

London Underground Limited



**Jubilee Line Extension,
1990 (No. 2) Bill:
*Environmental Statement Addendum***

February 1991



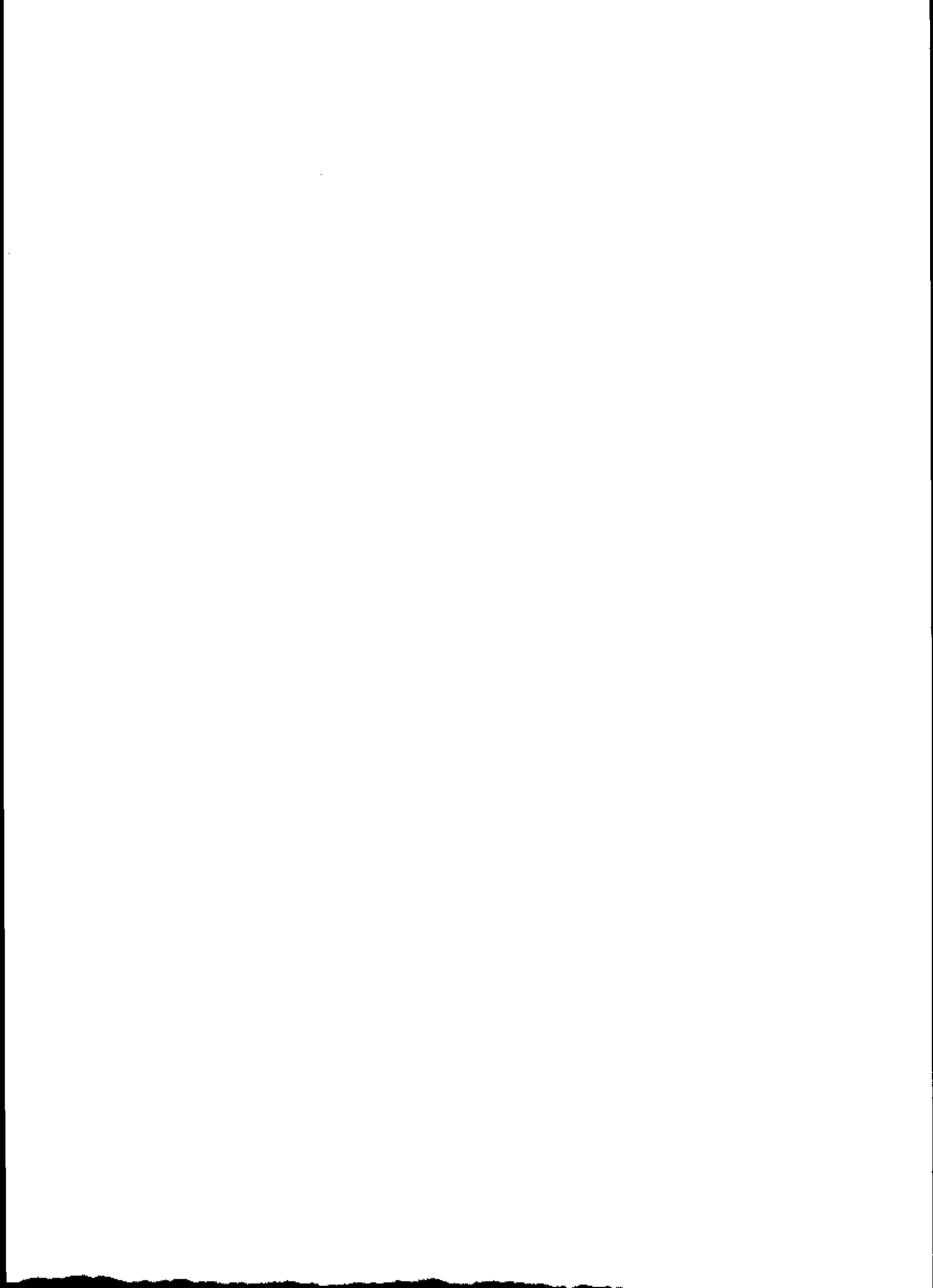
London Underground Limited

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- o To identify the nature and scale of the environmental effects that are likely to result from the revised construction proposals under the 1990 (No.2) Bill.
- o To identify any specific measures that should be taken to minimise those effects or any particular features which may require attention beyond the general mitigation measures outlined in the main Environmental Statement.

The issues addressed included the following potential impacts during construction and operation.

- o Disturbance due to noise and vibration, dust and visual intrusion affecting local residents and other sensitive land users during construction.
- o Loss of or restricted use of property during the period of construction.
- o Restrictions and delays to traffic due to construction vehicles or road closures and disturbance to pedestrians by footpath closures or loss of access.
- o Loss of amenity by, for example, loss of community facilities or recreation areas.
- o Effects on groundwater and the aquatic environment, on land and on ecology during both construction and operation.
- o Impacts on cultural and historical features and on archaeological features during both construction and operation.

The main construction areas proposed for the revised works and the main potentially significant impacts identified at each, which are additional to those described in the main Environmental Statement, are as follows (numbers refer to the map locations illustrated on the previous page):

- o **Waterloo Station (1).** The additional site here is at Mepham Street, which is needed to provide access to the work site on Tenison Way and for underpinning. Currently Mepham Street provides a route for traffic leaving Waterloo Station.

No significant additional impacts are predicted at this work site although an alternative route may have to be found for vehicles leaving Waterloo Station for a short period while Mepham Street is prepared, and care should be taken not to cause disturbance to the Southbank Conservation Area which is adjacent to it.

- o **Southwark Station (2).** The work sites here are extensions of those proposed for the original scheme. Additional land is required to build a pedestrian link between the proposed Jubilee Line underground Southwark Station and the existing British Rail Station at Waterloo East. In addition, ventilation and escape shafts are to be constructed at the Hatfields work site and the outer lanes of Blackfriars Road will be temporarily occupied for the underpinning of the existing railway bridge across Blackfriars Road. Most of the land needed for these works currently belongs to British Rail.

Several businesses located under railway arches will have to be relocated to accommodate the ventilation and escape shafts and, until works move below ground, there is some potential for noise disturbance. In addition, movement of lorries

servicing the work sites may cause increased noise and traffic congestion.

- o **Southwark Street/Redcross Way (3).** This is currently a development site containing only several disused buildings. It is intended for construction works on both the Northern Line improvements (Safety Measures Bill) and the Jubilee Line Extension. Proposed Jubilee Line works include the insertion of a tunnelling machine, the removal of spoil generated by tunnel and station construction, and the construction of a traction substation which would supply electricity to the underground rails.

There may be some noise disturbance, particularly during the initial stages of site preparation and, as the site is part of a built up area which includes both commercial and residential properties, there is potential for both dust and visual impacts. Increases in lorry movements are also likely to be noticeable.

