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DEFENCE ESTATE ORGANISATION (WORKS)

RAF UPPER HEYFORD

LAND QUALITY ASSESSMENT
PHASE ONE : DESK STUDY
LAND QUALITY STATEMENT

PROJECT NO: 07686
REPORT

March 1997

Defence Estate Organisation (Works)
Blakemore Drive
Sutton Coldfield
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Prepared by
ERM EnviroClean Ltd for
Ministry of Defence
Defence Estate Organisation
(Works) under commission
WS13/1982/3 June 1995

ERM

LOOSE MINUTE

D/DEO(W)/27/104/82/5

13 March 1997

[redacted]
Librarian

Land Quality Assessment RAF UPPER HEYFORD : Project No: 07686

1. I enclose one copy of the Phase One LQA Interpretive Report and Land Quality Statement for RAF Upper Heyford.. Please will you archive them under "Land Quality Assessment" They should also be referenced to the following key words:

contaminated land
geotechnical
risk assessment

2. Please call if you have any queries.

Thanks

[redacted]

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Environmental Engineer
HQ Defence Estate Organisation
SB207 3617SB

REPORT RELEASE SHEET

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Task Officer

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Reference 3377.19

For and on beh[redacted]
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Approved by: [redacted]

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Position: [redacted]

Date: 10/3/97

Approved by Task Officer:- [redacted]

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1 *INTRODUCTION*

ERM were appointed on 5th August 1996, by Defence Works Services, under the terms of the three year commission ref WS13/1982/3, to undertake a Land Quality Assessment of RAF Upper Heyford, Cambridgeshire.

The objectives of the Land Quality Assessment are as follows:

- To provide information relating to the environmental quality of the ground conditions present on the establishment.
- To consider the potential for future ground contamination occurring as a result of demolition of the existing buildings.
- To assess the potential human health and environmental risks at the site.

This document forms the Land Quality Statement and provides a summary of the environmental conditions at RAF Upper Heyford, the suitability of the site for re-use and the effects of contamination on development potential.

2 *ENVIRONMENTAL SETTING*

The environmental setting of the site has been described with reference to the following sources of information.

- Geological Sheet 218, Chipping Norton 1:50000, published by the British Geological Survey, 1968.
- Ordnance Survey Landranger Sheet 164, Oxford and surrounding area 1989, published at a scale of 1:50000.

- The Quality of Rivers and Canals in England and Wales (1990-1992), NRA River Quality Map, 1:750000.

- *Policy and Practice for the Protection of Groundwater,* Regional Appendix Thames Region, published by the National Rivers Authority (NRA), 1992.

- *Policy and Practice for the Protection of Groundwater,* Regional Appendix Anglian Region, published by the National Rivers Authority (NRA), 1992.

- Groundwater Vulnerability Map Series, Sheet 30 Northern Cotswolds, 1:100000, published by the Environment Agency (EA), 1996.

- EA database of licensed surface water and groundwater abstractions (1996).

RAF Upper Heyford is situated approximately 5km to the north-west of Bicester, Oxfordshire. The 494 hectare site is located at approximately 130 metres above ordnance datum (mAOD) on a plateau structure and is

bounded to the east and southwest by the communities of Ardley and Upper Heyford, respectively (national grid reference: SP 51 27). On the western edge of the airfield, the elevation drops approximately 50m over 1 km down to the River Cherwell and the Oxford Canal. The site comprises of runways, aircraft hangars, offices, workshops, fuel installation and weapons storage facilities.

In addition to the Oxford Canal and River Cherwell to the west, several surface water courses drain radially away from the plateau. Gallos Brook and Gagle Brook are noted to the south and further small brooks are observed around the site area in the north, north-west and westward towards the Oxford Canal. Several of these small streams are spring fed and are therefore dependant on groundwater discharges for flow. The Oxford Canal and the River Cherwell are classified as Class C (fair) according to the NRA's General Quality Assessment (GQA) Scheme.

