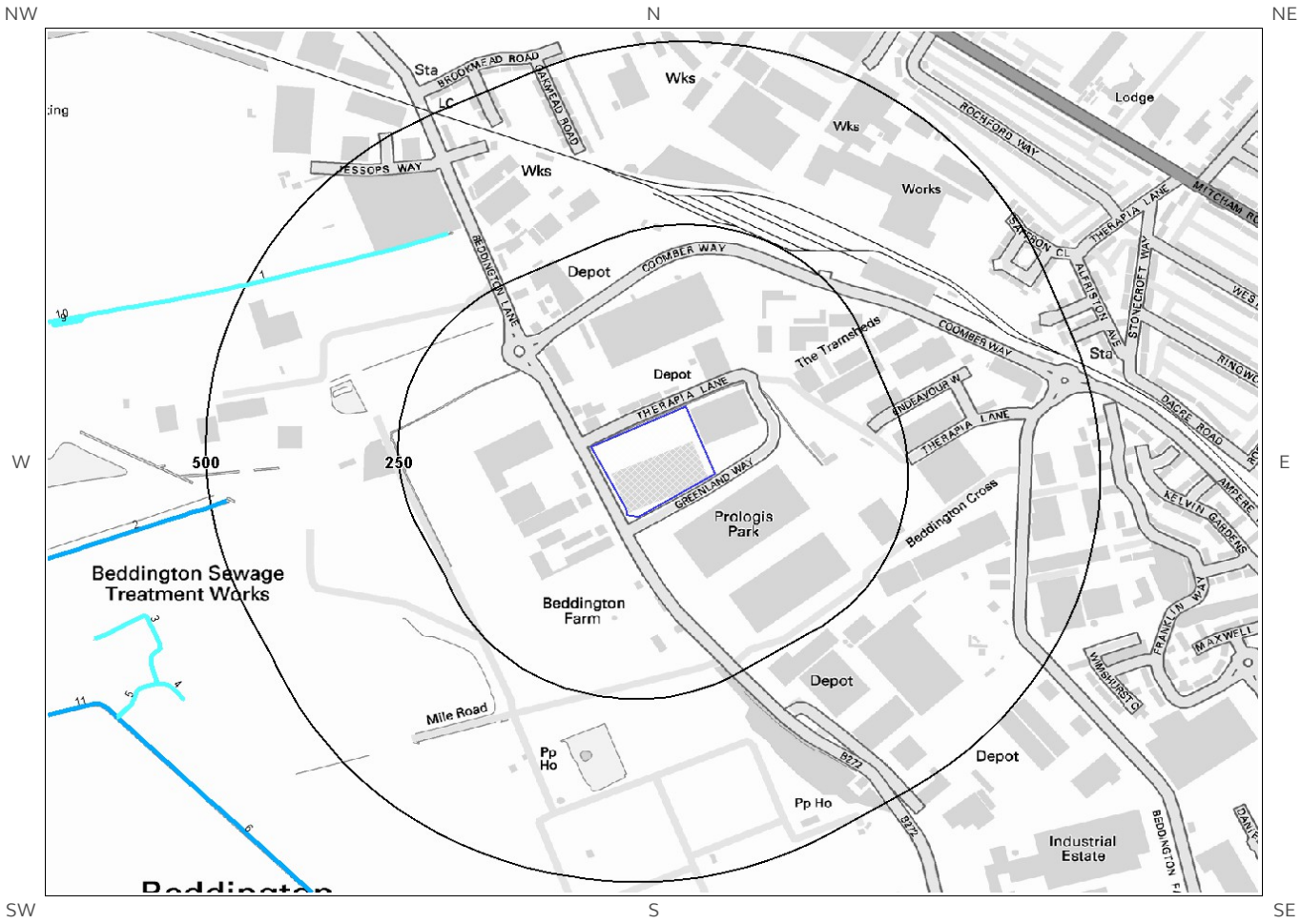
6e. Hydrology – Detailed River Network and River Quality



Site Outline

250
500
Search Buffers (m)

Primary River
Secondary River
Tertiary River
Lake/Reservoir
Underground River (inferred)
General Quality Assessment: Biology
General Quality Assessment: Chemistry

Canal
Canal Tunnel
Culvert
Multiple Channel Culvert
Underground River (Potential Sewer)
Underground River (local knowledge)

6.Hydrogeology and Hydrology

6.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (6a):

ID	Distance (m)	Direction	Designation	Description
1	0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	222	E	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

6.2 Aquifer within Bedrock Deposits

Are there records of strata classification within the bedrock geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the Groundsure Enviro Insight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	Designation	Description
3	0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
4	222	E	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

6.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? Yes

The following Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details	
5A	483	E	530256 166776	Status: Historical Licence No: 28/39/41/0084 Details: General Use Relating To Secondary Category (High Loss) Direct Source: Thames Groundwater Point: Beddington Farm Road Croydon Cro - Borehole Data Type: Point Name: HANSON QUARRY PROD EUROPE LTD	Annual Volume (m^3): 36432 Max Daily Volume (m^3): 132 Original Application No: WRA/S/1277 Original Start Date: 31/8/2006 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 31/8/2006 Version End Date:
6A	483	E	530256 166776	Status: Historical Licence No: TH/039/0041/017 Details: General Use Relating To Secondary Category (High Loss) Direct Source: Thames Groundwater Point: Beddington Farm Road Croydon Cro - Borehole Data Type: Point Name: HANSON QUARRY PRODUCTS EUROPE LTD	Annual Volume (m^3): 36432 Max Daily Volume (m^3): 132 Original Application No: NPS/WR/009241 Original Start Date: 2/5/2013 Expiry Date: 31/3/2019 Issue No: 1 Version Start Date: 2/5/2013 Version End Date:
Not shown	718	W	528900 166700	Status: Historical Licence No: 28/39/41/0073 Details: General Washing/Process Washing Direct Source: Thames Groundwater Point: Beddington Farm, Croydon, Borehole 'a' Data Type: Point Name: RMC MATERIALS LIMITED	Annual Volume (m^3): 1683000 Max Daily Volume (m^3): 18000 Original Application No: - Original Start Date: 9/8/1996 Expiry Date: 31/12/2006 Issue No: 103 Version Start Date: 20/4/2005 Version End Date:
Not shown	718	W	528900 166700	Status: Historical Licence No: 28/39/41/0073 Details: Dust suppression Direct Source: Thames Groundwater Point: Beddington Farm, Croydon, Borehole 'a' Data Type: Point Name: RMC MATERIALS LIMITED	Annual Volume (m^3): 1683000 Max Daily Volume (m^3): 18000 Original Application No: - Original Start Date: 9/8/1996 Expiry Date: 31/12/2006 Issue No: 103 Version Start Date: 20/4/2005 Version End Date:
Not shown	718	W	528900 166700	Status: Historical Licence No: 28/39/41/0073 Details: Mineral Washing Direct Source: Thames Groundwater Point: Beddington Farm, Croydon, Borehole 'a' Data Type: Point Name: RMC MATERIALS LIMITED	Annual Volume (m^3): 1683000 Max Daily Volume (m^3): 18000 Original Application No: - Original Start Date: 9/8/1996 Expiry Date: 31/12/2006 Issue No: 103 Version Start Date: 20/4/2005 Version End Date:
Not shown	718	W	528900 166700	Status: Historical Licence No: 28/39/41/0085 Details: Mineral Washing Direct Source: Thames Groundwater Point: Croydon Quarry, Beddington Lane - Wetpit Data Type: Point Name: CEMEX UK MATERIALS LIMITED	Annual Volume (m^3): 701500 Max Daily Volume (m^3): 6000 Original Application No: WRA/S/1305 Original Start Date: 31/7/2007 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 31/7/2007 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	718	W	528900 166700	Status: Historical Licence No: 28/39/41/0085 Details: General Washing/Process Washing Direct Source: Thames Groundwater Point: Croydon Quarry, Beddington Lane - Wetpit Data Type: Point Name: CEMEX UK MATERIALS LIMITED	Annual Volume (m^3): 701500 Max Daily Volume (m^3): 6000 Original Application No: WRA/S/1305 Original Start Date: 31/7/2007 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 31/7/2007 Version End Date:
Not shown	718	W	528900 166700	Status: Historical Licence No: 28/39/41/0085 Details: Dust Suppression Direct Source: Thames Groundwater Point: Croydon Quarry, Beddington Lane - Wetpit Data Type: Point Name: CEMEX UK MATERIALS LIMITED	Annual Volume (m^3): 701500 Max Daily Volume (m^3): 6000 Original Application No: WRA/S/1305 Original Start Date: 31/7/2007 Expiry Date: 31/3/2013 Issue No: 1 Version Start Date: 31/7/2007 Version End Date:
Not shown	1484	NW	528420 167620	Status: Historical Licence No: 28/39/41/0087 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: Mitcham Golf Club, Mitcham Junction - Borehole Data Type: Point Name: Trustees of Mitcham Golf Club	Annual Volume (m^3): 8000 Max Daily Volume (m^3): 60 Original Application No: NPS/WR/011363 Original Start Date: 31/7/2008 Expiry Date: 31/3/2013 Issue No: 2 Version Start Date: 3/10/2012 Version End Date:
Not shown	1485	NW	528420 167622	Status: Historical Licence No: TH/039/0041/010 Details: Spray Irrigation - Direct Direct Source: Thames Groundwater Point: Mitcham Golf Club, Mitcham Junction - Borehole Data Type: Point Name: Trustees of Mitcham Golf Club	Annual Volume (m^3): 8000 Max Daily Volume (m^3): 60 Original Application No: NPS/WR/009242 Original Start Date: 4/7/2013 Expiry Date: 31/3/2025 Issue No: 1 Version Start Date: 4/7/2013 Version End Date:
Not shown	1543	SE	530660 165440	Status: Historical Licence No: 28/39/41/0030 Details: Process water Direct Source: Thames Groundwater Point: Commerce Way, Purley Way, Croydon, - Borehole A Data Type: Point Name: SLOUGH INDUSTRIAL ESTATES LIMITED	Annual Volume (m^3): 236392 Max Daily Volume (m^3): 1005 Original Application No: - Original Start Date: 11/7/1966 Expiry Date: - Issue No: 104 Version Start Date: 15/12/2004 Version End Date:
Not shown	1543	SE	530660 165440	Status: Historical Licence No: 28/39/41/0030 Details: Non-Evaporative Cooling Direct Source: Thames Groundwater Point: Commerce Way, Purley Way, Croydon, - Borehole A Data Type: Point Name: SLOUGH INDUSTRIAL ESTATES LIMITED	Annual Volume (m^3): 236392 Max Daily Volume (m^3): 1005 Original Application No: - Original Start Date: 11/7/1966 Expiry Date: - Issue No: 104 Version Start Date: 15/12/2004 Version End Date:
Not shown	1653	W	528071 166158	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'b' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/002536 Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 6 Version Start Date: 26/3/2010 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1653	W	528071 166158	Status: Historical Licence No: TH/039/0041/014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'b' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/009265 Original Start Date: 21/5/2013 Expiry Date: 30/8/2016 Issue No: 1 Version Start Date: 21/5/2013 Version End Date:
Not shown	1657	W	528070 166150	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'b' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3750000 Max Daily Volume (m^3): 19000 Original Application No: - Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 1/8/2008 Version End Date:
Not shown	1657	W	528070 166150	Status: Historical Licence No: 28/39/41/0014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'b' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/4/1966 Expiry Date: 31/12/2004 Issue No: 103 Version Start Date: 16/1/2003 Version End Date:
Not shown	1684	W	528010 166240	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'a' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3750000 Max Daily Volume (m^3): 19000 Original Application No: - Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 1/8/2008 Version End Date:
Not shown	1684	W	528010 166240	Status: Historical Licence No: 28/39/41/0014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'a' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/4/1966 Expiry Date: 31/12/2004 Issue No: 103 Version Start Date: 16/1/2003 Version End Date:
Not shown	1699	W	527990 166252	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'a' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/002536 Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 6 Version Start Date: 26/3/2010 Version End Date:
Not shown	1699	W	527990 166252	Status: Historical Licence No: TH/039/0041/014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'a' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/009265 Original Start Date: 21/5/2013 Expiry Date: 30/8/2016 Issue No: 1 Version Start Date: 21/5/2013 Version End Date:
Not shown	1762	W	527870 166970	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Goatbridge Works, Middleton Road, Beddington Corner Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3750000 Max Daily Volume (m^3): 19000 Original Application No: - Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 1/8/2008 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1762	W	527870 166970	Status: Historical Licence No: 28/39/41/0014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Goatbridge Works, Middleton Road, Beddington Corner Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/4/1966 Expiry Date: 31/12/2004 Issue No: 103 Version Start Date: 16/1/2003 Version End Date:
Not shown	1768	W	527864 166975	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'd' Goatbridge Wks Middleton Rd Beddington Cnr Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/002536 Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 6 Version Start Date: 26/3/2010 Version End Date:
Not shown	1768	W	527864 166975	Status: Historical Licence No: TH/039/0041/014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'd' Goatbridge Wks Middleton Rd Beddington Cnr Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/009265 Original Start Date: 21/5/2013 Expiry Date: 30/8/2016 Issue No: 1 Version Start Date: 21/5/2013 Version End Date:
Not shown	1791	W	527875 166328	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'c' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/002536 Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 6 Version Start Date: 26/3/2010 Version End Date:
Not shown	1791	W	527875 166328	Status: Historical Licence No: TH/039/0041/014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'c' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/009265 Original Start Date: 21/5/2013 Expiry Date: 30/8/2016 Issue No: 1 Version Start Date: 21/5/2013 Version End Date:
Not shown	1793	W	527870 166340	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'c' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3750000 Max Daily Volume (m^3): 19000 Original Application No: - Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: 1/8/2008 Version End Date:
Not shown	1793	W	527870 166340	Status: Historical Licence No: 28/39/41/0014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'c' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/4/1966 Expiry Date: 31/12/2004 Issue No: 103 Version Start Date: 16/1/2003 Version End Date:
Not shown	1995	SW	528620 164950	Status: Historical Licence No: 28/39/41/0067 Details: Make-Up or Top Up Water Direct Source: Thames Groundwater Point: London Road ,wallington, Surrey Data Type: Point Name: LONDON BOROUGH OF SUTTON	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/2/1993 Expiry Date: - Issue No: 101 Version Start Date: 30/9/2002 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1995	SW	528620 164950	Status: Historical Licence No: 28/39/41/0067 Details: Make-Up or Top Up Water Direct Source: Thames Groundwater Point: London Road, Wallington, Surrey, - Borehole 'a' Data Type: Point Name: LONDON BOROUGH OF SUTTON	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/2/1993 Expiry Date: - Issue No: 101 Version Start Date: 30/9/2002 Version End Date:

6.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site? Yes

The following Surface Water Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (6b):

ID	Distance (m)	Direction	NGR	Details	
Not shown	1835	W	527800 167000	Status: Active Licence No: 28/39/41/0051 Details: General Use Relating To Secondary Category (Low Loss) Direct Source: Thames Surface Water - Non Tidal Point: River Wandle At Mitcham Junction Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 2495754 Max Daily Volume (m^3): 6819 Application No: WRA/38/18 Original Start Date: 15/12/1975 Expiry Date: - Issue No: 100 Version Start Date: 10/7/2014 Version End Date:

6.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site? Yes

The following Potable Water Abstraction Licences records are represented as points, lines and regions on the SPZ and Potable Water Abstraction Licences Map (6c):

ID	Distance (m)	Direction	NGR	Details	
Not shown	1653	W	528071 166158	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'b' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/002536 Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 6 Version Start Date: Version End Date:
Not shown	1653	W	528071 166158	Status: Active Licence No: TH/039/0041/014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'b' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/009265 Original Start Date: 21/5/2013 Expiry Date: 30/8/2016 Issue No: 1 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1657	W	528070 166150	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'b' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3750000 Max Daily Volume (m^3): 19000 Original Application No: - Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: Version End Date:
Not shown	1657	W	528070 166150	Status: Historical Licence No: 28/39/41/0014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'b' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/4/1966 Expiry Date: 31/12/2004 Issue No: 103 Version Start Date: Version End Date:
Not shown	1684	W	528010 166240	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'a' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3750000 Max Daily Volume (m^3): 19000 Original Application No: - Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: Version End Date:
Not shown	1684	W	528010 166240	Status: Historical Licence No: 28/39/41/0014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'a' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/4/1966 Expiry Date: 31/12/2004 Issue No: 103 Version Start Date: Version End Date:
Not shown	1699	W	527990 166252	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'a' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/002536 Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 6 Version Start Date: Version End Date:
Not shown	1699	W	527990 166252	Status: Active Licence No: TH/039/0041/014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'a' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/009265 Original Start Date: 21/5/2013 Expiry Date: 30/8/2016 Issue No: 1 Version Start Date: Version End Date:
Not shown	1762	W	527870 166970	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Goatbridge Works, Middleton Road, Beddington Corner Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3750000 Max Daily Volume (m^3): 19000 Original Application No: - Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: Version End Date:
Not shown	1762	W	527870 166970	Status: Historical Licence No: 28/39/41/0014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Goatbridge Works, Middleton Road, Beddington Corner Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/4/1966 Expiry Date: 31/12/2004 Issue No: 103 Version Start Date: Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1768	W	527864 166975	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'd' Goatbridge Wks Middleton Rd Beddington Cnr Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/002536 Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 6 Version Start Date: Version End Date:
Not shown	1768	W	527864 166975	Status: Active Licence No: TH/039/0041/014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'd' Goatbridge Wks Middleton Rd Beddington Cnr Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/009265 Original Start Date: 21/5/2013 Expiry Date: 30/8/2016 Issue No: 1 Version Start Date: Version End Date:
Not shown	1791	W	527875 166328	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'c' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/002536 Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 6 Version Start Date: Version End Date:
Not shown	1791	W	527875 166328	Status: Active Licence No: TH/039/0041/014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Bore 'c' New Rd Mitcham Junc Hackbridge Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3920000 Max Daily Volume (m^3): 19000 Original Application No: NPS/WR/009265 Original Start Date: 21/5/2013 Expiry Date: 30/8/2016 Issue No: 1 Version Start Date: Version End Date:
Not shown	1793	W	527870 166340	Status: Historical Licence No: 28/39/41/0079 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'c' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): 3750000 Max Daily Volume (m^3): 19000 Original Application No: - Original Start Date: 1/1/2005 Expiry Date: 31/3/2013 Issue No: 4 Version Start Date: Version End Date:
Not shown	1793	W	527870 166340	Status: Historical Licence No: 28/39/41/0014 Details: Potable Water Supply - Direct Direct Source: Thames Groundwater Point: Hackbridge Pumping Station 'c' Data Type: Point Name: SUTTON & EAST SURREY WATER PLC	Annual Volume (m^3): - Max Daily Volume (m^3): - Original Application No: - Original Start Date: 4/4/1966 Expiry Date: 31/12/2004 Issue No: 103 Version Start Date: Version End Date:

6.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site? Yes

The following Source Protection Zones records are represented on the SPZ and Potable Water Abstraction Map (6c):

ID	Distance (m)	Direction	Zone	Description
2	331	SW	3	Total catchment
1	360	W	2	Outer catchment

6.7 Source Protection Zones within Confined Aquifer

Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site? No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

6.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency information on groundwater vulnerability and soil leaching potential within 500m of the study site? Yes

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.
222	E	Minor Aquifer/High Leaching Potential	HU	Soil information for urban areas and restored mineral workings. These soils are therefore assumed to be highly permeable in the absence of site-specific information.

6.9 River Quality

Is there any Environment Agency information on river quality within 1500m of the study site? Yes

6.9.1 Biological Quality:

Database searched and no data found.

6.9.2 Chemical Quality:

Chemical quality data is based on the General Quality Assessment Headline Indicators scheme (GQAHI). In England, each chemical sample is measured for ammonia and dissolved oxygen. In Wales, the samples are measured for biological oxygen demand (BOD), ammonia and dissolved oxygen. The results are graded from A ('Very Good') to F ('Bad').

