

Appendix A

APPENDIX A

TABLE A – CATEGORIES OF SIGNIFICANT HARM

TABLE A – CATEGORIES OF SIGNIFICANT HARM		
	Type of Receptor	Description of harm to that type of receptor that is to be regarded as significant harm
1	Human beings	<p>Death, disease, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.</p> <p>For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.</p> <p>In this Chapter, this description of significant harm is referred to as a "human health effect".</p>
2	<p>Any ecological system, or living organism forming part of such a system, within a location which is:</p> <ul style="list-style-type: none"> an area notified as an area of special scientific interest under section 28 of the Wildlife and Countryside Act 1981; any land declared a national nature reserve under section 35 of that Act; any area designated as a marine nature reserve under section 36 of that Act; an area of special protection for birds, established under section 3 of that Act; any European Site within the meaning of regulation 10 of the Conservation (Natural Habitats etc) Regulations 1994 (i.e. Special Areas of Conservation and Special Protection Areas); any candidate Special Areas of Conservation or potential Special Protection Areas given equivalent protection; any habitat or site afforded policy protection under paragraph 6 of Planning Policy Statement (PPS 9) on nature conservation (i.e. candidate Special Areas of Conservation, potential Special Protection Areas and listed Ramsar sites); or any nature reserve established under section 21 of the National Parks and Access to the Countryside Act 1949. 	<p>For any protected location:</p> <ul style="list-style-type: none"> harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or harm which affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location. <p>In addition, in the case of a protected location which is a European Site (or a candidate Special Area of Conservation or a potential Special Protection Area), harm which is incompatible with the favourable conservation status of natural habitats at that location or species typically found there.</p> <p>In determining what constitutes such harm, the local authority should have regard to the advice of English Nature and to the requirements of the Conservation (Natural Habitats etc) Regulations 1994.</p> <p>In this Chapter, this description of significant harm is referred to as an "ecological system effect".</p>
3	<p>Property in the form of:</p> <ul style="list-style-type: none"> crops, including timber; produce grown domestically, or on allotments, for consumption; livestock; other owned or domesticated animals; wild animals which are the subject of shooting or fishing rights. 	<p>For crops, a substantial diminution in yield or other substantial loss in their value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage.</p> <p>The local authority should regard a substantial loss in value as occurring only when a substantial proportion of the animals or crops are dead or otherwise no longer fit for their intended purpose. Food should be regarded as being no longer fit for purpose when it fails to comply with the provisions of the Food Safety Act 1990. Where a diminution in yield or loss in value is caused by a pollutant linkage, a 20% diminution or loss should be regarded as a benchmark for what constitutes a substantial diminution or loss.</p> <p>In this Chapter, this description of significant harm is referred to as an "animal or crop effect".</p>
4	<p>Property in the form of buildings.</p> <p>For this purpose, "building" means any structure or erection, and any part of a building including any part below ground level, but does not include plant or machinery comprised in a building.</p>	<p>Structural failure, substantial damage or substantial interference with any right of occupation.</p> <p>For this purpose, the local authority should regard substantial damage or substantial interference as occurring when any part of the building ceases to be capable of being used for the purpose for which it is or was intended.</p> <p>Additionally, in the case of a scheduled Ancient Monument, substantial damage should be regarded as occurring when the damage significantly impairs the historic, architectural, traditional, artistic or archaeological interest by reason of which the monument was scheduled.</p> <p>In this Chapter, this description of significant harm is referred to as a "building effect".</p>

Source: DEFRA Circular 01/2006, Page 86

Appendix B

APPENDIX B

Rational behind the use of Geographical Information Systems (GIS)

A GIS is a digital system for the storage, manipulation, analysis and visualisation of spatial data. At the heart of a GIS is a database that allows the spatial data to be linked to attribute data. Spatial data is anything for which a grid reference can be given i.e. where something is. Attribute data is information about what is at a particular point. Maps are the most well known types of spatial data. They show the spatial distribution of features and the locational relationship of one object with another.

GIS is an ideal way of illustrating spatial relationships, and has the merit of allowing easy updating of the information in order to produce new plans.

GIS is a highly suitable way of managing land-use and ground information in order to identify pollutant linkages, assess risks, make decisions and communicate outcomes.

What are the advantages in moving to digital mapping and analysis? It is a simple thing to read a paper map, but when two or more maps have to be combined and overlain, the operation becomes less straightforward. Using conventional techniques, an overlay trace would have to be prepared for each map. These traces would then have to be analysed using manual measurement techniques and a final map prepared. All of these maps would then be stored in a map chest. Any point information would have to be plotted by hand. If these points relate to a database, then the paper map would have to be cross-referenced with the database. Each time a different attribute was needed, a different set of plots would be required. Large areas would have to be covered by many maps, increasing the storage problem. Using GIS, all these functions become more straightforward, as GIS was developed to make cartography and map analysis easier. Datasets containing both spatial and attribute data can be drawn together into a common structure, simplifying their analysis and manipulation. The increased performance of desktop computers means that questions can be asked of the data and answered rapidly, without the delays inherent in the time-consuming manual methods outlined above.