One spring water abstraction is situated in close proximity of the site at national grid reference SP496253. The supply is used for domestic and agricultural use.

The site is immediately underlain by approximately 3m of silty clays with minor sandy and gravelly horizons. This unconsolidated superficial material is underlain by the weathered top of the 20 to 34 m thick, Great Oolite Limestone unit. The limestone is in turn underlain by several hundred metres of mudstones, limestones and sandstones of the Lias group.

Groundwater is used extensively throughout the region for industrial purposes, public water supply and domestic use. Most large scale abstraction comes from the Great Oolite Limestone although the Lower Lias and the unconsolidated drift deposits may contain locally important minor aquifers where permeable horizons are sufficiently thick and continuous.

Hydraulic continuity between the superficial material and the underlying limestone bedrock is considered likely across the site. Given the prominence of the plateau feature and relative high exposure of the Oolite, it is expected that the limestone aquifer receives recharge water in the form of infiltrating precipitation. The groundwater elevation in the limestone is not known, although the presence of spring issues on the flanks of the plateau surrounding the site indicate the likely elevation of the water table. Five licensed groundwater abstractions are situated within 3km of the site and used for both domestic purposes and supplies.

3 *SITE HISTORY*

The history of the site has been described with reference to the following historical maps held at the Bodleian Map Library in Oxford.

- Ordnance Survey County Series, 1:2500, editions Oxfordshire Sheets: XXII.3, XVI.10, XVI.11, XVI.14, XVI.15, from: 1875, 1900, 1922.

- Ordnance Survey County Series, 1:10 560, edition Oxfordshire Sheet: XVI from 1885.

- Ordnance Survey County Series, 1:10 560, editions Oxfordshire Sheets: XVI.SW, XVI.SE from 1900, 1923.

- Ordnance Survey SP 52 NW, 1:10 560, from 1955, 1966, 1982, 1993.

- Ordnance Survey SP 42 NE, 1:10 560, from 1955, 1979.

- Ordnance Survey SP 4826-4926, SP 5025-5125, SP 5226-5326, SP 5227-5327, SP 5026-5126, SP 5027-5127, 1:2500, 1974.

The site had a 'greenfield' landuse prior to being occupied by Canadian Airforce in 1916. RAF Upper Heyford covers an area of 494 hectares and was originally laid down in the traditional 'A' shape pattern. Only the main runway remains from the original configuration.

The site closed in 1920 and was then re-opened as a bomber station in 1927 and later utilized for leaflet dropping sorties in 1940. The base was taken over by the USAF in 1951 and the main runway was then increased to 10,000ft. Further extensive modifications were carried out with the arrival in 1970 of the 20th Tactical Fighter Wing and the first F-111E swing wing bombers. Base population levels have peaked at 4,500 including non-military personnel. The base closed and was passed back to the RAF in 1994.

4 *POTENTIAL CONTAMINATION AND ENVIRONMENTAL RISK*

4.1 *CONTAMINANT SOURCES, PATHWAYS AND RECEPTORS*

The current most sensitive receptors to the potential release of contaminants from past and/or present activities at the site are ground and surface waters and the abstractions that rely on them. The soil cover provided by the superficial deposits is thin and as such it provides only limited protection to the underlying limestone aquifer. As such the aquifer unit is susceptible to impaction from surface or sub-surface releases of site-related constituents.

The on-site surface water drainage network, feeds into a series of oil interceptors across the site and, as such, the discharge of free phase oil product is prevented. It should be noted, however, that dissolved phase contaminants are not prevented from draining off-site by these interceptors. As such, the surface water drainage network may historically have and in the event of shallow groundmass contaminant source areas, may continue to provide off-site containment migration pathways.

