL provide a simple test for deciding if land is “suitable for use” and definitely not contaminated land. If C4SL are used in this manner, by a competent specialist, their applicability should be justified and supported by the conceptual model for the proposed development. Alternatively a developer or landowner may decide that a higher level of protection is preferred on a voluntary basis for a specific site, for instance by using generic assessment criteria or other industry derived values based on lower or minimal risk levels; the C4SL represent a risk level defined as “acceptably low”. These policy changes do not currently apply to Northern Ireland and Scotland. Values above generic assessment criteria and C4SL do not necessarily represent contaminated land, rather further consideration is required.

Decision makers must ensure that competent consultants are appointed for ground investigation, risk assessments, remediation and verification, to ensure that the land for new developments is appropriately assessed and remediated. Indeed, this is a crucial element in the NPPF.

“after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990.”

4. Due diligence, risk assessment & remediation

This section provides a narrative on steps and processes for evaluating the potential risk posed by land due to contamination, prior to acquisition as part of due diligence and for the subsequent development process. Further supporting information is provided in Annex F.

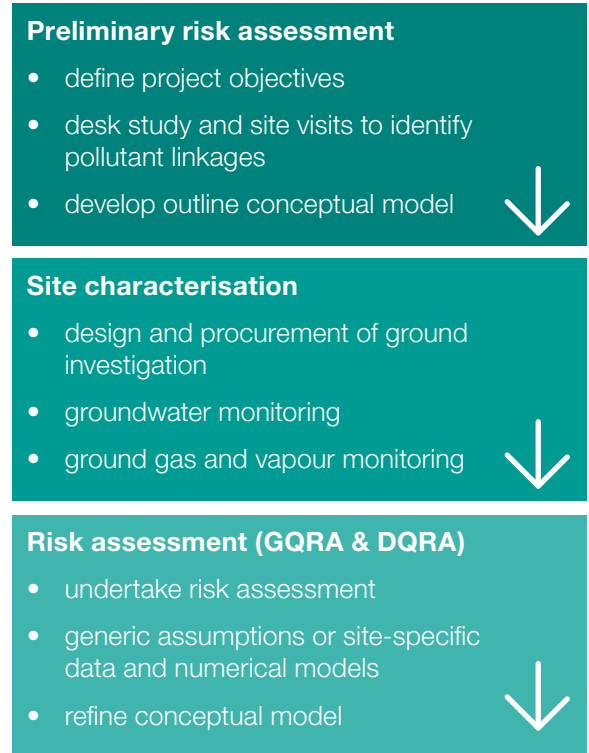
The level and nature of the risk will be dependent on the proposed use of the land and the sensitivity of the environment. The aim of the assessment is to ensure that the resultant development is “suitable for use” based on the contaminant linkages identified within the ‘source-pathway-receptor’ model. Contaminants may be identified within the ground or the groundwater in solid, liquid or gaseous form. Sensitive receptors could include humans, controlled waters, property and ecological receptors (fauna and flora). Sources and receptors can be located onsite and/or offsite.

The first step is a preliminary risk assessment (PRA) which is the absolute minimum action that should be effected prior to the acquisition of a brownfield site. This will involve a desktop review of available environmental and geotechnical information including the history of the site and should be supplemented with a site reconnaissance survey. At the appropriate time this may be followed by ground investigation to characterise the site.

The NPPF states that a competent person is “a person with a recognised relevant qualification, sufficient experience in dealing with the types(s) of pollution or land instability, and a membership of a relevant professional organisation”.

The resulting information would typically first be assessed as part of a generic quantitative risk assessment (GQRA). In some cases a more detailed quantitative risk assessment (DQRA) may be required. This uses additional data to derive site-specific assessment criteria (SSAC) for acceptable

Figure 1a Risk assessment



concentrations in soils, waters and/ or gas. Should unacceptable contamination be confirmed then remedial action (either specific remediation or risk management measures) will be required to ensure the development is suitable for the proposed use.

Remediation is a broad term that includes a range of risk management procedures and interventions to mitigate the unacceptable contaminant linkages identified by the risk assessment. SuRF UK⁵ has developed a framework to embed balanced decision making in the selection of the remediation options as an integral part

of sustainable development. The optimum solution is remediation that eliminates or

The assessment of whether a site is suitable for use may involve the use of C4SLs. These represent an acceptably low risk and provide “a simple test for deciding when land is suitable for use and definitely not contaminated land”

5. Footnote

controls unacceptable risks in an appropriate and timely manner, and which maximises the overall environmental, social and economic benefits of the remediation work. Considering remediation and contamination early in a project has many advantages and can result in a more sustainable approach, as well as the potential for significant cost savings and programme advantages. In doing so, it can also extend into wider considerations that relate to the integration of remediation with non-risk based aspects of project design (master planning, drainage, waste minimisation, energy and flood protection).

SuRF UK states “Sustainable remediation is the practice of demonstrating, in terms of environmental, economic and social indicators, that the benefit of undertaking remediation is greater than its impact and that the optimum remediation solution is selected through the use of balanced decision-making process”

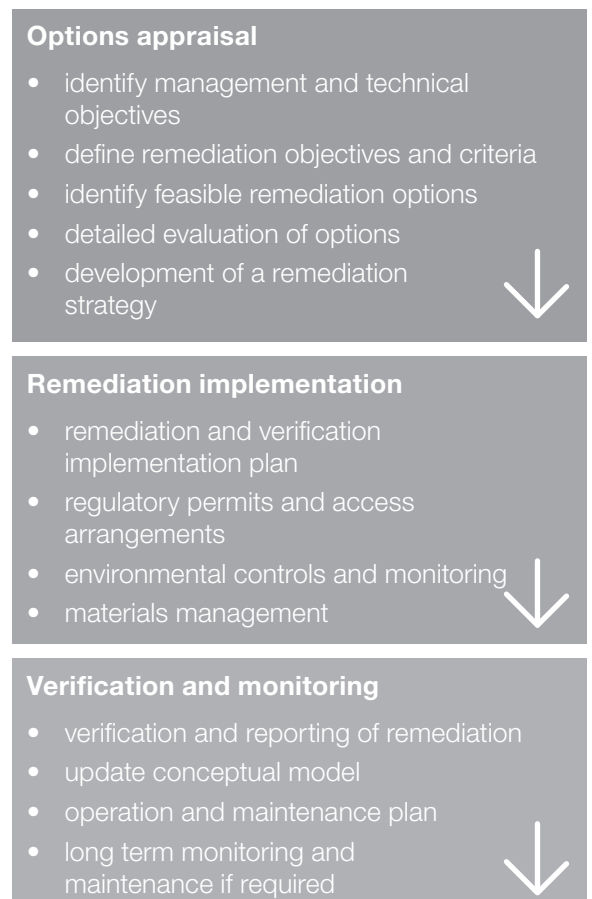
The Definition of Waste: Development Industry Code of Practice⁶ is an initiative to improve the sustainable and cost effective development of land. It enables the legitimate reuse of excavated materials on-site or their movement between sites under certain conditions with a significantly reduced regulatory burden. By following the Code of Practice, excavated materials used for the purpose of land development are unlikely to be considered as waste by the Environment Agency. The Code of Practice applies to both uncontaminated and contaminated excavated material from man-made and natural sources.

The potential for asbestos in the ground should be considered during the desk study stage at all sites. Work with asbestos in soil is regulated and the legal duties cannot be delegated.

Verification is the important final step to check whether remediation of land contamination has been successfully completed. It can provide evidence to regulators and landowners that remediation has met the agreed targets and the site is suitable for use. The Environment Agency recommends that multiple lines of evidence are collected to support the remediation end point.

Asbestos is a common contaminant present on previously developed land and it may also be present on “greenfield” sites. The presence of asbestos, even at low levels, can complicate the selection of remediation techniques, will require specific (regulated) approach to development work and may significantly increase costs. The Control of Asbestos Regulations 2012 (CAR) applies to all work with asbestos (including asbestos in soil and Made Ground). Some work may require a licensed asbestos contractor. The work may also need to be notified to the HSE in advance.

Figure 1b Remediation and verification



6. Environment Agency (2010) Verification of remediation of land contamination

5. Dereliction and demolition

This section provides an overview of issues associated with dereliction and associated demolition. Additional supporting information is provided in Annex G.

Planning approval may be required to demolish a building or structure. Early engagement with the local planning authority is recommended in order to ascertain if this may be needed. DCLG provide guidance on their website <http://planningguidance.planningportal.gov.uk/>. Some supporting information on situations where a demolition may require planning approval is provided in Annex G.

Ownership of a derelict building, structure or site that is not occupied imposes a duty of care upon the individual or corporate body in control of the premises. They must take all reasonable steps to ensure that the site remains safe and does not present any health and safety risks to any other parties.

The more control one has over certain premises, the more likely one is to be considered “occupier” for the purposes of the Occupiers’ Liability Acts. More than one person at the same time can have the status of occupier

Such duties are transferred along with ownership and will have cost implications. This applies during all phases of development from acquisition and any period of dormancy through to active demolition. In the absence of construction-related activity the prime legal duties relate to occupiers liability. The occupier has a duty of care to both invitees (which includes all parties having a statutory right of entry) and, to a lesser extent dependent on age, non-invitees including trespassers. The duties to invitees include:

- Safe access;
- Upkeep of any temporary works erected to provide necessary structural stability, and structural soundness in general;
- Creation of demarked areas where appropriate;

- Utilities are disconnected from supply sources;
- Providing building design and services drawings as required; and
- historical information on building structures and contents is obtained and maintained.

The costs of security, to protect the occupier from claims from injured parties may include:

- Establishment, routine inspection and maintenance of fencing, security office and provision of detection;
- Removal of resale value items;
- Signage for fragile roofs, prohibited areas, deep water, etc;
- Maintenance of right of way if they exists;
- Protection of openings to excavations or underground structures;

The longer a site has been dormant, the greater chance that habitual trespass has occurred and the potential cost for the provision of security may increase.

The site owner’s legal responsibilities when active demolition commences is to provide the fullest, practicable information regarding the premises to those undertaking the activity.

Those acquiring a derelict site or site with buildings might require the vendor to ensure that the site or premises will be available in a state considered ‘compliant’ with the statutory obligations placed on ‘occupiers’.

Construction (Design and Management) Regulations 2007⁷ place a significant duty on the client to provide information to the appointed contractor. Clients must provide those who need it with pre-construction information that can reasonably be obtained. A range of surveys and reports may be needed. This may include asbestos surveys, structural stability of site and nearby structures, the location of above and below ground live services in the work area and the inspection for other hazardous substances in the building etc. These should be done before work begins and not be left for the principal contractor to organise once the demolition work has started. In so doing, significant cost savings and programme advantages can be gained.

7. Proposed to be replaced by a new version in 2015

Dilapidated structures can be at risk of collapsing, especially in certain weather conditions, and they are a hazard to public safety. Deterioration may arise due to:

- Poor or inadequate maintenance;
- Fire or arson;
- Damage due to extreme and inclement weather conditions;
- Explosions from gas leakage; or
- Vandalism.

| Security of the site is paramount

Specific hazards may include unstable roofing, fencing or structures, loose or falling roof tiles, unstable chimneys or masts, unprotected chambers or excavations, confined spaces or rotten woodwork. The costs of temporary works to allow preparation of the site prior to commencement of demolition should be considered.

There should be a certificate of disconnection to ensure that there are no live supplies at the premises. Provision for temporary lighting may be required. All gas supplies should be disconnected and made safe, and any gas storage systems should be decommissioned and purged. All water supplies should be disconnected and systems drained. Plant and equipment should be decommissioned and made safe.

Typical hazardous substances to be considered include asbestos, lead, other metals (for instance mercury), hydrocarbons and chemicals in tanks or other storage vessels, and ionising radiation sources. Common biohazards include moulds and fungi, animal excreta, rats and vermin (including Weil's disease), sharps, and certain invasive plant species (giant hogweed for instance).