The following Chemical Quality records are shown on the Hydrology Map (6e):

					Chemical Quality Grade				
ID	Distance (m)	Direction	NGR	River Quality Grade	2005	2006	2007	2008	2009
Not shown	1181	S	529600 165470	River Name: Wandle (beddington Arm) Reach: Wandle Park - Wandle End/Start of Stretch: Sample Point NGR	A	A	A	A	A

6.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site? Yes

The following Detailed River Network records are represented on the Hydrology Map (6e):

ID	Distance (m)	Direction	Details	
1	346	NW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
2	478	W	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined

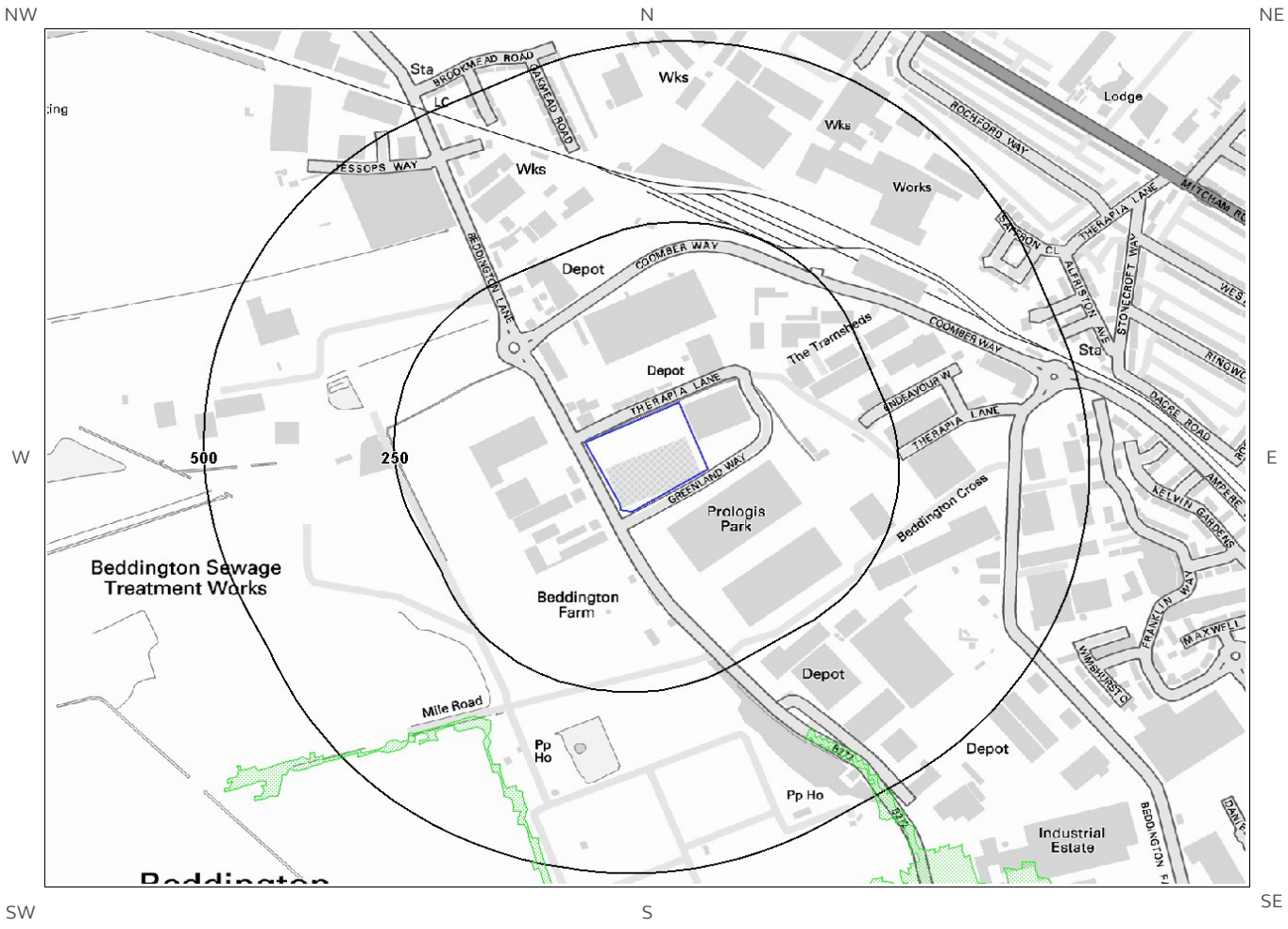
6.11 Surface Water Features

Are there any surface water features within 250m of the study site? Yes

The following surface water records are not represented on mapping:

Distance (m)	Direction
4	NW
96	E
140	NW
158	SW
168	SW
169	W
175	SW
197	SW
212	NW
236	SW

7a. Environment Agency Flood Map for Planning (from rivers and the sea)



Site Outline

Search Buffers (m)

Zone 2 Floodplain

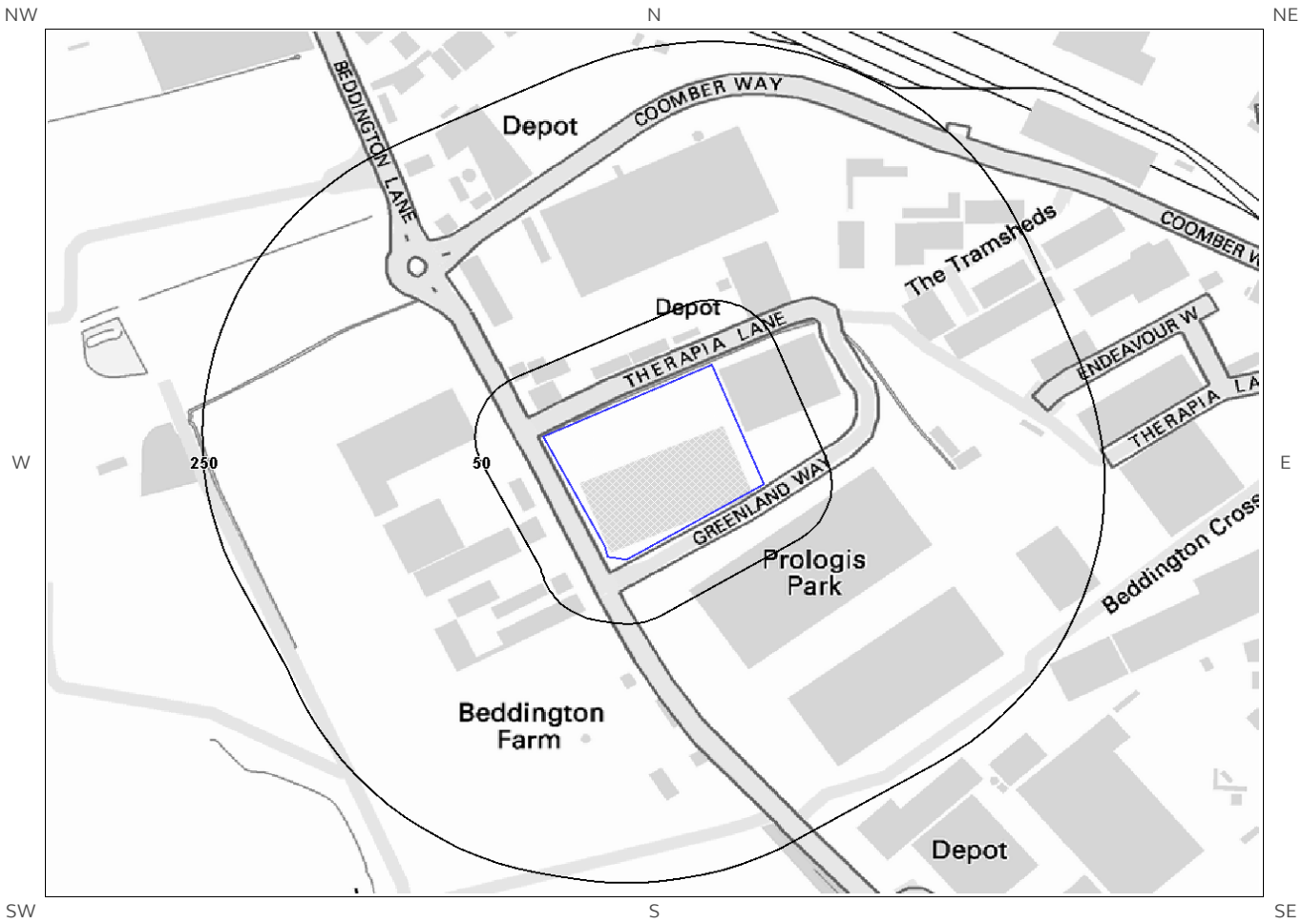
Zone 3 Floodplain

Flood Defences

Area used for Flood Storage

Area Benefiting from Flood Defences

7b. Environment Agency Risk of Flooding from Rivers and the Sea (RoFRaS) Map



Site Outline

100
250
Search Buffers (m)

RoFRaS Rating

- Very Low
- Low
- Medium
- High

7 Flooding

7.1 River and Coastal Zone 2 Flooding

Is the site within 250m of an Environment Agency Zone 2 floodplain? No

Environment Agency Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 7a – Flood Map for Planning:

Database searched and no data found.

7.2 River and Coastal Zone 3 Flooding

Is the site within 250m of an Environment Agency Zone 3 floodplain? No

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 7a – Flood Map for Planning.

Database searched and no data found.

7.3 Risk of Flooding from Rivers and the Sea (RoFRaS) Flood Rating

What is the highest risk of flooding onsite? Very Low

The Environment Agency RoFRaS database provides an indication of river and coastal flood risk at a national level on a 50m grid with the flood rating at the centre of the grid calculated and given above. The data considers the probability that the flood defences will overtop or breach by considering their location, type, condition and standard of protection.

RoFRaS data for the study site indicates the property is in an area with a Very Low (less than 1 in 1000) chance of flooding in any given year.

7.4 Flood Defences

Are there any Flood Defences within 250m of the study site? No

Database searched and no data found.

7.5 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

7.6 Areas benefiting from Flood Storage

Are there any areas used for Flood Storage within 250m of the study site? No

7.7 Groundwater Flooding Susceptibility Areas

7.7.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site? Yes

Does this relate to Clearwater Flooding or Superficial Deposits Flooding? Superficial Deposits Flooding

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

7.7.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Potential at Surface

Where potential for groundwater flooding to occur at surface is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

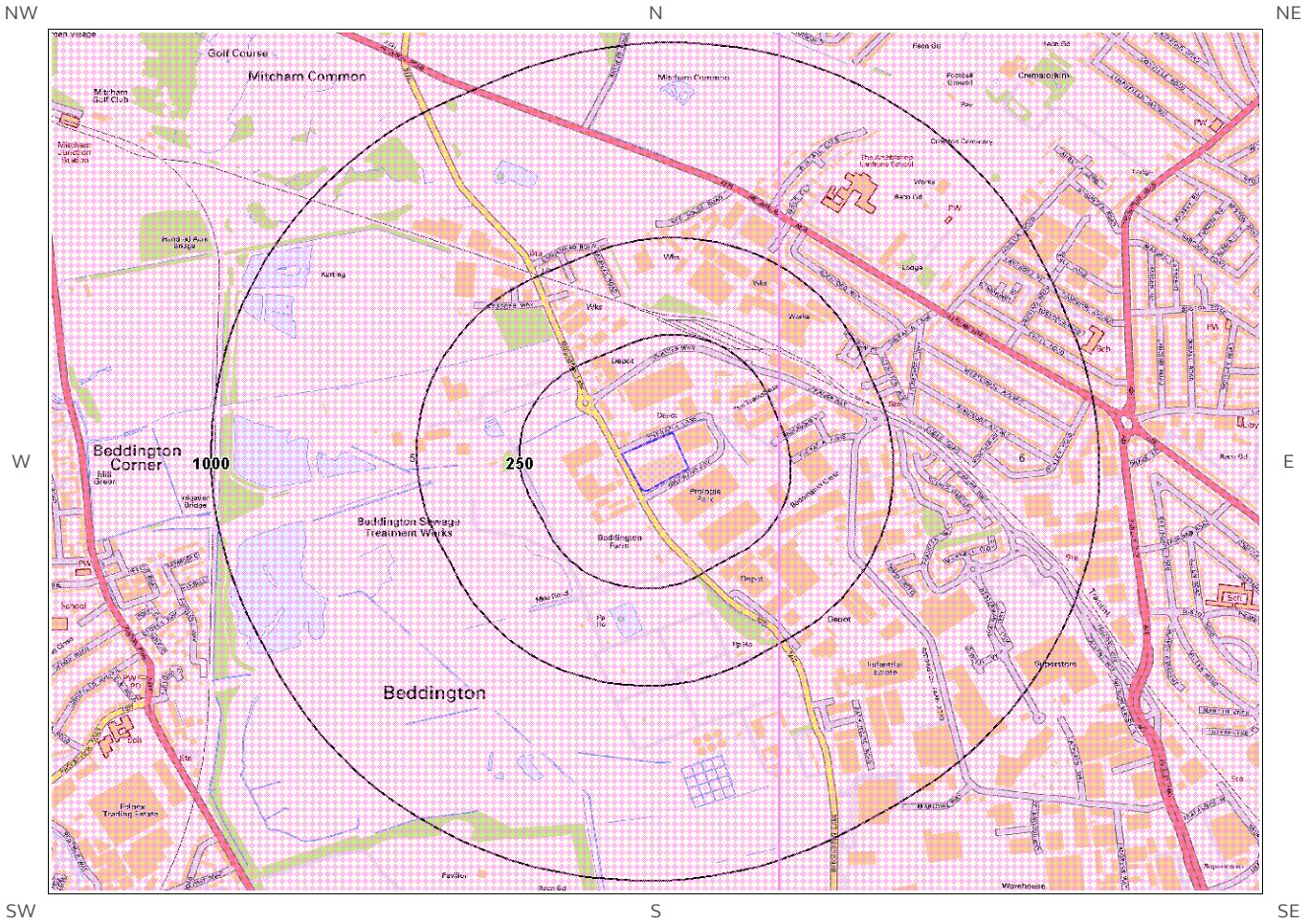
7.8 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? Moderate

Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

8. Designated Environmentally Sensitive Sites Map



Site Outline

100
250
Search Buffers (m)

AONB

National Park

SSSI

Special Protection Areas

Nitrate Vulnerable Zones

Green Belt

Environmentally Sensitive Areas

Special Areas of Conservation

World Heritage Sites

Nitrate Sensitive Areas

Ancient Woodland

National Nature Reserve

Local Nature Reserves

Ramsar Sites

8. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site?	Yes

8.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

0

Database searched and no data found.

8.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

8.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

8.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

8.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

8.6 Records of Ancient Woodland within 2000m of the study site:

0

Database searched and no data found.

8.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

4

The following Local Nature Reserve (LNR) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	LNR Name	Data Source
Not shown	1614	W	Spencer Road Wetlands	Natural England
Not shown	1716	SW	Wilderness Island	Natural England
Not shown	1749	W	Wandle Valley Wetland	Natural England
Not shown	1871	SW	The Spinney, Carshalton	Natural England

8.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

8.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

8.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

8.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

8.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

2

The following Nitrate Vulnerable Zone records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	NVZ Name	Data Source
5	0	On Site	Existing	DEFRA
6	222	E	Existing	DEFRA

8.14 Records of Green Belt land within 2000m of the study site:

0

Database searched and no data found.

9. Natural Hazards Findings

9.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a Groundsure Geo Insight, available from our website. The following information has been found:

9.1.1 Shrink Swell

What is the maximum Shrink-Swell*[*] hazard rating identified on the study site? Moderate

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly high plasticity. Do not plant or remove trees or shrubs near to buildings without expert advice about their effect and management. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a probable increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a probable increase in insurance risk during droughts or where vegetation with high moisture demands is present.

9.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

9.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? Negligible

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.

* This indicates an automatically generated 50m buffer and site.

9.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? Moderate

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Extra construction costs are likely. For existing property possible increase in insurance risk from compressibility, especially if water conditions or loading of the ground change significantly.

9.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

9.1.6 Running Sand

What is the maximum Running Sand** hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

9.2 Radon

9.2.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level.

* This indicates an automatically generated 50m buffer and site.

9.2.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing
ones as described in publication BR211 by the Building Research Establishment? No radon protective measures are necessary.

10. Mining

10.1 Coal Mining

Are there any coal mining areas within 75m of the study site?	No

Database searched and no data found.

10.2 Non-Coal Mining

Are there any Non-Coal Mining areas within 50m of the study site boundary?	No

Database searched and no data found.

10.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site?	No

Guidance: No Guidance Required.

Contact Details

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info@groundsure.com

British Geological Survey Enquiries
Kingsley Dunham Centre
Keyworth, Nottingham NG12 5GG
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Fax: 0115 936 3276.
Email:
Web:**www.bgs.ac.uk**
BGS Geological Hazards Reports and general geological enquiries:
enquiries@bgs.ac.uk

Environment Agency
National Customer Contact Centre, PO Box 544
Rotherham, S60 1BY
Tel: 08708 506 506
Web:**www.environment-agency.gov.uk**
Email:**enquiries@environment-agency.gov.uk**

Public Health England
Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
www.gov.uk/phe
Email:**enquiries@phe.gov.uk**
Main switchboard**: 020 7654 8000**

The Coal Authority
200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Ordnance Survey
Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505

Local Authority
Authority: London Borough of Sutton
Phone: 020 8770 5000
Web: http://www.sutton.gov.uk/
Address: Civic Offices, St. Nicholas Way, Sutton, SM1 1EA

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Virginia Villas, High Street, Hartley Witney,
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Tel: 01252 845444

Standard Terms and Conditions

Groundsure's Terms and Conditions can be viewed online at this link:
https://www.groundsure.com/terms-and-conditions-sept-2016

ANNEX E PREVIOUS REPORTS

APPENDIX A

MOTT MACDONALD ENVIRONMENT: REPORT

Ke 2079

London Borough of Sutton

Beddington Lane Landfill Site

Investigation of Contaminated Land
Draft Report
Volume I of II

October 1991

LONDON BOROUGH OF SUTTON
BEDDINGTON LANE LANDFILL SITE
INVESTIGATION OF CONTAMINATED LAND
DRAFT REPORT
VOLUME I OF II

Rev	Date	Originator	Checked	Approved	Status
0	August '91	J D Ridley S M Pruce	P F Lingwood	R A B Hall	Draft
01	October '91	S M Pruce S M Pruce	P F Lingwood H A Leberman	J M Barron	Draft

LONDON BOROUGH OF SUTTON
BEDDINGTON LANE LANDFILL SITE
INVESTIGATION OF CONTAMINATED LAND
DRAFT REPORT VOLUME I OF II
CONTENTS

Not Included

LIST OF TABLES

FIGURES

LIST OF ATTACHMENTS

ABBREVIATIONS

HSE	Health and Safety Executive
GIA	Volume for volume percentage Gas in Air
LEC	Lower Explosive Limit
LSM	Limiting Safe Mixture
m bgl	meters below ground level
UEL	Upper Explosive Limit
WMP	Waste Management Paper
ICRCL	Interdepartmental Committee on the Redevelopment of Contaminated Land

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Mott MacDonald Environmental Consultants were appointed by Sutton Borough Council in June 1991 to undertake a site investigation to identify the constraints to the development of Beddington Lane Landfill site. A site investigation was undertaken in June 1991, the results of which are contained in this report.

These results allowed the following conclusions to be drawn:

- the site is a potential hazard to the general public from landfill gas migrating out of the site and from unauthorised entry by children who may be exposed to the soil. The London Borough of Sutton, as owners of the site, are responsible in both civil and criminal cases for hazards arising from the site;

- the site is unsuitable for the development without remedial measures both to control landfill gas and to prevent contact with the tip material;

- a number of options for the development of the site have been examined. All will have an adverse effect on the environment and are likely to be expensive. It is not possible at this stage to define the most appropriate strategy without more information on the site and consideration of the council's requirements;

- it is considered that the site is a hazard to the public at present. Even if the site is not developed, remedial measures will in any case be required; and

- it is recommended that a further investigation is undertaken in order to:

  - assess the risk from landfill gas within and migrating out of the site;
  - provide a cost benefit analysis of developing the site; and
  - study any impact on the adjacent watercourse.

1.0 INTRODUCTION

1.0 INTRODUCTION

1.1 Background

In May 1991 the London Borough of Sutton, wishing to develop Beddington Lane Landfill Site, commissioned Mott MacDonald Environment to undertake a contaminated land survey.

Beddington Lane Landfill Site is situated south-east of Bedding Lane/Therapia Lane junction. The location of the site is indicated in Figure 1.1, Ordnance Survey plan TQ2966, grid reference 298-667, and occupies an area of approximately 5.5 hectares (14.5 acres).

1.2 The Consultancy Brief

A wide range of proposals are currently being considered by the London Borough of Sutton with regard to development of the site. Proposals involve one of the following options:

- leave the bulk of the material intact, level the surface, form an access ramp onto the site;
- remove bulk of waste material to ground level, leaving below ground level material intact;
- the removal of all waste material and fill with inert material to ground level; or
- the removal of all waste material only.

The proposal eventually adopted will depend upon the type and extent of ground contamination revealed by the site investigation.

The consultancy brief was to conduct a site investigation in order to determine uses to which the land may be put, together with the necessary health and safety precautions recommended. Uses to be considered should include a full range of possibilities from

playing fields, through storage and handling of materials, to full development for warehouse, office or retail use. (The site investigation comprised the excavation and logging of 15 trial pits and 10 boreholes, spaced at approximately 50m intervals).

1.3 Report Structure

Section 2 (Site History), gives a description of the site, its previous land use and the contaminants which may be associated with such use.

Section 3 (Investigation Strategy), gives a description of and reasons for the site investigation work undertaken, including the methodology adopted.

Section 4 (Results), presents the results of chemical analyses on both soil and water samples, landfill gas analyses and the results of the radioactivity survey.

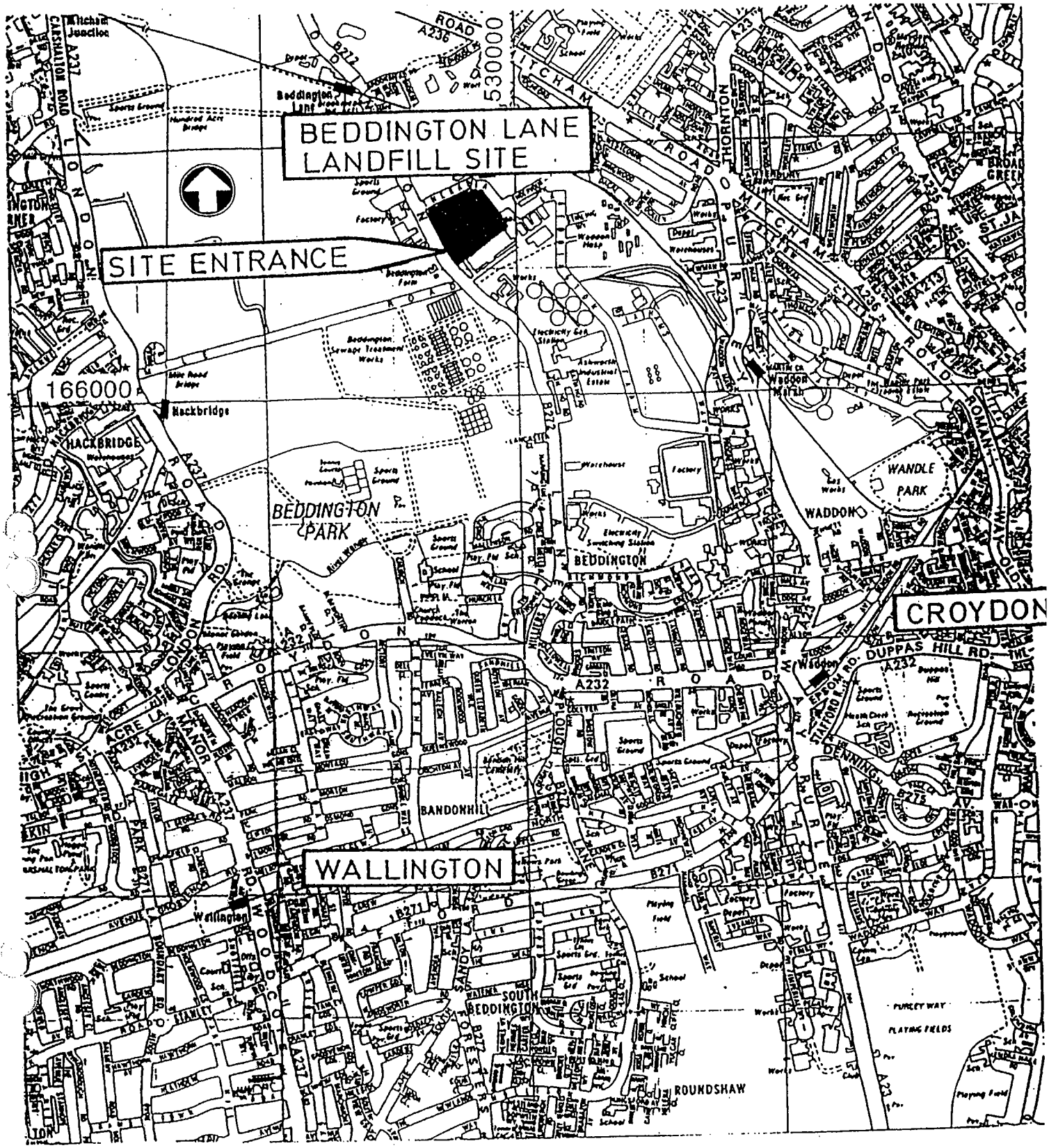
Section 5 (Assessment of Hazards) provides an explanation of the results and an indication of the risk or hazards posed.