GIS data should be held, manipulated and transferred in formats native to, or supported by, widely available GIS packages such as ArcView or MapInfo. Large amounts of data can be handled in such GIS and it is easy to view combined datasets. the use of obscure or obsolete GIS that do not import or export these widely used formats

should be avoided where possible, as considerable effort (and therefore costs) is often needed to re-format data when transfer to another system etc. is required.

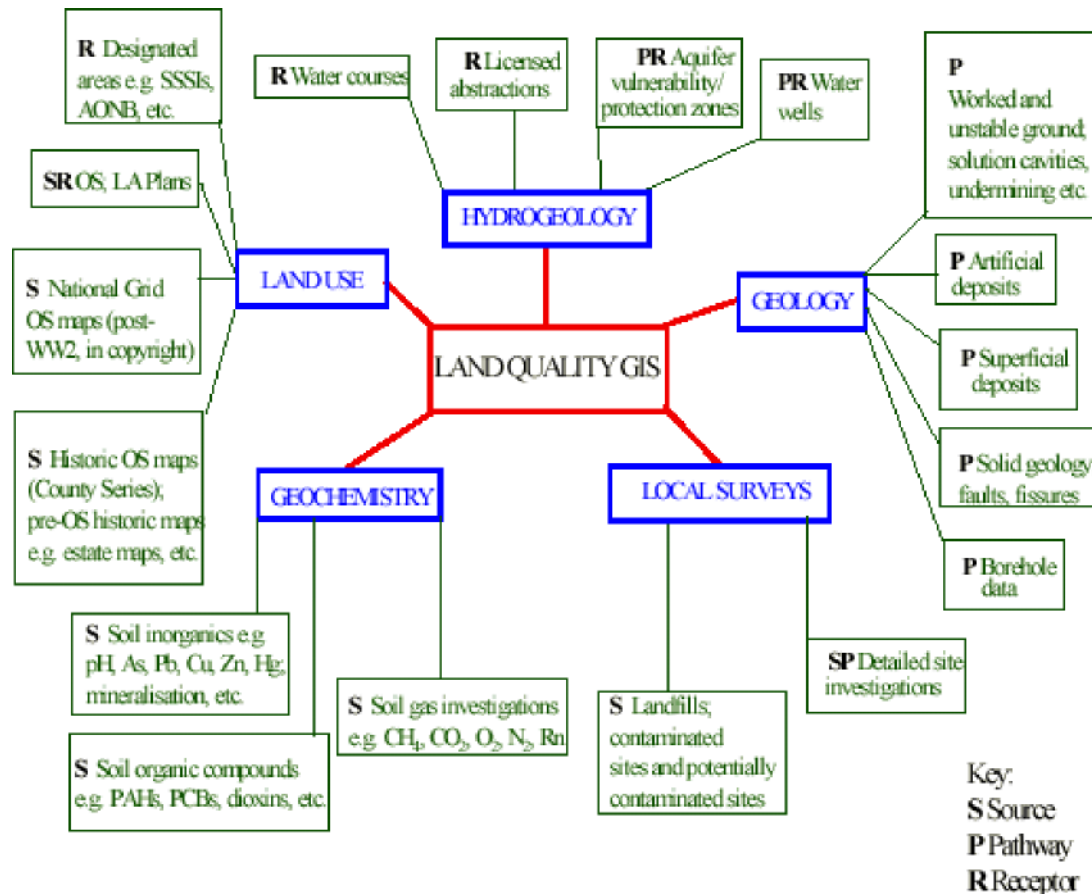
While the information needs of the LA environmental health, building control and planning departments are different, there is often a need to share data to ensure consistency of approach. Importantly, once a GIS has been developed and set up, all members of staff, not just the GIS specialists, can use it. In principle, data management by means of a digital system will increase departmental cross-talk, make it easier to evaluate ground conditions, and facilitate transmission of information to outside bodies, including the Environment Agency.

The **general benefits** of using GIS are several:

- ◆ provides a digital system for systematic data entry and storage; providing quality control forms part of the process of inputting information, GIS is a highly efficient way of storing huge amounts of data
- ◆ provides integrated data layers for easier management; different layers of information can be superimposed simultaneously for a given area
- ◆ GIS is a system that allows data to be translated easily into information, such as multi-layered maps or reports, which can support policy-making or planning decisions; if digital 3-D geology were represented in the GIS, it could provide a sound basis for making decisions on underground development plans
- ◆ provides an updateable knowledge store; if a key person leaves the organisation, the information is left behind in the GIS and not lost
- ◆ GIS is dynamic, versatile and can be interactive with larger modular IT environmental packages
- ◆ GIS can be made to be address-linked; the facility to click on a point or a single address to bring up a whole series of different databases is a powerful method to help answer enquiries for that address point
- ◆ GIS can be customised for automatic report generation; a programme language can be used to co-ordinate selected information that is spatially related to a given area or point on the map; the output to the printer can be programmed as a series of maps, tables, or diagrams with text
- ◆ GIS offers an accessible system for answering customer enquiries; a report writing facility may be required for this function, but once in place, a non-GIS expert can operate the GIS in order to respond to enquiries
- ◆ GIS makes it easier to export and import information to or from internal and external bodies; GIS is a way of increasing the efficiency of information transfer
- ◆ the GIS databases may have other departmental uses e.g. in Leisure and Education Departments
- ◆ GIS is useful when interpreting complex data e.g. the