- o **London Bridge Station (4).** A number of revisions are proposed at work sites in the vicinity of London Bridge Station and most of the land area involved is existing British Rail property or public roads. The surrounding land is owned primarily by Guy's Hospital although much of the work to be carried out in this area is not likely to cause undue annoyance as the buildings are used mainly for offices or other non-clinical purposes. Proposed works include ground treatment and underpinning as well as construction of a ventilation shaft in a courtyard adjoining Joiner Street. The major revisions, however, relate to a new ticket hall for London Bridge Station; this will require additional landtake on Joiner Road and permanent adjustments to the local road system.

There may be noise disturbance to offices overlooking the site during the initial phase of the works. Additionally, although the overall increase in movements of lorries should not be significant, there may be a lengthening of journey times for some road users due to the amended road layout.

- o **Old Jamaica Road (5).** Here the surrounding area is residential and includes a sheltered housing estate. The works require a short section of the road adjacent to the large work site described in the original proposals. The additional area is required for ground treatment which will take about four months.

There is some potential for additional noise disturbance to a church and a primary school but no other significant impacts are predicted.

- o **Ben Smith Way (6) and Major Road/John Roll Way (7).** The proposed revisions involve the construction of the Bermondsey Station by "cut and cover" methods (ie from the surface) instead of by tunnelling methods as originally proposed, ground treatment and underpinning. This will require an extension of the work site, beyond the boundaries originally proposed, on all four sides.

This construction area also includes stretches of Ben Smith Way and John Roll Way and a small area of adjacent grassland required for ground treatment, underpinning and an enlargement of the ventilation shaft.

The surrounding land uses are predominantly residential. There is potential for significant noise disturbance, particularly if there is night-time working,

and in this residential setting, dust and visual impacts may also occur. Traffic impacts including delays, diversions, and disturbance may also result both directly immediately around the site and indirectly if spoil is removed via the already congested Jamaica Road.

- o **Southwark Park (8).** A strip of the centre of the park is required for ground treatment. Work will take between six months and one year to complete.

There will be some loss of amenity during the operations as sections of the park are closed off, but no significant permanent impacts are predicted.

- o **Canada Water (Renforth Street) (9).** A short stretch of Renforth Street near the proposed Canada Water Station is required for ground treatment lasting about six weeks. The surrounding area is residential and the road is not heavily trafficked.

No significant impacts are expected.

- o **Canning Town Station (10).** The proposed Canning Town Station work site is to be expanded to include an additional section of the adjacent Victoria Dock Road. The surrounding area includes British Rail land and light industrial and commercial properties, with the nearest residences about 100m away. Impacts include the potential loss of seven commercial properties which rely on Victoria Dock Road for access. There may also be noise disturbance to a nearby housing estate during the early stages of construction.

Storey's Gate and part of Tenison Way have been referenced in the 1990 (No.2) Bill. However, these two areas were considered in the original (March 1990) Environmental Statement.

Mitigation of Impacts

Work at all the construction areas has the potential to cause disturbance. The main effects of the railway construction are likely to be felt by people who live or work close to the various construction sites, and to a lesser extent by visitors to those areas. The two most evident effects would be from noise and dust.

Noise would be caused by the breaking up and preparation of ground, by piling operations, by the operation of stationary equipment (such as compressors and diesel-powered vehicles), and by lorries delivering supplies and removing spoil. Dust would result from general site operations, the storage and use of construction materials, and from lorries moving to and from the construction sites. Where ground treatment and/or underpinning are carried out from a road surface whilst part of the road remains open to traffic, significant dust arisings can also occur.

In order to minimise these effects a key requirement should be the inclusion of a formal set of conditions in the contracts for the construction of the railway. These conditions should define the acceptable noise standards at the nearest building facade, as well as "good housekeeping" measures that must be applied to minimise noise, dust and visual intrusion. Effective monitoring would also be needed to ensure that these contractual conditions were consistently met.

The main Environmental Statement (Section B) describes in detail the generic mitigation measures which could be applied in each technical area of impact analysis. The following sections outline the

main measures which could be adopted to minimise the potential for disturbance arising at the revised work sites.

Noise

Particular measures to reduce noise could include the following.

- o Screening or enclosure of fixed plant such as pumps, compressors and ventilation fans (site buildings can provide useful screening).
- o Scheduling unavoidably noisy operations to avoid daytime or night-time working, as appropriate to the local land uses concerned.
- o Use of the quietest practicable piling methods.
- o Screening sites by hoardings.
- o Fitting and maintaining effective silencers on all diesel-engined vehicles and plant, and the use of electrically-powered equipment, where practicable.

Dust

Measures to prevent significant increase in dust deposition could include the following.

- o Enclosing material stockpiles, and using water sprays to damp down dusty materials.
- o Spraying the surface of long-term stockpiles with chemical bonding agents.

- o Hard surfacing of busy areas, on-site routing of vehicles, and enforced speed limits.
- o Sheeting of all vehicles carrying spoil and other dusty materials, and wheel-washing.
- o Operational controls (e.g. a limit on drop heights from conveyors).
- o Regular cleaning of roads on which mud deposits occur.

Land, Property and Cultural Impacts

Where land must be taken permanently, the area acquired should be kept to a minimum and the permanent structure should be constructed to suit its surroundings.

Areas which have been identified as having great potential archaeological value should be subject to a thorough archaeological assessment well before construction is due to begin.

Traffic and Access Aspects

Measures to minimise impacts due to traffic disturbance could include the following.

- o Restricting lorry traffic to specified routes to be determined in conjunction with the local authorities.
- o Scheduling deliveries of materials and plant, and departure of spoil loads, such that night-time lorry movements and overnight lorry parking are avoided.

Visual Impacts

Visual impacts should be avoided by the provision of appropriate screening.

Conclusions

The environmental effects predicted to arise from the construction and operation of the Jubilee Line Extension were fully analysed in the main Environmental Statement produced by Environmental Resources Limited. The actions necessary to minimise and mitigate these effects were also detailed.

The environmental consequences of the 1990 (No.2) Bill will not be different in nature to those of the original scheme, but the size and scope of the effects at revised or additional construction areas may change. The following potential key environmental impacts are identified in this addendum.

- o Dust arising from ground treatment and/or underpinning.
- o Traffic impact caused by construction vehicle movements and lane closures.
- o Noise impacts from expanded and additional work sites.
- o Potential loss of archaeological remains at nationally valuable sites.

Greatest attention should therefore be paid to the following measures necessary to reduce and ameliorate potential impacts of the revised scheme.

- o Good site practice and implementation of dust control measures.
- o Scheduling of underpinning and ground treatment work on roads to nights and weekends thus avoiding lane closures at busy times.
- o Control of noise on site by scheduling of operations and use of silenced equipment. Control of noise to nearby residents by use of screening.

C: BACKGROUND TO THIS ADDENDUM

**CI. BACKGROUND TO THIS ENVIRONMENTAL STATEMENT
ADDENDUM**

C1.1 The Environmental Statement for the Jubilee Line Extension

In November 1989 London Underground Limited (LUL) submitted proposals for the Jubilee Line Extension to Parliament in the form of a Private Bill.