The following information should be regarded as essential due diligence:

- Operation and maintenance manuals and records
- Existing 'as built' or 'as installed' drawings (or design drawings in their absence) covering architectural and Mechanical, Electrical, Plumbing (MEP) elements

- Previous site and building survey records/ reports (regardless of purpose)
- Historical records held for past usage of the site or structures, buildings and operation now defunct, decommissioned or removed.

The availability (or absence) of information and records may be a significant factor in commercial decisions regarding the approach during and after acquisition. The lack of such information may increase the requirements for post possession surveys including those to satisfy the client, designer and the principal contractor obligations and duties under the CDM regulations).

If an existing asbestos management plan does not exist, then a survey and assessment might be required as part of the due diligence process or might be undertaken afterwards, by a suitable competent person. A survey undertaken beforehand should also identify what actions the vendor needs to undertake to address noncompliance prior to completion of the sale, if there is time. The same survey and assessment might be used to estimate and agree costs that may inform the negotiation on value. Typical information that should be requested includes:

- Asbestos survey(s) by a competent person suitable for demolition purposes
- Licensed asbestos contractor clearance certificates (including air tests)
- Related plan of work and waste disposal records (waste transfer notes, etc.)

In the absence of information then the potential presence of asbestos should be presumed and the necessary cost allowances in order to satisfy the duty holder obligations in accordance with the Control of Asbestos Regulations 2012 allowed for. The 'duty to manage' obligations apply to those in control of property (including residential premises that are let or rented). Surveys for derelict sites should be asbestos refurbishment & demolition survey that is compliant with standards applicable at that time published by the Health and Safety Executive. A full survey will be useful in allowing an estimate of the cost for the removal.

6. Remediation costs

This section presents a model that can be used as a basis for an initial assessment of the potential cost of preparing sites affected by contamination.

The guide is not to be used for estimating other site preparation and servicing costs. It does not take account of extensive asbestos removal. For the purpose of this guide, the remediation of land affected by contamination has been defined as activities whose purpose is to prevent, minimise, remedy or mitigate the effects of harm to human health, pollution of controlled waters, ecological receptors (flora and fauna) or building materials and to restore the land or polluted waters to a state appropriate for its intended end purpose taking account of environmental and/or public health requirements.

The benchmark costs can be used to check on estimates provided from other sources (e.g. the project applicant or consulting engineers) they might provide a basis for querying the estimates if they lie outside the appropriate range taken from Figure 2 if the assumptions about the site conditions and the end use are the same. It does not take account of asbestos removal nor does it cover geotechnical activities.

The guide provides benchmark cost ranges for the remediation of contaminated land on Brownfield sites. The costs are based on per hectare costs of remediation and should be applied to the gross area of the site as available from sales documents or site survey. They are not related to actual areas of contamination (as this is unlikely to be known early in appraisal) nor to historic employment floor space.

Figure 2 sets out ranges of benchmark costs per hectare for the remediation of contaminated sites.

The costs are arranged according to previous use, proposed end use and water risk. Costs are rounded to the nearest £25,000 per hectare. A technical note to the table explains the method used for calculating the cost ranges.

How to select appropriate categories

Use of the benchmark unit costs will require a level of knowledge and judgement about the site, its location and history and its future uses. It will be necessary to obtain a minimum level of information about the site based on desktop assessment with respect to the following:

Previous use; different types of historic uses on the site may have generated particular levels and types of contamination which tend to determine the appropriate remediation techniques, the likely areas within the site requiring remediation and the likely unit costs of that remediation. Previous uses can often be determined by studying historic maps and through reports obtained from commercial supply.

For the purposes of this guide sites have been categorised from low potential to high potential for contamination. Category A sites represent the lowest potential for contamination and Category D sites represent a high potential for contamination. Annex D provides an expanded list of classified site types.

It should be noted that the selection of the category is not an exact science and a degree of professional judgement is required. There are a large number of potential previous uses and those provided in Figure 2 are simply an example. If the previous use is not in one of the categories then consider what it may be similar too by using information found in the Department of Environment (DOE) Industry Profiles which can be viewed on the www.gov.uk website⁸. For instance there are many types of chemical works listed and the category that a chemical works might be placed in could vary from A to D depending on the scale and type of operation. Similarly there are many types and configurations of rail land from tracks and sidings (likely category A or B) to large depots, maintenance and refuelling areas (possibly category C or D).

Categories A to D do not in any way relate to the categories in the National Land Use Database of Previously Developed Land (NLUD-PDL).

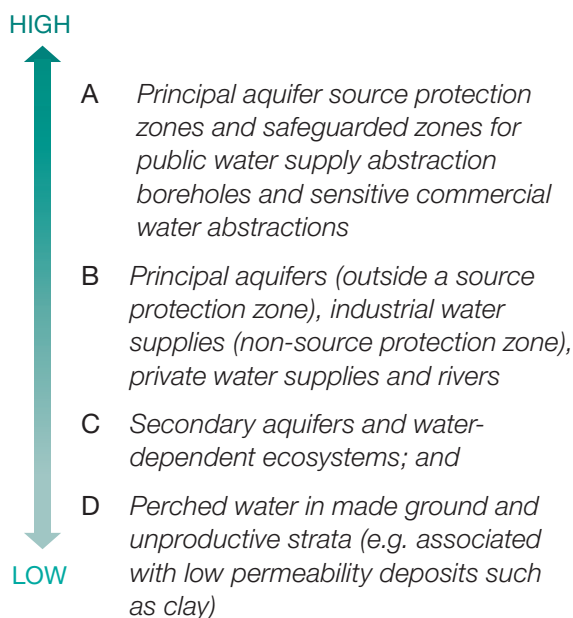
8. Department of Environment (DOE) industry profiles

Figure 2 Remediation costs

		Previous use			
		Low potential	Moderate potential		High potential
SENSITIVITY	Proposed end use	Site category A	Site category B	Site category C	Site category D
		Small scale and general industrial sites, colliery or mine spoil heaps, miscellaneous factories and 'works' (not heavy industry), sites with very small to small fuel tanks	Garages, workshops, pithead sites, railway lines, textiles, small scale timber treatment, sewage works, smaller chemical works, sites with small to mid-sized fuel tanks	Metal workings, scrap yards and shipyards. Paints and solvents, small gasworks/gas holder sites, smaller power stations, rail depots (maintenance and refuelling), sites with large fuel tanks	Major gasworks, iron and steel works, large chemical works, refineries and major fuel depots, ship breaking and building, larger power stations, sites with large tank farms
Description		£ 000's	£ 000's	£ 000's	£ 000's
Negligible to low water risk					
Low sensitivity	Employment or commercial with limited soft landscaping, business parks and data centres	50 to 130	180 to 360	255 to 590	305 to 655
Moderate sensitivity	Public open space. Residential without private gardens (flats and apartments), universities and colleges	50 to 130	205 to 435	255 to 640	305 to 740
High sensitivity	Residential with private gardens. Schools for younger children with pitches and play areas. Allotments and growing areas in developments.	75 to 205	255 to 640	305 to 740	335 to 845
Moderate to high water risk					
Low sensitivity	Employment or commercial with limited soft landscaping, business parks and data centres	125 to 250	255 to 640	510 to 1,230	540 to 1,230
Moderate sensitivity	Public open space. Residential without private gardens (flats and apartments), universities and colleges	130 to 255	360 to 920	485 to 1,305	540 to 1,230
High sensitivity	Residential with private gardens. Schools for younger children with pitches and play areas. Allotments and growing areas in developments.	180 to 410	410 to 1,050	540 to 1,460	715 to 1,765

Proposed end use; the sensitivity of the end use will dictate the level of remediation that is necessary, therefore cost may vary according to the nature of the proposed end use. It is therefore necessary to take a view about the likely future uses of the site; this will require the site to be placed within a broader regeneration and planning context.

Water risk; if the potentially contaminated site is in an area where there are sensitive water receptors on, adjacent to, or under the land, then it may be necessary to perform additional remediation of soils or water over and above that required to deliver a development suitable for the proposed end use. In such circumstances, unit costs can increase significantly. Some remediation techniques considered adequate in regulatory terms to break the pathway between contaminant(s) and human health receptor(s), may not be sufficient in scope to render the site suitable for redevelopment. The water sensitivity can be identified by looking at appropriate Environment Agency and other maps and can be summarised as follows in decreasing order:



Groundwater source protection zones are further divided as follows (with Zone 1 being the most sensitive):

- Inner zone (zone 1) defined as the 50 day travel time (minimum 50m) and Inner Zone (zone 1c) for subsurface activity only.

- Outer zone (zone 2) defined as the 400 day travel time (minimum radius of 250m or 500m depending on size of abstraction) and Outer zone (zone 2c) for subsurface activity only.
- Total catchment (zone 3) defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source and total catchment (zone 3c) for subsurface activity only.
- Special interest (zone 4) defined as the area of special interest defined for some sources.

The NHBC, Chartered Institute of Environmental Health (CIEH) and Environment Agency guidance⁹ defines water sensitivity for groundwater, surface water (excluding coastal waters), coastal waters and artificial drainage systems. The guidance provides background for six sensitivity levels (which range from very high [H]) to very low [L2]). These classifications have been simplified in Figure 3 for the purpose of this guide:

How to narrow down the range

There is no such thing as a typical contaminated site. Therefore a range of costs have been provided for use in making an allowance for the remediation costs.

Due to the non-typical nature of sites and multiple variables impacting on remediation costs, the ranges can be wide and there will be instances where the costs are outside of the ranges.

Certain factors may influence where the remediation costs will sit within the range, below is a list of factors that will impact on the costs.

Number of factors; Not all factors have an equal impact on costs and each site context will vary. However it is reasonable to assume that if several of the factors apply to the site and indicate that the higher range should be used, then the higher range might be selected. If the majority of the factors suggest the higher range then it may be that the costs will exceed the proposed ranges. The same approach may be adopted for the low spectrum of the range

Size of the site; Where sites are significantly smaller than five hectares, the upper end of the cost ranges should be considered to allow for the absence of economies of scale. Conversely, the lower end of the ranges should be considered for very large sites. If a site is particularly small it is possible that the ranges will not apply.

Site context; In areas where the surrounding sites are known to have needed remediation, it is likely that costs will be greater than the mid-range cost. Sites in areas historically clear of problems could result in lower costs. However, there are contrary factors. If a site is located in an area where the surrounding land and water is already heavily affected by contamination, such as background soil contamination or regionally affected groundwater, this may limit the effectiveness of site specific remediation and as such less money might be required. This factor should be applied with caution and some intervention may be required where it is practical.

Duration in use; The longer an area has been used for a particular historical purpose, there is likely to be a higher potential for contamination. Sites that are recent may be less contaminated than those used for similar purposes in earlier years. This is due to increased levels of environmental awareness and more stringent environmental regulations and control.

Geology; The risk to groundwater or surface water may be a primary driver for the remediation and the underlying geology will be relevant. If it is known, or can be easily established, that the site lies on areas where the underlying geology is of cohesive material (clays), then the potential for high remediation cost may reduce and lower cost ranges can be used. Conversely, if the site overlies sandstones, chalk or other permeable strata

then the use of higher cost ranges should be considered. It is possible that cohesive materials may overlie an aquifer and offer some form of protection, which may reduce remediation costs.

Depth of contamination; The depth of the contamination will significantly affect the costs. The further below ground level the contaminated material is (i.e. that identified as requiring remediation), the greater the cost might be if it is in a sensitive setting. Notwithstanding it is unlikely that this will be known at an early stage, however, if it is known then the higher range might be selected. It is also possible that deeper contamination in low sensitivity settings may require less remediation if the surface layers sufficiently protected end users and, for instance, the site is located on unproductive strata.

Spread of contamination; The greater area of contamination the greater the cost of remediation will be. This may not be known at an early stage, however if there is a wide covering of previous uses then the higher range might be selected.

For example a small local gasworks on a corner of the site for 20 years will be different to a large producing gasworks over the entire site that has been in operation for over 100 years, often with a range of other supporting industries (tar works etc).

These differences may affect the range of costs selected, or may indeed indicate that a higher or lower category should be selected.