Section 6 (Development Options), discusses the options for developing the Site proposed by the London Borough of Sutton.

Section 7 (Health and Safety), recommends precautions that will be required during any development.

Section 8 (Conclusions and Recommendations), concludes the report and makes recommendations regarding development of the Site.

Cost estimates for development of the Site have not been requested. However, where appropriate, financial implications of the respective development options and some associated mitigatory work have been assessed.



BEDDINGTON LANE LANDFILL SITE

Title: BEDDINGTON LANE LANDFILL SITE INVESTIGATION 1991 LOCATION PLAN					Drawing no. FIGURE 1.1	Rev. 0
Date JLY 9	Drawn MT	Checked SP	Approved	Scale 1:21000		

Mott MacDonald
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St Anne House, 20-26 Wellesley Road
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Telephone 081-686 5041
Fax 081-681 5706 / 081-688 11
Telex 917241 MOTTAY G

2.0 SITE HISTORY

2.0 SITE HISTORY

2.1 Historical Background

The site is situated in an area of mixed industrial uses. It is understood that the site was originally a sand and gravel working, excavated to approximately 5-6 metres below ground level. No site records are available before 1965. The exact extent of waste disposal operations prior to this date are unknown, although it is believed that some minor landfill operations were carried out.

In 1965 when the site was taken over by the Greater London Council (GLC), the area had been filled and raised above the surrounding ground level by up to 6 metres. No records are available as to the engineering of the site for landfilling. It is believed that there were no special precautions built in to control leachate or landfill gas. The site remained in this condition up until 1986 when the GLC was abolished, whereupon it was vested in the London Borough of Sutton for waste disposal purposes.

2.2 Previous Investigations

In 1989 the Council commissioned the Polytechnic of East London to undertake a site investigation and gas monitoring programme. A grid comprising 16 boreholes was used (Fig. 2.1). Waste was located in the boreholes to a maximum depth of 9m bgl.

Gas monitoring revealed significant concentrations of methane and carbon dioxide in a number of boreholes, and significant levels of carbon dioxide and oxygen in others suggesting distinct areas of anaerobic and aerobic decomposition within the waste. The presence of oxygen indicates that there is significant dilution of landfill gas by air.

Leachate condensate was recorded at the surface of two boreholes and phenolic and oily odours were recorded frequently. During 1990 and the early part of 1991, regular gas monitoring was conducted in the drains and service ducts outside the site boundary, and no landfill gas was detected.

2.3 Site Geology/Hydrogeology

Prior to sand and gravel extraction, the superficial geology comprised up to 10 metres of the second River Terrace located on the London clay. The second River Terrace is one of the lowest and youngest terraces and typically consists of coarse, sandy gravels.

The solid geology below the site consists of 107-137m of London clay, underlaid by the Woolwich and Reading beds 13-26m and the Thanet Beds 0-18m.

2.4 Groundwater

Groundwater levels have not been recorded immediately outside of the site. However, investigations elsewhere indicate that the gases may often be saturated to 1m below ground level. The gravels in the upper horizons are likely to be highly permeable an groundwater will probably flow down the slope of the gravel/London clay interface. This has been shown to be very undulating and to consist of a number of local dips and hollows, some of which may be continuous.

2.5 Surface Water

A surface water stream flows along the western boundary of the site. Its appearance suggests that it is contaminated but this contamination may be derived from upstream rather than the landfill site. The water levels within the site are generally below surrounding ground level. It is therefore probable that water from the stream is flowing into rather than out of the landfill.

3.0 INVESTIGATION METHODOLOGY

3.0 INVESTIGATION METHODOLOGY

3.1 Objectives

The investigation strategy was designed to:

- o accurately identify the ground conditions/characteristics of the site;
- o identify uses to which the site may be put; and
- o recommend a strategy for the safe development of the site.

To achieve these objectives a site investigation strategy was devised, based on a 50 metre grid sampling system and two distinct phases, as outlined in Sections 3.2 and 3.3 below.

3.2 Trial Pits

A total of fifteen trial pits were excavated to a depth of about 3 metres; the approximate location of the trial pits is shown in Figure 3.1. A detailed examination of the deposited waste was made in order to:

- o determine the presence of a capping layer;
- o identify the type of material deposited;
- o describe the manner of deposition;
- o determine the presence of water; and
- o collect soil and water samples for laboratory analysis.

For health and safety reasons, trial pits were logged from the surface as follows (according to BS5930 : 1981, Code of Practice for Site Investigations):

- excavate and stockpile topsoil;
- excavate and stockpile clay capping, if present;
- log, sample and test in situ to a maximum depth of 1.2m; and
- excavate pit to full depth, inspecting material excavated, recording colour and odour, depth of strata changes, description of each stratum as excavation proceeds, sketch pit face.

Tests were carried out periodically for gas (Section 3.5) and radioactivity (Section 3.6).

Records were also made of the following:

- the depth, location, colour and smell of any seepages or inflows;
- the ease or difficulty of excavation;
- the stability of the trial pit; and
- a photographic record of the excavated material and trial pit.

On completion, each trial pit was back filled in layers not greater than 1 metre and each layer compacted with the back of the excavator bucket. Any hazardous material was replaced first and the excavated topsoil last.

The trial pit logs and photographs are contained in Attachments 2 and 3 respectively.

3.3 Boreholes

Ten boreholes were drilled between June 28th and July 7th 1991 at the locations shown on the Site Plan, Figure 3.1 Eight of the boreholes were drilled to a depth of 10 to 12m,

and two to a depth of 20m.

The boreholes were drilled by South Eastern Soils by cable tool percussion boring. Large bulk disturbed samples were taken at 1m intervals through the Made Ground and London Clay, and these were subsequently logged by a Mott MacDonald engineer. Standard Penetrations Tests (SPTs) were carried out near to the top and base of the Made Ground and at 1.5m intervals within the two deeper boreholes in the London Clay. A limited number of undisturbed samples (U100s) were taken in the London Clay. Water samples were also taken from a number of boreholes.

The purpose of the boreholes was to:

- identify the type of material deposited at depths greater than 3 metres;
- assess the density of the ground by carrying out Standard Penetration Tests (SPT) at regular intervals throughout the waste; and
- collect soil and water samples for laboratory analysis.

Samples were taken at varying depths so as to explore all the available options for developing the site.

3.4 Chemical Analyses

3.4.1 Soil

London Borough of Sutton requested analysis for the following parameters:

Lead	Total Cyanide
Zinc (total and available)	Free Cyanide
Copper (total and available)	Toluene Extractable Matter
Nickel (total and available)	Boron (Water Soluble)
Chromium	Sulphate
Mercury	Sulphide
Cadmium	Sulphur (Elemental)

pH	Arsenic

The Consultants recommended analysis for moisture content, loss on ignition and calorific value in order to assist in assessing the characteristics of the waste.

In addition, a number of soil samples were analysed for the presence of phenols due to the detection of a slight chemical odour in the excavated waste. It was suspected that asbestos may be present on the site. The Consultants originally allowed for the analysis of 5 samples, however due to the occurrence of asbestos in a number of samples, analysis was extended to all soil samples.

3.4.2 Leachate

Water samples were taken from boreholes for laboratory analysis for the following indicator parameters:

pH	BOD (Biochemical Oxygen Demand)
Ammonia	COD (Chemical Oxygen Demand)
Chloride	

3.5 Landfill Gas

Prior to this survey, methane, carbon dioxide and oxygen monitoring was conducted by the Polytechnic of East London between October 1989 and January 1991 (Borehole Installation Project 204.167/P032-008, September 1989). During this period, approximately 12 surveys were conducted using portable GMI Oxygas Gascoseekers and portable CO_2 meters on a grid of 16 boreholes (see Figure 2.1).

It was considered that for this survey, monitoring at 8 out of the 16 boreholes was sufficient to be representative of site conditions and to ensure compatibility with the previous Polytechnic of East London data. The following gases were analysed:

- methane (CH_4)
- carbon dioxide (CO_2)
- oxygen (O_2)

- hydrogen (H_2)
- hydrogen sulphide (H_2S)

The latter two gases were analysed by Dräger tubes on site and the remainder by gas chromatography at a NAMAS accredited laboratory. Consequently, this survey is not only the most recent but also the most accurate and comprehensive to date. The results and borehole locations are given in Table A6.1, Attachment 6 and discussed in Section 4.0.

3.6 Radioactivity Survey

A survey of the site and immediate surroundings was conducted, on 27th June 1991, in order to:

- identify the presence of elevated levels of beta and gamma radiation as an indication of radioactive contamination; and
- assess the risk, if any, involved in the development of the site.

Measurements were taken:

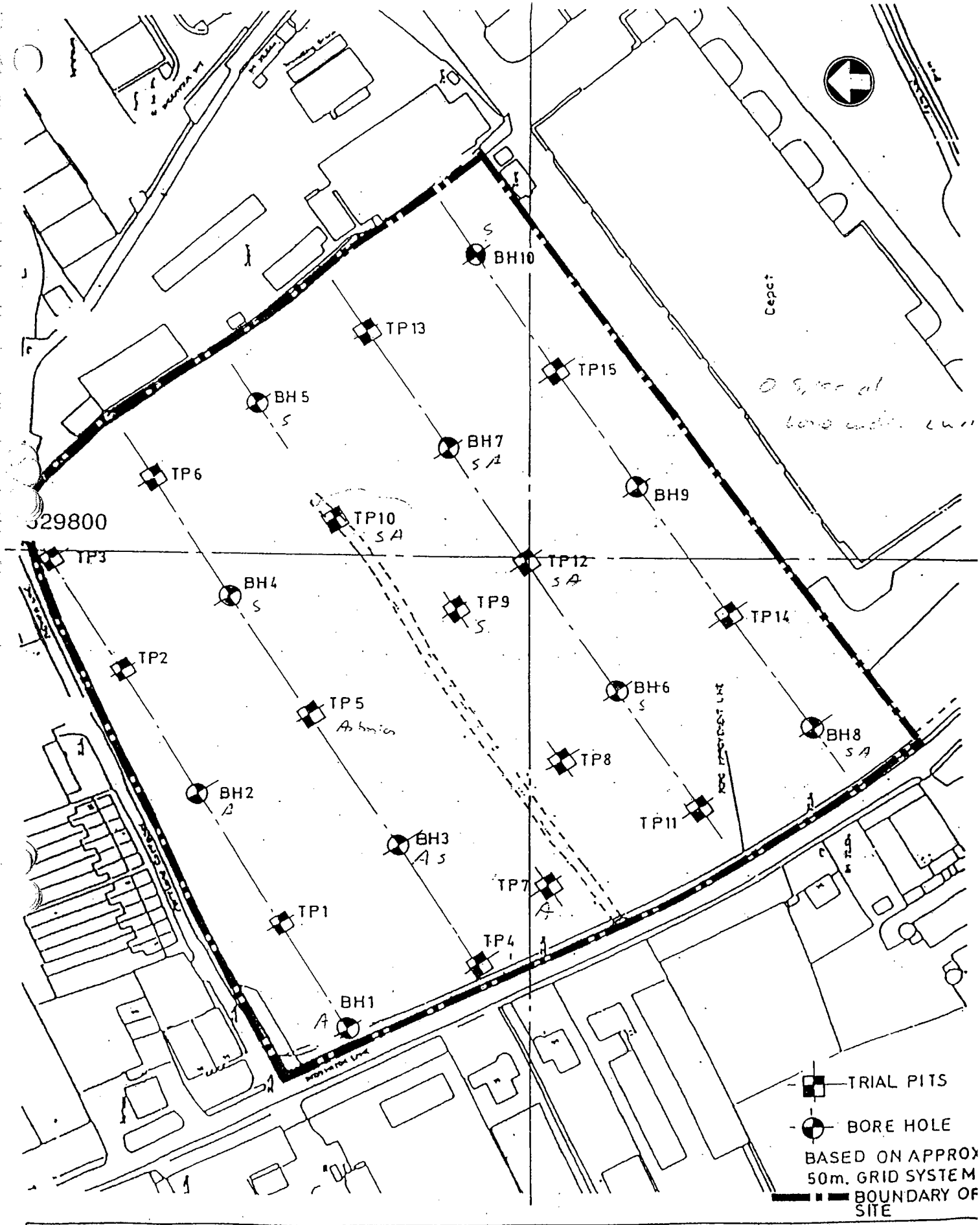
- at 15 trial pit locations on the site (Figure 3.1); and
- at selected fixed structures within 100 metres of the site.

A mini instrument series 900 Mini Contamination Monitor with type EL tube was used for the survey. This was fitted with a Geiger-Muller probe which has a sensitivity sufficient to measure down to 3.5Bqcm^{-2}Measurementswere taken along transects at 5 to 10cm above the ground surface.

3.7 Waste Characteristics

The investigation required the determination of the following waste characteristics:

- method of placing and compaction;



Title: BEDDINGTON LANE LANDFILL SITE INVESTIGATION 1991 LOCATION OF BOREHOLES AND TRIAL PITS					Mott MacDonald	
Date: JUL 91	Drawn: MT	Checked: SP	Approved:	Scale: 1:1250	Drawing no. FIGURE 3.1	Rev. 0

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4.0 RESULTS

4.0 RESULTS

4.1 Introduction

The full analytical results for soil, gas and water analyses, the radioactivity survey and the geotechnical tests, are given in Attachment 4 to 8 respectively. These results have been collated and assessed in relation to:

- o appropriate guidelines and legislative standards;
- o the spatial and vertical distributions of the samples;
- o the proposed options for development; and
- o the results available from previous studies.

4.2 Soil Contamination

4.2.1 Guidelines

In order to assess the significance of any contamination the results (Attachment 4, Tables 4.1 and 4.2) have been (where possible) compared with established guidelines for contaminated soil. These are derived from the Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL), Guidance Note 59/83 second edition (Department of Environment). These guidelines are provided to assist in the interpretation of data and provide a basis for decision making, and not to give a definitive risk/no risk assessment.

The guidance note establishes 'threshold' and 'action' trigger concentrations for potentially contaminated soil and using these, three zones of potential risk may be defined:

- o threshold trigger concentrations define the level at which the contaminant becomes significant, below this it is considered that the site is uncontaminated (Zone I);
- o above the threshold trigger concentration but below the action trigger

concentration there is an intermediate zone (Zone II) where there is a need to consider whether the presence of the contaminant justifies remedial action. This does not automatically indicate that the risk is significant; and

- the third zone (Zone III), where the concentration is equal to or greater than the action trigger level and the risk resulting from the contaminant is considered to be sufficiently high that its presence is unacceptable. Some form of remedial action or change in the proposed use of the site is therefore required.

At present, ICRCL guidelines are available for twenty contaminants and a variety of proposed end uses (e.g. domestic gardens, allotments, buildings or hard cover). The guidelines are reproduced in Attachment 8. In assessing the hazard posed by other soil contaminants (e.g. toluene extractable matter and the 'available' metals) it has been necessary to use professional judgement and the Consultants experience of similar sites.

In order to provide an indication of the combustibility of the waste material, two tests were undertaken:

- loss on ignition; and

- the calorific value, when the loss on ignition exceeded 15% (i.e. that associated with a loamy soil).

The ICRCL document 'Notes on the Development and after-use of Landfill Sites' recognises that a sample with a calorific value in excess of 11.0MJ/kg would almost certainly sustain smouldering whilst below 2.0MJ/kg the waste would be unlikely to.

All soil samples taken have been analysed for the presence of asbestos. The ICRCL does not provide a trigger concentration for asbestos, although it is widely considered that the presence of asbestos, even in small concentrations, can constitute a potential risk.

The hazards associated with each of the contaminants and their potential impact upon any proposed development are discussed in Section 5.0.

4.2.2 Summary of Results

Lead

Of the sixty nine samples analysed, thirty three samples exceeded the ICRCL threshold trigger concentration for 'domestic gardens, allotments' of 500mg/kg. Of these, one sample (BH8 at 7.0m) with a concentration of 5,050mg/kg also exceeded the threshold trigger concentration for 'parks, playing fields, open space' of 2,000mg/kg. No action trigger concentrations have yet been set for this contaminant.

The contamination was detected randomly across the site and at depths down to 7.0m below ground level (bgl).

Total Zinc

Of the sixty nine samples analysed, forty seven exceeded the ICRCL threshold trigger concentration for 'any uses where plants are to be grown' of 300mg/kg. The highest concentration recorded was 4,200mg/kg in BH8 at 7.0m. No action trigger concentrations have yet been set for this contaminant.

The contaminant was detected randomly across the site at depths down to 7.0m bgl.

Available Zinc

Concentrations of available zinc ranged between 9.7 and 365mg/kg in the sixty nine samples analysed. Using five samples can be classified as 'slightly contaminated'.

Total Copper

Of the sixty nine samples analysed, thirty six exceeded the ICRCL threshold trigger concentration for 'any uses where plants are to be grown' of 130mg/kg. The highest concentration, 3,000mg/kg was found in BH8 at 7.0m. Action trigger concentrations have yet to be set for this contaminant.

The contamination was disturbed randomly across the site and detected depths down to the base of the fill (approx. 9.0m).

Available Copper

Of the sixty nine samples the following levels of contamination were found (based on the Consultants professional judgement):

- sixty samples were 'uncontaminated';
- five samples were 'slightly uncontaminated' (i.e. between 100-200mg/kg);
- three samples were 'contaminated' (i.e. between 200-500mg/kg); and
- one sample (BH8 at 7.0m) was 'heavily contaminated' (i.e. between 500-2000mg/kg) and had a concentration of 940mg/kg.

Contamination was detected randomly across the site at depths down to 7.0m bgl.

Total Nickel

Fifteen samples of the sixty nine analysed exceeded the ICRCL threshold trigger concentration for "any uses where plants are to be grown". The highest concentration, 590mg/kg was detected in BH8 at 7.0m depth. An action trigger concentration has not been established.

The contamination was distributed randomly across the site and with depth.

Available Nickel

One sample from the sixty nine analysed was found to be 'contaminated' according to the Consultants professional judgement. This was sample BH8 at 7.0m depth. The remaining samples were found to be typical of uncontaminated soils.

Chromium

None of the sixty nine samples analysed exceeded the ICRCL threshold trigger concentration.

Mercury

Of the sixty nine samples analysed, thirty one exceeded the ICRCL threshold trigger concentration for 'domestic gardens, allotments' of 1mg/kg. Of these one sample also exceeded the threshold trigger concentration for 'parks, playing fields and open space' of 20mg/kg. This was detected in sample BH1 at 4.0m depth which had a concentration of 34.6mg/kg. An action trigger concentration has not been established for this contaminant.

The contamination was distributed randomly across the site up to a depth of 7.0m.

Cadmium

Thirteen of the sixty nine samples analysed exceeded the ICRCL threshold trigger concentration for 'domestic gardens, allotments' of 3mg/kg. Of these, one sample (BH8 7.0m) also exceeded the threshold trigger concentration for 'parks, playing fields and open space' of 15mg/kg; the concentration detected was 35.1mg/kg. An action trigger concentration has not been established for this contaminant.

The contamination was distributed randomly across the Site and at depths down to 7.0m. No contamination was detected in any of the surface samples analysed.

Arsenic

Of the sixty nine samples analysed, thirty three exceeded the ICRCL threshold trigger concentration for 'domestic gardens, allotments' of 10mg/kg. Of these, three samples (TP10 at 1.0m; TP10 at 2.5m; BH1 at 4.0m) also exceeded the threshold trigger concentration for 'parks, playing fields and open space' of 40mg/kg. The highest concentration detected, 62.2mg/kg was found in BH1 at 4.0m depth. An action trigger concentration has not yet been established for Arsenic.

Arsenic contamination was distributed randomly across the Sites and present in all depths down to the base of the fill and at one sample below the base of the fill (BH1 at 19.0m depth) at a concentration of 10.8mg/kg.

pH

The lowest pH was 6.1; the highest 10.3. The average pH across the Site was approximately 7.5 i.e. within the neutral to alkaline range.

Phenol

No contamination was detected in any of the six samples analysed despite the phenolic odour reported by the Polytechnic of East London.

Total Cyanide

Of the sixty nine samples analysed no contamination was detected. The highest concentration was 40.9mg/kg.

Free Cyanide

Of the sixty nine samples analysed no contamination was detected. The highest concentration found was 9.2mg/kg in TP1 at 5.0m depth.

Water Soluble Boron

Of the sixty eight samples analysed (one result is still due), forty one samples exceeded the ICRCL threshold trigger concentration for "any uses where plants are to be grown" of 3mg/kg. The highest concentration detected, 87.4mg/kg was found in BH4 at 3.0m depth. No action trigger concentration has yet been set.

Contamination was distributed randomly across the Site, and also in the two samples taken from below the waste (3.89mg/kg in BH1 at 19.0m depth and 3.90mg/kg in BH10 at 19.25m depth).

Sulphate

Of the sixty nine samples analysed, thirty exceeded the ICRCL threshold trigger concentration of 2000mg/kg (0.2%) for 'domestic gardens, allotments, landscaped areas' 'buildings' and 'hard cover'. None of the action trigger concentrations were exceeded.