Environmental Resources Limited (ERL) was asked by LUL to provide an independent assessment of the potential environmental effects of the proposals described in the Bill. To this end, ERL performed an Environmental Assessment with the following objectives.

- 1) To identify the potential environmental impacts of the proposed Extension to the Jubilee Line, taking account of its characteristics, the sensitivity of the local environment and the concerns of interested parties.
- 2) To predict and evaluate the extent and significance of the potential impacts.
- 3) To identify measures that should be taken to mitigate adverse impacts and to monitor their effects.

Although formal Environmental Assessment was not a legal requirement for the project, the investigation was carried out and the results presented in an Environmental Statement (ES), in a manner consistent with the requirements of the relevant EC

Directive¹ as implemented in England and Wales by the Town and Country Planning Act (Assessment of Environmental Effects) Regulations of 1988². Department of the Environment information and advice concerning the implementation of the regulations, the conduct of an Environmental Assessment and the content of an Environmental Statement was also taken into account^{3,4}.

C1.2 The Addendum to the Environmental Statement

In November 1990 LUL presented a second Bill concerning the Jubilee Line Extension (JLE) to Parliament which sought additional powers so that modifications to the original design and construction methods of the Extension could be accommodated. This was the "London Underground 1990 (No.2) Bill" and is hereafter referred to as "the 1990 (No.2) Bill".

ERL was commissioned to provide a summary of the environmental effects of the revisions proposed in the 1990 (No.2) Bill in the form of an Addendum to the original ES. The procedure and methodology detailed in our earlier ES were adhered to.

¹ Council Directive of 27 June on the assessment of the effects of certain public and private projects on the environment (85/337/EEC) ●JEC 175; 5:7:85.

² The Town and Country Planning (Assessment of Environmental Effects) Regulations 1988. Statutory Instrument No. 1199; in force July 1988.

³ Joint Circular from the Department of the Environment and Welsh Office on Environmental Assessment, Circular No. 15/88, 23/88.

⁴ Department of the Environment and Welsh Office; Environmental Assessment; A Guide to the Procedures, HMS● 1989.

C1.3

The Contents of this Addendum

A detailed description of the Jubilee Line Extension project as a whole, which includes the rationale for the development and details the environmental impacts of the line when it is operational, is given in the Environmental Statement.

This Addendum focuses on the environmental implications of the changes to the project proposed in the 1990 (No.2) Bill. In most cases these relate to modifications of construction methods or the work area at work sites specified in the main ES. In two cases, however, completely new work sites are proposed.

Information which relates to issues which occur route-wide is to be found in the main ES. The Addendum provides information which is specific to the revised or additional sites listed in the 1990 (No.2) Bill.

C2. THE REVISED/ADDITIONAL WORKS UNDER THE 1990 (NO.2) BILL AND THEIR POTENTIAL ENVIRONMENTAL EFFECTS

C2.1 Introduction

This section provides a summary of the proposed 1990 (No.2) Bill revisions to the JLE scheme and identifies the potential environmental effects of the revised works. These are examined in more detail in subsequent sections. A full description of the overall scheme and its potential environmental effects was provided in the main ES (pages 9-23). A map of the route of the JLE is shown in Figure C2.1(a).

C2.2 The Revised/Additional Works

The revised or additional works proposed under the 1990 (No. 2) Bill are listed in Table C2.2 and are shown in Figure C2.2(a). They fall into four principal categories.

o Revised Station Construction

Four of the stations servicing the Jubilee Line Extension are subject to construction proposals contained in the 1990 (No.2) Bill; these are:

- Southwark Station;
- London Bridge Station;
- Bermondsey Station;
- Canning Town Station.

The altered proposals relate to increased work site areas needed to accommodate improved passenger facilities, or to changed construction methods.

o Shafts from the Surface to the Underground Tunnels

There will be draught relief shafts at each end of every JLE underground station. Tunnel ventilation shafts and emergency escape shafts will also be provided in stations and running tunnels, to meet the requirements of the Railway Inspectorate. The 1990 (No.2) Bill proposals envisage:

- revised siting of shafts at Southwark Station;
- an enlarged shaft at Ben Smith Way;
- an additional shaft at London Bridge Station;
- an additional cabling shaft west of London Bridge Station;
- an additional cabling shaft on the Southwark Street/Redcross Way Site.

o Ground Treatment and Underpinning

In areas where the sub-surface material requires consolidation or where potential water ingress is expected, ground treatment may be necessary. This involves injecting consolidating and hardening agents, such as cement grout, bentonite, etc into the ground from the surface through a borehole. The revised proposals indicate that ground treatment will be necessary in the Woolwich and Reading Beds, at the beginning and end of tunnel drives and above an emergency reversing/train stabling facility intended to be located below Southwark Park. This will involve the temporary acquisition of surface areas at:

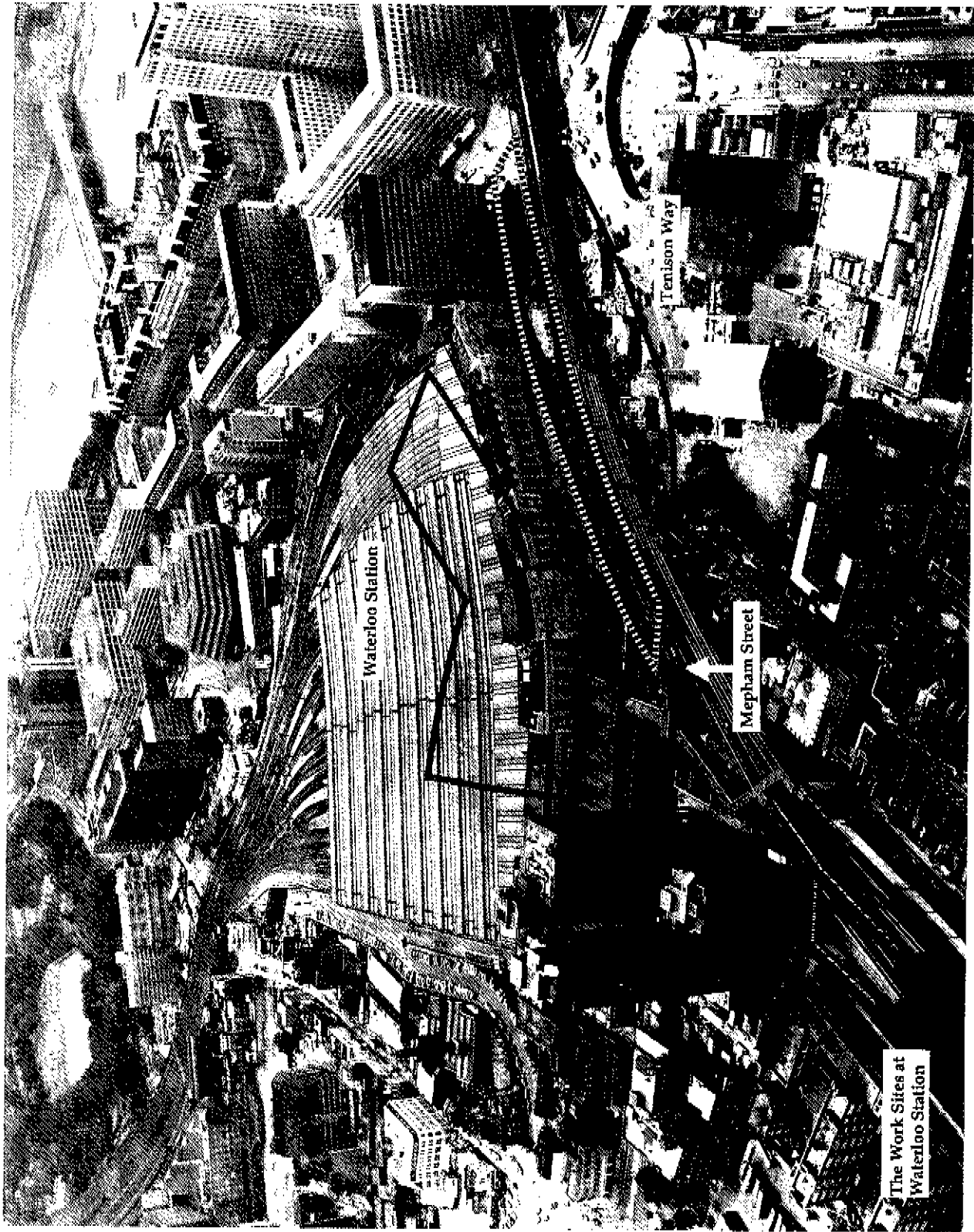
- Old Jamaica Road;
- Renforth Street;
- Southwark Park.