Figure 3 Remediation costs - water risk clarification characteristics

Negligible to low water risk site characteristics	Moderate to high water risk site characteristics
Any aquifer protected by a significant thickness of cohesive strata that won't be breached during construction or where appropriate control can mitigate the breach	Source protection zones 1 and 2 on site associated with a sensitive water abstraction either on or close to the site. The aquifer is not protected by a significant thickness of cohesive soil
Unproductive strata, perched water in made ground, or secondary aquifer in low sensitivity environment.	Shallow principal aquifer (unprotected) that has some form of local abstraction (closer than 250m)
No surface water or no linked surface water within 250m of the site	Sensitive surface water on or close to the site and linked by shallow aquifer. Shallow (unprotected) secondary aquifer on site.
Canalised river or canal or dock not directly linked to groundwater	Preferential pathways which could result in the rapid migration of contamination, either lateral or to depth (for instance to deeper aquifer)

9. NHBC, EIC and EA Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66

Number and scale of previous uses; If the site has had more than one type of previous use it is possible that multiple contaminants may be present that vary in nature. As a result this may increase the number of remediation options required and thus increase the cost. It would be prudent to select the higher range. The scale of previous use will also be a factor.

Market conditions/remediation strategy/contractor selection; The adopted remediation strategy will impact on the cost of the remediation. The amount of remediation, and therefore cost, is very sensitive to the level at which remediation targets are set and to a wide range of other variables. It is not unusual on one scheme, for several contractors to propose different remediation strategies and techniques to suit their operational capability, experience and preference. This may result in a range of costs for the site remediation.

The current market conditions should be considered as this may have an impact on the remediation costs due to contractor availability.

Site location; The guide range allows for an outer London location. Should the site be within a restricted city centre, this will have an adverse impact on the costs. Conversely if the site is in an open rural area this may contribute to a lower cost range. See Section 8 for regional weightings.

Procurement strategy and the client's approach to risk; The procurement strategy will have an impact on the cost of the remediation.

A procurement strategy is composed of the;

1. procurement option (traditional, design build management contracting, construction management);
2. contract selection (e.g. NEC 3- Engineering Construction Contract or JCT Standard Building Contract);
3. tendering option (single stage, two stage, negotiated, framework, serial); and
4. pricing options (e.g lump sum, re-measurable, cost plus).

The client's time, cost, quality and risk requirements should dictate the appropriate composition of the procurement strategy.

No matter how much site investigation is completed and how much the contamination is defined, there will always be a level of uncertainty risk in relation to the quantities.

The client's appetite for risk and therefore how the procurement strategy allocates that risk will impact on the cost.

If the client passes this risk to the contractor, and requests onerous contract terms and risk mechanisms e.g. extensive amendments to limit his risk, extensive and complex warranties, high delay damages (Liquidated and Ascertained Damages) and commits the contractor to a lump sum, it can be expected that the contractor will attach a proportionate risk premium to the remediation works, particularly in stable or rising markets.


Conversely if the client offers a lower risk profile to the contractor e.g. client ownership of ground conditions, simple contract terms and conditions and re-measurable quantities, then a smaller risk premium and lower cost can be expected from the market place.

An understanding of the likely procurement strategy can be used as a range indicator with the higher risk profile for the client potentially leading to a lower cost range (assuming the client appropriately manages and mitigates their retained risk) and the lower client risk profile potentially leading to higher cost range.

This is not a procurement guide and is only provided to indicate that the procurement strategy can impact on the cost of remediation.

See Figure 4 for a summary.

Figure 4 Remediation costs range indicators



Range determining factors	Low	Mid	High
Size	If greater than 5ha	If circa 5ha site	If less than 5ha. If less than 1ha range may not apply
Site context	No history of contamination in surrounding area	Some history of contaminated sites in surrounding area	Significant history of contaminated sites in surrounding area. However if there is a regional contamination issue this might reduce the amount of remediation by an individual site.
Number of previous uses and duration	Single use site (unless that use was high potential and over a long time)	Primarily single use	Mixed uses
Geology	Non permeable barrier close to surface or at depth but protecting a sensitive aquifer	Variable or thin layers	Permeable geology in sensitive areas
Depth	Shallow or surface	Top metre or so	Deep and thick layers of contamination requiring excavation or treatment
Spread of concentration	Isolated hot spots	Large areas but not complete site cover	Majority of site covered
Site location	Easy access, rural location	Outer city areas	Inner city areas, restricted access
Market conditions	Not active, stagnant recession like economy	Stable	Active market, buoyant economy for several years
Procurement strategy	High client risk profile	Proportionate and appropriate ownership of risk	Low client risk profile

More information can be found in the Department of Environment (DOE) Industry Profiles which can be viewed on the www.gov.uk.

Potential issues for users of the remediation guide

What if the site has been used for multiple purposes in different category? In selecting the appropriate range the project manager should use their judgement based on the information available. If it is predominantly one use then select that category.

If there are multiple uses without a dominant category it would be prudent to select the category that represents the highest potential e.g. if the previous use is haulage centre (Category B) and oil refinery (Category D) then select Category D. Professional judgement in light of the available information is key. Once the previous use category is selected it may be prudent to select a high range to allow for the possibility for the requirement of multiple remediation options.

What if there are multiple end uses for the site? The project manager should use their judgement based on the information available. If it is predominantly one use then select that category.

If there are multiple uses without a dominant category it would be prudent to select the category that represents the highest sensitivity for the end use. Alternatively, for mixed use, it may be appropriate to proportion the cost range per use to the percentage of area for each use.

Putting the most sensitive end use in clean areas and least sensitive end use in likely more contaminated areas may save money and provide programme benefits.

What if previous use is not in one of the categories? Although an extensive list of sites have been provided in Annex B there may be certain sites that are not listed. The project manager should use their judgment to select the most likely category based on similar type sites. The categorisation of the additional uses present in appendix B are simply suggestions and not meant to be definitive, rather a guide. Each site will have its particular characteristics which should be taken into account.

When does this note not apply? It does not cover gross contamination of asbestos, unexploded ordinance (UXO) and military related sites, radiological or biologically contaminated land and major landfill disposal costs.

Note is for use in England only. The benchmark data used and case studies are based on case studies within England. This note does not consider appropriate ranges for Wales, Scotland, N. Ireland and Ireland, although Section 8 does include regional weightings for these areas.

Update for Inflation BCIS offers all in Tender Price Index that can be used to update the guide ranges for inflation or deflation.

7. Dereliction & demolition costs

This section presents a range of costs that can be used as a starting point for assessment of the potential costs of derelict sites and where demolition is required.

This guidance note is not to be used for estimating other site preparation and servicing costs. It does not take account of extensive asbestos removal nor does it cover geotechnical activities. Infrastructure costs are included only so far as they relate to the abandonment of redundant services at the boundaries of derelict sites (i.e. not off-site works), and the grubbing out of pipes, cables and other utility related obstructions below ground. The costs associated with the provision of new site accesses and service infrastructures are not included, as these will apply, more or less equally, to both brownfield and greenfield sites.

The range of costs reflect a range of works that may be necessary to create a 'development platform' on a piece of derelict land. A development platform is considered to be a site where necessary works have been undertaken to prepare the site for development for its intended future purpose.

Costs given are on a fluctuating (current day) basis, adjusted for outer London and have been categorised as follows:

- Complex or non-complex sites;
- Existing site use; and
- 'Fixed' or 'variable' costs

Further definition of each category is included below, Figures 6, 7 and 8 with the total ranges shown in figure 6.

Benchmark cost assessment

The first step is to categorise the site by the existing use of the buildings on the site. The project applicant must then also consider whether the site is either complex or non-complex. General guidance on this is given below with more detailed considerations included in Annex C.

Once these two factors have been determined, costs can then be taken from the relevant ranges provided in Figure 5. Within each box a range of costs is given and an appropriate figure selected according to the extent of works anticipated.

The benchmark costs can also be used to check on costs estimates (e.g. by the project applicant or by the consultant engineers). They might provide a basis for querying the estimates if they lie outside the range taken from the tables.

The benchmark unit area costs are designed to be used without commissioning studies to interpret them. For some projects, particularly those that are large or complex, it would be inappropriate to apply this guidance note without professional advice. There may be a need to consult professionals to carry out desk research to generate enough background information along the above lines to identify the benchmark cost range and to establish the range.

Sites may have a mixed pattern of intended end uses that span the categories in the table. In this instance the relevant cost ranges should be applied to the different uses based on the relevant gross external area (GEA) of each building. Where these different uses are contained in a single "mixed use" building, then the predominant use should dictate which range should be applied. For example if proposed building is 50% residential use, 30% commercial and 20% retail, then the residential cost ranges should be applied to calculate costs.

The following qualifications apply to these benchmark costs.

- As the size of the site increases the fixed costs reduce proportional to the area;
- Certain components of the model may or may not apply to particular sites, for example, the site may have only below ground electric services to stop up, or both overhead and below ground supplies to divert;
- Below ground obstructions are assumed to be removed within the plane of normal development with obstructions below that depth being left in place.

How to use

1. Determine existing building use;
2. Determine whether complex or non-complex;

3. According to the guidance notes given below, decide on an appropriate cost to apply to the buildings to be demolished and the site area to be stripped;
4. Multiply the area of the building (m² GEA) by the cost selected in 3;
5. Decide on an appropriate cost for site strip (see guidance notes below);
6. Multiply the cost selected in 5 by the m² area to be stripped;
7. Decide on the appropriate fixed costs for fees, site investigations and services removal to be applied to the site; then
8. Add together 4, 6 and 7

The ranges presented must be applied in conjunction with guidance notes on the respective categories.

Figure 5 Demolition costs

	Previous use	Residential		Employment		Retail		Industrial	
		Non complex	Complex	Non complex	Complex	Non complex	Complex	Non complex	Complex
	Basis								
Removal of redundant services	Fixed (£000 per site)	£20 - £100	£30 - £160	£20 - £100	£30 - £160	£20 - £100	£30 - £160	£20 - £100	£30 - £160
Site clearance	Variable (£/m ² site area)	£5 - £25	£15 - £75	£5 - £25	£15 - £75	£5 - £25	£15 - £75	£5 - £25	£15 - £75
Demolitions	Variable (£/m ² existing building GEA)	£11 - £68	£48 - £165	£11 - £80	£69 - £135	£27 - £70	£31 - £170	£11 - £58	£32 - £63
Site investigation	Fixed (£000 per site)	£10 - £90	£40 - £260	£10 - £90	£40 - £260	£10 - £90	£40 - £260	£10 - £90	£40 - £260
Fees	Fixed (£000 per site)	£90 - £230	£190 - £670	£90 - £230	£190 - £670	£90 - £230	£190 - £670	£90 - £230	£190 - £670

Fixed costs

These are shown in £000's and should be applied on a per site basis. The table below explains the cost elements that are should be applied as fixed costs and explain what is included and excluded from the costs:

Figure 6 Dereliction- Fixed cost items

Element fixed costs		
Sub element	Included	Excluded
Removal of redundant services	<ol style="list-style-type: none"> 1. Contractors preliminaries, overheads and profit 2. Stopping up of services at the site boundary 3. Removal of redundant services 	<ol style="list-style-type: none"> 1. Temporary diversions 2. Permanent diversions 3. Statutory undertakers fees associated with diversions (whether temporary or permanent) or stopping up) 4. Diversion of streams rivers or waterways
Site investigation	<ol style="list-style-type: none"> 1. Physical Investigation Works, including contamination surveys, geo technical and ordnance surveys 2. Provision of equipment and temporary works 3. Provision of temporary fences, barriers and the like 4. Attendance 5. Laboratory tests 	<ol style="list-style-type: none"> 1. Extraordinary site investigation works such as archaeological surveys, reptile or wildlife surveys 2. Wildlife protection or relocation measures 3. Other extraordinary investigation works
Professional fees	<ol style="list-style-type: none"> 1. Due diligence 2. Desktop appraisal 3. Topographical survey 4. Architect 5. Geotechnical engineer 6. Environmental engineer 7. Cost consultant 8. Structural engineer 9. Services enquiries 10. Archaeologist 11. Statutory fees 12. Estate agent 	<ol style="list-style-type: none"> 1. Planning fees 2. Building Control fees 3. Over sailing fees 4. Building scheme registration fees 5. Right of light fees 6. Fee in connection with other agreement s between employer and neighbours 7. Other fees licenses and permits 8. Considerate contractor's scheme fees (paid by demo contractor and included in his preliminaries)

Variable costs

These should be applied on an area basis using m². In the case of demolition of buildings, Gross External Area is the m² basis to be used. This is measured between the outside faces of the external walls and without deducting for internal walls, columns, stairwells, lift wells and the like. Further guidance on this is included in Annex I.