- spatial relationships between land use and any soil contaminants present can be explored in GIS making the identification of pollution linkages easier
- ◆ provides a sound basis for site risk assessments e.g. the GIS databases can be adapted as input files for modeling in LANDSIM, CONSIM and other model codes
 - ◆ GIS offers a good visualisation facility for presentations to contractors or to Agency staff and the public
 - ◆ GIS could be used in training new LA staff; it is possible to draw up a variety of different maps of the area illustrating land use, geology, problem sites etc, for discussion with the newcomer
 - ◆ GIS can provide overall cost savings for a LA; more efficient management of environmental information will give long-term advantages as less time and therefore fewer staff are required to prepare information for regulatory or enquiry purposes.

Figure 1 shows the layers that typical a GIS system for contaminated land purposes should contain.



Source: Some guidance on the use of digital Environmental Data, British Geological Survey (BGS) Technical Report WE/99/14

Appendix C



DUNDEE CITY COUNCIL

ENVIRONMENTAL & CONSUMER PROTECTION DEPARTMENT

DREAM - DUNDEE RISK EVALUATOR ASSESSMENT MODEL

SEPTEMBER 2001

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DUNDEE CITY COUNCIL
ENVIRONMENTAL & CONSUMER PROTECTION DEPARTMENT
DREAM - Dundee Risk Evaluator Assessment Model

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**DUNDEE CITY COUNCIL
ENVIRONMENTAL & CONSUMER PROTECTION DEPARTMENT
DREAM - Dundee Risk Evaluator Assessment Model**

1 INTRODUCTION

The new contaminated land regime requires the Authority to adopt a strategic approach to inspect its area. "The approach should be seen to:

- Be rational, ordered and efficient;
- Be proportionate to the seriousness of any actual or potential risk;
- Seek to ensure that the most pressing and serious problems are located first;
- Ensure that resources are concentrated on investigating areas where the authority
- is most likely to identify contaminated land; and
- Ensure that the local authority efficiently identifies requirements for the
- detailed inspection of particular areas of land."

In order to advance the strategy in line with the above objectives, Dundee City Council have decided that it is necessary to develop a methodology that will enable the prioritisation of sites based on the pollutant linkage principle.

DREAM (Dundee Risk Evaluator Assessment Model) has been developed by the Scientific Officer responsible for contaminated land within the Environmental & Consumer Protection Department (ECPD) of Dundee City Council.

2 RISK ASSESSMENT PROTOCOLS

In order for DREAM to be acknowledged as, fair, impartial and open to examination, it is considered essential that the entire assessment procedure should be transparent.

2.1 DREAM PARAMETERS

In order to carry out the prioritisation of a site using DREAM, it is necessary to identify or determine certain parameters relating to the site. These are as follows:

2.1.1 Sources of contamination

- Historical land uses occurring on the site (S_{Hist})

2.1.2 Sensitive receptors

- Current land use (R_{HH});
- Surface water receptors (R_{SW});
- Groundwater receptors (R_{GW});
- Ecological receptors (R_{Eco}); and
- Property receptors (R_{Prop});

2.1.3 Pathways

- Human health pathways (P_{HH});
- Surface water receptor proximity (P_{SW});
- Aquifer protection of groundwater receptors (P_{GWAP});
- Geological sensitivity of groundwater receptors (P_{GWGS});
- Proximity to designated ecological receptors (P_{Eco}); and
- Harm to designated property receptors (P_{Prop}).

DREAM uses a numerical algorithm developed by the ECPD Pollution Control Section of Dundee City Council. The values associated with the parameters have been selected to emphasise the Authority's current priorities though DREAM retains the flexibility to evolve through time should priorities change.

2.2 PRINCIPLES BEHIND DREAM

The DREAM model is based on the pollutant linkage principle at the centre of the contaminated land regime. DREAM enables scoring of the principal sources of contamination, pathways and receptors to derive individual pollutant linkage scores, which may be combined to give an overall Site Index Score (SIS). In addition, the model also assumes that if receptors or pathways are absent within a linkage, the linkage is considered incomplete and will fail to achieve a linkage score.

2.3 SCIENTIFIC BASIS

The model procedures are based upon professional experience and methodologies derived from a number of published documents including:

- DoE¹ Industry Profiles (47 Vol.);
- DoE Contaminated Land Research Report CLR No. 6 (1995) - Prioritisation and Categorisation Procedure for Sites which may be Contaminated; and
- Desk Reference Guide to Potentially Contaminative Land Uses

2.4 THE DREAM ALGORITHM

DREAM requires a simple algorithm to allow the calculation of the potential risk that may be posed by a particular site. This algorithm has been constructed using empirical means and has been tested to ensure that the SIS accurately reflects the Authorities priorities. The DREAM algorithm is as follows:

$$SIS = PLS_{HH} + PLS_{SW} + PLS_{GW} + PLS_{Eco} + PLS_{Prop}$$

$$SIS = S_{Hist} \times (R_{HH} \times \sum P_{HH}) + S_{Hist} \times (R_{SW} \times P_{SW}) + S_{Hist} \times (R_{GW} \times \{P_{GWAP} + P_{GWGS}\}) + S_{Hist} \times (R_{Eco} \times P_{Eco}) + S_{Hist} \times (R_{Prop} \times P_{Prop})$$

2.5 MULTIPLE LAND USE

Should an assessment be carried out on a site with multiple historical land uses, the assessment model will be carried out considering the historical land use with the highest S_{Hist} score.