Table C2.2: Construction Activities along Railway Route			
Construction Site Location	Existing Use	Construction Activities	Surrounding Land Use
Waterloo Station (1)			
o Mepham Street	Access	Underpinning and provision of vehicular access to Waterloo Station construction sites. Lowering of the road may be required to gain access to the proposed ticket hall.	Business and commercial premises
Southwark Station and Hatfields (2)	BR property, garages, small businesses under viaduct, access	Escalators and stairs provided to link BR and LUL Stations via concourse. Relocation of ventilation shafts and an escape shaft. Ground treatment on Blackfriars road.	Residential properties, workshops, warehousing, offices, railway viaduct.
Southwark Street/Redcross Way (3)	Development site, empty warehouses and offices	Shaft construction. Insertion of tunnelling machine and removal of spoil. Traction substation.	Offices
London Bridge Station (4)	Underground car park, forecourt at upper level	Construction of escalator shaft.	Offices, Guys Hospital buildings
o Joiner Street	Access	Pedestrianisation of north end. Construction of ticket hall & pedestrian concourse	Warehouses, wine bar, offices
o Stainer Street	Access	Road widening	Small businesses in railway arches
o Bermondsey Street	Railway arches, small businesses	Construction of traction substation	Small businesses in railway arches
o St Thomas Street	Access	Ground treatment. Construction of road "umbrella"	Offices, Guys Hospital
o London Bridge Street	Access	Ground treatment	Offices
o Joiner Street Courtyard	Car park, access	Ventilation shaft and spoil removal	Offices
Old Jamaica Road (5)	Access	Ground treatment	Residences, commercial
Ben Smith Way (6)	Access and Children's Play area	Ground treatment	Residences, play area

Table C2.3: Checklist of Possible Construction Impacts

Activity	Impact to be Investigated
Occupation of construction sites	<ul style="list-style-type: none"> • Loss of or disturbance to existing land uses and property • Loss of or disturbance to existing ecology
Site preparation and construction activities (demolition of buildings, breaking up of existing foundations, cutting operations, piling, excavation, materials handling and storage, etc)	<ul style="list-style-type: none"> • Noise, dust, visual impacts • Soil/sludge contamination • Changes in surface and groundwater regime • Run-off and water quality impacts; effects on groundwater recharge • Disruption to road and pedestrian access
Ground treatment and underpinning	<ul style="list-style-type: none"> • Noise, visual impacts • Disruption of traffic • Damage to archaeological sites • Effects on groundwater quality • Disturbance to existing ecology • Dust
Transport of construction materials/equipment/workers	<ul style="list-style-type: none"> • Traffic noise and disturbance • Impacts on transport networks
Presence of temporary structures, plant and equipment on site	<ul style="list-style-type: none"> • Visual impact
Spoil removal and disposal	<ul style="list-style-type: none"> • Increased pressures on transport networks • Dust • Water quality impacts • Impacts on local disposal capacity for tunnel spoil, construction debris and special wastes

**ROUTE SECTION 1:
GREEN PARK TO WATERLOO**



The Work Sites at
Waterloo Station

Table C3.2:

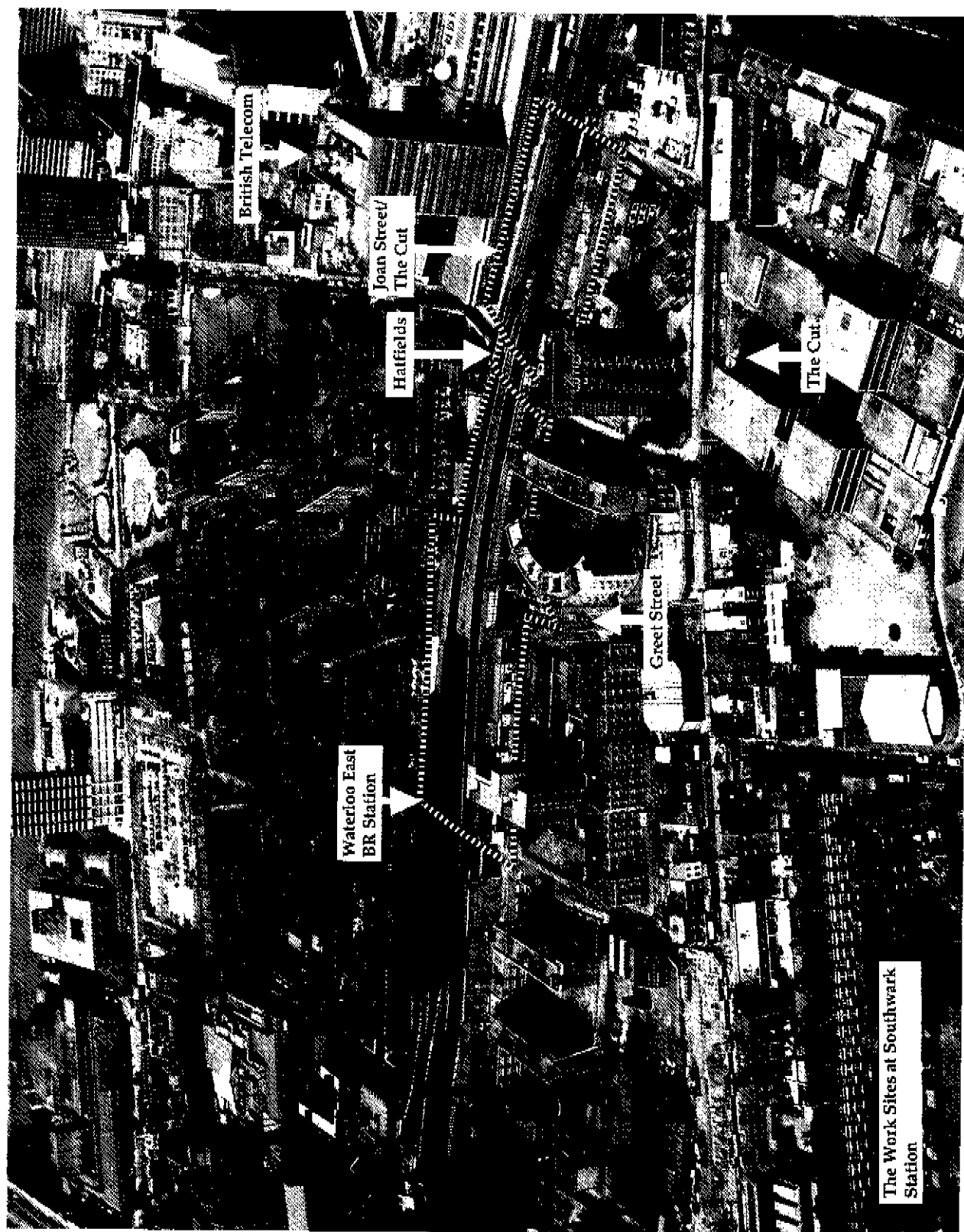
Impacts of Construction: Green Park to Waterloo

Main Sites**Waterloo**

The additional working area includes a length of Mepham Street between Waterloo Station and Tenison Way. This is a commercial area.

Land and Property Impact	No additional impacts.
Noise and Vibration	Present background levels are about 57dB(A) during the day and 45dB(A) at night. Typical noise levels during construction will be between 62 and 68dB(A) at 40m from the site. At 150m, background and construction noise levels are similar. Although some properties at the eastern end of Mepham Street may be affected, overall disturbance is expected to be low due to the screening of noise by archways on either side of the street.
Dust and Visual Impacts	The revised works, in particular underpinning, increase the potential for dust generation. Strict standards of construction practice should be adopted to minimise dust impacts to adjacent properties. Additional visual impacts will not be significant.
Access and Traffic Aspects	Mepham Street, which is to be an access road to the construction sites at Waterloo Station, will be accessed from York Road. A large proportion of traffic currently using Mepham Street consists of taxis travelling between Waterloo Station and Waterloo Road. Some of this traffic is likely to be temporarily diverted for several days only onto York Road. Pedestrian access is to be maintained. Therefore, no significant impacts are predicted.
Cultural Resources	The Mepham Street works approach the boundary of the Southbank Conservation Area and attention should be paid on this site to safeguard adjacent buildings.

**ROUTE SECTION 2:
WATERLOO TO LONDON BRIDGE**



site, will be required for underpinning. This will be necessary to stabilise the railway bridge support before underground work commences. It will not be necessary to close the entire road, and at least two lanes will remain open at any one time. The work should be completed within ten weeks.

In addition stretches of a number of roads within this construction area may be required for underpinning of arches. In all cases the flow of traffic may be restricted for the up to ten week construction period. These include:

- . Brad Street;
- . Wootton Street;
- . Greet Street;
- . Hatfields;
- . Joan Street;
- . Isabella Street.

o **Southwark Street/Redcross Way**

This is a completely new work site to the JLE scheme at which works for both the Extension project and the improvements to the Northern Line, under the Safety Measures Bill (Additional Provision) will take place. Part of the site lies inside the Borough High Street Conservation Area and a number of Listed Buildings are close by, including the Grade II Listed Hop Exchange on Southwark Street. In addition the site lies on an area of National Archaeological Importance.

The site will be used for shaft construction, tunnelling and the removal of spoil. Tunnelling from the site will include the running tunnels to London Bridge Station. In addition, a permanent traction substation, to provide electricity to the

underground railway will be located at the south of the site. The site will be occupied for the full 4½ year construction period.

o **London Bridge**

The revised/additional works proposed in and around the London Bridge Station construction area take place at six sites as shown on Figure C3.3(b).

- **Joiner Street.** Joiner Street is an important thoroughfare for traffic in this area and is designated as such by the Department of Transport. Under the revised scheme, it is proposed that part of it be pedestrianised. The north end will be closed to traffic whilst the south end will remain open for access. The additional area is needed to provide a ticket hall and pedestrian concourse at London Bridge Station.
- **Stainer Street.** It may be necessary to provide an alternative route for through traffic if Joiner Street is closed and it is proposed that Stainer Street replace Joiner Street as part of the local designated road network. The northern end of Stainer Street may need widening at the junction with Tooley Street and this would require substantial modifications to the railway arches which cross at that point and which lie within a Conservation Area. Stainer Street would be closed for about one year during construction. The site is close to a number of Listed Buildings within the Tooley Street Conservation Area.
- **Bermondsey Street** work area is slightly to the east of the Joiner Street/Stainer Street works. It may be required for the construction of a traction substation

disturbance to offices and lecture rooms of the Price Waterhouse Training Centre;

- to minimise potential disruption to traffic on Blackfriars Road and on London Bridge Street during underpinning work, the restriction of lane closures to night and weekends should be considered;
- an assessment of the potential for ground settlement at Joan Street/The Cut should be carried out and buildings which might be affected by settlement should be identified.

Table C3.3: Impacts of Construction: Waterloo to London Bridge

Main Sites

Southwark Station

There are two main additions to the previously proposed sites involving land extending west over about 1.5ha of BR-owned land, towards Waterloo East station and crossed by Hatfields. The proposed construction work includes an underground ticket hall and a pedestrian link with a covered concourse bordering Brad Street, a residential area to the north and Wootton Street, a commercial and residential area to the south. Joan Street and Isabella Street will be occupied by this site. A further addition relates to a section of Blackfriars Road, where underpinning should be carried out over a period of up to ten weeks.