The table below explains the cost elements that are should be applied as variable costs and explain what is included and excluded from the costs:

Figure 7 Variable cost items

Element – variable costs			
Sub element	Application	Included	Excluded
Site clearance and levelling	Total area of site less the footprints of existing buildings in m2	<ol style="list-style-type: none"> 1. Contractors preliminaries, overheads and profit 2. General vegetation clearance 3. Localised cut and fill 4. Compacting of the ground 	<ol style="list-style-type: none"> 1. Clearance or treatment of Japanese knotweed or other invasive or injurious weeds and plants 2. Use of imported fill 3. Extensive levelling over more than 20% of the site area
Demolition of existing structures above and below ground	GEA is as defined by the RICS code of measuring practice, as explained in Annex I	<ol style="list-style-type: none"> 1. Soft strip of the interior of the building 2. Demolition works to the building 3. Temporary propping and shoring required 4. Breaking out of ground bearing slabs and foundations 5. Cutting off the tops of existing piles 6. Pile probing and recording 7. Backfilling of voids with crushed materials from demolition arisings 	<ol style="list-style-type: none"> 1. Works to retain and protect existing structures (retained facades) 2. Extensive asbestos removal 3. Underpinning of existing buildings or highways. 4. Extensive treatment or removal of contaminated soil (see above)

Complex and non-complex sites

The following tables sets out general factors to be considered in determining whether a site is complex or non-complex as well as grouping these together as factors determining where in the cost ranges a site might lie – for example, whether it is non-complex but high (i.e. use upper end of the range) or complex but low (i.e. use the bottom end of the range). Further guidance is included in the worked examples and case studies included in Annex C.

Figure 8 Considerations impacting on high or low range by complexity

Low range determining factors	
Non-complex	Complex
<ul style="list-style-type: none"> • Density of the site – low density of buildings, low rise buildings • Surrounding environment –easy access, rural or isolated location • Demolitions above ground would relate to stand alone buildings with little in the way of known contaminants • Some residual value in salvaged materials; • Little or no below ground works to remove obstruction or backfill voids. • Limited number of basic site investigations required • Existing level site, light or little vegetation growth, little hard breakout • Removal of a single service corridor – terminated at the site boundary (gas, LV, water up to 75mm dia main, drainage and foul up to 300mm dia, communications – copper). • Steady market conditions. 	<ul style="list-style-type: none"> • Density of the site, mid-rise buildings, in dense configurations • Demolition does not require extensive shoring and propping, and limited restrictions on working method (head height, site density, etc) • Obstructions in the ground, such as machinery bases and pits, may need removal and may require a number of specialised techniques. • Areas of deep foundations • Large number of site investigations needed • Areas of local cut and fill, hard breakout and heavy vegetation growth • Multiple service corridors, terminated at the site boundaries in multiple locations (Gas, LV, water up to 75mm dia main, Drainage and foul up to 600mm dia, some communications – copper). • Steady market conditions.

Figure 8 Considerations impacting on high or low range by complexity (continued)

High range determining factors	
Non-Complex	Complex
<ul style="list-style-type: none"> • Density of site, simple buildings, but little space between buildings and limited areas for demolition plant and equipment to be positioned • Some work required to infill pits and shallow basements • Isolated areas of deep foundations • Large amount of redundant services within the building to remove; building strip out likely to be complex • Mix of uses present on the site • Low levels of salvageable materials with residual value • Urban environment • Areas of local cut and fill and hard break out, moderate vegetation growth • Presence of contaminants likely • Removal of a single service corridor (gas, LV, water up to 75mm dia main, drainage and foul between 300mm and 600mm dia, communications – copper and fibre optic, decommission and remove generator) • Onerous contractual arrangements likely, including extensive warranties and risk transfer mechanisms • Heated market 	<ul style="list-style-type: none"> • Higher potential for hazardous materials and contaminants may be encountered despite undertaking a site investigation. • Surrounding environment may be dense with neighbour issues likely • Large amount of redundant services to remove; building stripout likely to be complex • Extensive hard breakout, large quantities of cut and fill and very heavy vegetation growth including tree removal • Multiple service corridors, terminated at the site boundaries in multiple locations (gas, LV, water up to 75mm dia main, Drainage and foul between 300mm and 600mm dia, communications – copper and fibre optic, decommission and remove generator) • Extensive shoring and propping required, and careful working to prevent cross contamination, nuisance etc. Underpinning if adjoining highways and buildings may also be required but is excluded from the cost ranges • Heated market

Further guidance and details on range determining for existing building use and professional fees is included in Annex H.

8. Regional variances and inflation

The benchmark costs in Figure 2 and 5, for Remediation and Demolition respectively are based on a database of actual costs held by Homes and Communities Agency and its partners indexed to outer London for contamination (Figure 2) and non-complex derelict sites (Figure 5). The estimates reflect prices prevailing in 2014 (4th Quarter). The costs need to be adjusted to other regions (see Figure 10 below) and to take account of future price fluctuations.

Update for Inflation

BCIS offers all in Tender Price Index that can be used to update the guide ranges for inflation or deflation.

Figure 9 Regional adjustment factors SPON's 2014

Region	Adjustment to Measured Works section 2014
Outer London	1.00
Inner London	1.08
East Anglia	1.00
East Midlands	0.92
Northern	0.86
Northern Ireland	0.56
North West	0.86
Scotland	0.91
South East	1.02
South West	0.96
Wales	0.9
West Midlands	0.92
Yorkshire and Humberside	0.92

Annex A: Acknowledgements

This report has been compiled on behalf of the Homes and Communities Agency by Ove Arup & Partners.

The following market leading contractors have contributed to this guide:

Remediation:	Demolition:
BAM Nuttall	BAM Nuttall
HBR Ltd	MGL Demolition
Vertase FLI	VHE
VHE	

Annex B: Remediation previous use categorisation extended list

Figure 10 updates and expands the example industrial land-uses for each category. The expanded example list of industrial land uses now includes the Department of Environment (DOE) Industry Profiles (www.gov.uk)¹⁰.

For the purposes of this guide, sites have been categorised where Category A sites represents a lower potential for contamination and Category D sites represent a higher potential for contamination. The potential for more significant contamination (and cost) increases from A to D.

Category A sites are not necessarily free of contamination and gross or widespread contamination is not necessarily present at Category D sites. In addition, any [lower level of] contamination present at Category A sites may still present an unacceptable risk at high sensitivity sites. Conversely, the [higher level of] contamination present at Category D sites may not necessary present an unacceptable risk at low sensitivity sites (hard cover development in an area of negligible water risk for instance).

It should also be noted that there is a large number of potential historical and present uses and therefore the example list provided in Figure 10 should not be regarded as exhaustive or definitive but a guide only.

The selection of the most appropriate category is subjective and dependent on many factors, which requires a degree of professional judgement. For instance there are many types of chemical works listed and the category that a 'chemical works' might be placed in could vary from A to D depending on the scale, duration and type of operation. Similarly there are many types and configurations of rail land from tracks and sidings (likely Category A or B) to large depots, maintenance and refuelling areas (possibly Category C or D).

All brownfield sites have the potential to be underlain by made ground of unknown origin which may have been bought to site (e.g. burying of waste/demolition material) or from the import of fill/wastes from offsite industrial sites which may have a higher potential of contamination.

10. Department of Environment (DOE) industry profiles

Figure 10 Contamination previous use categories

<p>A</p>	<p>Small scale and general light industrial sites, colliery or mine spoil heaps, miscellaneous factories and 'works' (not heavy industry), sites with very small fuel tanks</p>	<ol style="list-style-type: none"> 1. Colliery / mine spoil heaps 2. Miscellaneous/unspecified factories and works (light industrial) 3. Animal and animal products processing works (excluding tanneries) 4. Ceramics, cement and asphalt manufacturing works 5. Smaller chemical works: <ul style="list-style-type: none"> - linoleum, vinyl and bitumen-based floor covering manufacturing works - Rubber/tyre processing and manufacturing works 6. Smaller engineering works, aircraft manufacturing works (not associated with wars) 	<ol style="list-style-type: none"> 7. Smaller metal manufacturing, refining and finishing works – precious metal recovery works 8. Miscellaneous industries including photographic processing industry, printing and bookbinding works 9. Pulp and paper manufacturing works 10. Railway land (single track and running lines only) 11. Textile works and dye work 12. Smaller waste recycling, treatment and disposal sites: <ul style="list-style-type: none"> - drum and tank cleaning and recycling plants - hazardous waste treatment plants
<p>B</p>	<p>Garages, workshops, pithead sites, railway lines, textiles, small scale timber treatment, sewage works, smaller chemical works, sites with small to mid-sized fuel tanks</p>	<ol style="list-style-type: none"> 1. Pithead sites 2. Airports (excluding tank farms) 3. Chemical works: <ul style="list-style-type: none"> - cosmetics and toiletries manufacturing works - disinfectants manufacturing works - mastics, sealants, adhesives and roofing felt manufacturing works - soap and detergent manufacturing works 	<ol style="list-style-type: none"> 4. Railway land (sidings and multiple tracks) 5. Road vehicles fuelling, service and repair – transport and haulage centre 6. Sewage works and sewage farms 7. Small to medium timber treatment and products 8. Animal and animal products processing works – tanneries 9. Miscellaneous industries incl. charcoal works, dry cleaners, fibreglass resins manufacturing works

<p>C</p>	<p>Metal workings, scrap yards and shipyards. Paints and solvents, small gasworks/gas holder sites, smaller power stations, rail depots (maintenance and refuelling), sites with large fuel tanks or small tank farms</p>	<ol style="list-style-type: none"> 1. Chemical works: <ul style="list-style-type: none"> - coatings, paints and printing inks manufacturing works - fertiliser manufacturing works - pesticide manufacturing works - pharmaceuticals manufacturing works 2. Engineering works: <ul style="list-style-type: none"> - electrical and electronic equipment manufacturing works (including works manufacturing equipment containing PCBs) - vehicle manufacturing works 3. Metal manufacturing, refining and finishing works: <ul style="list-style-type: none"> - non-ferrous metal works (excluding lead works) - electroplating and other metal finishing works 	<ol style="list-style-type: none"> 4. Road vehicles fuelling service and repair – garages and filling stations 5. Waste recycling, treatment and disposal sites: <ul style="list-style-type: none"> - metal recycling sites: - landfills and other waste treatment or waste disposal sites - solvent recovery sites 6. Railway land (infrastructure engineering depots)
<p>D</p>	<p>Major gasworks, iron and steel works, large chemical works, refineries and major fuel depots, ship breaking and building, larger power stations, sites with large tank farms</p>	<ol style="list-style-type: none"> 1. Asbestos manufacturing works 2. Chemical works: <ul style="list-style-type: none"> - explosives, propellants and pyrotechnics manufacturing works - fine chemicals manufacturing works - inorganic chemicals manufacturing works - organic chemicals manufacturing works 3. Engineering works: <ul style="list-style-type: none"> - mechanical engineering and ordnance works - railway engineering works - ship building repair and ship breaking including naval shipyards 	<ol style="list-style-type: none"> 4. Larger gas works, coke works and other coal carbonisation plants 5. Metal manufacturing refining and finishing works: <ul style="list-style-type: none"> - iron and steel works - lead works 6. Oil refineries and bulk storage of crude oil and petroleum products 7. Power stations (excluding nuclear power stations which are not included in this advice) 8. Large and complex landfills such as those with industrial and toxic wastes, or mobile contaminants

Annex C: Classification of site type by use and complexity

The following table provides more detailed range determining factors categorized by existing building type/ use on the site.