¹ Industry Profiles - Department of the Environment 1994 - 1995

3 SOURCES

3.1 HISTORICAL LAND USES OCCURRING ON THE SITE (*S_{Hist}*)

The DoE Industry Profiles and the Desk Reference Guide to Potentially Contaminated Land Uses provide detailed insight into the operating procedures in a large number of industrial settings. These documents provide a scientific basis for the categorisation of the contaminative potential of industries and form the basis for our risk ranking.

Historical land uses are scored on a 1 - 4 scale, where 1 has been assigned to land uses which are considered to be the least likely to cause contamination, to a maximum value of 4 which has been assigned to the industries that pose the greatest potential to cause extreme contamination of the land.

S_{Hist} is a professional judgement based on the consequence and confidence of the severity and likelihood of contamination arising from the industrial processes carried out on a site. It should be appreciated that there is the possibility that industrial land uses with a low *S_{Hist}* may present a greater risk than the DoE industry profiles may indicate due to specific incidents occurring on the site. Should this come to the attention of the Authority, *S_{Hist}* may be adjusted on a site specific basis as thought appropriate. In such cases, the rationale justifying the alteration of the *S_{Hist}* will be reported. Conversely, remedial works may have already been carried out on a site that may substantially reduce the potential risks posed by the historical land use. Again, *S_{Hist}* may be adjusted with rationale explaining the adjustment attached.

DREAM's default *S_{Hist}* values for 51 industries including the 47 reported in the DoE Industry Profiles are as follows:

Historical Land Use	<i>S_{Hist}</i>	Historical Land Use	<i>S_{Hist}</i>
Asbestos manufacturing works	4	Metal manufacturing - refining, finishing, plating	3
Charcoal works	4	Power stations (excluding nuclear)	3
Chemical works - explosives, propellants, pyrotechnics	4	Road vehicle fuelling - transport & haulage centre	3
Chemical works - organic chemicals	4	Sewage works & sewage farms	3
Chemical works - pesticide manufacturing	4	Waste recycling - drum & tank cleaning sites	3
Engineering works - mechanical & ordnance	4	Animal & animal products processing works	2
Gas works, coke works & coal carbonisation plants	4	Chemical works - fertiliser manufacturing	2

Historical Land Use	SHist	Historical Land Use	SHist
Oil refineries, oil & petroleum bulk storage	4	Chemical works - rubber processing	2
Pulp & paper manufacturing works	4	Chemical works - mastics, sealants, adhesives	2
Timber treatment works	4	Chemical works - pharmaceuticals	2
Waste recycling - Hazardous waste treatment sites	4	Chemical works - soaps & detergents	2
Waste recycling - Landfills	4	Dockyards & dockland	2
Waster recycling - solvent recovery works	4	Engineering works - aircraft manufacture	2
Chemical works - coatings (paint & printing inks)	3	Engineering works - electrical & electronics	2
Chemical works - cosmetics & toiletries	3	Engineering works - vehicle manufacture	2
Chemical works - disinfectant maufacturing	3	Photographic works	2
Chemical works - fine chemicals manufacturing	3	Printing works	2
Chemical works - inorganic chemicals	3	Railway land	2
Chemical works - lino, vinyl & bitumen flooring	3	Textile works & dye works	2
Engineering works - railway engineering works	3	Timber products manufacturing works	2
Engineering works - Shipbuilding	3	Waste recycling - metal recycling sites	1
Fibreglass & resin works	3	Airports	1
Metal manufacturing - refining, finishing Fe & steel	3	Dry cleaners	1
Metal manufacturing - refining, finishing precious	3	Glass manufacturing	1
Metal manufacturing - refining, finishing, lead	3	Agricultural	1
Metal manufacturing - refining, finishing, non-Fe	3		

In addition to the industrial land uses noted above, the Authority will be able to add additional land uses to the list as they become identified.

4 RECEPTORS

4.1 CURRENT LAND USE (R_{HH})

R_{HH} is the parameter that will allow Dundee City Council to prioritise the sensitivity of human health receptors based on the current use of the land under study. R_{HH} is scored on a 1 - 5 scale, with the least sensitive receptors scoring the lowest values and the most sensitive receptors attaining the highest scores.

The sensitivity of a land use is primarily based on a number assumptions pertaining to the behavioural patterns and physical characteristics associated with the occupants or users ("sensitive receptors") of the parcel of land.

Behavioural characteristics may include:

- time exposed to contaminant;
rate of dermal exposure;
- inhalation rate; and
soil ingestion rate, whereas,

Physical characteristics comprise:

- sensitive receptor age and sex; and
- sensitive receptor body weight.

A large volume of research has been carried out to determining how behavioural patterns and physical characteristics of sensitive receptor interact to cause risk. The priorities adopted by Dundee City Council represent the commonly accepted land use sensitivity determination.