Land and Property Impact	Several properties within the arches under the BR viaduct on Hatfields will be affected. These include five commercial properties which will be lost permanently where the arches have now been designated for other uses such as emergency escape and ventilation shafts or passage and stairways exits. Additionally access to several garages and a printers' may be lost.
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Noise and Vibration	Background levels on Isabella Street are currently about 65dB(A) during the day and 45dB(A) at night. Cut and cover work in this area will result in disturbance at the surgery and public house at Hatfields until station works move below ground level. In addition, percussive drilling and night work will give potential for disturbance. If piling is required at this site, consideration should be given to screening or other measures to reduce noise. A similar situation exists for Greet Street and Wootton Street.
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Dust and Visual Impacts	The adoption of strict standards of construction practice should minimise adverse impacts on adjacent properties. Special measures to control dust are not expected to be necessary at these sites. Visual impacts should be minimised by the provision of appropriate screening. As these sites are in a built-up area, no significant permanent visual impacts are anticipated.
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Access and Traffic Aspects	Total lorry movements associated with the combined Southwark Station sites are predicted to be in the order of 96 movements per day during peak construction (or 48 trips). The work sites will be accessed via Hatfields, Joan Street, Blackfriars Road, Scoresby Street and The Cut. Existing traffic flows are very low and therefore increases in traffic noise and lorry disturbance may be noticeable. On Blackfriars Road, the temporary closure of the outer lanes during construction is predicted to cause some additional traffic congestion. The northbound lane to be closed is a bus lane, therefore buses may be particularly affected, especially at peak hours. Some pedestrian inconvenience may also be experienced.
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Cultural Resources	Listed Buildings on Blackfriars Road will potentially suffer no greater impacts than those envisaged in the main ES. However, the Southwark Station extension now borders the Roupell Street Conservation Area and the backs of Grade II Listed Buildings on Roupell Street. Strict on and off site controls will be necessary to safeguard these buildings.
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Table C3.3 (Continued): Impacts of Construction: Waterloo to London Bridge

Southwark Street/Redcross Way

This site occupies an area on the corner of Southwark Street and Redcross Way and contains a six storey office building and four single storey warehouses, all currently unoccupied. It is part of a built-up area with commercial and residential premises adjacent to it, and lies within the Borough High Street Conservation Area. The site will be occupied for the full construction period of four and a half years.

Land and Property Impacts	This new site will be used for tunnelling and spoil removal, which necessitates the demolition of 5 buildings: 4 single storey warehouses and 1 six-storey office and storage building. However, these buildings are currently unoccupied. Much of the site will be sold for redevelopment after construction work is completed but there will be some permanent landtake by a traction substation.
Noise and Vibration	Current background noise levels are about 60dB(A) by day and 50dB(A) by night. Worst case noise levels during site clearance and preparation may reach 77dB(A) for short periods. More typically noise levels will be between 62 and 69dB(A). This may cause some disturbance to offices overlooking the site, in particular the lecture rooms of the Price Waterhouse Training Centre. Disturbance on Redcross Way could be significant at night.
Dust and Visual Impacts	Strict standards of construction practice should be adopted to minimise dust impacts to adjacent properties. No particular additional measures are considered to be necessary at this site. Visual impacts should be minimised by the provision of appropriate screening.
Access and Traffic Aspects	Total lorry movements per day are predicted to be in the order of 92 during peak construction (or 46 trips). The site will be accessed via Southwark Street and Union Street and some increases in traffic noise, lorry annoyance and possibly congestion are likely.
Cultural Resources	14 Grade II Listed Buildings on Borough High Street either back on to this site or are close to it. In addition the Hop Exchange (Grade II) on Southwark Street is situated across the road. Special care is needed by lorries removing spoil from this site. As an area of National Archaeological Importance, preliminary archaeological site investigation of the works area is essential.

Table C3.3 (Continued): Impacts of Construction: Waterloo to London Bridge

London Bridge Station

A number of additional/extended sites are proposed as part of the London Bridge Station Works. Most occupy roads such as St. Thomas Street, Joiner Street, Stainer Street and London Bridge Street and will restrict access to the predominantly commercial premises thereon. One site borders Bermondsey Street, where a traction substation may be built. A ventilation shaft will be constructed from Joiner Street courtyard which is mostly bounded by offices. Guy's hospital lies close to the southern edge of the site.

Land and Property Impacts	Additional temporary or permanent loss of properties beyond those detailed in the main ES may affect 12 businesses, also some access restrictions to buildings are envisaged, primarily on St. Thomas Street where office parking space will be lost. Permanent removal of vehicle access to the northern end of Joiner Street will alter access arrangements for New London Bridge House.
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Noise and Vibration	Background noise levels at London Bridge station are currently 60dB(A) by day and 53dB(A) by night. Typical noise levels expected at Philip Harris House (under construction) may be in the range 61dB(A). For offices bordering the site, typical sound levels during site preparation and preliminary works may be as high as 85dB(A). Here, rooms on lower levels overlooking the site are likely to experience some noise disturbance. In addition, pneumatic drills and hammers during initial works are likely to disturb offices on the north side of Tooley Street.
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Dust and Visual Impacts	Strict standards of construction practice should be adopted to minimise dust impacts on adjacent properties. No special measures are considered necessary at these sites. The Jubilee Line Extension facilities will be incorporated within the existing station and arches and it is not anticipated that there will be any new potential sources of visual impact other than visually minor modifications to the existing structures.
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Access and Traffic Aspects	Total lorry movements at the construction site associated with the ticket hall at Joiner Street will be in the order of 52 per day (or 26 trips). Joiner Street will be used as a work site to access the construction works. Access is via St Thomas Street and Tooley Street. The existing traffic volumes in the vicinity are relatively high and therefore overall increases in lorry annoyance will not be significant. Journey times for existing road users may be lengthened if they are diverted onto Stainer Street.
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Significant traffic disruptions are likely to occur for a short period of time at London Bridge Street where lanes will be closed to allow ground treatment to take place. This is the main exit for taxis and buses servicing London Bridge Station and therefore provisions may need to be made to minimise traffic disruption.

Temporary lane closures on sections of St Thomas Street for a short period of time are likely to cause some disruption and possibly diversions to existing road users. There may be additional congestion in areas such as Borough High Street.

Table C3.3 (Continued):

Impacts of Construction: Waterloo to London Bridge

Cultural Resources

Some surface works may have an effect in an area with a number of Listed Buildings. However, much of the work will be of short duration. The proposed work site at Stainer Street is close to a number of Grade II Listed houses on Tooley Street. The St. Thomas Street works back onto several Grade II and Grade II* buildings on St. Thomas Street as well as Guy's Hospital (Grade II*).

Bermondsey Street works approach London Bridge Station (Grade II) and London Bridge Street groundworks will take place close to some Grade II Listed Buildings behind St. Thomas Street. However, the increased overall activity in the area will require that strict on and off-site controls are maintained. Initial archaeological investigation prior to commencement of work is important.

**ROUTE SECTION 3:
LONDON BRIDGE TO CANADA WATER**

Table C3.4 (Continued): Impacts of Construction: London Bridge to Canada Water

Major Road/John Roll Way

This extended site lies within a residential area and now covers some adjacent roads and a footpath. It forms the work site for Bermondsey Station and fronts onto Jamaica Road. A Conservation Area lies 25m to the north of the site. The nearest residential properties, providing sheltered accommodation, are approximately 15m from the southern boundary of the site.