Figure 11a Classifications based on use and site complexity

Existing site use and range		Non-complex	Complex
Residential	Low	Low-rise (0-5 storeys), simple structures, load bearing brick walls, timber framed, simple fit out and servicing. Regular building shape. Single or double skin brickwork. Perimeter walls on strip foundations and pad footings. No basements or pits likely to be encountered.	Mid-rise (5-15 storeys); complex structures, such as reinforced concrete frame; core wall structures. Panelised cladding system or facing brick and windows. Deep foundations (piles and ground beams) with single storey basements likely over the footprint of buildings. Fit out of building likely to be more elaborate in nature.
	High	Less regular shape, with setbacks and recesses around the building. Localised structural reinforcement, isolated pits or basements, more extensive servicing and fit out of the building. Elements of deeper foundations.	Post tensioned concrete frames, hybrid structures and local transfer structures likely. Multiple façade types and construction (unitised, stick system and hand set brick and stone). Deeper (2 storey plus) basements likely to be encountered and complex fit out of the building to remove.
Employment	Low	Low-rise (0-5 storeys); simple frame structures (steel frame, concrete or timber); no core areas; regular building shape, simple cladding (stick system or blockwork/brickwork single or double skin with windows). Perimeter walls on strip foundations and pad footings. Shallow or no basements or isolated pits likely to be encountered.	Mid-rise (5-15 storeys); more regular building shape building shape, simple unitised (panelised) cladding system. Deep foundations (piles and ground beams) with one or two storey basements likely over the footprint of buildings. Simple servicing and fit out to strip out.
	High	Low-rise (0-5) storeys composite structures (steel and concrete); small core areas to demolish; unitised cladding systems. Less regular shape, with setbacks and recesses around the building. Localised structural reinforcement. Isolated pits or basements.	Mid-rise (5-15 storeys) complex steel or concrete structures (bracings, cantilevers and transfer structures). Multiple façade types and construction (unitised, stick system and hand set brick and stone). Deeper (2 storey plus) basements and underground car parks likely to be encountered and complex fit out of the building to remove. More extensive servicing and fit out of the building, elements of deeper foundations.

Figure 11b Classifications based on use and site complexity

Existing site use and range		Non-complex	Complex
Retail	Low	Low-rise (0-2 storeys) steel portal frame limited or no mezzanine structures with simple panelised cladding and glazed shop fronts. No core areas perimeter walls on strip foundations and pad footings. No basements or isolated pits likely to be encountered, simple fit out.	Mid-rise (3-5 storeys); simple structures (either steel frame or reinforced concrete frame structures); unitised/ panelised cladding system; simple core arrangements (multiple areas of cores and circulation space). Large areas of glazed shop fronts and high spec unitised/ panelised curtain walling; deep foundations (piles and ground beams) with one or two storey basements likely over the footprint of buildings.
	High	Low-rise (0-2 storeys) large mezzanine areas; extensive shop front areas, large servicing areas, including loading bays; shallow basements likely to be encountered.	Mid-rise (3-5 storeys) complex structures (either steel frame or reinforced concrete frame structures). Multiple façade types and construction (unitised, stick system and hand set brick and stone). Complex core and circulation areas. Deeper (2 storey plus) basements and underground car parks likely to be encountered and complex fit out of the building to remove more extensive servicing and fit out of the building; deeper foundations.
Industrial	Low	Low-rise (0-2 storeys), steel portal frame, small office area, used as storage facility/ light industrial. Simple cladding solutions; panelised profiled metal cladding; limited/ simple servicing (lighting, cooling, small power, etc). Perimeter walls on strip foundations and pad footings. Shallow or no basements or isolated pits likely to be encountered.	Low-rise (0-2 storeys) simple portal frame; some office areas; used as manufacturing facility, data centre or similar. Deep foundations (piles and ground beams) with no basements and isolated lift pits.
	High	Low-rise (0-2 storeys) irregular building shape; larger office areas; different cladding types, shallow basements encountered; and potentially deeper foundations (e.g pile caps and minipilling).	Low-rise (0-2 storeys) complex steel portal frame (long span structures, extensive areas of office. 1-2 storey basements, including underground car parking structures to be dealt with.

Annex D: Remediation case studies

Case Study A

Scheme and site description

The site is in outer London and is eight hectares in area. The site was decommissioned gradually over the last 10 years but parts of the site still in operation. Since the late 1940's, the site has been occupied by several small scale light industrial units marked as 'works' on historic plans. During the site reconnaissance, a small above ground fuel oil tank was identified.

In the surrounding area historical gravel extraction and subsequent landfilling has taken place. There was previously a former sewage works 50m from the site and a former small gas works 100m from the site. The site is predominately surrounded by light industrial units with some residential housing within 25m.

The information above results in a **Category A classification**, which may indicate a **low potential** for significant widespread contamination.

The site is to be developed into five warehouse units with office space, which represents a **low sensitivity** proposed end use.

Initial assessments indicated a **moderate water sensitivity** as there is a sensitive river approximately 100m from the site. The underlying gravel deposits are classified as a Secondary A aquifer, with groundwater flowing towards the nearby river. The gravel aquifer is underlain by the low permeability London Clay, which is an unproductive strata and will act to prevent any contaminant migration to a deeper principal aquifer.

Identification of benchmark cost

The forecast cost range for the site, based on the categorisation (see Figure 12), was £125,000 to £250,000 per hectare, which equates to between £1m and £2m for the whole site. Based on the summary of cost range indicators (Figure 13), the cost estimate is considered to be somewhere in the middle, rather than near the lower or upper estimates.

Remediation strategy

An intrusive ground investigation indicated the site to be contaminated with pockets of hydrocarbons, solvents and metals including lead. Contamination was generally encountered near surface, but smaller, localised deeper areas of contamination up to a maximum of 3m below ground level were identified in one area.

Very limited thickness of free phase hydrocarbons were identified at three standpipes close to each other. A small groundwater plume of chlorinated and non-chlorinated organic solvents was also identified moving off site.

The remediation options appraisal concluded that it was cost effective to remove the localised lead and hydrocarbon contamination rather than undertake onsite soil stabilisation for a relatively small volume. However a specific area of leachable metal contamination was subject to ex-situ stabilisation (based on DQRA) and then re-used on site. During tank removal and dealing with one area of deeper contamination a small amount of free phase hydrocarbons was removed, and at the same time some simple chemical treatment (by oxidisation) was carried out around the small plume. Following the initial remediation, monitored natural attenuation was undertaken for three years.


Assessment of the benchmark cost compared to actual cost

The cost of the above remediation strategy was approximately £1.57 million equating to approximately £200,000 per hectare providing a good match to the midpoint as expected with the range factors.

Figure 12 Case Study A selected categories

		Previous use			
		Low potential	Moderate potential		High potential
SENSITIVITY	Proposed end use	Site category A	Site category B	Site category C	Site category D
		Small scale and general light industrial/sites, colliery or mine spoil heaps, miscellaneous factories and 'works' (not heavy industry), sites with very small fuel tanks	Garages, workshops, pithead sites, railway lines, textiles, small scale timber treatment, sewage works, smaller chemical works, sites with small to mid-sized fuel tanks	Metal workings, scrap yards and shipyards. Paints and solvents, small gasworks/gas holder sites, smaller power stations, rail depots (maintenance and refuelling), sites with large fuel tanks	Major gasworks, iron and steel works, large chemical works, refineries and major fuel depots, ship breaking and building, larger power stations, sites with large tank farms
		£ 000's	£ 000's	£ 000's	£ 000's
Negligible to low water risk					
Low sensitivity	Employment or commercial with limited soft landscaping, business parks and data centres	50 to 130	180 to 360	255 to 590	305 to 655
Moderate sensitivity	Public open space. Residential without private gardens (flats and appartments), universities and colleges	50 to 130	205 to 435	255 to 640	305 to 740
High sensitivity	Residential with private gardens. Schools for younger children with pitches and play areas. Allotments and growing areas in developments.	75 to 205	255 to 640	305 to 740	335 to 845
Moderate to high water risk					
Low sensitivity	Employment or commercial with limited soft landscaping (tree pits), business parks and data centres	125 to 250	255 to 640	510 to 1,230	540 to 1,230
Moderate sensitivity	Public open space. Residential without private gardens (flats and appartments), universities and colleges	130 to 255	360 to 920	485 to 1,305	540 to 1,230
High sensitivity	Residential with private gardens. Schools for younger children with pitches and play areas. Allotments and growing areas in developments.	180 to 410	410 to 1,050	540 to 1,460	715 to 1,765

Figure 13 Case Study A range indicators



Range determining factors	Low	Mid	High
Size	If greater than 5ha	If circa 5ha site	If less than 5ha. If less than 1ha range may not apply
Site context	No history of contamination in surrounding area	Some history of contaminated sites in surrounding area	Significant history of contaminated sites in immediate surrounding area
Number of previous uses and duration	Single use site	Primarily single use	Mixed uses
Geology	Non permeable barrier close to surface	Non permeable barrier	Permeable geology
Depth	Key shallow or surface	Top metre or so	Deep and thick layers of contamination requiring excavation or treatment
Spread/ concentration	Isolated hot spots	Large areas but not complete site cover	Majority of site covered
Site location	Easy access, rural location	Outer city areas	Inner city areas, restricted access
Market conditions	Not active, stagnant recession like economy	Stable	Active market, buoyant economy for several years
Procurement strategy	High client risk profile	Proportionate and appropriate ownership of risk	Low client risk profile

Case Study B

Scheme and site description

This is a six hectare riverside site in the Yorkshire and Humberside region. The site has previously been used as a woollen mill, dye works and sewage works, and includes a number of sludge and filter beds. A permitted landfill is located less than 250m from the site boundary, used for the disposal of inert, industrial, commercial and household waste.

The information above results in a **Category B** classification, which may indicate a moderate potential for significant contamination.

The site is to be developed into approximately 200 new residential homes with private gardens and some recreational space, which is a **high sensitivity** proposed end use.

Underlying alluvium and sand and gravel deposits are classified as a Secondary A aquifer, but are not considered a significant groundwater resource. Bedrock is Millstone Grit, a Secondary B aquifer. The shallow aquifer is in continuity with the river, which forms one of the site boundaries. Initial assessments indicated a **moderate to high water sensitivity**.

Identification of benchmark cost

The forecast range for the site, based on the categorisation (see Figure 14), was £410,000 to £1,050,000 per hectare or between £2.46m and £6.3m for the whole site. Based on the summary of cost range indicators (Figure 15), the cost estimate is likely to be in the mid to high end of the estimated range.

Remediation strategy

Following ground investigations, metal and polyaromatic hydrocarbon soil contamination was identified to be widespread within the Made Ground at depths up to 4m below ground level. Localised benzene and phenol contamination was identified within the Made Ground. Elevated ammoniacal nitrogen was also identified within the shallow groundwater.

The proposed remediation strategy was to excavate the Made Ground and the hot spots, and where necessary undertake stabilisation treatment. Installation of a site wide clean cover system was also required. A small volume was removed from site, with the remainder treated and managed on site.

Shallow groundwater treatment was via ex-situ separation and activated carbon treatment, with additional chemical oxidation where needed. In addition to gas protection measures for the residential properties, installation of a virtual gas curtain was also recommended.


Assessment of the benchmark cost compared to actual cost

The cost of the above remediation strategy was approximately £4.7 million equating to approximately £790,000 per hectare. This is consistent with the mid to high guide expected taking account of the range factors.