Standard current land uses	R_{HH}
Allotments	4
Commercial / Industrial	1
Parks / open space / recreational	3
Residential with Gardens	5
Residential without Gardens	3
Non - standard current land uses	R_{HH}
Schools	3
Hospitals	2

It is anticipated that further non-standard land uses identified during the implementation of the inspection strategy will be assigned an appropriate R_{HH} .

4.2 SURFACE WATER RECEPTORS (R_{SW})

Surface waters provide amenity to a range of users and the Authority recognise the need to safeguard surface waters for the long term benefit of the council stakeholders. Burns, streams, rivers and reservoirs are open to public access and degradation of either aesthetic quality or water chemistry is likely to be observed and reported to the Authority or SEPA by interested parties.

When considering the significance of a surface water body and assessing its sensitivity to mobile contaminants arising from the land, the end use of the water resource is fundamental in completing the assessment. The Authority consider that the following surface water body uses require protection and in recognition of the different standards sought, the greater the score, the more sensitive the receptor is considered.

Surface water receptor	R _{sw}
Classified as shellfish / salmonid / drinking / bathing water	5
Classified cyprinid / other use	3
Non - classified	2

4.3 GROUNDWATER RECEPTORS (R_{gw})

Groundwater is perhaps the receptor most often overlooked as it is "out of site and out of mind". Dundee's unique geological setting requires that groundwater quality and aquifer protection is addressed.

The Authority recognise that at present, groundwater abstraction is not widespread throughout the City, however increasing water charges may lead to a greater incidence of groundwater abstraction in the future as people switch from potable water supplies to private supplies.

The Authority and SEPA are striving to ensure that the water resources of today are managed in a sustainable manner and maintained for the future by preventing them from becoming contaminated to a state which is unfit for human consumption without costly water treatment processes.

It is recognised that not all groundwater resources have the same priority. The Authority consider that aquifers which provide drinking water or supply significant base flow to rivers be afforded the greatest degree of protection. Potential groundwater resources should be protected, but are given less importance than active supplies. Groundwater which is unlikely to be used is given the lowest priority.

Groundwater receptor	R _{GW}
Groundwater used or provides river baseflow in close proximity	5
Potential for groundwater use or provides base flow in less close proximity	3
Groundwater unlikely to be used	1

4.4 ECOLOGICAL RECEPTORS (R_{ECO})

Part IIA provides definitions of a number of specialist ecological receptors which should be considered when evaluating an area of land's potential to cause contamination. Part IIA does not differentiate between ecological receptors and a single score will be applied if an ecological receptor is considered vulnerable.

Ecological receptor classification	R _{Eco}
Ecological receptor defined in Part IIA	5

4.5 PROPERTY RECEPTORS (R_{PROP})

Property receptors are perhaps the most difficult to classify as this branch of receptors cover an extremely diverse group of objects. The values assigned represent the Authority's priorities for dealing with potential threats to property receptors.

Property Types	R _{Prop}
Council owned housing	5
Fishery and game stock	2
Crops	1
Historic and ancient buildings	4
Industrial / commercial	3
Livestock	2
Private Housing	5

5 PATHWAYS

5.1 HUMAN HEALTH PATHWAYS (P_{HH})

Soil contamination may reach the user or occupant of a piece of land via a number of mechanisms. The mechanisms available depend on the current land use and the individual site characteristics. (e.g. vegetable ingestion is an unlikely exposure route within an industrial setting, but much more probable within an allotment environment)

There are five major pathways by which soil contamination may be taken in to a human receptor. These are as follows:

Human Health Pathways (if present, each scores 1 point)	P_{HH}
Ingestion of soil or soil related dust	1
Inhalation of outdoor vapours	1
Inhalation of indoor vapours	1
Dermal contact	1
Ingestion of home grown vegetables	1

As noted above, the pathways likely to be present are closely linked to the current land use, R_{HH} . It is important to consider not only all the pathways that are present at the time of assessment, but also to consider pathways, which may be introduced through site development which does not require planning permission (e.g. a paved or tarmac patio in residential property could be converted to a vegetable plot, etc.)

5.2 SURFACE WATER RECEPTOR PROXIMITY (P_{sw})

The likelihood of a surface water body becoming contaminated from an area of land is closely linked to the proximity of the water course to the land under study and the hydrological situation of the site. It is considered more likely that sites up-hydraulic gradient of watercourses have a greater opportunity to pollute a surface waters than sites down gradient. It is also considered that a site with a direct outfall to a watercourse (e.g. old field drains), or with a watercourse adjacent to the site is more likely to cause a pollution incident than the same site with a watercourse some distance away. To reflect this, we have adopted the following scoring rationale to take into account surface water proximity and hydraulic gradient.

Surface water receptor proximity	P _{sw}
Direct discharge	5
Adjacent to site	4
< 50m from site boundary, down gradient of site	4
<250m from site boundary, down gradient of site	3
< 50m from site boundary, cross / up gradient of site	2
<250m from site boundary, cross / up gradient of site	1
> 250m from site boundary, down gradient of site	1
> 250m from site boundary, cross / up gradient of site	0

5.3 AQUIFER PROTECTION OF GROUNDWATER RECEPTORS (P_{GWAP})

The "Aquifer Protection" (R_{GWAP}) of a groundwater resource is intended to reflect the effectiveness of the underlying strata in preventing downward migration of mobile contaminants from the soils to the aquifer. A substantial thickness of boulder clay can form an effective barrier to many contaminants, protecting the aquifer and is awarded a low R_{GWAP} score. An aquifer overlain by permeable sands and gravels is poorly protected from mobile contaminants and awarded a high R_{GWAP} score.