Land and Property Impact	No additional temporary or permanent loss of properties is expected. Some access restrictions to residences on Ben Smith Way and Major Road will occur over the 4 year construction period.
Noise and Vibration	Current background noise levels at this work site are 55dB(A) during the day and 45dB(A) at night. Predicted typical noise levels of 70 to 80dB(A) indicate that significant disturbance is possible in residential areas around the site, however no night work should be necessary in respect of the revised proposals. There is significant potential for noise disturbance at this site.
Dust and Visual Impacts	Ground treatment can give rise to deposits of mud on roads leading to dust which can then be spread widely by traffic. Strict site controls should be adopted to minimise dust impacts at adjacent properties. Particular attention may be required for the sheltered housing to the south of the site. Visual impacts should be minimised by the provision of appropriate screening.
Access and Traffic Aspects	A total of 108 lorry movements per day (or 54 trips) are predicted to be generated by the works at Major Road/John Roll Way during peak construction. This work site is to be accessed from the busy Jamaica Road via Major Road. It is anticipated that some traffic disruption may occur on Jamaica Road as a result of lorries entering and leaving the site.
Cultural Resources	The extended works will potentially have a greater impact on the Wilson Street Conservation Area and Grade II Listed houses on Jamaica Road due to increased traffic and dust.

Table C3.4 (Continued): Impacts of Construction: London Bridge to Canada Water

Ben Smith Way

A length of John Roll Way, from the junction with Major Road to about 30 metres beyond Ben Smith Way, and about 40 metres of Ben Smith Way are required for ground treatment and to underpin buildings above the underground platforms at Bermondsey Station. Additional land is required at the work site adjacent to Ben Smith Way in order to accommodate a revised ventilation shaft design.

Land and Property Impacts The revised ventilation shaft design will necessitate a small amount of additional permanent landtake. No significant impacts are predicted.

Noise and Vibration Current background noise levels are about 55dB(A) during the day and 45dB(A) at night. Ground treatment at this site is expected to cause short-term day time disturbance to residents in Ben Smith Way and John Roll Way. Expected worst case levels at the closest properties are predicted to be 85-90dB(A) during the day, but it is not envisaged that there will be night-time working.

Dust and Visual Impacts The revised works, especially underpinning, will increase the potential for dust generation. Strict standards of construction practice should be adopted to minimise dust impacts to nearby residential properties. Ground treatment activities will be visually intrusive for a short period of time but no additional permanent visual impacts are predicted as a result of the revised ventilation shaft design.

Access and Traffic Aspects Local residents are expected to experience some temporary traffic disruption due to the ground treatment which is to take place on John Roll Way and Ben Smith Way. Here, lane closures are expected, however, one lane will be kept open and traffic flows will be maintained.

Cultural Resources The extended works will potentially have a greater impact on the Wilson Street Conservation Area and Grade II Listed Buildings on Jamaica Road due to increased dust emissions.

Table C3.4 (Continued): Impacts of Construction: London Bridge to Canada Water

Southwark Park

This area will be needed for ground treatment works prior to underground construction activities. The work will be carried out progressively within 30 x 40 metre strips along the northern end of the park. The park is surrounded by predominantly residential properties to the west and north along Southwark Park Road and Jamaica Road respectively. Rotherhithe Free Church and St Anne's Hospital lie 10m and 55m respectively from the south east corner of the site. Southwark Park stretches a further 11m to the south east.

Land and Property Impact	Although a small area (approximately 250m ²) will be taken for the duration of work for equipment and material storage, other work will occur progressively within 30x40 metre strips. In total, the work may take 9-12 months. The land will be reinstated after work is completed.
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Noise and Vibration	Ground treatment work using rotary percussive drilling plant will cause variable noise levels as work proceeds across the park. During this period acceptable day time levels without mitigation would only be achieved when work moved at least 30 metres from dwellings. It is envisaged that only day-time working will take place.
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Dust and Visual Impact	Ground treatment could give rise to deposits of mud on the surface of the park which would produce dust when dry. Strict site controls should be adopted to minimise dust impacts. Particular attention may be required to reduce dust in the park and at the hospital and church adjacent to the site. Visual impacts would be noticeable to park users for the duration of the construction phase but would be partially obscured by trees from longer views and should not constitute a significant impact. Areas of work will be appropriately screened.
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Access and Traffic Aspects	No significant impacts are predicted. Access will be gained via Culling Road.
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Cultural Resources	No Listed Buildings will be affected by the works. There will be a temporary restriction of access to some of the parkland and some loss of amenity in that portion of the park which remains open.
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Table C3.4 (Continued): Impacts of Construction: London Bridge to Canada Water

Canada Water (Renforth Street)

This additional site is required for ground treatment and will occupy a 25m stretch of Renforth Street. The work will last 4-6 weeks, but will not involve complete road closure. The surrounding area is residential.

Land and Property Impact No significant impacts are predicted.