Figure 14 Case Study B selected categories

		Previous use			
		Low potential	Moderate potential	High potential	
SENSITIVITY	Proposed end use	Site category A	Site category B	Site category C	Site category D
		£ 000's	£ 000's	£ 000's	£ 000's
Description		Small scale and general light industrial/sites, colliery or mine spoil heaps, miscellaneous factories and 'works' (not heavy industry), sites with very small fuel tanks	Garages, workshops, pithead sites, railway lines, textiles, small scale timber treatment, sewage works, smaller chemical works, sites with small to mid-sized fuel tanks	Metal workings, scrap yards and shipyards. Paints and solvents, small gasworks/gas holder sites, smaller power stations, rail depots (maintenance and refuelling), sites with large fuel tanks	Major gasworks, iron and steel works, large chemical works, refineries and major fuel depots, ship breaking and building, larger power stations, sites with large tank farms
Negligible to low water risk					
Low sensitivity	Employment or commercial with limited soft landscaping, business parks and data centres	50 to 130	205 to 435	255 to 590	305 to 655
Moderate sensitivity	Public open space. Residential without private gardens (flats and appartments), universities and colleges	50 to 130	180 to 360	255 to 640	305 to 740
High sensitivity	Residential with private gardens. Schools for younger children with pitches and play areas. Allotments and growing areas in developments.	75 to 205	255 to 640	305 to 740	335 to 845
Moderate to high water risk					
Low sensitivity	Employment or commercial with limited soft landscaping, business parks and data centres	125 to 250	255 to 640	510 to 1,230	540 to 1,230
Moderate sensitivity	Public open space. Residential without private gardens (flats and appartments), universities and colleges	130 to 255	360 to 920	485 to 1,305	540 to 1,230
High sensitivity	Residential with private gardens. Schools for younger children with pitches and play areas. Allotments and growing areas in developments.	180 to 410	410 to 1,050	540 to 1,460	715 to 1,765

Figure 16 Case Study B range indicators



Range determining factors	Low	Mid	High
Size	If greater than 5ha	If circa 5ha site	If less than 5ha. If less than 1ha range may not apply
Site context	No history of contamination in surrounding area	Some history of contaminated sites in surrounding area	Significant history of contaminated sites in immediate surrounding area
Number of previous uses and duration	Single use site	Primarily single use	Mixed uses
Geology	Non permeable barrier close to surface	Non permeable barrier	Permeable geology
Depth	Key hallow or surface	Top metre or so	Deep and thick layers of contamination requiring excavation or treatment
Spread/ concentration	Isolated hot spots	Large areas but not complete site cover	Majority of site covered
Site location	Easy access, rural location	Outer city areas	Inner city areas, restricted access
Market conditions	Not active, stagnant recession like economy	Stable	Active market, buoyant economy for several years
Procurement strategy	High client risk profile	Proportionate and appropriate ownership of risk	Low client risk profile

Annex E: Dereliction case studies

Case Study C: High rise commercial tower blocks

Scheme and site description

The site has an area of 1.3 hectares. The site usage was for commercial office purposes, comprising a total GEA of circa 10,000 m² across two buildings that were 13 storeys above ground and one storey below ground. The combined footprint of the two buildings was 760 m². The buildings were rectangular in shape and were constructed using concrete frame techniques with no transfer structures required. The buildings were built in the 1980's and the exterior dressed in panelised cladding. The basement was used to cater for the relatively simple servicing requirements of the single use buildings.

Identification of unit benchmark

The estimated cost was based on the following category classifications:

- Site clearance and levelling: complex / low cost range

The existing site clearance works comprised removal of hardstanding over a relatively flat site, so the extent of cut and fill was anticipated to be minimal. Costs for this element of the works were anticipated to be complex, due to the requirement for a large amount of hard breakout to be removed, and within the low cost range due to the works not anticipated to be require significant cut and fill of earth.

Site clearance		
Basis	Employment	
	Non-complex	Complex
Per m ² site area	£5 - £25	£15 - £75

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the complex / low cost range, so a range of £15 to £45 will be applied. Note the value of £45 is the midpoint of the complex cost range.

- Demolition works: complex / low cost range

The two buildings to be demolished are mid-rise (5 to 15 storeys) and located within a dense urban environment. The category classification was anticipated to be complex because of this, but within the low cost range due to the regular footprint and relatively simple structure anticipated (in situ concrete frame).

Demolitions		
Basis	Employment	
	Non-complex	Complex
m ² GEA	£11 - £80	£69 - £135

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the complex / low cost range, so a range of £69 to £102 will be applied. Note the value of £102 is the midpoint of the complex cost range.

- Removal of redundant services: non-complex / high cost range

This element of work was categorised as non-complex because only a single service corridor was identified within the site.

Removal of redundant services		
Basis	Employment	
	Non-complex	Complex
Per site	£20,000 - £100,000	£30,000 - £160,000

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the non-complex/high cost range, so a range of £60,000 to £100,000 will be applied. Note the value of £60,000 is the midpoint of the non-complex cost range.

- Site investigations: non-complex / low cost range

Desktop studies indicated a low likelihood of ground contamination present in the site resulting from the previous commercial office use of the site. Costs for site investigation works were anticipated to be both non-complex and within the low cost range.

Site investigations		
Basis	Employment	
	Non-complex	Complex
Per site	£10,000 - £90,000	£40,000 - £260,000

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the non-complex/low cost range, so a range of £10,000 to £50,000 will be applied. Note the value of £50,000 is the midpoint of the non-complex cost range.

- Fees: non-complex / low cost range

Due to the minimal amount of contamination and specialist consultants anticipated to be required, professional fees associated with the demolition works were therefore anticipated to fall within the non-complex and low cost categories.

Fees		
Basis	Employment	
	Non-complex	Complex
Per site	£90,000 - £230,000	£190,000 - £670,000

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the non-complex/low cost range, so a range of £90,000 to £160,000 will be applied. Note the value of £160,000 is the midpoint of the non-complex cost range.

Calculation methodology

The calculations below illustrate how the estimated cost for the overall demolition works were derived:

- **Site clearance and levelling; costs for complex low range:**

Midpoint of complex range is:

$$\frac{[15+75]}{2} = 45$$

Complex low range is therefore: 15 to 45

Minimum estimated cost

$$= [\text{complex low min.}] \times [\text{site area} - \text{footprint}]$$

$$= [15] \times [13,000 - 760]$$

$$= \mathbf{183,600}$$

Maximum estimated cost

$$= [\text{complex low max.}] \times [\text{site area} - \text{footprint}]$$

$$= [45] \times [13,000 - 760]$$

$$= \mathbf{550,800}$$

- **Demolition works; costs for complex low range:**

Midpoint of complex range is:

$$\frac{[69+135]}{2} = 102$$

Minimum estimated cost

$$= [\text{complex low min.}] \times [\text{GEA}]$$

$$= [69] \times [10,000]$$

$$= \mathbf{690,000}$$

Maximum estimated cost

$$= [\text{complex low max.}] \times [\text{GEA}]$$

$$= [102] \times [10,000]$$

$$= \mathbf{1,020,000}$$

- **Removal of redundant services; costs for non-complex high range:**

Midpoint of non-complex range is:

$$\frac{[20,000+100,000]}{2} = 60,000$$

Non-complex high range is therefore:
60,000 to 100,000

Minimum estimated cost

= [non-complex high min.]

= **60,000**

Maximum estimated cost

= [non-complex high max.]

= **100,000**

- **Site Investigations: costs for non-complex low range:**

Midpoint of non-complex range is:

$$\frac{[10,000+90,000]}{2} = 50,000$$

Non-complex high range is therefore:
10,000 to 50,000

Minimum estimated cost

= [non-complex low min.]

= **10,000**

Maximum estimated cost

= [non-complex low max.]

= **50,000**

- **Fees: costs for non-complex low range:**

Midpoint of non-complex range is:

$$\frac{[90,000+230,000]}{2} = 160,000$$

Non-complex high range is therefore:
90,000 to 160,000

Minimum estimated cost

= [non-complex low min.]

= **90,000**

Maximum estimated cost

= [non-complex low max.]

= **160,000**

Cost element	Low	High
Site clearance and levelling	183,600	550,800
Demolition works	690,000	1,020,000
Removal of redundant services	60,000	100,000
Site Investigations	10,000	50,000
Fees	90,000	160,000
Total	1,033,600	1,880,800
Total, say	1,030,000	1,880,000

The estimated cost for the overall demolition scope was £1,030,000 to £1,880,000 as based on the classifications identified above. The actual cost was £1,400,000 for the site works (adjusted to fourth quarter 2014 prices).

Assessment of the benchmark cost compared to actual cost

The actual cost associated with the demolition works is between the lowest and highest estimated possible demolition costs associated with the site classifications of employment, cost levels and complexity of works. Whilst the out-turn costs do fall within the anticipated range, it is pertinent to be aware of factors that will affect the out-turn costs. For example, logistical issues imposed by a constrained site will impact the ease and speed of demolition activities and addressing this will incur a cost premium.

Case Study D: Light industrial warehouses and attached offices

Scheme and site description

The site encompassed an area of 2.3 hectares. The site usage was classified as industrial and comprising a total gross external floor area (GEA) of circa 26,000 m² of a combination of office space and large open span single storey warehouses enclosed in a portal frame. The footprint of the development comprised 19,000 m². Because of the intensive labour and specialist nature of the previous use, the development was highly serviced.

- **Site clearance and levelling: complex / low cost range**

The majority of the site was enclosed by the building, and the remainder comprised hardstanding over an uneven site. Cut and fill works to level the site would be required. This element of work was anticipated to be complex and low cost.

Site clearance		
Basis	Industrial	
	Non-complex	Complex
Per m ² site area	£5 - £25	£15 - £75

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the complex / low cost range, so a range of £15 to £45 will be applied. Note the value of £45 is the midpoint of the complex cost range.

- **Demolition works: non-complex / low cost range**

The category classification for this element was work was anticipated to be non-complex and fall within the low cost range, because the buildings to be demolished were low-rise (less than 5 storeys) and used for light industrial duties (non-complex fit out). There were also no deep basements (greater than 2 storeys) or deep foundations within the development. Despite being located in a dense urban environment the demolition works scope was anticipated to be logistically simple.

Demolitions		
Basis	Industrial	
	Non-complex	Complex
m ² GEA	£11 - £58	£15 - £75

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the non-complex / low cost range, so a range of £11 to £35 will be applied. Note the value of £35 is the midpoint of the complex cost range.

- **Removal of redundant services: non-complex / high cost range**

The removal of extensive service corridors and capping off and removal of existing underground buried services. This element of works was anticipated to be complex and high cost.

Removal of redundant services		
Basis	Industrial	
	Non-complex	Complex
Per site	£20,000 - £100,000	£30,000 - £160,000

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the non-complex/high cost range, so a range of £60,000 to £100,000 will be applied. Note the value of £60,000 is the midpoint of the non-complex cost range.

- **Site Investigations: complex / low cost range**

The presence of ground contaminants was expected due to the industrial use of the previous site and together with the higher amount of surveys associated with verifying and managing the site, the classification of this element of works was anticipated to be complex and towards the mid to lower end of the complex cost range.

Site investigations		
Basis	Industrial	
	Non-complex	Complex
Per site	£10,000 - £90,000	£40,000 - £260,000

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the complex/low cost range, so a range of £150,000 to £260,000 will be applied. Note the value of £150,000 is the midpoint of the non-complex cost range.

- **Fees: non-complex / low cost range**

The large amount of contamination and specialist consultants anticipated to be required (e.g. an archaeological watching brief was probable due to the central city location of the site), professional fees associated with the demolition works were expected to fall within the non-complex and high cost categories.

Fees		
Basis	Industrial	
	Non-complex	Complex
Per site	£90,000 - £230,000	£190,000 - £670,000

Extract from Figure 15 Dereliction – cost ranges

The costs are estimated to fall within the non-complex/low cost range, so a range of £90,000 to £160,000 will be applied. Note the value of £160,000 is the midpoint of the non-complex cost range.