Protection of groundwater receptors	P _{GWAP}
Permeable strata, clayey sands or discontinuous lenses of boulder clay overlying aquifer	2
Continuous dense plastic boulder clay overlying aquifer	1

5.4 GEOLOGICAL SENSITIVITY OF GROUNDWATER RECEPTORS (P_{GWGS})

Rock strata underlying parcels of land may have varying hydrogeological properties and significance. The major groundwater resources are the most likely to be exploited in the future and, to reflect their importance, it is considered appropriate to place the greatest importance to the protection of these resources.

Sensitivity of groundwater receptors	P _{GWGS}
Lower Devonian sedimentary strata underlying site	3
Lower Devonian volcanic strata underlying site	2
Lower Devonian igneous strata underlying site	1
Quaternary strata underlying site	2

5.5 PROXIMITY TO DESIGNATED ECOLOGICAL RECEPTORS (P_{Eco})

The likelihood of significant harm being caused to an ecological receptor by a parcel of land is related to the proximity of the site to the receptor.

Proximity of designated ecological receptors	P_{Eco}
On or adjacent to the site	5
Less than 50m from site boundary	4
Greater than 50m, but less than 250 from site boundary	3
Greater than 250m, but less than 500m from site boundary	2
Greater than 500m, but less than 1,000m from site boundary	1
Greater than 1,000m from site boundary	0

The ecological receptor pollutant linkage is designed to be indicative of the potential threat posed to a designated ecological receptor and not to be considered as a full determination of the severity of the pollutant linkage. Further investigation into **actual** presence of the linkage will be necessary if it appears that the ecological linkage is significant.

5.6 HARM TO DESIGNATED PROPERTY RECEPTORS (P_{PROP})

Pathways to property receptors are varied and diverse, so difficult to identify individually. At this stage, it is considered sufficient to make an initial determination whether harm, or the or the significant possibility of significant harm, is occurring to property.

Harm occurring to property	P_{Prop}
Actual harm or the significant possibility of significant harm occurring to property	5
No harm	0

As with P_{Eco} , the property receptor pollutant linkage is designed to be indicative of the potential threat posed to property receptors and not to be considered as a full determination of the severity of the pollutant linkage. Further investigation into **actual** presence of the linkage will be necessary if it appears that the property linkage is significant.

5.7 NO PATHWAY OR NO RECEPTORS PRESENT

As DREAM considers the linkage assessments within the context of Part IIA, should a pathway or receptor fail to be identified within a potential pollutant linkage, the linkage is considered to be absent. If no linkages are present, it is not possible to classify the land as contaminated land.

6 DREAM OUTPUT

6.1 POLLUTANT LINKAGE SCORE (PLS) & SITE INDEX SCORE (SIS)

DREAM produces individual "Pollutant Linkage Scores" (PLS) and a combined "Site Index Score" (SIS) for a site, based on the parameters inputted in Chapter 3, 4 and 5 above. The SIS represents the total risk index that a parcel of land poses to the local environment, and the individual components, the PLS reflect the risk to each different environmental setting.

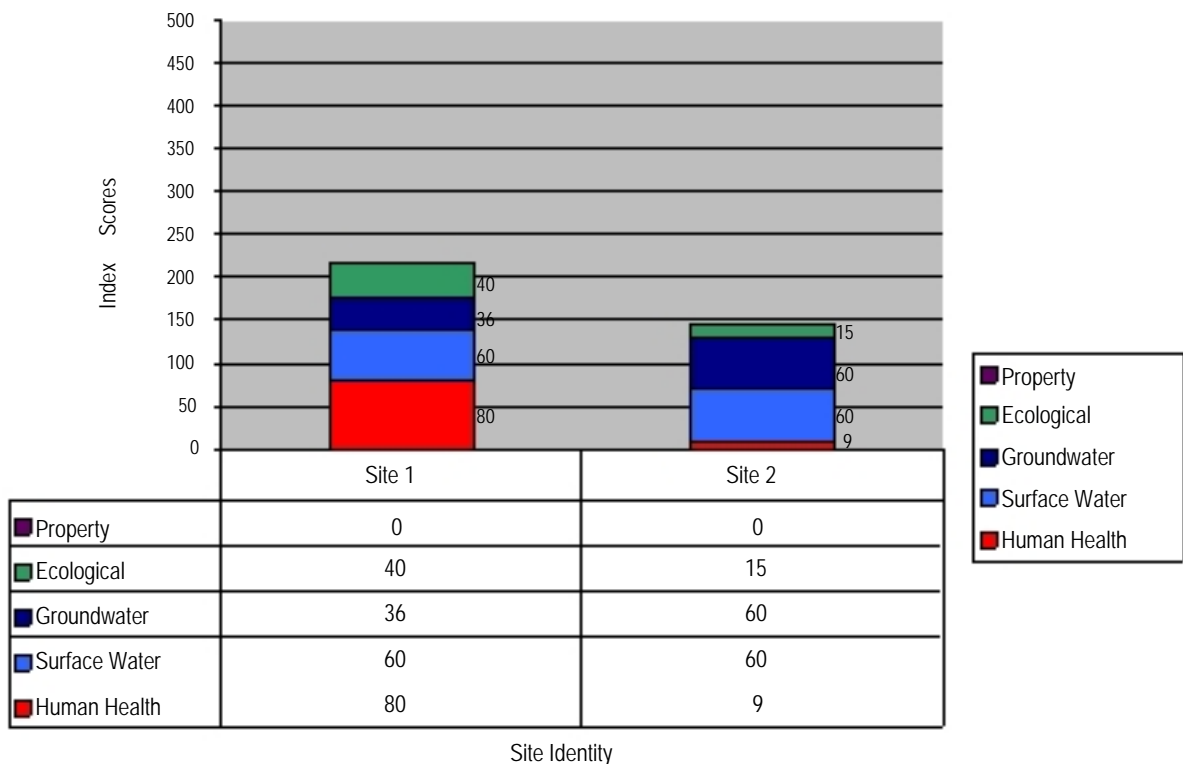
The SIS represents the sum of all five individual pollutant linkages identified above by the formula detailed in Chapter 2.4.