Contamination was distributed randomly across the Site.

Sulphide

None of the sixty nine samples analysed exceeded the ICRCL threshold trigger concentration of 250mg/kg. The highest concentration, 142mg/kg, was found in BH3 at 2.5m depth.

Sulphur

Of the sixty nine samples analysed, just one (BH4 at 3.0m with a concentration of 8,810mg/kg) exceeded the ICRCL threshold trigger concentration for 'all proposed uses' of 5,000mg/kg.

Toluene Extractable Matter

Using the Consultants professional judgement the sixty nine samples analysed can be placed into the following categories:

- fifty three samples were 'uncontaminated';
- six samples were slightly contaminated (i.e. between 5,000mg/kg and 1%);
- eight samples were 'contaminated' (i.e. between 1% and 5%);
- one sample, TP12, 2.8m, had a concentration of 7.75% and can therefore be categorised as 'heavily contaminated'; and
- one sample, TP5, 0.4m, with a concentration of 83.3% can be categorised as

'unusually heavily contaminated'.

Contamination was detected randomly across the Site from the surface down to 7.0m depth.

Moisture Content

This ranged between 9.5% (TP14 at 0.2m) and 46.3% (BH3 at 2.5m).

Loss on Ignition

Of the sixty nine samples analysed, eleven had a loss on ignition of greater than 15%. These were therefore further analysed for calorific value.

Calorific Value

Of the eleven samples analysed:

- one sample (TP5 at 4.0m) with a calorific value of 11.0MJ/kg would almost certainly sustain smouldering;
- four samples may potentially sustain smoulding; and
- six samples are unlikely to sustain smouldering.

Asbestos

Amosite (brown asbestos) and/or chrysotile (white asbestos) was detected in concentrations up to 40% in twelve of the sixty nine samples analysed. The asbestos was detected randomly across the Site and to within 1.0m of the surface of the Site in loose fibrous and board form.

4.3 Leachate

4.3.1 Introduction

Leachate is the terminology adopted for the liquid encountered within and often outside a landfill site. The site investigation only gave access to leachate monitoring within the site. As far as we are aware, no information is available regarding the presence of leachate outside of the site, if it indeed exists.

4.3.2 Levels

Leachate was identified at all the boreholes drilled, Table 3.1. No monitoring over time could be undertaken because the holes were subsequently backfilled. The levels are very variable as would be expected from the hetrogenerity of the waste within the site. However generally, leachate levels are between 3m and 7m below the upper surface of the landfill with 1.5m to 4m of the waste being saturated. If it is estimated that the landfill site measures approximately 3m above the level of the surrounding ground, then all water levels are 2-4m below this level.

4.3.3 Quality

No specific guidelines directly relevant to water contamination on landfill sites are available. However, the results of the water analysis of the six samples taken near the base of the fill (see Attachment 5) indicate:

- a neutral to alkaline pH;
- a very high Chemical Oxygen Demand (COD) ranging between 10,000mg/l to 29,000mg/l;
- a high Biochemical Oxygen Demand (BOD) ranging between 112 and 3,049mg/l;
- a chloride content between 65 and 405mg/l; and
- an ammonia content of several hundred mg/l (between 320 and 1,000mg/l).

It should be noted that the contaminants analysed were only indicators and represent only a small number of potential contaminants which may be present. However, the results indicate that the groundwater ('leachate') within the site is heavily polluted.

- methane - monitoring should continue until the maximum concentration of gas falls below 1% by volume;

- carbon dioxide - concentrations should not exceed 0.5% by volume. Unconfirmed reports indicate that in the latest (unpublished) revision of WMP27, the carbon dioxide limits are relaxed to 1.5% by volume.

- hydrogen - no actual guidelines are recommended. However, typical values of 0.05% by volume are given; and

- hydrogen sulphide - again, no guidelines are recommended but typical values of 0.00002% by volume are given

Interdepartmental Committee on the Redevelopment of Contaminated Land Guidance Note 17/78 (ICRCL17/78)

Guidelines within ICRCL17/78 are more stringent than those contained in the Building Regulations, but are the same as those contained in WMP27 and have therefore been used in assessing the significance of gas concentrations measured at the site.

Health and Safety Executive (HSE) Guidance Note 40/90

The HSE give the following guidelines for human exposure to landfill gases as long term exposure limits (8 hour time weighted average (TWA) reference period) and short term exposure limits (10 minute TWA reference period):

- methane - no guidance is given by the HSE on asphyxiant gases such as methane and hydrogen. However, the oxygen content of air should never be allowed to fall below a minimum of 18% by volume;

- carbon dioxide - the long term exposure limit is 0.5% by volume and the short term exposure is 1.5% by volume; and

- hydrogen sulphide - the long term exposure limit is 0.001% by volume and the short term exposure limit is 0.0015% by volume.

These Guidelines are summarised in Table 4.5.

4.4.2 Summary of Results

Methane

Data from the July 1991 monitoring is given in Table A61 (Attachment 6) and shown as a methane "contour" map in Figure 4.2. A computer generated 3 dimensional visualisation of the methane concentrations is given in Figure 4.3.

The results vary widely from < 1% to a maximum of 24%. There appears to be no downward trend in methane generation over the period of monitoring, however there are spacial differences in concentrations. The North Western part of the site (the A-series boreholes on Fig. 2.1) contains the highest methane concentrations, ranging from a low of 1.5% to a high of 24%, averaging at 13.2% over the monitoring period. Over 60% of all measured concentrations exceed the ICRCL 1% GIA guidelines. The general trend of the spacial distribution is higher concentrations at the North West of the Site to lower concentrations at the South East perimeter.

The ramifications of these methane concentrations are discussed in Section 5.3.

Carbon Dioxide

Data from the July 1991 monitoring is shown in Table 4.1. (Attachment 6) with a carbon dioxide "contour" map given in Figure 4.4 and visualised in 3 dimensional in Figure 4.5. Carbon dioxide concentrations vary from < 1% to 26% by volume, nearly all of which the 98%, are above ICRCL guidelines concentrations. There appear to be no temporal trends in carbon dioxide concentrations which in common with methane appears highest at the North Western part of the site and lowest in the South East. The hazards associated with these carbon dioxide concentrations are discussed in Section 5.3.

Oxygen

The data from the July 1991 monitoring are given in Table A6.1 (Attachment 6) and shown as an oxygen "contour" map in Figure 4.6. A 3 dimensional computer visualisation of this data is shown in Figure 4.7 - this can be compared to the 3 dimensional methane visualisation in Figure 4.5 to show the inverse relationship between these two gases. It

should be noted that the orientation of Figure 4.7 has been changed by 180° to enable the surface to be viewed.

The oxygen concentrations measured were generally low, most below 1%, and corresponded to the higher concentrations of methane as would be expected; the generation of methane requires anaerobic conditions, i.e. oxygen-free. The peaks in oxygen concentration were mirrored by very low concentrations of methane.

Hydrogen and Hydrogen Sulphide

The concentrations of hydrogen and hydrogen sulphide measured in July 1991, are given in Table A6.1 in Attachment 6.

The hydrogen concentrations were so low as to be undetectable, suggesting that the anaerobic digestion process is in an advanced stage - most hydrogen is generally produced within the first five years.

The hydrogen sulphide concentrations that were detectable ranged from 0.0001% to 0.0006% by volume, and although these concentrations are considerably higher than the "typical" values stated in WMP27, they are almost insignificant when compared to the concentrations of other landfill gas constituents.

4.5 Radioactivity Survey

The results of the survey, as detailed in Attachment 7 and summarised in Figure 4.1, show an average measurement of 1-2 counts per second being detected on the site. Level encountered at the locations around the site were of the same magnitude but with a maximum reading of 4 counts per second immediately south of the site. These results compare with the normal background range for clay and chalk areas of 2-3 counts per second.

4.6 Waste Characteristics

4.6.1 Ground Conditions

The ground conditions encountered are described on the borehole logs, Attachment I and are summarised in the Table 4.6.

The Made Ground contains a high proportion of inorganic soil mixed with man-made materials. The gravel with the Made Ground is predominantly composed of flint and brick fragments. Within stratum a_2 man-made materials are sometimes absent, and the stratum resembles natural Terrace Gravel. Stratum a_3 is a mixture of clay derived from the London Clay and material from the overlying stratum a_2; where man-made materials are occasionally absent it resembles the Terrace Deposits of the area.

The top of the London Clay was sometimes softened, but the brown weathered clay was generally absent. The clay is fissured and contains partings and thin laminae of silt.

Groundwater was encountered in the boreholes generally at 5 to 8m depth.

4.6.2 Engineering Properties

The Standard Penetration Test (SPT) results indicate that the insitu density of the Made Ground is variable, with SPT N values ranging from 1 to 36. It is not possible to relate N value to an absolute value of insitu density in such materials, but as an indicator of relative variations across the site the N values suggest that below 3m within the Made Ground the density is similar across the whole site. At shallow depth (less than 3m) there is, in general terms, an apparent difference in density between the northern and southern halves of the site; the southern half being denser than the underlying material and the northern half being looser than the underlying material. It should be noted that this observation is based on a limited number of test results, in what is a variable material.

In the London Clay the SPT results show a consistent trend of increasing N value with depth, from about 35 at the top of the clay to about 55 at 17m bgl. Atterberg Liquid and Plastic Limit index tests were carried out on four samples of the London Clay. The results are within the range found for this material, although the Liquid Limit results are lower than average. The insitu undrained strength of the clay may be estimated from the N value and the Atterberg Limits (Stround and Butler 1978); the above results indicate an undrained strength of about 160kN/m², increasing to about 250kN/m² by 17m depth. Quick undrained triaxial tests were carried out on three 100mm diameter specimens of

London Clay obtained from U100 driven samples. The results show strengths that are somewhat lower than those assessed from the SPT tests. The borehole logs give visually assessed strengths for the clay, however these strengths have been largely assessed from bulk disturbed samples and are therefore approximate and will tend to under-estimate the undisturbed insitu strength. For preliminary design purposes, to aid in the planning of the proposed development, it is recommended that the strength profile derived from the SPT tests is utilised.

Once the nature of the proposed development of the site has been determined, further geotechnical investigations will be required.

4.6.3 Other Waste Characteristics

Method of Placing and Compaction

The identification of three distinct layers of Made Ground (Table 4.6) suggests that the waste may have been placed in three stages. There is an absence of any notable capping material and this, together with the seemingly random nature of waste emplacements within each stage suggests that the site was poorly managed by modern standards. It is likely that little compaction has been achieved during placement of the waste and this tends to be confirmed by the presence of uncrushed bottles and tin cans in many of the trial pits (Attachment 2).

Age of Waste

It has been reported that the Site was used prior to 1965 for waste disposal purposes by Beddington and Wallington Council. The Site was subsequently taken over by the GLC; on abolition of the GLC in 1986 the Site became the responsibility of the London Borough of Sutton.

During the course of the excavation of trial pits across the Site, a number of newspapers were found at various depths in the waste (see Attachment II). The print on many of the newspapers was still visible and they could therefore be dated. This confirmed that:

- commencement of waste emplacement probably pre-dates the mid 1950s (the

earliest newspaper, 1956 was found at a depth of approx. 4.0m);

- o emplacement of the bulk of the waste probably ceased in the mid to late 1960s (the bulk of the newspaper found were dated 1962 to 1966); and that
- o based on the above conclusions, the estimated average age of the waste is approximately 30 to 35 years.

Type of Waste

The main types of waste deposited at the Site consisted of the following:

- o boulders, cobbles, gravel and sand;
- o brick and concrete fragments;
- o soil;
- o glass, tin, paper and plastic;
- o coal fragments and ash;
- o wood;
- o tyres and rubber;
- o fabric; and
- o asbestos sheeting

Average Density of the Waste

Landfill compactors are at present widely used to compact the waste to placement densities in the range of 0.75t/m³ to in excess of 1.0 t/m^3. Subsequent settlement may further increase the density of the waste material to 1.0 to 1.2 t/m^3. At completed sites, e.g.

Beddington Lane, there is little compaction and therefore the density of the waste material will not be as great.

The material encountered during the course of the Site Investigation is highly variable and described in the trial pit and borehole logs as predominantly 'made ground', 'clay' and 'gravel'. The density is therefore likely to be highly variable across the Site and this is confirmed by the results of the Standard Penetration Tests undertaken during drilling. We therefore estimate that the average density of the waste at the Site is approximately $0.8t/m^3$.

Rate of Decomposition

The largely inert nature of much of the waste material suggests that decomposition being confined to a small proportion of the waste present, principally paper, wood and plastic. This consists primarily of cellulose and lignin and these are considered to biodegrade slowly. This is exemplified by the discovery of a newspaper dating back to 1956 in TP5 which showed little sign of degradation.

The relatively high moisture content of much of the waste together with the discovery of material still open to biodegradation suggests that decomposition is still actively taking place and may continue for many years. Evidence that decomposition is still actively occurring is provided by the detection of landfill gas across much of the site.

In addition, the absence of any notable capping across the Site indicates that the ingress of air into the waste may be occurring. This will tend to inhibit the rate of decomposition of much of the organic waste material.

Estimated Rate of Settlement

It is not possible to accurately estimate the rate of settlement of the site but it is known that settlement will continue to occur as the organic fraction of the waste decomposes. It is considered that decomposition will continue for many years and therefore settlement will also continue for an equal period of time. Settlement is likely to occur at different rates across the Site.

TABLE 4.1
PERCENTAGE OF SAMPLES EXCEEDING ICRCL TRIGGER AND ACTION LEVELS

Trigger Levels				Action Levels
Contaminant	**Domestic gardens and allotments**	**Parks etc.**	**Any use where plants are to be grown**	**All proposed uses**
Lead	51	1	-	-
Zinc	-	-	68	-
Copper	-	-	62	-
Nickel	-	-	22	-
Chromium (total)	0	0	-	-
Mercury	43	1	-	-
Cadmium	19	1	-	-
Arsenic	48	4	-	-
pH	0	0	-	-
Phenol	0	-	-	-
Cyanide	0	0	-	-
Baron (Water Soluble)	-	-	59	-
Sulphate	43	-	-	-
Sulphides	0	0	0	0
Sulphur	-	-	-	1
Number of contaminants exceeding	5	4	4	1

Asbestos was detected in 17% of samples

Notes: - guidelines not available
o guidelines available but not exceeded

69 samples were analysed for each contaminant.

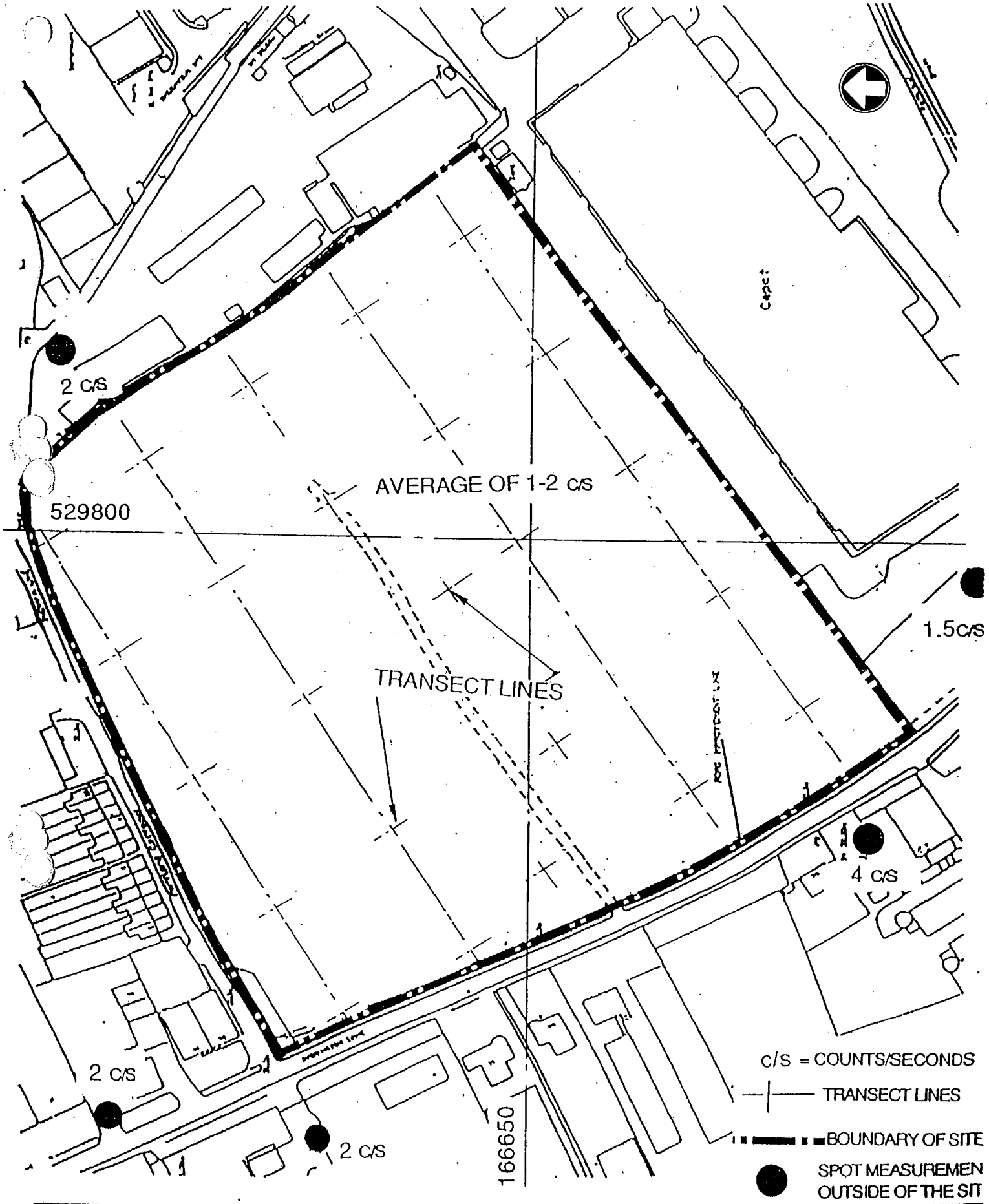
TABLE 4.3
WATER LEVELS WITHIN BEDDINGTON LANE LANDFILL

Borehole number	Depth below Landfill surface m bgl	Depth of waste m bgl	Water level above base of waste m
1	6.10	8.60	2.50
2	5.10	9.00	3.90
3	5.30	7.80	2.50
4	3.20	8.90	5.70
5	6.80	9.70	2.90
6	8.25	10.65	2.40
7	7.40	8.80	1.40
8	7.20	10.60	3.40
9	7.45	10.80	3.35
10	7.30	10.25	2.95

Note: o The recorded levels are those at which water was struck. This frequently rose during or shortly after drilling, and then fell.

TABLE 4.6 SUMMARY OF GROUND CONDITIONS

Stratum	Stratum Description	Thickness (m)
a_1	Brown, sandy, gravelly CLAY, commonly containing glass, metal, wood and plastic bags, and more rarely paper, bitumen and plastics (MADE GROUND)	2.5 to 8.7m (typically 6.0 to 7.0)
a_2	Grey, clayey, often sandy GRAVEL, commonly containing metal and glass fragments (MADE GROUND)	0.4 to 7.15m (typically 1.5 to 2.5m)
a_3	Soft to firm, grey CLAY with some cloth, glass or metal fragments and occasional gravel (MADE GROUND)	0.0 to 1.5m (typically 1.0)
b_1	Stiff becoming very stiff, grey fissured CLAY (LONDON CLAY)	Up to 11.4m penetrated



Title: BEDDINGTON LANE
LANDFILL SITE INVESTIGATION 1991
RADIOACTIVITY SURVEY

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Date	Drawn	Checked	Approved	Scale	Drawing no.	Rev.
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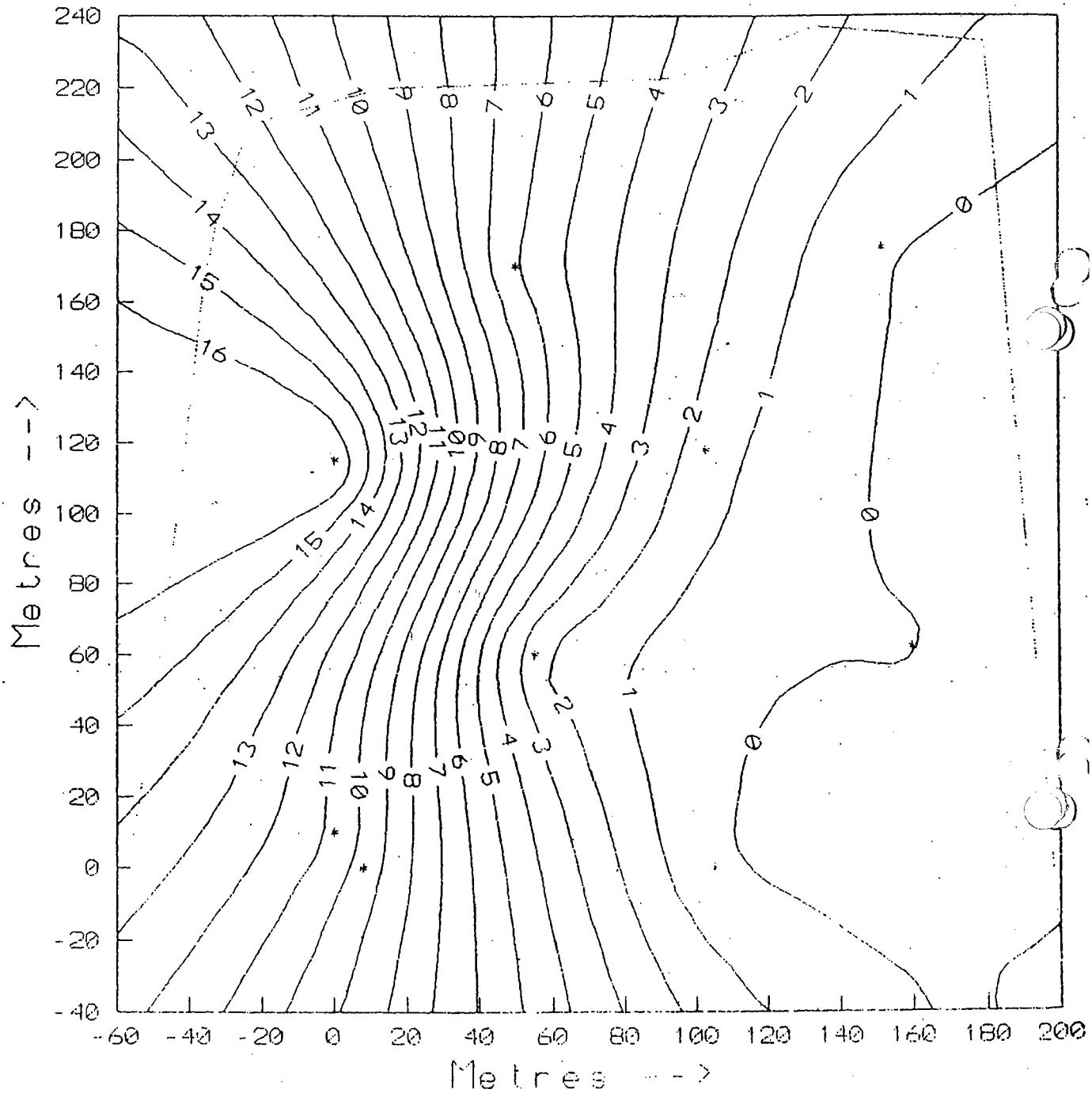