Calculation methodology

The calculations below illustrate how the estimated cost for the overall demolition works were derived:

- **Site clearance and levelling; costs for complex low range:**

Midpoint of complex range is:

$$\frac{[15+75]}{2} = 45$$

Complex low range is therefore: 15 to 45

Minimum estimated cost

$$\begin{aligned} &= [\text{complex low min.}] \times [\text{site area} - \text{footprint}] \\ &= [15] \times [23,000 - 19,000] \\ &= \mathbf{60,000} \end{aligned}$$

Maximum estimated cost

$$\begin{aligned} &= [\text{complex low max.}] \times [\text{site area} - \text{footprint}] \\ &= [45] \times [23,000 - 19,000] \\ &= \mathbf{180,000} \end{aligned}$$

- **Demolition works; costs for non-complex low range:**

Midpoint of non-complex range is:

$$\frac{[11+58]}{2} = 102$$

Non-complex low range is therefore: 11 to 35

Minimum estimated cost

$$\begin{aligned} &= [\text{non-complex low min.}] \times [\text{GEA}] \\ &= [11] \times [26,000] \\ &= \mathbf{286,000} \end{aligned}$$

Maximum estimated cost

$$\begin{aligned} &= [\text{non-complex low max.}] \times [\text{GEA}] \\ &= [35] \times [26,000] \\ &= \mathbf{910,000} \end{aligned}$$

- **Removal of redundant services; costs for non-complex high range:**

Midpoint of non-complex range is:

$$\frac{[20,000+100,000]}{2} = 60,000$$

Non-complex high range is therefore:
60,000 to 100,000

Minimum estimated cost

= [non-complex high min.]

= **60,000**

Maximum estimated cost

= [non-complex high max.]

= **100,000**

- **Site investigations; costs for complex low range:**

Midpoint of non-complex range is:

$$\frac{[40,000+260,000]}{2} = 150,000$$

Complex low range is therefore:
150,000 to 240,000

Minimum estimated cost

= [complex low min.]

= **150,000**

Maximum estimated cost

= [complex low max.]

= **240,000**

- **Fees: costs for non-complex low range;**

Midpoint of non-complex range is:

$$\frac{[90,000+230,000]}{2} = 160,000$$

Non-complex high range is therefore:
90,000 to 160,000

Minimum estimated cost

= [non-complex low min.]

= **90,000**

Maximum estimated cost

= [non-complex low max.]

= **160,000**

Cost element	Low	High
Site clearance and levelling	60,000	180,000
Demolition works	286,000	910,000
Removal of redundant services	60,000	100,000
Site Investigations	150,000	240,000
Fees	90,000	160,000
Total	646,000	1,590,000
Total, say	650,000	1,590,000

The estimated cost for the overall demolition scope was £650,000 to £1,590,000 as based on the classifications identified above. The actual cost was £900,000 for the site works (adjusted to fourth quarter 2014 prices).

Assessment of the benchmark cost compared to actual cost

The actual cost associated with the demolition works is between the lowest and highest estimated possible demolition costs associated with the site classifications of industrial previous use, range of cost levels and anticipated complexity of works. The actual cost is towards the lower end of the identified range. The principal driver for the cost range are the costs associated with the demolition works. It is important to understand the impact of costs associated with demolition and removal of the structural frame, services and costs associated with any specialised strip out works.

Annex F: Extended notes for Chapter 3 and 4

The annex provides some additional supporting information to Chapters 3 and 4. Both the chapters and this Annex are not intended to be an exhaustive summary. Regulations and guidance change and it is important to get specialist advice on these matters.

Contamination policy, regulation & procedural Context

The *Environmental Protection Act 1990*¹¹ and the *Environment Act 1995*¹² which introduced Part 2A, includes the legal definition of contaminated land and how it is to be identified and dealt with. It refers to the existing use of the site and endorses the principle of a 'suitable for use' approach for contaminated land, where remedial action is only required if there is an unacceptable risk of harm to human health or risk of pollution of the environment. The Statutory Guidance¹³ describes the risk assessment methodology, defines land to be determined as contaminated in a regulatory sense, and introduces the four category test for contaminated land (for where there's a significant possibility of significant harm to human health).

The Contaminated Land (England) Regulations 2006¹⁴ and Contaminated Land (England) (Amendment) Regulations, 2012¹⁵ elaborate on various details of the Part 2A regime, such as dealing with 'special sites', public registers and remediation notices and the rules for how appeals can be made against decisions taken. The amendment regulations introduced the definition of "significant pollution" and the "significant possibility of significant pollution of controlled waters" (in respect of controlled waters as defined in the *Water Act 2003*¹⁶).

The *Water Framework Directive*¹⁷ (2000/60/EC) (WFD) established an integrated approach to the protection, improvement and sustainable use of Europe's surface waters and groundwaters. It aims to ensure the progressive reduction of pollution of groundwater and prevent its further pollution. The *Groundwater Daughter Directive*¹⁸ (2006/118/EC) (GWDD) clarifies the requirements of the WFD and requires threshold values to be determined for assessing good groundwater chemical status.

"Under Part 2A the starting point should be that land is not contaminated land unless there is reason to consider otherwise"

2012 Statutory Guidance

The *Environmental Permitting (England and Wales) Regulations 2010*¹⁹ implements a means of regulating polluting activities through environmental permits. The regulations sets out water pollution offences and environmental permits replace former water discharge consents and groundwater authorisations. Under the regulations, groundwater activities relate to inputs of pollutants to groundwater and it is now an offence to allow such an activity to take place without an environmental permit or exemption. The *Water Framework Directive 2000* and the *Groundwater Daughter Directive 2006* are transposed by these regulations.

11. Statutory Instrument (1990): *Environmental Protection Act*, HMSO

12. Statutory Instrument (1995): *Environment Act*, HMSO

13. Statutory Instrument (2012): *Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance*, Defra

14. Statutory Instrument (2006): *Contaminated Land (England) Regulations*, HMSO

15. Statutory Instrument (2012): *Contaminated Land (England) (Amendment) Regulations*, HMSO

16. Statutory Instrument (2003): *Water Act*. HMSO

17. Directive of European Parliament and the Council (2000), '*Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy*'

18. Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (Daughter to 2000/60/EC)

19. Statutory Instrument (2010): *The Environmental Permitting (England and Wales) Regulations*, HMSO

The *Hazardous Waste (England and Wales) Regulations 2005*²⁰ (as amended by the *Hazardous Waste (England and Wales) Regulations 2009*²¹) sets out the procedures when producing, disposing of, carrying or receiving hazardous waste. Hazardous waste is essentially waste that contains hazardous properties which if mismanaged has the potential to cause harm to the environment and human health. As a result, controls apply from the point of its production, to its movement, management, and recovery or disposal.

The *Environmental Damage (Prevention and Remediation) Regulations 2009*²² implement the *Environmental Liability Directive*²³ (2004/35/EC) with regard to the prevention and remedying of environmental damage. The regulations introduced obligations to ensure that the polluter pays for damage caused, supplementing existing legislation. “Environmental damage” is defined by the Directive as damage to protected species and natural habitats, damage to water and damage to soil.

“The entry of a substance into groundwater or a slight deterioration in groundwater quality in itself is not pollution under WFD and GWDD. Pollution will only result where the entry or deterioration is linked to a harmful effect at a receptor”

GP3, 2013 Environment Agency

Due diligence

Good due diligence procedures should reduce the level of risk and uncertainty associated with projects (including the abnormal costs of remediation). The decision to financially approve public sector expenditure is subject to prior appraisal and due diligence procedures. These procedures ensure that decision makers approve the lowest risk and highest value for money projects. Various organisations such as funders, developers and government departments will use their own appraisal systems. Project managers may wish to comply with the guidance on appraisal set down in HM Treasury and other departments.

Due diligence of the site conditions will typically be undertaken before an interested party commits to securing an interest or investing in the subject land or property. This document should not be used on its own for this purpose, without other inputs, but its application may raise issues for due diligence and may be used to inform the specification of terms of reference and the selection of the appropriate consultants.

20. Statutory Instrument (2005): Hazardous Waste (England and Wales) Regulations, HMSO

21. Statutory Instrument (2009): The Hazardous Waste (England and Wales) (Amendment) Regulations 2009, HMSO

22. Statutory Instrument (2009): The Environmental Damage (Prevention and Remediation) Regulations, HMSO

23. Directive of European Parliament and the Council EC (2004) Environmental liability with regard to prevention and remedying of environmental damage, Official Journal of the European Union

Further detailed background on investigation, evaluation and remediation is set out in industry guidance, such as the Environment Agency pages on www.gov.uk ²⁴ and their reports such as GPLC²⁵ and CLR11²⁶. There are a wide range of applicable British Standards such as BS10175²⁷ and BS8576²⁸ and BS8485²⁹ to name just three, and multiple guidance documents from organisations such as the NHBC³⁰, CIRIA³¹ and CL:AIRE³². Local planning guidance (including contamination land strategies) may be available from the Local Authority in whose area the land sits, and each local authority may specify the minimum requirements required to support a planning application or to discharge planning consent conditions. Care should be taken to ensure that the most up to date guidance is utilised.

The land contamination assessment process is based upon the principle of risk assessment and the iterative gathering of information to qualify the level of risk that may be presented by the land. The assessment process is a linear one and if for any reason a stage is omitted or is undertaken incorrectly, then it is possible that subsequent stages will be insufficiently robust or incorrect.

A selection of common mistakes are described below:

- Poorly defined project objectives; this is the starting point of land contamination assessment and the project objectives will have a significant influence on works proposed. For example, are the works to support a planning application, due diligence or divestment, permit application, to investigate a pollution incident or to provide advice on contractual or construction risks. The scope of work for each may vary.

- Inadequate preliminary risk assessments: This is often the first stage and there can sometimes be a tendency to omit elements in order to reduce the fee, such as a site reconnaissance, which is specified by the NPPF as one of the minimum requirements in support of a planning application. Additional costs associated with undertaking a robust PRA (and developing a good conceptual model) will often be relatively low in relation to the total project costs and potential risks and will help to properly scope ground investigation (and possibly prevent over scoping) and reduce uncertainty in the ground conditions.
- Undertaking intrusive ground investigations for land contamination purposes without first completing a robust preliminary risk assessment (including conceptual model), which provides the justification of the ground investigation design. Contamination testing may simply be 'tagged' on to a geotechnical investigation without providing any clear justification as to why it is appropriate which may result in information being missed or unnecessary testing being specified.

24. Environment Agency website (2014): <https://www.gov.uk/government/organisations/environment-agency>

25. Environment Agency (2010): GPLC1 - Guiding Principles for Land Contamination, March 2010.

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28. British Standards Institution (2013): BS 8576 Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds

29. British Standards Institution (2007): BS8485:2007, Code of Practice for the Characterization and Remediation from Ground Gas in Affected Developments, London, BSI.

30. National House-Building Council

31. Construction Industry Research and Information Association

32. Contaminated Land: Applications in Real Environments

- Inappropriate investigation design, in particular, soil gas and groundwater monitoring wells. This may result in significant increases in cost and delays in subsequent remediation if the groundwater or ground gas monitoring has been poorly targeted or installed. In extreme cases, this may result in significant costs and delays of a year or more. Other issues include understanding the impact of heterogeneity introducing bias during sampling, not investigating potentially erroneous or anomalous data, and incorrect selection of sample preparation and laboratory test methods. The design of investigations should continuously be refined, for example, to reflect the encountered conditions during the site works and changes in atmospheric conditions (with gas monitoring).
- A poorly defined conceptual model; the conceptual model underpins contamination risk assessment. In order for there to be a “risk” there must be a contaminant source, a receptor sensitive to that source and a pathway to link the two. These ‘plausible pollutant linkages’ are fundamental to the investigations and risk assessments that follow.
- Over conservatism in the assessment of risk, which may result in unnecessary remediation being undertaken or insufficient consideration of the efficiency of contaminant pathway and the tendency to assess a pathway which may not be significant. If there is no plausible contaminant pathway, then there will be no significant pollutant linkage (and therefore remediation), even if there are significant contaminant sources and sensitive receptors present. There is of course the option to complete further voluntary remediation beyond actual pollutant linkages, for instance associated with perception and land value but that should be explicitly recognised and agreed.