Each pollutant linkage can score up to a maximum of 100, resulting in a maximum SIS of 500. The SIS will be plotted on a chart to illustrate the total SIS and individual PLS.

The ability to break down a SIS into its individual pollutant linkage components enables the Council to quickly determine which linkages are significant on a particular parcel of land and which linkages present little or no threat to receptors.

It is hoped that comparisons between sites can be displayed in a graphical manner such as demonstrated below.

Example Sites



6.2 CATEGORISING AND PRIORITISING SITES ON BASIS OF PLS

Pollutant linkages will be reviewed individually and be classified into Priority Categories in accordance with CLR6 to allow the identification of the linkages requiring priority attention. The Priority Category thresholds have been determined empirically to provide appropriate action levels. The Priority Categories comprise:

Priority Category	PLS
Priority Category 1	60 - 100
Priority Category 2	40 - 59
Priority Category 3	20 - 39
Priority Category 4	0 - 19

6.2.1 Priority Category 1

Linkages falling within Priority Category 1 indicate that the land is probably or certainly not suitable for present use and environmental setting. Contaminants are probably or certainly present and likely to have an unacceptable impact on key receptors and urgent action is needed in the short term to resolve these issues.

6.2.2 Priority Category 2

Linkages falling within Priority Category 2 indicate that the site may not be suitable for present use and environmental setting. Contaminants are probably or certainly present and likely to have an unacceptable impact on key receptors and action is needed in the medium term to resolve these issues.

6.2.3 Priority Category 3

Linkages falling within Priority Category 3 indicate that the site is considered suitable for its present use and environmental setting. Contaminants may be present but are unlikely to have an unacceptable impact on key receptors and action is unlikely to be needed if the site remains in its current use or otherwise remains undisturbed.

6.2.4 Priority Category 4

Linkages falling within Priority Category 4 indicate that the site considered suitable for its present use and environmental setting. Contaminants may be present but very unlikely to have an unacceptable impact on key receptors and no action is likely to be needed if the site remains in its current use or otherwise remains undisturbed.

7 REVIEW OF DREAM

DREAM was developed in house in a response to the absence of commercially available software that adequately identified potentially problematic sites within Dundee. DREAM has taken into account the unique set of environmental, geological and historical parameters that define Dundee and has attempted to provide a locally tailored solution to the problem of the identification of potentially contaminated land.

With this in mind, it will be necessary for the DREAM model to evolve with time to accommodate new and unforeseeable scenarios which may be encountered. To allow for this, DREAM will be kept under constant review to ensure that it is performing to the high level expected and new release versions will be published with the annual review of the strategy.

There may be the occasion in the future where it is felt that a commercially produced software package can better serve the purpose of identifying potentially contaminated sites within Dundee. Should this be the case, the Council will undertake a trial of the product to determine its suitability.

8 EXAMPLES

8.1 SCENARIO 1

- Site of old gasworks (R_{Hist}) ;
- Residential development with garden (R_{HH});
- Human health pathways - ingestion of soil, dermal contact, inhalation of outdoor vapour and ingestion of vegetables (P_{HH});
- Salmonid stream 150m down gradient of site (R_{SW} and P_{SW});
- Potential for groundwater to be used for drinking water in future (R_{GW});
- Aquifer of Lower Devonian igneous strata protected by 10 m of dense boulder clay (P_{GWGS} and P_{GWAP});
- SSSI 400m away (R_{Eco} and P_{Eco}); and
- No property issues (R_{Prop} and P_{Prop})

$$SIS = PLS_{HH} + PLS_{SW} + PLS_{GW} + PLS_{Eco} + PLS_{Prop}$$

$$SIS = S_{Hist} \times (R_{HH} \times \sum P_{HH}) + S_{Hist} \times (R_{SW} \times P_{SW}) + S_{Hist} \times (R_{GW} \times \{P_{GWAP} + P_{GWGS}\}) + S_{Hist} \times (R_{Eco} \times P_{Eco}) + S_{Hist} \times (R_{Prop} \times P_{Prop})$$