Any future site personnel/construction workers may also be potential receptors due to direct contact with on-site contaminant source areas within the shallow groundmass. Grazing animals may also be receptors of concern due to grazing in source areas located on the site, and by drinking potentially contaminated surface waters on the flanks of the plateau (off-site).

The ESR states that there are no historical records of significant spillage incidents occurring at the Upper Heyford site since the USAF began using the site in 1950. The ESR does indicate, however, that there have been a number of fuel spill incidents over the years, as well as two aircraft mishaps, one of which occurred off-base.

The only documented evidence of these spillages and aircraft mishaps were included in the ESR report and the information supplied is limited in detail. The report indicates fuel leaks and spills at POL 17 and on the south side of Facility 221 and states that all potential contamination was cleaned up to 'above standards'. Whilst the ESR was being prepared, POL 19 was in the process of investigation by Miller Environmental Limited. Miller Environmental were undertaking an investigation in order to assess the degree of potential contamination within the subsurface deposits at POL 19 located in Area A. This was carried out following the loss of 1,145 US gallons ($4.3m^3$) of unleaded fuel to the groundmass from an offset fill pipe of which only $2.63m^3$ of emulsified product were recovered from an adjacent interceptor. Investigation of POL 19 was still being carried out at the time of the ESR publication.

The 'on-site' aircraft incident involved an aircraft over-run to the '09' (west) end of the runway. It is reported that all contaminated soils resulting from the incident were disposed of to a site licensed by the Oxfordshire County Council under the Environmental Protection Act 1990 and the site of the incident was cleaned up to the satisfaction of the National Rivers Authority (NRA), now part of the EA. No other details of the incident, including nature of contaminant impact, its extent or impact on underlying groundwaters were available. Further discussions with the EA highlighted a potential contamination incident resulting from integrity failure of the POL supply pipeline at Upper Heyford. No further details on the incident were available.

MOD supplied anecdotal evidence indicated two further spill incidents relating to the POL fuel storage facilities. The only information on the spill incidents is as follows:

- Fuel spill at POL 21 (May 1990). Some contaminated soil removed.
- Fuel spill at POL 23 (1992). $350m^3$ spillage.

No visual evidence of contamination was observed during the site reconnaissance.

During the site history several potential contamination incidents were documented by the EA. Their records include a POL supply pipeline failure

at RAF Upper Heyford and several further POL fuel spillages. They were, however, unable to supply details of the incidents or locations of the spillage events.

There are a number of potential sources of contamination located within RAF Upper Heyford. The areas of most immediate concern are tabulated in Table 4.1a below.

Table 4.1a ***Potential Sources of Human/Environmental Risk***

POL site	Human Health	Groundwater	Surface Water
POL 1 Area A Fac 270	E	C	C
POL 2 Area A Fac 254	E	C	C
POL 3 Area A Fac 274	E	C	C
POL 5 Area D Fac 385	E	C	C
POL 6 Area D Fac 382	E	C	C
POL 7 Area D Fac 385	E	C	C
POL 8 Area D Fac 386	E	C	C
POL 9 Area C Fac 215	E	C	C
POL 10 Area C Fac 219	E	C	C
POL 11 Area C Fac 229	E	C	C
POL 13 Area B Fac 283	E	C	C
POL 14 Area B Fac 284	E	C	C

POL site	Human Health	Groundwater	Surface Water
POL 15 Area B Fac 241	E	C	C
POL 16 Area B Fac 242	E	C	C
POL 17 Area B Fac 245	E	C	C
POL 19 Area A Fac 614	E	C	C
POL 20 Area D Fac 375	E	C	C
POL 21A Area A Fac 392	E	C	C
POL 21B Area A Fac 393	E	C	C
POL 21C Area A Fac 394	E	C	C
POL 22 Area C Fac 395	E	C	C
POL 23A Area B Fac 285	E	C	C
POL 23B Area B Fac 269	E	C	C
POL 24 Area A Fac 269	E	C	C
POL 25A Area D Fac 376	E	C	C
POL 25B Area D Fac 377	E	C	C
Fuel Tank Area C Fac. un-named	E	C	C
POL fuel supply pipeline	E	C	C
Former Waste Area adjacent to POL 20.	C/D	C	C