Figure 4.2 - Methane Concentration Contour Map from July 1991 Monitoring

Note: 1. Figures are Concentrations of Methane (% GIA)
2. Green Stars are Borehole Locations

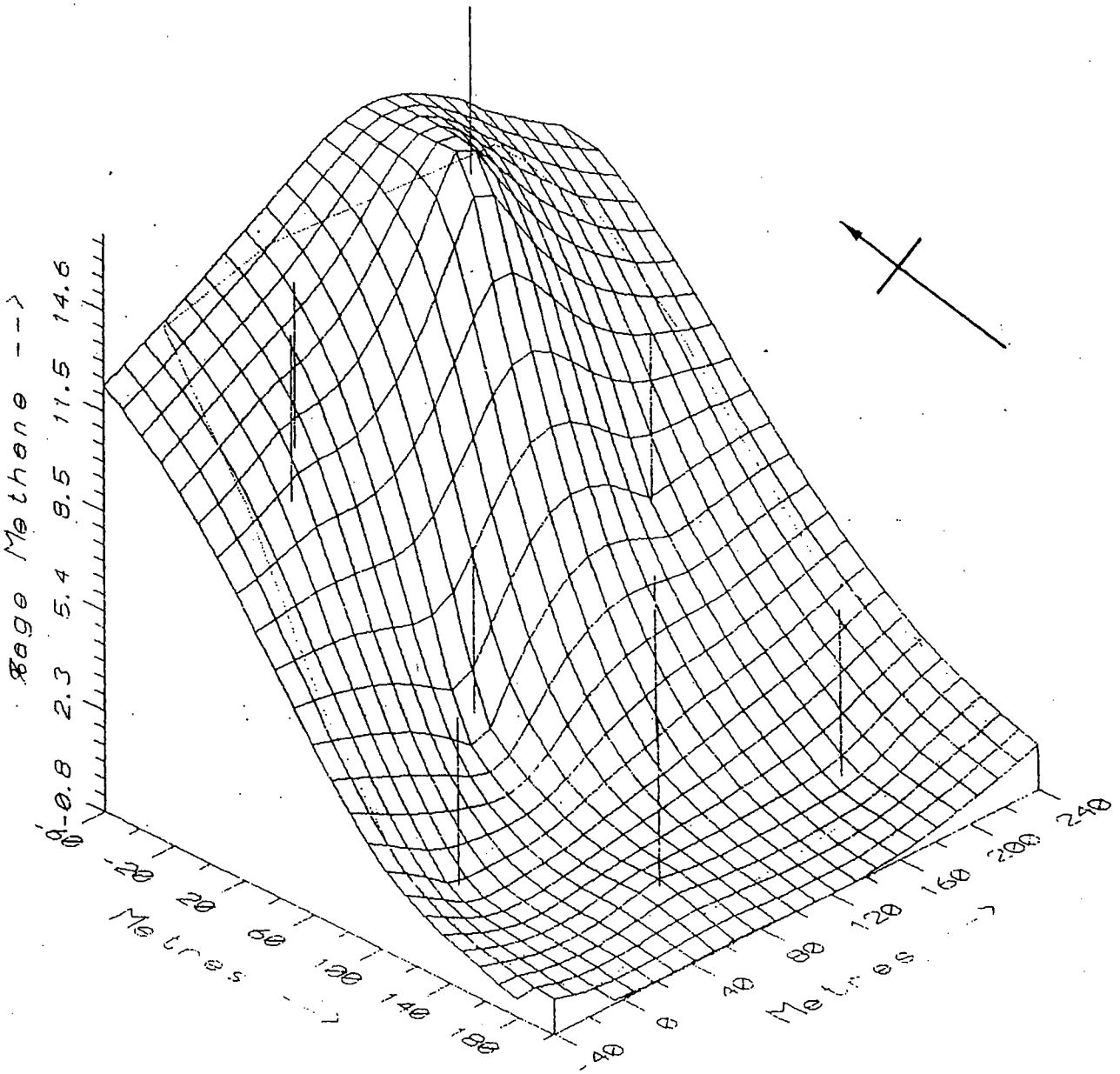


Figure 4.3 - 3 Dimensional Visualisation of Methane Concentrations from July 1991 Monitoring

Note: 1. Pink Line is the Site Boundary
2. Green Lines are Borehole Locations

ed2517

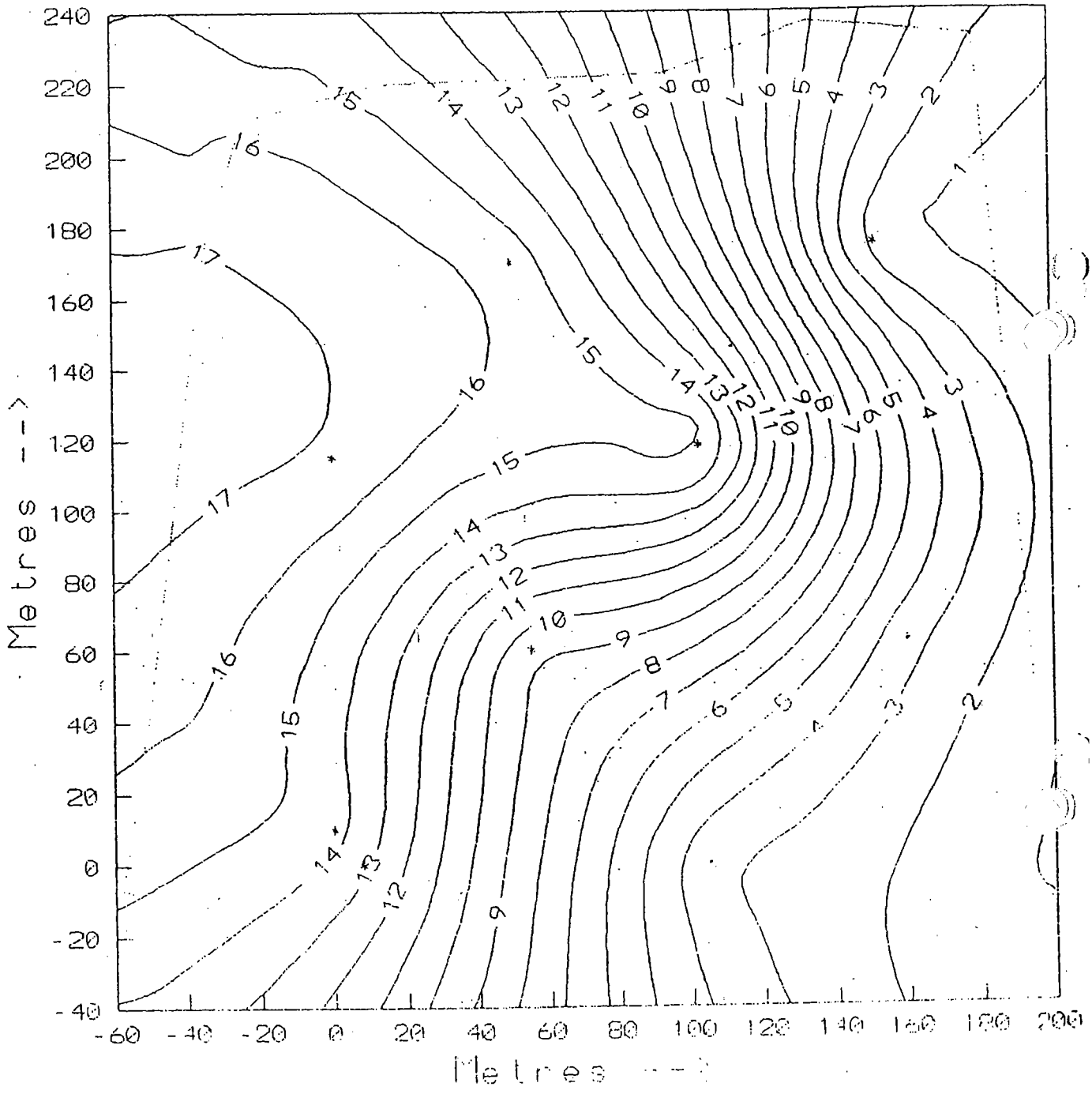


Figure 4.4 - Carbon Dioxide Concentration Contour Map from July 1991 Monitoring

Note 1. Figures in Blue are Percentages of Carbon Dioxide
2. Green Stars are Borehole Locations

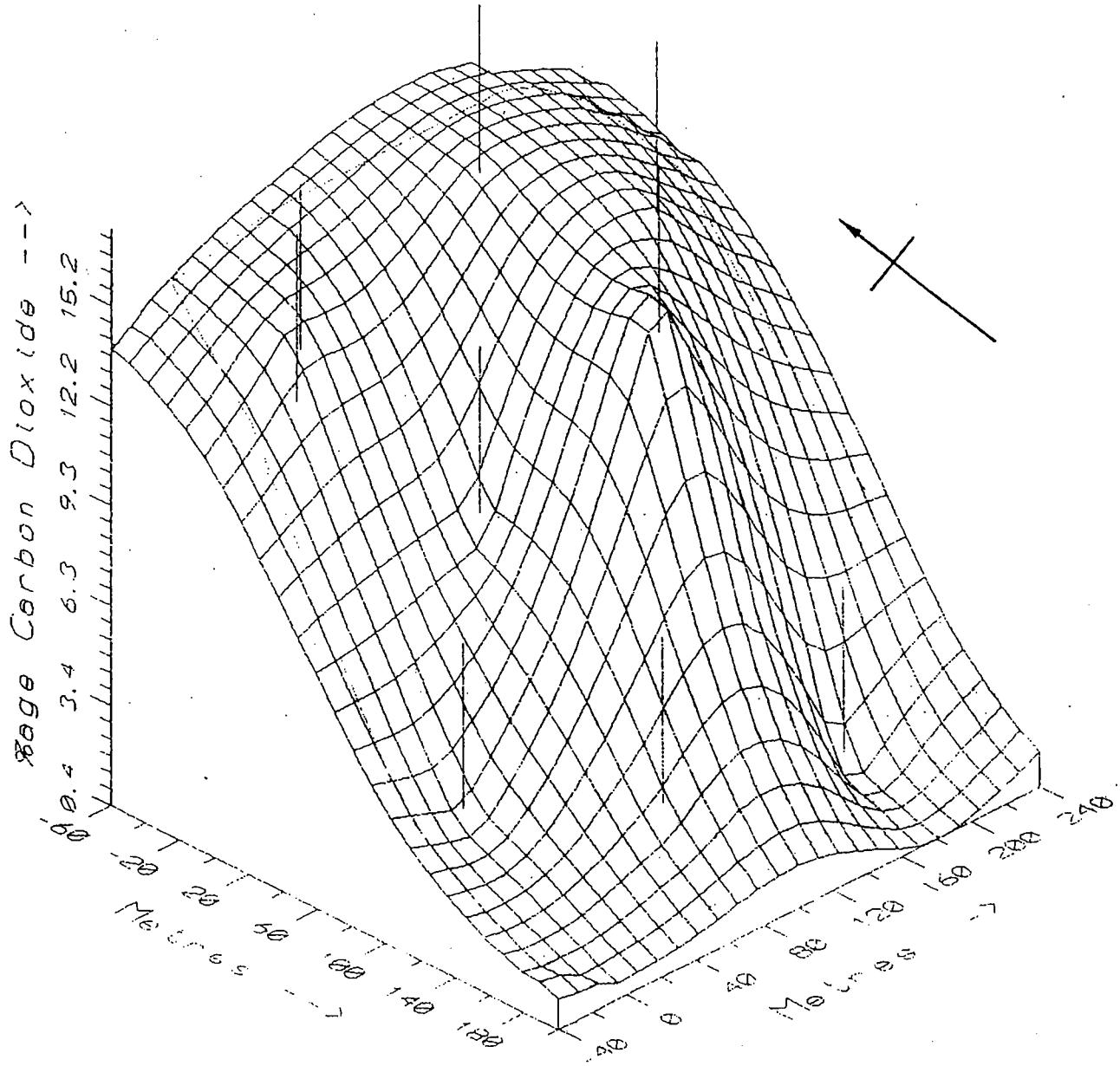


Figure 4.5 - 3 Dimensional Visualisation of Carbon Dioxide Concentrations from July 1991 Monitoring

Note 1. Pink Line is the Site Boundary
2. Green Lines are Borehole Locations

5.0 HAZARD ASSESSMENT

5.0 HAZARD ASSESSMENT

5.1 Soil Contamination

Analysis of the soil samples has indicated the presence of a number of contaminants at levels above their respective trigger concentrations. The risk posed by this soil contamination depends upon a number of factors, including:

- nature of the contamination;
- mobility and solubility of the contamination;
- level of exposure; and
- land use and the presence of susceptible targets.

These target groups comprise:

- construction workers, other on site personnel during any development, future site occupiers and those currently using or living around the perimeter of the Site, (i.e. human health);
- plant life;
- groundwater and surface waters local to the Site (see also Section 5.2); and
- construction materials.

The application of conventional risk analysis to the assessment of contaminated land is difficult since the risk of potentially harmful interactions occurring is often unknown and not easily estimated. Few dose-response relationships have been proven for contaminated soil and therefore criteria, such as the ICRCL trigger levels are based on the concept of a "no observed effect level".

Presence of contamination on a site does not necessarily mean that a hazard exists, or that remedial action must be taken. The final decision should be based upon a number of factors, including:

- o end use;
- o magnitude and variability of analytical results;
- o the number of different contaminants present;
- o nature of the hazard;
- o ground conditions; and
- o cost.

Different end uses have differing levels of sensitivity to contamination.

Most Sensitive -	Residential development with gardens.
-	Agricultural land or allotments.
-	Amenity areas, parks and landscaped areas.
-	Commercial and Industrial buildings.
Least Sensitive -	Hard covered areas (roads, car parks etc).

A variety of land uses are being considered for Beddington Lane including playing fields, storage and handling of materials, and warehouse office and retail use. These uses are not the most sensitive options with regard to the impact of any contamination present.

5.1.1 Human Health

Contamination can affect humans via direct and indirect pathways:

o	Direct	-	ingestion of contaminated soil
		-	inhalation of contaminated dust
		-	skin contact
		-	uptake of contaminants in vegetables and fruit
o	Indirect	-	contamination of water resources
		-	contamination of drinking water
		-	toxic/flammable gases
		-	fire or explosion

Those contaminants identified by the ICRCL as posing a potential hazard to health include arsenic, cadmium, chromium, lead and mercury. In addition, phenol, cyanide (total and

free), toluene extractable matter and asbestos pose a potential hazard to health.

The soil analysis results indicate widespread contamination of the Site due to the presence of arsenic, cadmium, lead, mercury, toluene extractable matter and asbestos. 'Action' trigger concentrations (i.e. the level above which remedial action or a change in development use is required) have not been set for arsenic, cadmium, lead and mercury. However, the threshold trigger concentrations for these contaminants have been widely exceeded and therefore it is considered that the Site could not be developed for housing or recreational use without remedial action. In addition the high concentration of some of the contaminants notably asbestos and toluene extractable matter are likely to preclude development of the Site for anything but as an area of hardstanding unless remedial action is taken.

Apart from cadmium and asbestos, the contaminants discussed above were found in significant concentrations at, or very close to, the surface of the Site. Therefore there is a risk to existing users of the Site such as those using it for recreational purposes. (It should be noted that the Site is currently accessible to the public although it is not designated as a recreational area). Some children have a compulsive habit to eat non-food material including soil. This condition (known as pica) whilst not of widespread concern, does represent a hazard to such children at this Site.

The principal human health effects for the contaminants considered to be most significant on site are summarised in Table 6.1. The development of the site, including the implementation of any remedial measures is likely to involve the excavation of at least a proportion of the waste material. The precautions necessary to safeguard the health and safety of construction personnel are discussed in detail in Section 6.0.

5.1.2 Phytotoxicity

Those contaminants considered to be most hazardous to plants (i.e. phytotoxic) include boron (water soluble), copper, nickel and zinc. These four contaminants exceeded their respective threshold trigger concentrations in between fifteen and forty seven of the sixty nine samples analysed. Action trigger concentrations have not yet been set for these contaminants, however the widespread contamination detected across the Site and with depth is likely to preclude development of the site for any uses where plants are to be

grown unless remedial action is taken.

In addition to concentrations of 'total' copper, nickel and zinc being analysed, the 'available' concentrations of these metals was also determined. This assesses the availability of the metallic soil constituent to the plant. The results (Attachment 4) confirm that these metals represent a hazard to the growth of plants on the Site.

The neutral to alkaline pH range of the waste material suggests the solubility of these metals, and others affecting human health, is relatively low. Hence their mobility and availability to plants are not as great as would be expected in an acidic soil.

5.1.3 Surface and Groundwater

The occurrence of contaminants in the waste material indicate that a risk of pollution of the groundwater and local surface waters exists. This is discussed further in Section 5.2.

5.1.4 Construction Materials

The main contaminant causing a hazard to construction materials is sulphate. This attacks concrete and its widespread occurrence at levels exceeding the ICRCL threshold trigger concentration of 2,000mg/kg indicates that a mitigatory measure such as the use of sulphate resisting cements will be required if, for example, the site is developed as an area of hardstanding. The presence of toluene extractable matter may indicate the presence of tars and this can affect the setting of concrete.

5.2 Leachate

The water analysis results (Attachment 6) indicate that the groundwater ('leachate') within the Site is heavily polluted. It is considered that this may cause a hazard, in particular to:

- adjacent surface water courses, including that running close to the northern perimeter of the site;
- adjacent properties and people either through aggressive attack on the materials of construction or through the release of toxic or flammable substances; and

o construction personnel present during any development.

Should the development of the site include partial or total excavation of the waste material, the disposal of the associated leachate will require careful consideration, and liaison with the National Rivers Authority (NRA). In addition it is considered prudent that an investigation is undertaken of any polluting effect that the site may have on the watercourse in the north of the site.

5.3 Landfill Gas

5.3.1 Characteristics

Landfill gas is a complex mixture of individual gases each of which has its associated hazards (Section 4.4.1). Therefore, to assess the hazard of landfill gas at this site, the hazards of its constituent gases must be assessed both in isolation and as a landfill gas constituent.

Methane

Methane is a colourless, odourless, asphyxiant gas whose density is less than that of air. It is flammable, and will burn when mixed with air in certain proportions which define the limits of flammability. The lower explosive limit (LEL) for methane in air is normally 5% by volume; the Upper Explosive Limit (UEL) is 15% by volume. Any mixture of methane in air within these limits will burn if ignited. When the proportion of methane exceeds the UEL value the mixture should still be regarded as hazardous since it could be diluted by air to below the UEL, especially around the edge of the gas body. Only mixtures containing less than the LEL proportion should be considered non-flammable. It is normal to allow a safety factor of at least 5, i.e. the methane concentration should not exceed 1% by volume in air (20% LEL).

Carbon Dioxide

Carbon dioxide is colourless, odourless and an asphyxiant. It is non-flammable and denser than air. The Health and Safety Executive (HSE) recommend short-term exposure limit (10 minutes) for carbon dioxide as 1.5% by volume in air, and the long-term limit (8

hours) as 0.5% by volume. It is normally present in air at a concentration of 0.03% by volume.

Hydrogen and Hydrogen Sulphide

Hydrogen is a colourless, odourless, highly flammable gas, which is much less dense than air. Produced during the early stages of anaerobic decomposition, it has an LEL of 4% by volume in air and a UEL of 74% by volume.

Hydrogen sulphide is colourless and highly toxic with a strong unpleasant odour of bad eggs at low concentrations. It is flammable in air with a LEL of 4.3% and UEL of 45.5% by volume in air. Its principle hazard is one of toxicity, however, with the toxic effects becoming more severe as the concentration increases. The HSE short-term exposure limit is 0.0015% and the long term is 0.001% by volume; death can occur within a few minutes at concentrations of around 0.07%. Potentially hazardous concentrations of hydrogen sulphide may not be detectable by smell due to olfactory fatigue after only seconds of exposure.

With the risk from the constituent gases established, it is possible to give an overall risk assessment of the landfill gas with regard to flammability, asphyxiation, toxicity and density. Generation duration and potential gas migration can also be assessed.

Flammability

When methane or hydrogen are mixed in air flammable or explosive concentrations can be produced. The presence of carbon dioxide in landfill gas affects the LEL and UEL of methane; of the 8 samples taken in June 1991, 5 are above the Limiting Scale Mixture (LSM), i.e. the methane/carbon dioxide ratio at which the two gases will not be flammable. Whatever the dilution with air, three samples below the LSM were located to the north of the site and coincide with boreholes with high methane concentrations.

Asphyxiation

An asphyxiation risk is present whenever persons have to enter any confined space in or near a landfill site. The oxygen content of air should never be allowed to fall below 18%

by volume, according to HSE Guidance Note EH 40/90. Elevated levels of carbon dioxide can have health effects as this gas is involved in the control of respiration in the body.