$$SIS = 4 \times (5 \times 4) + 4 \times (5 \times 3) + 4 \times (3 \times \{1 + 2\}) + 4 \times (5 \times 2) + 4 \times (0 \times 0)$$

$$SIS = \begin{matrix} 80 \\ PC1 \end{matrix} + \begin{matrix} 60 \\ PC3 \end{matrix} + \begin{matrix} 36 \\ PC2 \end{matrix} + \begin{matrix} 40 \\ PC3 \end{matrix} + \begin{matrix} 0 \\ PC4 \end{matrix}$$

$$SIS = 216$$

Human Health = Primary pollutant linkage of concern

Groundwater = Secondary pollutant linkage of concern

8.2 SCENARIO 2

- Site of chemical works for inks (R_{HistS}) ;
- Commercial / Industrial land use (R_{HH});
- Human health pathways - ingestion of soil, dermal contact and inhalation of outdoor vapour (P_{HH});
- Drinking water stream, less than 50m down gradient of site (R_{SW} and P_{SW});
- Groundwater used for private drinking water supply (R_{GW});
- Aquifer of Lower Devonian sedimentary strata protected by 10 m of dense boulder clay (P_{GWGS} and P_{GWAP});
- SSSI 600m away (R_{Eco} and P_{Eco}); and
- No property issues (R_{Prop} and P_{Prop})

$$SIS = PLS_{HH} + PLS_{SW} + PLS_{GW} + PLS_{Eco} + PLS_{Prop}$$

$$SIS = S_{Hist} \times (R_{HH} \times \sum P_{HH}) + S_{Hist} \times (R_{SW} \times P_{SW}) + S_{Hist} \times (R_{GW} \times \{P_{GWAP} + P_{GWGS}\}) + S_{Hist} \times (R_{Eco} \times P_{Eco}) + S_{Hist} \times (R_{Prop} \times P_{Prop})$$

$$SIS = 3 \times (1 \times 3) + 3 \times (5 \times 4) + 3 \times (5 \times \{1 + 3\}) + 3 \times (5 \times 1) + 3 \times (0 \times 0)$$

$$SIS = \frac{9}{PC4} + \frac{60}{PC2} + \frac{60}{PC2} + \frac{15}{PC4} + \frac{0}{PC4}$$

$$SIS = 144$$

Surface water and groundwater = Joint primary pollutant linkages of concern

Appendix D

APPENDIX D

Liason and communication -

contacts

Environment Agency - Kent & East Sussex Area

Tel 01732 223127

Lawrence Hamer
Groundwater & Contaminated Land
Orchard House
Endeavour Park
London Road
Addington, West Malling
Kent

Fax. 01732 875057

Natural England

Tel (01273) 476 595

Conservation Officer
Phoenix House
32-33 North St, Lewes,
BN7 2PH

English Heritage

Tel 01483 252000

English Heritage S.E. Region
Eastgate Court, 195-205 High Street
Guildford
Surrey
GU1 3EH

Fax 01483 252001

Department for Environment Food and Rural Affairs

Tel. 020-7238-5280

Tom Coles
Head of Contaminated Land Policy
Contaminated Land Team, Soils
Programme,
Defra Area 3C Nobel House
17 Smith Square
London
SW1P 3JR

HSE

Peter Gray
Health & Safety Executive No.3 East
Grinstead House London Road
East Grinstead
RH19 1RR

Tel: (01342) 334 200

Fax: (01342) 334 222

Food Standards Agency

Dr. Patrick Miller,
Contaminants Division
Food Standards Agency
238, Ergon House
17 Smith Square
P.O. Box 31037
LONDON, SW1P 3WG

Tel. 020 7276 8277

East Sussex County Council

Ian Blake
Transport and the Environment Department
East Sussex County Council
County Hall
St Annes Crescent
Lewes
East Sussex

Tel: 01273 481600

ESCC County Archivist

The County Archivist
The Maltings
Castle Precinct
Lewes
East Sussex
BN7 1 YT

Tel: 01273 481600

BGS (British Geological Survey)

Roger Parnaby
BGS
Kingsley Durham Centre
Keyworth
Notts.
NG12 5GG

Tel: 0115 936 3100

Fax: 0115 936 3200

Health Protection Agency

Dr Angela Iverson
36-38 Friars Walk
Lewes
East Sussex
BN7 2PB

Tel: (01273) 403591

East Sussex Fire Brigade

Fire Safety Office
Fire Station
North Street
Lewes
East Sussex BN7 2PE

Tel: (01323) 462 161

Petroleum Licensing

Mick Huckstepp
Petroleum Licensing Officer
East Sussex Fire & Rescue Service
20 Upperton Road,
Eastbourne,
East Sussex BN21 1EU

Tel: (0845) 130 8855

Southern Water Services

Jim Macintyre
Regional Network Manager
Southern Water
Southern House
Yeoman Road
Worthing
BN13 3NX

Tel: 0845 278 0845

South East Water

Andrew Ball
Water Resources Analyst
South East Water
3 Church Road
Haywards Heath
West Sussex
RH16 3NY

Tel: (01444) 448311