The PRA is normally followed by intrusive ground investigations to characterise the site and determine the geological stratigraphy underlying the site and to allow the collection of soil samples and installation of standpipes for the collection of groundwater samples and monitoring of ground gases and vapour. Soil and groundwater samples should be analysed at a UKAS accredited analytical laboratory following MCERTS³¹ procedures (where appropriate). The resulting information, alongside that from any ground gas monitoring, would typically first be assessed as part of a generic quantitative risk assessment (GQRA). This involves the initial assessment of the data using either generic assessment criteria (GAC) generated by CLEA for human health and an appropriate model for assessment risks to water, or where supported by the conceptual model then category four screening levels (C4SL). Values exceeding the GAC or C4SL do not necessarily indicate remediation is required (although that might be the case) rather further assessment and consideration is necessary, such as DQRA to derive site specific assessment criteria.

Definition of Waste: Development Industry Code of Practice³² may allow the sustainable re-use of material (either on or offsite) provided that:

1. use of the material will not create an unacceptable risk of pollution to the environment or harm to human health;
2. the material is suitable for its intended purpose in all respects, particular chemically and geotechnically;
3. there is a certainty of use for this material (normally within a year); and
4. materials are only used in the quantities necessary for that use (for instance as defined in a planning application).

31. Environment Agency’s Monitoring Certification Scheme

32. CL:AIRE (2011): *The Definition of Waste: Development Industry Code of Practice Version 2*, February 2011, CL:AIRE

The Environment Agency³³ details the four stages of the verification process:

1. development of the remediation strategy;
2. formulating the verification plan to establish the requirements for gathering data to demonstrate compliance;
3. implementation and reporting of the verification plan; and
4. long term monitoring and maintenance, if required.

CIRIA report C733³⁴ brings together background information and practical detail on the methods and procedures used in the assessment and management of sites affected by asbestos. The guide includes a summary of the relevant legislation, consideration of the effects on human health of asbestos inhalation, compliance with CAR 2012, the sampling and monitoring of asbestos, the process of risk evaluation and good practice with regard to communicating the potential risks to the public. There are currently no generic assessment criteria for asbestos in soils and it is unlikely any such criteria will be available in the near future. The assessment is undertaken by considering multiple 'lines of evidence' on a site specific basis. An industry code of practice and other guidance is being developed by the Joint Industries Working Group (JIWG) in conjunction with the HSE and Environment Agency (along with other organisations) to facilitate regulatory compliance. A human health risk assessment framework is being developed by the Society of Brownfield Risk assessment (SoBRA) to feed into this code of practice.

33. Environment Agency (2010), Land Contamination: Verification of Remediation.

34. CIRIA (2014): *Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks*, CIRIA C733, London, CIRIA

Annex G: Extended notes for Chapter 5

Situations that dictate whether planning approval is required for demolition are provided below.

1. Where the building is more than 50 cubic metres (when measured externally), including dwelling houses. In such instances an application must be made to the relevant local planning authority (LPA) to determine whether the prior approval of the LPA will be required for the method of demolition and any proposed restoration of the site. If the LPA do not respond within 28 days, the demolition may proceed;
2. Where the building or site is subject to heritage planning controls. Demolition (including partial demolition of a Listed Building or a building within a conservation area requires Listed Building Consent or Planning Permission from the local planning authority.
3. Trees within a site may be subject to heritage planning and tree protection controls. If a tree is covered by a Tree Preservation Order, the local planning authority's consent is usually required. If a tree is located within a Conservation Area and is not already covered by a Tree Preservation Order the authority must usually be given at least six weeks' notice.
4. Where flora, fauna or natural features within the site are protected by European or national legislation. It is advisable to speak to the local planning authority early on and consider seeking specialist advice if the development is likely to have a significant effect on a protected site or species, either individually or in combination with other plans or projects.
5. Where the building is residential. If the proposed structure for demolition is a residential building, a six week notice period must be given to the local planning authority to enable all building matters to be addressed.

Health and safety duties fall on the owner/ occupier of buildings during all phases of development from acquisition and any period of dormancy through to active demolition. In the absence of construction-related activity the prime legal duties relate to occupiers liability.

The process of clearance prior to re-development will then attract the duty on the owner to provide information relating to the structure relevant to ensuring that adequate information is communicated to the appointed contractors.

Occupiers Liability Acts (1957 and 1984 for England and Wales, 1960 for Scotland) require that the occupier has a duty of care to both invitees (which includes all parties having a statutory right of entry) and, to a lesser extent dependent on age, non-invitees including trespassers.

For invitees the issues include:

- Safe access for surveyors, including maintaining all fixed structures used for access.
- Upkeep of any temporary works erected to provide necessary structural stability, and similarly, structural soundness in general for buildings and structures where a substantial period (typically measured in years) is planned to elapse prior to demolition/re-development commencing.
- Creation of demarked, prohibited areas where structural issues render the area/access unsafe.
- Ensuring site utilities are disconnected from all supply sources.
- Providing building design and services drawings as required.
- Ensuring that all historical information on building structure and contents is obtained at purchase and maintained in an accessible location.

The cost of such stewardship should be considered during purchase particularly where long dormancy is anticipated.

Non-invitee (trespassers) issues include:

- Provide warning / safeguards in respect of risks; a) the occupier is aware of and b) believes that the [trespasser] is in the vicinity of the risks.
- Assessing which risks the occupier might be expected to offer some protection in the circumstances. these include:
- The nature of the premises (how dangerous are they? A private house? An electrified railway line?);
- Is the danger hidden or obvious and the degree of danger
- Is the risk of injury high or low
- The gravity of possible injury;
- The age, nature and character of entry (e.g. burglar, child trespasser or adult inadvertently trespassing);
- The foreseeability of the trespasser (i.e. the more likely people are to trespass; the more precautions must be taken).

The costs of security, based on a risk assessment, to protect the occupier from claims from injured parties will typically include for:

- Establishment, routine inspection and maintenance of adequate fencing.
- Provision of passive detection, CCTV etc.
- Pre-removal of resale value items (lead, copper, stainless steel, bronze artefacts and sculpture).
- Manning a site security office.
- Provision of signage for fragile roofs, prohibited areas, deep water etc.
- Is there a deemed right of way running through the site.
- Fencing or covering openings to excavations or underground structures.

The site owner's legal responsibilities when active demolition / clearance commences is to provide the fullest, practicable information regarding the premises to those undertaking the activity. This includes those undertaking enabling or preparatory works.

The following website is a portal containing comprehensive information on how clients can fulfil their duties.

<http://www.hse.gov.uk/construction/safetytopics/demolition.htm>

Clients must provide those who need it with pre-construction information that can reasonably be obtained.

A property developer was given an eight-month suspended prison sentence and ordered to pay £100,000. The accused ignored the presence of asbestos insulation board at the site.

He knew the potentially dangerous material formed part of the building, but ignored advice.

The HSE visited the building and an inspector identified what was needed to do to comply with the relevant legislation.

A complaint was received by HSE from a member of the public.

The accused was then told to have surveys carried out and to arrange for the licensed removal of the material. When inspectors re-visited the site they found building rubble containing asbestos. Although employees had been wearing disposable overalls and face masks, no other controls were in place.

The asbestos containing material should have been dampened down and double-bagged, and then removed by a licensed contractor. High efficiency vacuums should have been used rather than a broom.

The HSE inspector said the accused showed a wilful disregard for the health and safety and there were a catalogue of serious errors, safety failings and ignorance of the laws.

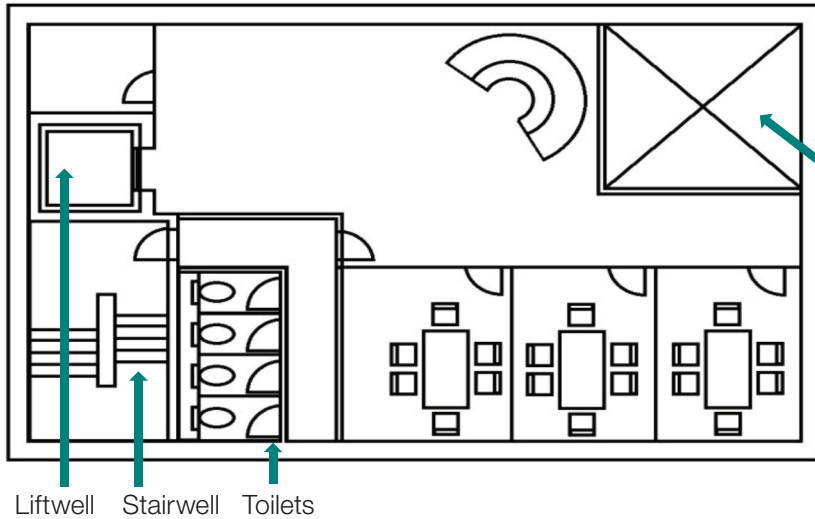
Annex H: Demolitions classification fees

The following table provides further guidance on selecting a cost from the ranges included for Professional fees allowances in conjunction with the “complex and non-complex” classifications for demolition. It should be noted that the services provided will need to be tailored to the specific needs of the site, and the details included below are intended for guidance, rather than a check list or scope of services required:

Figure 19 Demolitions classification - fees

Range	Non-complex	Complex
Low	<ul style="list-style-type: none"> • Activities require a low level of limited resources to undertake • Due diligence • Desktop appraisal • Topographical • Architect • Geotechnical engineer • Environmental engineer • Cost consultant • Other inc lab tests 	<ul style="list-style-type: none"> • Wide range of site investigations • Contamination surveys • Ordnance • Geotechnical investigations
High	<ul style="list-style-type: none"> • Activities require a moderate level of limited resources to undertake • Due diligence • Desktop appraisal • Topographical • Architect • Geotechnical engineer • Civil engineer • Ecologist • Services enquires • Environmental engineer • Archeologist • Cost consultant • Agent • Other inc lab tests 	<ul style="list-style-type: none"> • Activities require a very high level of limited resources to undertake • Due diligence • Desktop appraisal • Topographical • Architect • Geotechnical engineer • Civil engineer • Ecologist • Services Enquires • Environmental engineer • Archeologist • Cost consultant • Agent • Other inc lab tests

Annex I: Area definitions

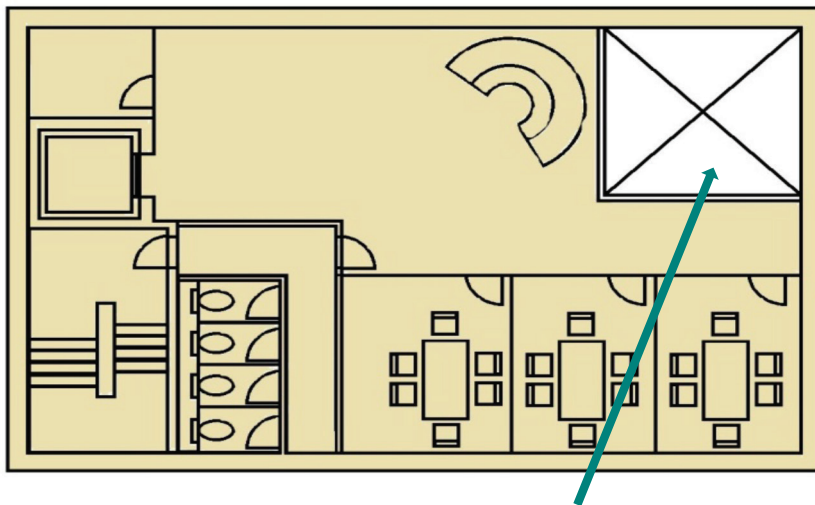


Sample floor space

Indicative floor space showing a mixture of office tenant space, communal stairs and communal toilets.

Balcony and void overlooking to floor below

External Wall



Gross external area (GEA)

GEA is the area of a building measured externally at each floor level.

The following is excluded from GEA measurement;

- external open-sided balconies, covered ways and fire escapes;
- canopies;
- open vehicle parking areas, roof terraces, and the like
- voids over or under structural, raked or stepped floors; and
- greenhouses, garden stores, fuel stores, and the like in residential property

Atria spaces are measured at ground floor level only.
Voids above are not measured on the floors they intersect.

Code of measuring practice 2006 for further detail and definitions "RICS Guidance Note"
A Guide for Property Professionals, 6th Edition.

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