Toxicity

Some of the minor constituents of landfill gas could have toxic effects, if present at high enough concentrations. However, trace gasses are not thought to represent a health hazard to humans after allowing for normal atmospheric dilution, although some concern has been expressed about exposure to some minor components formed in certain circumstances soon after the deposition of wastes.

The presence of landfill gas in soil will detrimentally affect vegetation, resulting in vegetation stress: stunting, wilting, die-back and eventual mortality.

Density

The density of landfill gas depends on the proportion of components present. Thus a mixture of 10% hydrogen (density 0.09kg/m³) and 90% carbon dioxide (density 1.97kg/m³) typically produced in the early stages of anaerobic decomposition will be heavier than air (density 1.29kg/m³), while 60% methane (density 0.72kg/m³) with 40% carbon dioxide - a typical gas composition - will be slightly lighter than air. Landfill gas components do not normally stratify when collecting in voids however some absorbtion of carbon dioxide or oxidation of methane has been known to occur.

5.3.2 Generation Duration

Landfill gas is produced at the highest rate during the first five or so years after site completion. Subsequent to this the production rate reduces. Sites completed over 60 years ago are still known to be generating landfill gas.

The site investigation has identified organic matter, i.e. newspapers that remain substantially intact after nearly forty years, suggesting that the site will continue to generate gas for perhaps another 30 years and beyond the design life of contemporary industrial units that may be a component of the proposed development.

5.3.3 Potential Migration

Unless suitably engineered, landfill gas and leachate may migrate laterally outside of the side. Primarily, gas migration is initiated by pressure differentials caused by containment within the site as well as changes in atmospheric pressures and groundwater levels. Landfill gas is at present venting naturally through the surface of the site although lateral migration may take place through the surrounding gravel strata or preferably along pathways such as underground sewage services ducts, etc.

The Department of the Environment advises that local planning authorities should exercise due caution in granting planning permission for development on or near landfill sites, and that permission should not be granted unless reliable arrangements can be made to overcome the danger of migrating gas (DOE circular 17/89)..

5.3.4 On-Site Assessment

Section 4.4.1 identifies guidelines which may be used to assess the risk for the development of completed landfill sites. The results of the most recent site survey indicate there is a serious cause for concern. Measured methane levels exceed those in the guidelines by a factor of 13 on average. It is therefore considered that development of the site is not possible without the installation of appropriate mitigatory means.

5.3.5 Off-Site Assessment

To date, there has been no movement of landfill gas concentrations outside of the site. Both Waste Management Paper 27, and the General Development Order 1988 recommend an assessment of properties within 250 metres of the perimeter of the site (Figure 5.1). A preliminary inventory (Table 5.1) indicates that the site is surrounded by sensitive receivers.

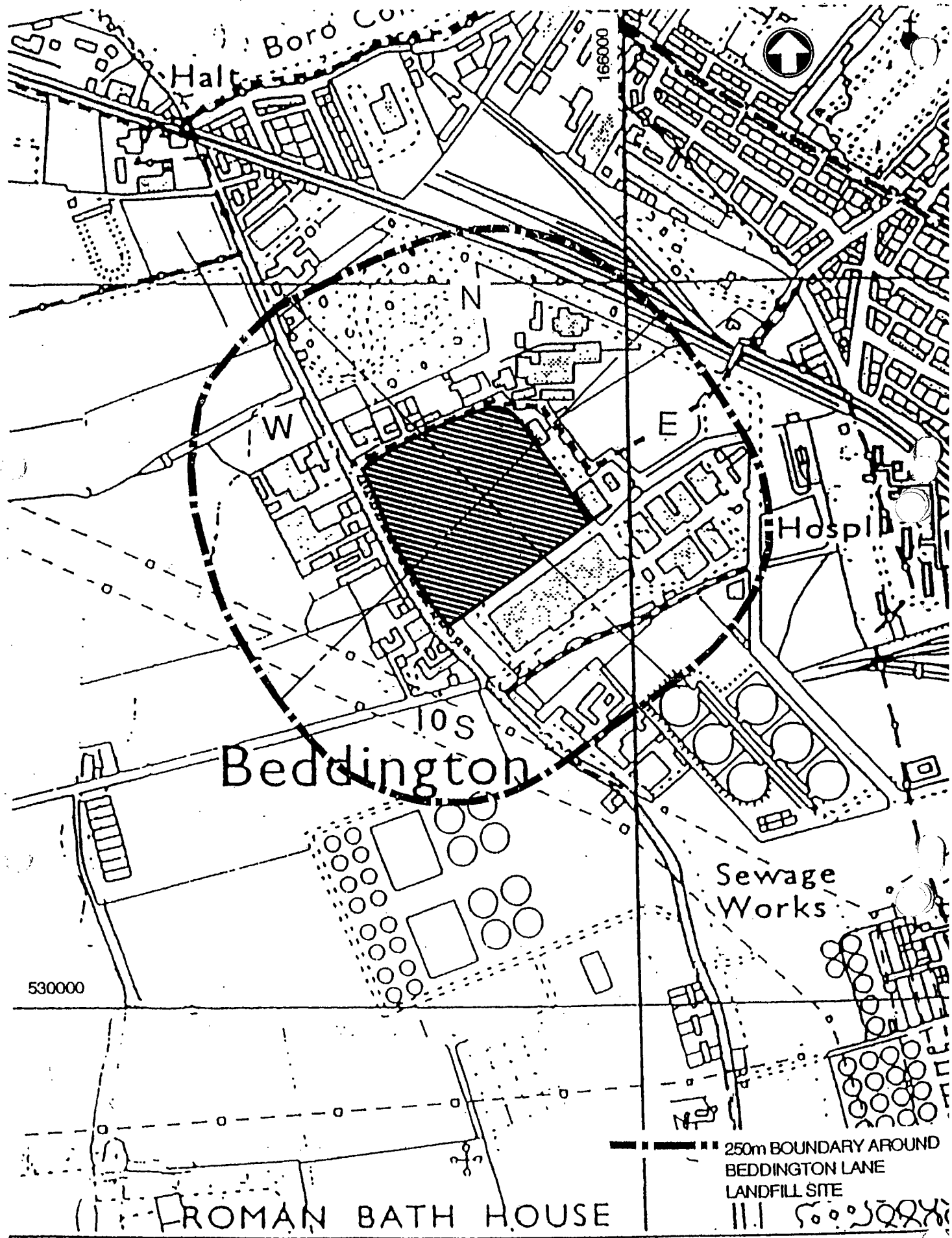
Existing situation

It is considered likely that gas is migrating out of the site through the surrounding ground and service ducts. The risk which this poses to occupants and the general public is not known. The London Borough of Sutton, as owner of the site, are responsible under both

TABLE 5.1

LAND USES WITHIN 250M OF BEDDINGTON LANE LANDFILL SITE

	Quadrant			
Land Use	North	East	South	West
Domestic	*	*		*
Industrial and Commercial	*	*	*	*
Made ground	*			
Parks and open space	*			
Hard standing	*	*	*	



Title BEDDINGTON LANE LANDFILL SITE INVESTIGATION 1991 LANDFILL GAS MIGRATION ASSESSMENT					Mott MacDonald Mott MacDonald Civil Limited St Anne House, 20-26 Wellesley Road Croydon CR9 2UL	Telephone 081-686 5041 Fax 081-681 5706 / 081-68 Telex 917241 MOTTAY
Date	Drawn	Checked	Approved	Scale	Drawing no. FIGURE 5.1	Rev.

6.0 HEALTH AND SAFETY DURING DEVELOPMENT

6.0 HEALTH AND SAFETY DURING DEVELOPMENT

6.1 Introduction

Health and safety legislation comes under the auspices of the Health and Safety at Work, etc., Act 1974. This Act applies to everyone at work and to all work premises and activities and establishes responsibilities for employers and employees for ensuring, as far as reasonably practicable, the health, safety and welfare of all persons affected by work activities including members of the public lawfully or unlawfully entering the work place. Additionally, the Control of Substances Hazardous to Health (Amendment) Regulations 1990 details more specific requirements relating to the exposure of employees to substances hazardous to their health.

Under this legislation, protection of site staff against risks to health would ideally be provided by the removal of restriction of the hazard itself. However, this is not often possible and therefore the working environment must be assessed to ensure that the appropriate safety measures are employed. The extent of the precautions required will be site specific but general site safety incorporates some basic practices. These include the provision of fundamental personal protective equipment such as safety boots, appropriate overalls, gloves and eye protection, with other equipment (head protection, dust masks, etc.) being available where necessary; suitable and sufficient first aid facilities and procedures and appropriate washing amenities. Site staff should be given adequate training and instruction on the potential hazards in the workplace, their health and safety responsibilities and safe systems of work including basic personal hygiene practices which are important on contaminated sites.

The following sections identify the specific health and safety hazards and the precautions required during the development of the site. It does not examine existing hazards presented by the site, off-site hazards or those which may control the type of development. A summary of the principle human health effects of the contaminants identified on the site is outlined in Table 6.1.

6.2 Landfill Gas

The Site investigation together with previous gas monitoring undertaken has confirmed the presence of landfill gas (principally Methane and Carbon dioxide) and Oxygen depleted atmospheres in the waste. Landfill gas in certain circumstances may be flammable, toxic, explosive or result in asphyxiation.

The development of the Site, including any excavation of waste will expose construction workers and other individuals to such hazards. Therefore the implementation and maintenance of safety measures and precautions will be required (guidelines can be found in the Health and Safety Executive's "Entry into Confined Spaces Guidance Note GS5" and "Occupational Exposure Guidance Limits EH40", and Her Majesty's Inspectorate of Pollution, "Waste Management Paper No. 27, The Control of Landfill Gas".

It is recommended that the following safety measures and precautions are undertaken during development of the Site:

- naked lights, flames and smoking shall not be allowed on the Site and spark arresters to be fitted to excavation equipment and vehicles;
- appropriate warning signs to be erected;
- all electrical installations to conform to recommendations in BS 5345 (Code of Practice for the selection, installation and maintenance of electrical apparatus);
- all equipment shall be certified as complying with the required safety standards and be approved by the British Approval Service Electrical Equipment in Flammable Areas (BASEEFA);
- attention should be drawn to the possibility that underground service trenches and site roads provide pathways for gas migration and gas collecting measures should be installed, as required;

- the air space below and around all site accommodation, whether for personnel or materials, to be monitored on, at least, a daily basis for the presence of asphyxiating, toxic and flammable gases by staff who are knowledgeable and experienced in the use of equipment and the interpretation of data obtained; and

- an adequate supply of safety equipment specific to landfill gas should be maintained at all times. This shall include portable carbon dioxide and methane gas monitors with integral alarms for locating in the working areas.

In addition, the odour associated with landfill gas may cause a nuisance. It is recommended in such instances that consideration is given to providing an appropriate spray system to control odour.

It is not known whether landfill gas is currently migrating out of the site of the hazard this may pose to adjacent properties. The development of the site may increase these hazards but this is considered unlikely. The design of the development may need to accommodate means to prevent the accumulation and or the ignition of the gas.

6.3 Asbestos

The fibrous nature of asbestos supplies its great strength and workability but it is this property which also makes the material a serious health hazard. The smaller fibres may be inhaled and give rise to irreparable, and potentially fatal, damage to the health of the exposed person.

The disease most associated with the exposure to asbestos fibres is asbestosis, a form of scarring of the lung causing reduction in the lung function. Exposure to asbestos can also give rise to several types of cancer, most notably mesothelioma, a cancer of the lung or bowel cavity membranes. Asbestos related diseases are at best crippling and at worst fatal, and prevention of inhalation of the fibres is the only cure.

The main types of asbestos most commonly encountered are:

- crocidolite (blue asbestos);

- o inhalation of contaminated dust; and

- o ingestion of contaminated material.

Site staff could be subject to any of these three routes of exposure during excavation and general site operations. While the presence of contamination on site does not necessarily imply that a hazard exists, it is recommended that, as a matter of good practice, the potential risk should be reduced as far as is reasonably practicable by employing at least the basic health and safety precautions and procedures as detailed in Section 6.1. The situation will need to be monitored and additional safety action taken when required.

6.5 Leptospirosis

The disease is produced by bacteria (Leptospira) which is passed on to the human environment via animals' urine, commonly rats.

The bacteria is water-borne and infection generally occurs by water contaminated with urine. However, any surface on which urine has been passed should be considered a potential risk. The disease has a two-stage effect, producing primary symptoms similar to influenza which may be rapidly followed by more serious conditions as the disease develops. The major route of entry is through cuts and abrasions in the skin but the leptospirosis bacteria can also enter the body by eating, drinking and smoking products which have been contaminated by dirty hands.

When undertaking work in potentially contaminated areas, various precautions to prevent or reduce the risk from Leptospirosis should be adopted. Firstly, it is important to prevent the contact of the skin with potentially contaminated water by wearing protective clothing; impermeable gloves and reinforced boots are especially necessary. Site personnel should avoid wiping their faces with hands when in a potentially contaminated environment or when wearing protective clothing which is still wet, as this could lead to entry through the nose or mouth. Cuts and abrasions should be protected with waterproof coverings even when protective clothing is being worn. Any cuts received on site must receive first aid attention immediately to reduce the risk of infection.

Site personnel should not eat, drink or smoke in a potentially contaminated area or whilst

wearing what may be contaminated clothing; this is not only important where the Leptospira bacteria could possibly be present, but also where any other form of hazardous contamination could potentially occur.

It is vital that all site staff are aware of the disease, its potential and the necessary actions for prevention or reduction of the risk. A leaflet is available from the Health and Safety Executive entitled "Leptospirosis - are you at risk?" (ref. IND(G)84L 9/90) which summarises the main points regarding this disease.

9.0 REFERENCES

9.0 REFERENCES

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Resistance to Weather and Ground Moisture.

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BOREHOLE No. 1
Sheet 1 of 3

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 20.0m. CASED TO 9.40m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level
—

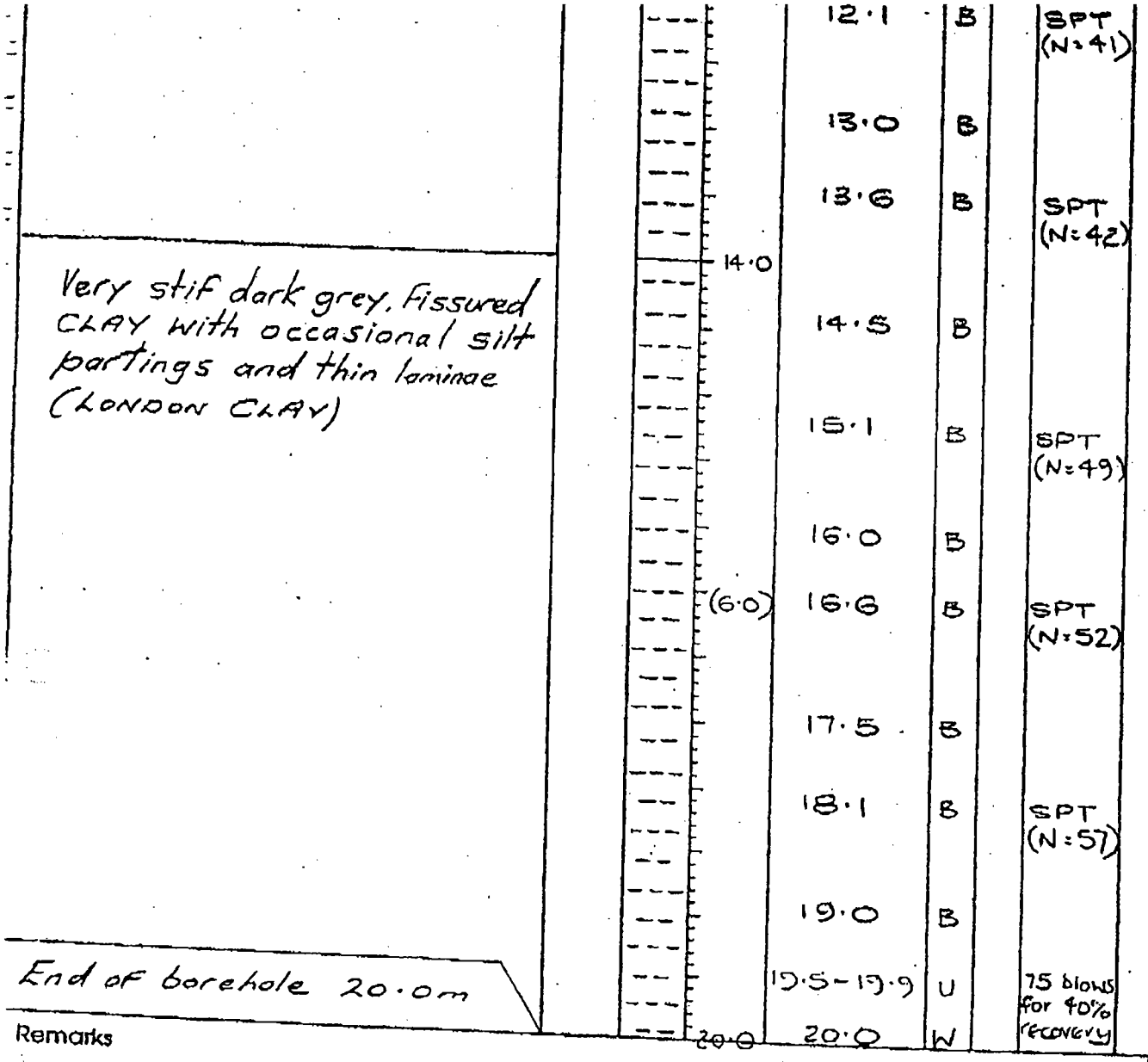
Coordinates
—

Date
28/6 - 1/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
Dark brown sandy gravelly, slightly malodorous CLAY. Gravel of predominantly flint with some coarse gravel sized glass. Some plastic bags (MADE GROUND)				1.0	B			
Clayey, very sandy gravel. Gravel predominantly of brick.				2.0	B		SPT (N=1)	SPT sunk under own weight
With occasional slightly decomposed wood fragments and metal fragments			(5.9)	3.0	B			
				4.0	B			
With occasional metal fragments up to 300mm				5.0	B		SPT (N=18)	▽
			5.9	5.9	B			▼ Water strike at 6.1m rising to 5.21m after 20 mins. Overnight water sample from 6.5m
				6.5	W			
Dark grey slightly clayey, slightly sandy, subangular to subrounded, fine to coarse GRAVEL predominantly of flint. (MADE GROUND/TERRACE GRAVEL?)			(2.7)	6.9	B			
				7.9	B			
			8.6	8.6	B			
Stiff dark grey fissured CLAY with occasional silt partings and thin laminae (LONDON CLAY)			(5.4)	9.1 - 9.5	U		(18 blows)	
							SPT (N=35)	

Remarks

logged by AL
Scale 1:50
Fig.


Very stif dark grey, fissured CLAY with occasional silt partings and thin laminae (LONDON CLAY)
End of borehole 20.0m
Remarks
14.0
(6.0)
20.0
12.1
13.0
13.6
14.5
15.1
16.0
16.6
17.5
18.1
19.0
19.5-19.9
20.0
B
B
B
B
B
B
B
B
B
U
W
SPT (N=41)
SPT (N=42)
SPT (N=49)
SPT (N=52)
SPT (N=57)
75 blows for 90% recovery
logged by AL
Scale 1:50
Fig.

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BOREHOLE No. 1

Sheet 3 of 3

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 20.0m. CASED TO 9.4m

Location No. 20113

Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level
—

Coordinates
—

Date
28/6 - 1/7/91

Description

GROUNDWATER OBSERVATIONS DURING BORING

DATE	TIME	HOLE DEPTH (m)	CASING DEPTH (m)	WATER DEPTH (m)	REMARKS
28/6	--	6.10	-	6.10	Water strike
	-	6.10	-	5.21	after 20mins
	EOS	6.50	6.50	5.53	
1/7	SOS	6.50	6.50	5.10	
	EOB	20.00	9.40	17.10	

Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Samples/Tests: Sample Type	Samples/Tests: Sample No.	Samples/Tests: Test	Field records

Remarks

logged by AL

Scale 1:50

Fig.

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BOREHOLE No. 2
Sheet 1 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 10·0m. CASED TO 8·1m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —

Coordinates —

Date 2/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
Dark brown, sandy, gravelly, slightly maloderous CLAY with some gravel sized glass fragments and plastic bags. (MADE GROUND)				1·0	B			
With some metal bottle tops and slightly decomposed paper.				2·0	B		SPT (N=8)	
With some slightly decomposed cotton cloths			(5·0)	3·0	B			
With some slightly decomposed wood and occasional metal fragments				4·0	B			Water strike 5·1m rising to 4·7m after 20min ▽
			5·0	5·0	B		SPT (N=15)	▼
Dark grey clayey subangular to subrounded fine to medium slightly maloderous GRAVEL composed of 30% flint, 30% ash, 40% slag (MADE GROUND)				5·1	W			
With occasional glass fragments copper wire and plastic bags.				6·0	B			
With some glass fragments and occasional thin strips of steel			(2·6)	7·0	B			
Soft grey CLAY with some glass and metal fragments and occasional gravel. (MADE GROUND)			7·6	7·6	B			
			(1·4)					
Stiff dark grey fissured CLAY (LONDON CLAY)			9·0	9·0	B			
			(1·0)					
End of borehole 10·0m			10·0	10·0	B			

Remarks

Chiselling concrete boulder 1·30 – 1·55 m, ½ hr.

logged by AL

Scale 1:50

Fig.

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BOREHOLE No. 2
Sheet 2 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 10.0m. CASED TO 8.1m.