POL site	Human Health	Groundwater	Surface Water
Fire Training Area A	C/D	C	C
Fuel Supply Station Fac. 493	C/D	C	C

KEY:
A: Immediate significant risk to human health
B: Immediate significant risk of damage to the environment
C: Major Remediation Liability
D: Minor Remediation Liability
E: Minor Significance, no remediation required
F: No effect on re-use options or site value

4.2 *ENVIRONMENTAL RISK*

ERM consider that the nature of the activities carried out on-site since 1916, the presence of the potential contaminant sources identified at RAF Upper Heyford, together with its location on a major aquifer unit (Great Oolite Limestone) and the presence of nearby potable supply abstractors suggest that the site represents a potentially serious risk to the environment.

Due to the absence of any extensive superficial cover, the limestone aquifer will have been vulnerable to spillage/leakage of contaminants on-site. The considerable rate of groundwater flow within limestone deposits, generally controlled by fractures and fissures, permits the rapid transfer of contamination through the saturated groundmass. In addition, the site is situated on a plateau area and all groundwater and surface water flow is expected to flow down gradient into several catchments areas. From the reviewing the Ordnance Survey mapping of the site area, and from discussions within the EA, it is apparent that several spring issues exist on the plateau flanks supported from groundwater flow. As such off-site impacts may already have occurred, although no documented impacts are known.

Surface water drainage systems leaving the site are a further potential contaminant pathways for impact of surrounding surface water resources. Although interceptors were present on the drains at the periphery of the site. Such units will not intercept dissolved phase contaminants. As such off-site impacts could have occurred. In the event of groundmass source areas being present, the surface drains could continue to provide a pathway for contaminant seepages from source areas.

Given the sensitivity of the setting and nature of operations, intrusive investigations are required to confirm, or otherwise, the potential for detrimental impacts on groundwater/surface water resources. In terms of the potential redevelopment of the site, this will be a requirement of the Environment Agency, as statutory consultee to any planning permission process (per discussions between ERM and EA). Additionally, even without redevelopment proposals, the EA would in all likelihood require evaluation of impacts, in their primary role of protection of water resources.

Such investigations for environmental risk evaluation could initially be focused on the sampling of surface water/springs on the periphery of the plateau. Given the predicted groundwater flows, analysis of such water would provide an initial indicator of site impacts on groundwater resources. Supporting information from the installation of a small number of groundwater monitoring wells, down hydraulic gradient of the identified potentail source areas is also likely to be required by the EA. In the event of impacts being identified, further and more detailed groundwater investigations will be required to understand impacts and allow risks posed to be evaluated and appropriate remedial actions scoped.

5 *SUITABILITY FOR RE-DEVELOPMENT*

The site clearly has high redevelopment potential. However, the results of the LQA suggest potentially significant sources of groundmass impact from site activities, particularly associated with the POL installations and POL distribution ring main pipeline. Given the nature of the activities on-site therefore, the current suitability of the site for a range of redevelopment end users (without remedial action) cannot be predicted without confirmation of groundmass quality. Therefore intrusive investigations are required, focused on areas of contaminant concern. Such investigation in parallel with the groundwater/surface water investigations identified above, are likely to be required to demonstrate the suitability of the site for redevelopment (with or without remediation) based on risk to future end-users and impacts on water resources.

Such information is likely to be a major component of any potential purchaser's due-diligence programme, will allow the MOD to assess the liability exposure as land owner and is likely to be requirement of any planning process related to redevelopment of the site. The data will also allow decision's to be made on the need for remedial action, either to allow redevelopment for intended land use or mitigate impacts on water resources, and allow costs for such actions to be provisionally set.