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level
–

Coordinates
–

Date
2/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records

GROUNDWATER OBSERVATIONS DURING BORING

DATE	TIME	HOLE DEPTH (m)	CASING DEPTH (m)	WATER DEPTH (m)	REMARKS
2/7	-	5.10	-	5.10	WATER STRIKE
		5.10	-	4.70	AFTER 20mins
		1000	8.10	DRY	

Remarks

logged by AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 3
Sheet 1 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 10·0m. CASED TO 8·3m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —

Coordinates —

Date 2/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
								Water strikes
Dark brown sandy, gravelly slightly maloderous CLAY. Gravel of predominantly brick and flint with some slightly decomposed cloth, plastic bags and gravel sized glass fragments. (MADE GROUND)				0·5	B			
				1·5	B			
Strong petrochemical odour with occasional wood fragments				2·5	B		SPT (N=7)	
			(5·5)					
				3·5	B			
With some slightly decomposed wood fragments and occasional metal fragments				4·5	B			
				5·3	W			▼ Water strike at 5·30 rising to 5·21 after 20 mins
			5·5	5·5	B		SPT (N=19)	
Dark grey slightly clayey, slightly sandy subangular to subrounded fine to coarse slightly maloderous GRAVEL with occasional cobbles. Gravel predominantly of flint. (MADE GROUND)			(2·3)	6·9	B			
				7·5	B			
			7·8	7·8	B			
Soft to Firm greyish brown CLAY (LONDON CLAY)			(1·2)					
			9·0	9·0	B			
Stiff dark grey Fissured CLAY (LONDON CLAY)			(1·0)					
End of borehole 10·0m			10·0	10·0	B			

Remarks

logged by AL

Scale 1:50

Fig.

Mott MacDonald

BOREHOLE No. 3
Sheet 2 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 10.0m. CASED TO 8.3m.

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level –
Coordinates –
Date 2/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records

GROUNDWATER OBSERVATIONS DURING BORING

DATE	TIME	HOLE DEPTH (m)	CASING DEPTH (m)	WATER DEPTH (m)	REMARKS
2/7	-	5.30	-	5.30	WATER STRIKE
		5.30	-	5.21	AFTER 20 mins
		10.00	8.30	DRY	

Remarks

logged by AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 4
Sheet 1 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 9.50m. CASED TO 7.8m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —
Coordinates —
Date 6/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
Dark brown, sandy, gravelly, slightly maloderous CLAY. Gravel of predominantly brick, occasionally flint, rarely ash. With occasional slightly decomposed cloth. (MADE GROUND)				1.0	B			
With some slightly decomposed wood fragments				2.0	B		SPT (N:7)	
With much glass fragments. Strong bituminous odour			(7.9)	3.0	B			▼ Water strike at 3.20m no rise after 20mins
				4.0	B			
With frequent slightly decomposed cloth. Strongly maloderous				5.0	B		SPT (N:20)	
				6.0	B			
				6.5	W			
Dark grey clayey slightly sandy angular to subangular fine to coarse maloderous GRAVEL with occasional cobbles (MADE GROUND)			7.0 (0.4) 7.4	7.0	B			
				7.4	B			
Soft mid grey slightly sandy slightly gravelly CLAY with some cloth. (MADE GROUND)			(1.5) 8.9	8.4	B			
Stiff dark grey fissured CLAY with occasional silt partings and thin laminae. (LONDON CLAY)			(1.6)					
End of borehole 9.5m			9.5	9.5	B			

Remarks

logged by AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 5
Sheet 1 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 11·0m. CASED TO 9·4m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —

Coordinates —

Date 5/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
Dark brown slightly sandy, gravelly slightly maloderous CLAY with some glass fragments. Gravel predominantly of brick and flint with occasional ash. (MADE GROUND)				0·5	B			
With occasional cobbles up to 100mm				1·5	B			
With some cobble sized fragments of hard plastic, some bituminous coal. Very malodourous				2·5	B		SPT (N=25)	
With slightly decomposed wood fragments				3·5	B			
With some slightly decomposed cloth and cobbles up to 100mm			(8·7)	4·5	B			
				5·5	B		SPT (N=21)	
				6·5	B			
				6·6	W			Water strike at 6·80m rising to 6·65m after 20 mins
With occasional glass, mirror and metal sheet fragments				7·5	B			
				8·5	B			
			8·7	8·7	B			
Firm dark greenish grey slightly fine sandy CLAY (MADE GROUND/TERRACE DEPOSITS?)			(1·0)					
Stiff dark grey fissured CLAY with occasional silt partings and laminae (LONDON CLAY)			9·7 (1·3)	9·7	B			

Remarks

Chiselling 0·25m to 0·75m. 3/4 hr.

Logged by AL

Scale 1:50

Fig.

Mott MacDonald

BOREHOLE No. 6
Sheet 1 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 11.50m. CASED TO 9.80m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —
Coordinates —
Date 6/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
Dark brown, sandy very gravelly CLAY. Gravel predominantly of flint and brick. With occasional glass fragments and plastic bags. Isolated cobble of tarmac of 200mm size. (MADE GROUND).			(1.5)	0.5	B			
Black gravelly CLAY with much bituminous material binding the soil together. (MADE GROUND)			1.5 (1.0)	1.5	B			
Dark grey clayey sandy angular to subrounded fine to coarse slightly malodourous GRAVEL predominantly of brick and concrete with some flint, with some glass fragments and occasional undecomposed paper.			2.5	2.5	B		SPT (N=23)	
				3.5	B			
				4.5	B			
Occasional cobbles of brick and concrete. Some undecomposed paper.			(7.15)	5.5	B		SPT (N=3)	
				6.5	B			
				7.5	B			
				8.25	W			▼ Water strike at 8.25m rising to 8.20m after 20 mins
Gravel of predominantly brick with some flint and occasional ash.				8.5	B			
Stiff dark grey slightly Sandy CLAY (MADE GROUND/TERRACE DEPOSITS?)			9.65 (1.0)	9.5	B			
				9.65	B			

Remarks

logged by AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 6
Sheet 2 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 11.50m. CASED TO 9.80m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —
Coordinates —
Date 6/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
As sheet 1 (MADE GROUND/TERRACE DEPOSITS?)			(1.0)					
Stiff dark grey fissured CLAY with occasional thin silt laminae. (LONDON CLAY)			10.65	10.65	B			
			(1.15)					
End of borehole 11.5m			11.5	11.5	B			

GROUNDWATER OBSERVATIONS DURING BORING

DATE	TIME	HOLE DEPTH (m)	CASING DEPTH (m)	WATER DEPTH (m)	REMARKS
6/7	-	8.25	-	8.25	WATER STRIKE
	-	8.25	-	8.20	AFTER 20 mins
	-	11.50	9.80	11.33	

Remarks

logged by AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 7
Sheet 1 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 11.0m. CASED TO 9.29m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —
Coordinates —
Date 4.5/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
Dark greyish brown sandy gravelly slightly malodorous CLAY. Gravel predominantly of Flint and brick, occasional cobbles (MADE GROUND)				1.0	B			
				2.0	B		SPT (N=26)	
With occasional slightly decomposed wood fragments.				3.0	B			
			(8.0)	4.0	B			
With some ash occasional glass and pottery fragments				5.0	B		SPT (N=14)	
With some broken glass highly decomposed cloth Malodourous				6.0	B			
				7.0	B			
With some gravel sized fragments of concrete				7.4	W			▼ Water strike at 7.40m rising to 7.35m after 20 mins
Dark grey slightly clayey slightly sandy angular to subangular fine to coarse, slightly malodorous GRAVEL of brick and flint (MADE GROUND)			8.0 (0.6)	8.0	B			
Soft to Firm grey brown			8.8 (2.2)	8.8	B			
Stiff dark grey Fissured CLAY (LONDON CLAY)				9.8	B			

Remarks

Chiselling intermittantly 0.80 to 2.00m. 1 hr

logged AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 7
Sheet 2 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 11.0m. CASED TO 9.29m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —
Coordinates —
Date 4-5/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
As sheet 1 (LONDON CLAY)			(2.2)					
			11.0	11.0	B			
End of borehole 11.0m								

GROUNDWATER OBSERVATIONS DURING BORING

DATE	TIME	HOLE DEPTH (m)	CASING DEPTH (m)	WATER DEPTH (m)	REMARKS
4/7	-	7.40	-	7.40	WATER STRIKE
	-	7.40	-	7.35	AFTER 20 mins
	EOS	11.00	9.29	DRY	
5/7	SOS	11.00	9.29	10.30	

Remarks

logged by AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 8
Sheet 1 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 11.50m. CASED TO 10.3m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —
Coordinates —
Date 5/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
Dark brown slightly sandy, gravelly slightly malodorous CLAY gravel of angular to subangular fine to coarse flint and brick. With some glass fragments and occasional cobbles (MADE GROUND)				1.0	B			
With some metal sheet fragments up to 150mm				2.0	B		SPT (N=36)	
				3.0	B			
With occasional slightly decomposed paper and plastic bags			(8.0)	4.0	B			
				5.0	B		SPT (N=15)	
With occasional ash.				6.0	B			
With slightly decomposed wood fragments.				7.0	B			
				7.2	W			▼ Water strike 7.20m rising to 7.15m after 10 mins
Dark greyish brown clayey subangular fine to coarse slightly malodorous GRAVEL with some glass fragments and occasional slightly decomposed wood fragments (MADE GROUND)			8.0	8.0	B			
Soft to firm brownish grey sandy gravelly CLAY. Gravel predominantly of brick and flint with occasional bituminous fragments (MADE GROUND)			(1.6)	9.0	B			
			9.6 (1.0)	9.6	B			

Remarks

Chiselling intermittantly GL to 4.00m, 3/4 hr.

Logged AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 8
Sheet 2 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 11.50m. CASED TO 10.3m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —
Coordinates —
Date 5/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
As sheet 1 (MADE GROUND)			(1.0)					
Stiff dark grey fissured CLAY with occasional silt partings and thin laminae. (LONDON CLAY)			10.6	10.6	B			
			(0.9)					
End of borehole 11.5m			11.5	11.5	B			

GROUNDWATER OBSERVATIONS DURING BORING

DATE	TIME	HOLE DEPTH (m)	CASING DEPTH (m)	WATER DEPTH (m)	REMARKS
5/7	-	7.20	-	7.20	WATER STRIKE
	-	7.20	-	7.15	AFTER 20mins
	..	11.50	10.30	DRY	

Remarks

logged by AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 9
Sheet 1 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 12.0m. CASED TO 10.25m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level
—

Coordinates
—

Date
4/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
Brown Sandy, gravelly CLAY. Gravel predominantly of brick and concrete with some Flint. With some slightly decomposed paper sheets, occasional glass fragments and plastic bags. (MADE GROUND)			(2.0)	1.0	B			
Light brown angular Fine to coarse GRAVEL and COBBLES of brick and concrete with occasional slightly decomposed wood fragments (MADE GROUND)			2.0 (1.0)	2.0	B			
Dark brown sandy gravely slightly maloderous CLAY. Gravel of brick and concrete. Occasional concrete cobbles (MADE GROUND)			3.0 (4.0)	3.0	B		SPT (N=9)	
				4.0	B			
				5.0	B			
With some slightly decomposed cloth.				6.0	B		SPT (N=11)	
			7.0	7.0	B			
Black sandy, clayey angular Fine to coarse maloderous GRAVEL with some glass and slightly decomposed wood fragments (MADE GROUND)				7.45	W			▼ Water strike at 7.45m rising to 7.35m after 20mi
With occasional sheet metal and aluminium rods.				8.0	B			
With occasional copper piping.			(2.8)					
				9.0	B			
Soft to Firm greenish grey slightly Sandy, slightly gravelly CLAY with occasional cloth and metal fragments (MADE GROUND)			9.8 (1.0)	9.8	B			

Remarks

Logged AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 9
Sheet 2 of 2

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 12.0m. CASED TO 10.25m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —
Coordinates —
Date 4/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records
As Sheet 1 (MADE GROUND)			(1.0)					
			10.8	10.8	B			
Stiff dark grey fissured CLAY with occasional silt partings and thin laminae. (LONDON CLAY)			(1.2)					
			12.0	12.0	B			
End of borehole 12.0m								

GROUNDWATER OBSERVATIONS DURING BORING

DATE	TIME	HOLE DEPTH (m)	CASING DEPTH (m)	WATER DEPTH (m)	REMARKS
4/7	-	7.45	-	7.45	WATER STRIKE
	-	7.45	-	7.35	AFTER 20 mins
	-	12.00	10.25	11.35	

Remarks

logged by AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 10
Sheet 1 of 3

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 20.0m. CASED TO 10.55M

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —

Coordinates —

Date 3/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field records
Grey sandy, very gravelly slightly maloderous CLAY. Gravel composed of predominantly brick and flint with some concrete and ash. With occasional decomposed wood fragments. (MADE GROUND)			(5.0)	1.0	B			
				2.0	B		SPT (N=35)	
With chalk and coal gravel				3.0	B			
				4.0	B			
Light grey very gravelly slightly maloderous CLAY with some cobbles. Gravel and cobbles of flint, rubber, chalk and vitreous purple and black fragments (plastic?) (MADE GROUND)			5.0 (1.0) 6.0	5.0	B		SPT 73 blows for 127mm	
Black sandy, very gravelly slightly maloderous CLAY. Gravel of predominantly flint and ash with some brick and glass (MADE GROUND)			(1.0) 7.0	6.0	B			
				7.0	B			
				7.3	W			▼ Water strike at 7.30m rising to 7.20m after 20 mins
Dark grey, slightly clayey, sandy angular to sub angular, fine to coarse strongly oderous (bituminous) GRAVEL. Gravel of predominantly flint with some glass. (MADE GROUND)			(2.0) 9.0	8.0	B			
				9.0	B			
Firm dark grey slightly gravelly CLAY with trace of glass and metal fragments. (MADE GROUND)			(1.25)	9.5 - 9.95	U			

Remarks
Chiselling 5.30 to 5.90m, 3/4 hr.

Logged AL
Scale 1:50
Fig.

Mott MacDonald

BOREHOLE No. 10
Sheet 2 of 3

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 20·0m. CASED TO 10·55m

Location No. 20113
Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level —

Coordinates —

Date 3/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample Type	Sample No.	Test	Field records
AS SHEET 1 (MADE GROUND)			10·25	10·25	B			
STIFF DARK GREY FISSURED CLAY WITH OCCASIONAL SILT PARTINGS AND THIN LAMINAE. (LONDON CLAY)				11·0	B		SPT (N=40)	
				11·75	B			
				12·5	B		SPT (N=34)	
				13·25	B			
				14·0	B		SPT (N=44)	
			(9·75)	14·75	B			
				15·5	B		SPT (N=41)	
				16·25	B			
				17·0	B		SPT (N=58)	
				17·75	B			
				18·5	B		SPT (N=53)	
				19·25	B			
				19·5 - 19·9	U		(55 blows)	
End of borehole 20·0m			20·0	19·9	B			

Remarks

logged by AL
Scale 1:50
Fig.

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BOREHOLE No. 10

Sheet 3 of 3

Equipment & Methods
CABLE TOOL BORING 150mm DIAMETER TO 20.0m. CASED TO 10.55m

Location No. 20113

Location BEDDINGTON LANE LANDFILL SITE

Carried out for
LONDON BOROUGH OF SUTTON.

Ground Level
-

Coordinates
-

Date
3/7/91

Description	Reduced Level	Legend	Depth and Thickness	Samples/Tests: Depth	Sample: Type	Sample: No.	Test	Field records

GROUNDWATER OBSERVATIONS DURING BORING

DATE	TIME	HOLE DEPTH (m)	CASING DEPTH (m)	WATER DEPTH (m)	REMARKS
3/7	-	7.30	-	7.30	WATER STRIKE
	-	7.30	-	7.20	AFTER 20 mins
	-	20.00	10.55	DRY	

Remarks

logged by
AK

Scale
1:50

Fig.

ATTACHMENT 2
TRIAL PIT LOGS

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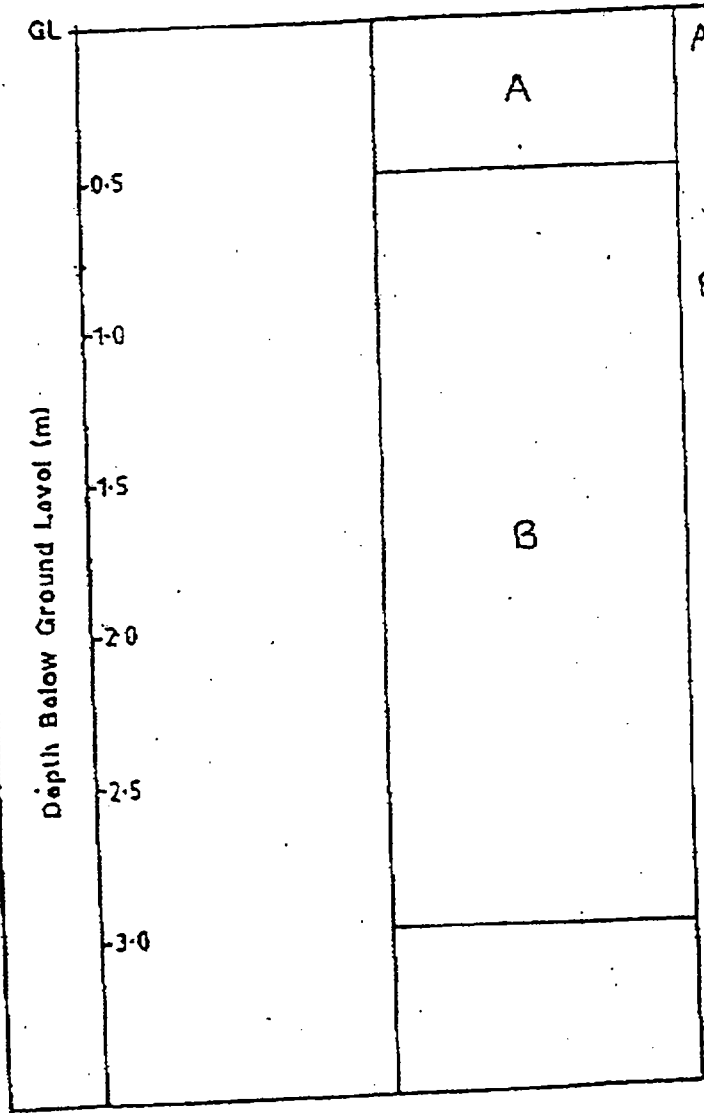
BEDDINGTON LANE TRIAL PIT

Fig.

Sketch of Faces

Face 4



Samples			
	No.	Type	Depth (m)
A 0.0 - 0.5 Brown subrounded fine to medium GRAVEL with some sand, composed of brick, limestone and occassional glass bottles uncrushed.	1		0.5
	2		1.5
B 0.5 - 3.0 Dense, brown (redish tint), slightly malodourous MADE GROUND composed of 50% subangular fine to coarse gravel with some sand, 20% shredded black plastic 20% boulders and cobbles of brick and concrete, and 10% glass bottles and jars uncrushed, tin cans moderately rusted and slightly decomposed paper.	3		3.0

Notes
No seepage or groundwater infiltration detected
No indication of the age of the waste
No neat generation or ga evolution
moderately easy digging

Equipment and Methods
Excavated To 3.0m
By JCB CASE 580
Support None

Date Excavated 27/6/91
Date Logged 27/6/91
Drawn By: JDR
By JDR
Checked By:

TRIAL PIT NO. TP1
Sheet 1 of 1

Equipment and Methods

Excavated To 2.1m

By JCB CASE 580

Support None

Date Excavated 28.6.91

Date Logged 28.6.91 By JDR

Drawn By: JDR

Checked By:

TRIAL PIT No. TP2

Sheet 1 of 1

Samples No.	Type	Depth
1		0.1m
2		0.4m
3		2.0m

A 0.0 - 0.1 Brown angular fine to medium GRAVEL with much sand, composed of flint, occassional cobbles of brick.

B 0.1 - 1.4 Brown, reddish tint, slightly malodorous MADE GROUND composed of 50% gravel with some sand, 20% glass bottles and jars uncrushed, 20% boulders and cobbles of brick and concrete, 10% plastic containers and wood slightly decomposed.

C 1.4 - 2.1 Brown, slight chemical odour MADE GROUND composed of 40% gravel with some sand, 30% paper shredded and moderately decomposed, dated 1966, 20% glass bottles uncrushed, 10% plastic sheets and containers and fragments of coal.

Sketch of Faces

Stable trial pit

Easy digging down to 2.0m depth.

Age of waste - 1966.

Notes

Concrete base at 2.1m

No radioactivity above background levels

No seepages or groundwater detected

No gas generation

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BEDDINGTON LANE TRIAL PIT

Fig.

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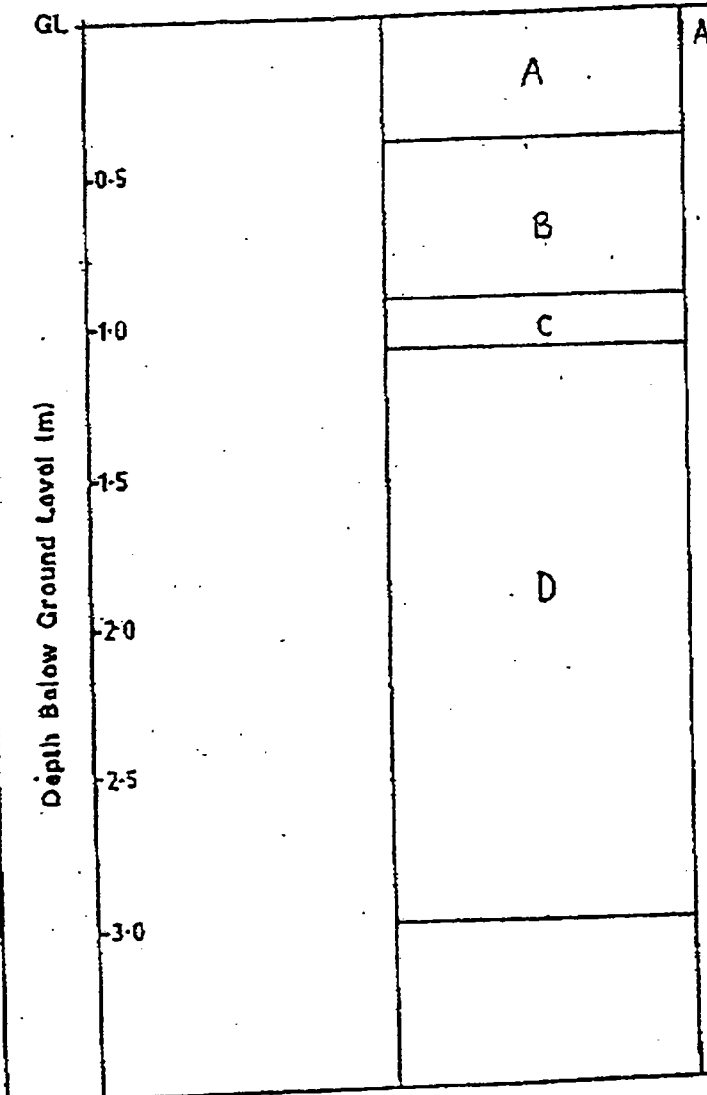
BEDDINGTON LANE TRIAL PIT

Fig.

Sketch of Faces

Face 4



		Samples	
		No. Type	Depth
A	0.0 - 0.4	1	0.2m
B	0.4 - 0.9	2	0.9m
C	0.9 - 1.1	3	3.0m
D	1.1 - 3.0		

A 0.0 - 0.4 Firm, brown slightly sandy CLAY with some subangular fine to medium gravel, composed of occassional boulders and cobbles of brick and concrete.

B 0.4 - 0.9 Light brown, no detectable odour MADE GROUND, composed of 50% gravel with much sand, 30% boulders and cobbles of brick and concrete, 10% glass bottles uncrushed and 10% plastic containers partially crushed and polystyrene (rare bones).

C 0.9 - 1.1 Layer of sand

D 1.1 - 3.0 Brown, slight organic smell MADE GROUND composed of 50% gravel with some sand., 10% newspaper moderately decomposed dated 1964, 10% glass bottles and jars uncrushed, 10% wood slightly decomposed 10% plastic containers partially crushed and 10% boulders and cobbles of brick and concrete.

Notes

No seepages or groundwater detected
No gas / heat
Waste dated 1964 (newspap
Presence of bones

Relatively unstable 0.0 - 1.0m, stable 1.0 - 3.0m
Easy digging

Equipment and Methods
Excavated To 3.0m
By JCB CASE 580
Support None

Date Excavated 28.6.91
Date Logged 28.6.91 By JDR
Drawn By: JDR
Checked By:

TRIAL PIT No. TP3

Sheet 1 of 1

Equipment and Methods
Excavated To 3.2m
By JCB CASE 580
Support None

Date Excavated 27.6.91
Date Logged 27.6.91 By JDR
Drawn By: JDR
Checked By:

TRIAL PIT No. TP4

Sheet 1 of 1

Samples		
No.	Type	Depth
1		0.1m
2		1.0m
3		3.0m

A 0.0 - 0.1 Brown Sub angular - subrounded fine to coarse GRAVEL with some sand and occassional Flints.

B 0.1 - 1.6 Brown subrounded medium-coarse GRAVEL with some sand, occassional Flint and cobbles, uncrushed glass bottles and slightly decomposed wood.

C 1.6 - 3.2 firm blueish grey CLAY with a little subangular fine gravel, occassional wood slightly decomposed cobbles (brick) and partially rusted and crushed tin cans

Sketch of Faces

Notes
No MADE GROUND, low percentage of waste.
No seepages or groundwater infiltration
No gas/heat

Easy digging
Stable trial pit
No indication of the age of the waste.

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BEDDINGTON LANE TRIAL PIT

Fig.

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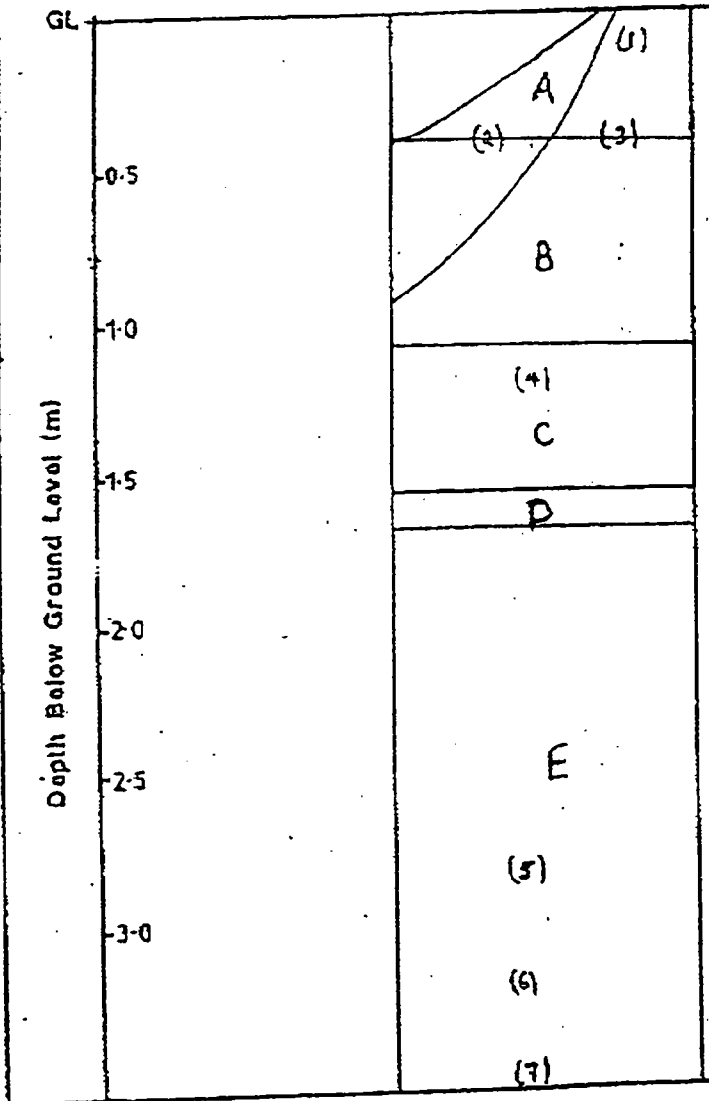
Croydon CR9 2UL

BEDDINGTON LANE TRIAL PIT

Fig.

Sketch of Faces

FACE 4



			Samples	
			No. Type	Depth
A	0.0 - 0.4	Brown subangular, fine to medium GRAVEL with much sand, composed of limestone ash, asphalt, with occassional glass and plastic fragments and rare brick cobbles.	1	0.15m
			2	0.4m
B	0.4 - 1.1	Dark brown (reddish tint) slight chemical odour MADE GROUND composed of mainly newspapers 60% slightly decomposed dated 1966, 10% glass bottles and jars uncrushed, 10% plastic containers, 10% partially rusted tin cans, 10% slightly decomposed wood	3	0.4m
			4	1.3m
C	1.1 - 1.6	Stiff, light brown sandy CLAY with a little subangular fine to coarse gravel composed of bricks and ash, and occassional glass and plastic fragments.	5	2.8m
			6	3.2m
D	1.6 - 1.7	Light grey subangular coarse LIMEMORTAR GRAVEL with moderate bitumen odour.	7	4.0m
E	1.7 - 4.0m	Dense, black, moderate chemical odour MADE GROUND composed of 50% soil dark grey very sandy clay with some subangular fine to coarse gravel, 20% cobbles and boulders of brick and concrete, 20% paper, dated 1956 card and wood slightly decomposed 10% glass bottles uncrushed, tin cans partially rusted		

Notes

Two bands of clay at 0.4 and 0.9m respectively

Newspapers dated 1966 in stratum B and 1956 in stratum E

No seepages or groundwater ...iltration

N.B Syringe present at 4.0m depth.

Stable trial pit

Moderately easy digging

Equipment and Methods

Excavated To 4.0m
By JCB CASE 580

Support None

Date Excavated 23.6.91

Date Logged 23.6.91

Drawn By: JDR

Checked By: By JDR

TRIAL PIT No. TP5

Sheet 01

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BEDDINGTON LANE TRIAL PIT

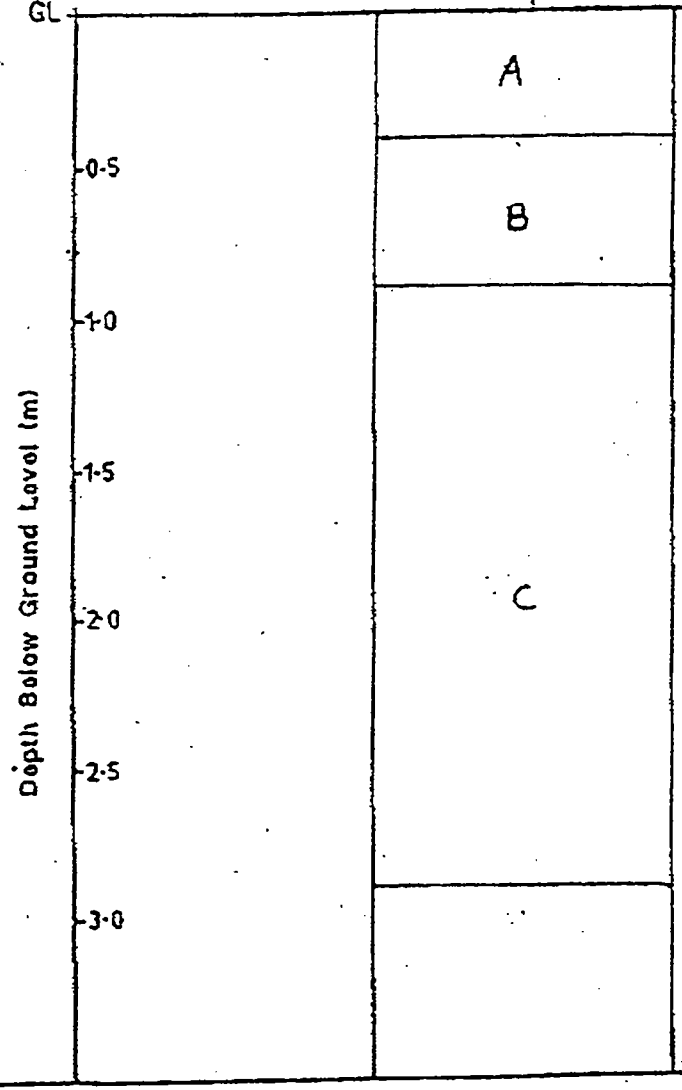
Fig.

Equipment and Methods
Excavated To 2.9m
By JCB CASE 580
Support None

Date Excavated 28.6.91
Date Logged 28.6.91 By JDR
Drawn by: JDR
Checked by:

TRIAL PIT No. TP6
Sheet of

FACE 4



Sketch of Faces

Samples			
	No.	Type	Depth
	1		0.4m
	2		1.9m
	3		2.9m

A 0.0-0.4 Stiff brown slightly sandy CLAY with a little subangular fine to coarse gravel, composed of occassional boulders of brick and rare fragments of glass and plastic.

B 0.4-1.9 Light brown, slight chemical odour MADE GROUND composed of mainly subangular fine to coarse gravel (50%). 20% glass bottles and jars uncrushed, 10% wood slightly decomposed, 10% plastic containers and 10% tin cans moderately rusted.

C 1.9-2.9 Dense, black moderate chemical odour MADE GROUND composed of 50% brownish grey clay with a little sand and some subangular fine to coarse gravel, 20% boulders and cobbles of bricks, concrete and flint, 10% bottles and jars uncrushed 10% plastic and wood slightly decomposed

Notes

No seepages or groundwater infiltration

No gas / heat generation

No indication of the age of the waste.

Stable trial pit

Moderately easy digging

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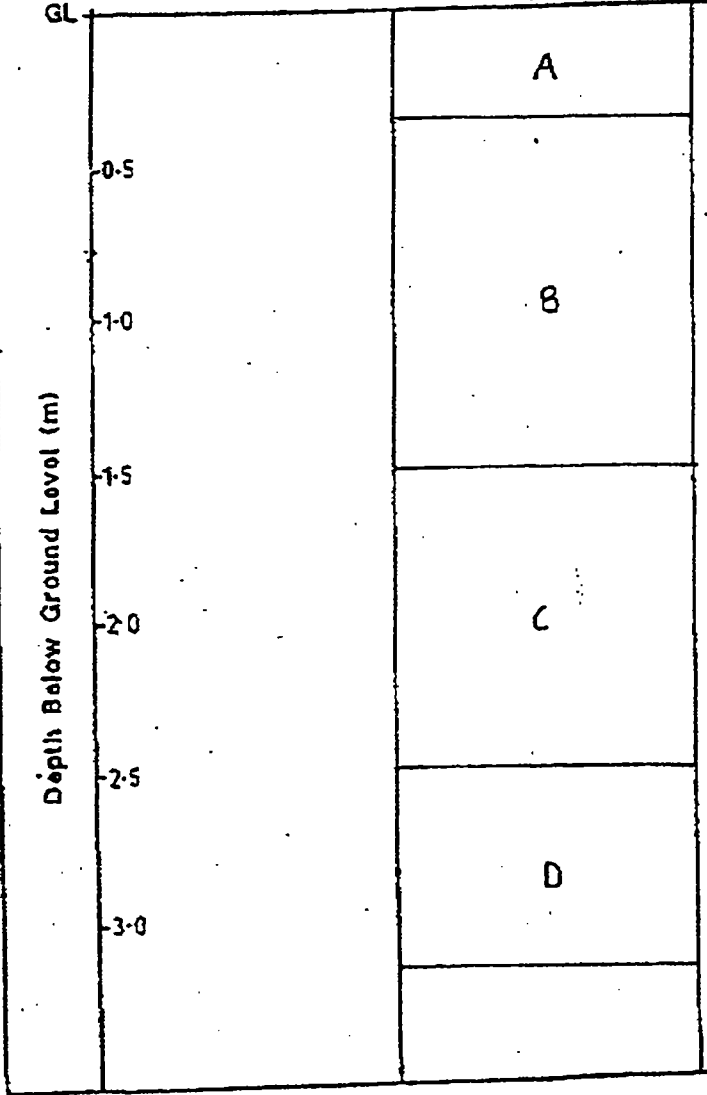
BEDDINGTON LANE TRIAL PIT

Fig.

Skeich of Faces

FACE 2



A 0·0 - 0·3 Firm light brown CLAY with some sand and with subrounded fine to medium gravel, composed of occassional brick and wood moderately decomposed.

B 0·3 - 1·5 Brown subrounded to subangular fine to coarse GRAVEL with much sand, composed of cobbles and boulders, large car part 4ft x 3ft, occassional glass bottles uncrushed and rare coal, Flint and plastic

C 1·5 - 2·5 Loose - Dense brown slightly malodourous MADE GROUND composed of 40% soil (brown) with little sand and some subangular fine to medium gravel, 25% cobbles and boulders (brick and concrete) 10% crushed plastic, 15% metal fragments and car parts including wheel and tyre. 10% glass bottles mostly crushed. Rare paper moderately decomposed and material Fabrics

D 2·5 - 3·2 Layer of partially crushed asbestos sheeting 100%.

Samples	
No. Type	Depth
1	0·2m
2	1·0m
3	2·0m
4	3·0m

Notes

Presence of hazardous material, asbestos at 2·5m
No seepage or groundwater infiltration.
No heat generation.
No indication of the date of the waste.

Stable trial pit
Easy digging

Equipment and Methods
Excavated To 3·2m
By JCB CASE 580
Support None

Date Excavated 1·7·91
Date Logged 1·7·91
Drawn By: JDR
Checked By: BY JDR

TRIAL PIT No. TP7

Sheet 1 of 1

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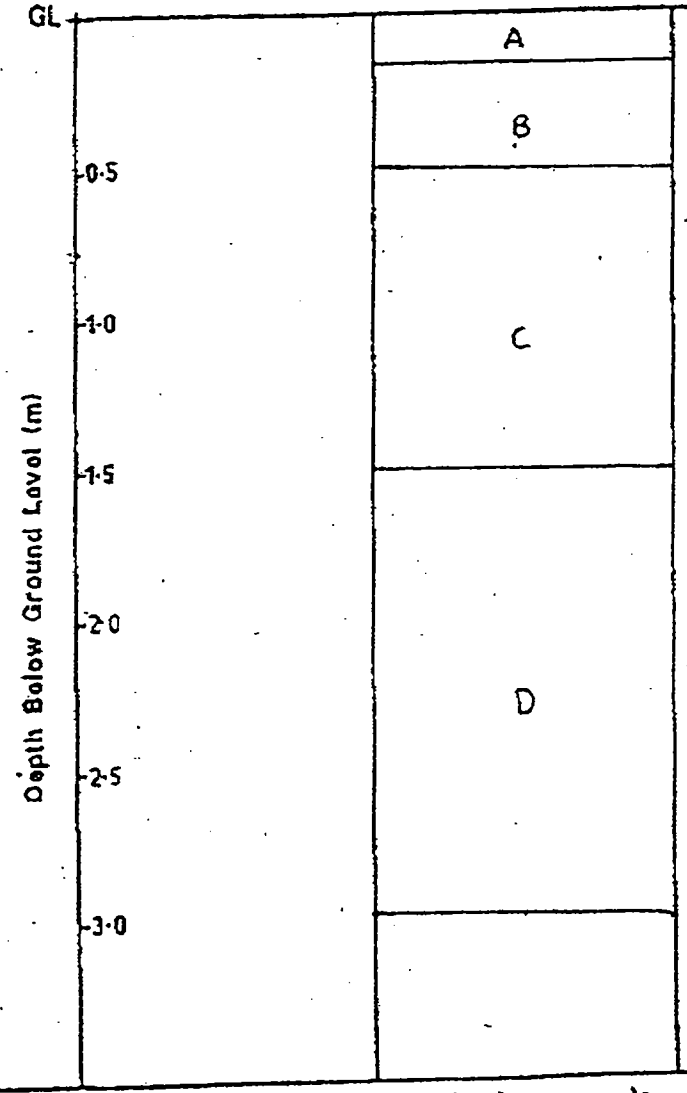
BEDDINGTON LANE TRIAL PIT

Fig.

Sketch of Faces



A 0.0 - 0.2 Firm light brown CLAY with little sand and subangular to subrounded fine to coarse gravel composed of occassional uncrushed glass bottles and brick boulders

B 0.2 - 0.5 Firm dark brown CLAY with little sand and subrounded to subangular fine to medium gravel, with occassional brick and coal.

C 0.5 - 1.5 Firm light brown CLAY with some sand and subrounded to subangular fine to coarse gravel composed of glass bottles uncrushed, plastic sheets and containers, cobbles and boulders, bits of rubber and wood moderately decomposed.

D 1.5 - 3.0m Dense, slightly malodourous MADE GROUND composed of soil subrounded fine to coarse gravel 40%, cobbles and boulders 20%, newspaper slightly decomposed dated 1965, 10%, wood slightly decomposed 10% glass bottles uncrushed 10%, car parts metal sheets and tyres(x2) 10%

Samples	
No. Type	Depth
1	0.4m
2	1.0m
3	2.8m

Notes Stable trial pit, relatively easy digging
No seepages or groundwater infiltration
No gas.
No heat generation.
Date of newspaper 1965

Equipment and Methods
Excavated To 3.0m
By JCB CASE 580
Support None

Date Excavated 1.7.91
Date Logged 1.7.91
Drawn By: JDR
Checked By: JDR

TRIAL PIT No. TP8
Sheet of

Equipment and Methods

Excavated To 3·0m

By JCB CASE 580

Support None

Date Excavated 1·7·91

Date Logged 1·7·91 By JDR

Drawn By: JDR

Checked By:

TRIAL PIT No. TP9

Sheet 1 of 1

Samples No.	Type	Depth
	1	0·4m
	2	1·5m
	3	3·0m

A 0·0-0·4 Firm light brown CLAY with some sand and subangular fine to medium gravel composed of occassional boulders and cobbles of brick and flint.

B 0·4-1·5 Firm brown CLAY with little sand and some subangular fine to coarse gravel, composed of occassional coal, brick, sandstone and glass bottles uncrushed, and rare plastic sheeting and slightly decomposed wood

C 1·5-3·0 Loose-dense slightly malodorous MADE GROUND composed of 40% soil with little sand and subangular fine to coarse gravel, wood slightly decomposed 10%, newspaper moderately decomposed glass bottles and plastic containers partially crushed 10%, large 3ft x 3ft galvanised water tanks x2 20%, and metal fragments, cobbles and boulders, bag of hardened cement 30%.

Sketch of Faces

Unstable trial pit due to large components in the waste
Difficult digging.

Notes
No indication of the age of the waste
No gas or heat generation
No seepages or groundwater detected.

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BEDDINGTON LANE TRIAL PIT

Fig.

Equipment and Methods

Excavated To 2·4m

By JcB CASE 580

Support None

Date Excavated 28·6·91

Date Logged 28·6·91 By JDR

Drawn By: JDR

Checked By:

TRIAL PIT No. TP10

Sheet 1 of 1

Samples No.	Type	Depth
1		0·2m
2		1·0m
3		2·4m

A 0·0 - 0·2 Brown subrounded fine to coarse GRAVEL with some sand composed of occasional cobbles of brick.

B 0·2 - 2·4m Dense black moderate bitumen odour MADE GROUND composed of tarmac, ash and road building materials 90%, and boulders and cobbles of brick, and occassional glass bottles uncrushed, 10%

Sketch of Faces

FACE 4

Notes

Stable trial pit difficult digging

Located on access road therefore predominantly road building materials

No seepage or groundwater

No gas or vapour generation

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Croydon CR9 2UL

BEDDINGTON LANE TRIAL PIT

Fig.

Equipment and Methods
Excavated To 3.0m
By JCB CASE 580
Support None

Date Excavated 1.7.91
Date Logged 1.7.91 By JDR
Drawn By: JDR
Checked By:

TRIAL PIT No. TP11

Sheet 1 of 1

Samples		
No.	Type	Depth
1		0.2m
2		1.0m
3		3.0m

A 0.0 - 0.2 Firm brown CLAY with little sand and some subangular fine to coarse gravel, composed of occasional bricks.

B 0.2 - 1.1 Firm light brown CLAY with some sand and subangular fine to coarse gravel, composed of galvanised water tank 3Ft x 3Ft, cobbles and boulders of brick and coal, glass bottles and light bulbs uncrushed, plastic containers partially crushed and rare ash.

C 1.1 - 3.0m Dense black slightly malodorous MADE GROUND composed of 50% firm brown clay with little sand and some subangular fine to coarse gravel, 20% newspaper moderately decomposed, 15% metal sheets, tin cans partially rusted, 10% cobbles and boulders of brick and concrete and 5% glass bottles uncrushed.

Sketch of Faces

Stable trial pit
Easy digging

Notes
No indication of the age of the waste
No gas or heat detected
No seepage or groundwater

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BEDDINGTON LANE TRIAL PIT

Fig.