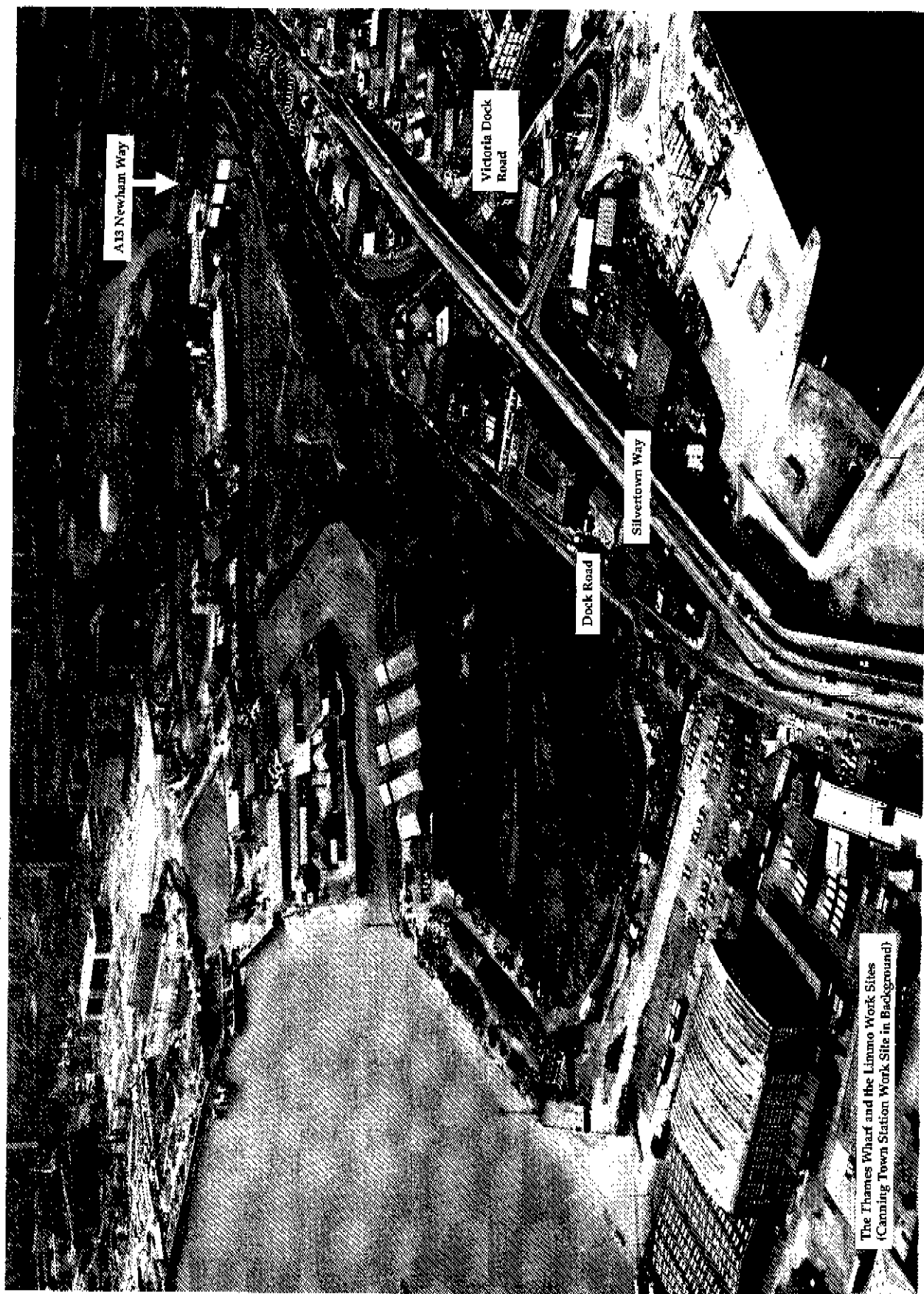
Noise and Vibration Present day-time background noise levels are around 50-55dB(A). Significant noise levels may disturb nearby residents, but drilling operations will be limited to day-time hours and will be of relatively short duration. Expected noise levels at a distance of 10m from the ground treatment operation are 80-85dB(A).

Dust and Visual Impacts Ground treatment can give rise to deposits of mud on roads which dry and lead to dust formation. This can be spread widely by traffic. Strict standards of construction practice should be adopted to minimise dust impacts to adjacent properties. No significant visual impacts are predicted.

Access and Traffic Aspects No significance impacts are predicted.

Cultural Resources The Grade II Listed pumping station is close to the Renforth Street site, but no significant impact is predicted.

**ROUTE SECTION 5:
CANARY WHARF TO CANNING TOWN**



A13 Newham Way

Victoria Dock Road

Dock Road

Silvertown Way

The Thames Wharf and the Limmo Work Sites
(Canning Town Station Work Site in Background)

Table C3.5: Impacts of Construction: Canary Wharf to Canning Town

Main Sites

Canning Town

About 200m of Victoria Dock Road up to the fence line of existing properties will be permanently lost as a result of British Rail realignment. Additionally, the demolition of up to six commercial properties may be necessary. The surrounding area consists of derelict land as well as commercial and business premises and across Silvertown Way is a housing estate.

Land and Property Impact	Several properties on Victoria Dock Road will be temporarily deprived of access and may be lost. These comprise six shops and offices and one derelict public house. One petrol station will be affected temporarily.
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Noise and Vibration	Daytime background noise levels in the area are currently about 58dB(A). Noise levels during construction are expected to be typically 62-69dB(A) at nearest dwellings, reaching 73dB(A) as a worst case during early stages of site clearance, preparation and preliminary works. From these results, it is not expected that construction works will cause much disturbance, except possibly for short periods of time during the early stages.
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Dust and Visual Impacts	Strict standards of construction practice should be adopted to minimise dust impacts. Visual impacts should be avoided by the provision of adequate screening. At Canning Town Station, the Jubilee Line Extension works will comprise modifications to existing BR facilities. As the site is currently used as a BR rail corridor, it is unlikely that the works will result in long term visual impact.
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Access and Traffic Aspects	No significant traffic impacts are predicted as the sections of roads to be lost will no longer be required for access once the construction work begins.
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Cultural Resources	The closest Listed Building at Jubilee Wharf, Orchard Place (Grade II) will not be additionally affected by the site extension.
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D: SUMMARIES OF SPECIALIST FINDINGS

D1. LAND USE AND PROPERTY IMPACTS

D1.1 Introduction

The revised proposals will require acquisition of land and property in addition to that identified in the main ES.

In this section we identify the effects on land and property arising from temporary occupation of these revised construction sites. Additionally, effects from permanent landtake associated with new surface structures are examined.

Information is presented as follows:

- Section D1.2 deals with the key issues arising from property acquisitions or landtake;
- Section D1.3 describes impacts on Historic Buildings and other surface structures of importance;
- Section D1.4 summarises the results of the archaeological investigation of the sites;
- Section D1.5 summarises the effects of the revised proposals with regard to settlement;
- Appendix D1 is a list of Listed Buildings in the vicinity of the revised work sites.

D1.2 Property and Land Use

Key impacts arising from the occupation of land additional to that required by the original JLE proposals, are summarised below.

o Loss of Homes, Businesses and Community Facilities:

- temporary loss of access to garages and a printer's works during construction;
- permanent loss of five business premises under the arches along Hatfields;
- permanent loss of four vacant single storey warehouses and one vacant six storey office/storage block on the Southwark Street/Redcross Way Site;
- permanent loss of ten commercial and business premises and loss of some land belonging to two others within the revised London Bridge Station construction area;
- permanent loss of six commercial and business premises and one derelict public house on Victoria Dock Road, subject to consideration of revised access;
- temporary loss of the central area of Southwark Park including 250m² storage area and successive 30 x 40m sections over a total period of nine to twelve months.

In addition, a number of streets will have sections temporarily or permanently closed. These are listed in Appendix D3. Permanent landtake includes five railway arches at Hatfields work site where a ventilation shaft, stairway and emergency escape shaft are to be built, and an area of Joiner Street courtyard where a ventilation shaft is to be built. These shafts occupy about 25m² of land on a permanent basis. One traction substation, at either Southwark Street/Redcross Way or Bermondsey

Street, will also require small (about 600m²) areas of land permanently.

Closure of businesses as a result of construction may lead to the immediate loss of jobs where employers choose not to relocate. It is not possible to predict how employers will respond to closure, but statutory compensation provisions should be sufficient to enable re-establishment of businesses in alternative locations.

D1.3 Impacts on Historic Buildings and Other Features

D1.3.1 Features of historic or related importance which will be affected by the revised surface works have been identified. Listed Buildings within or adjacent to the limits of deviation and close to sites referenced in the 1990 (No.2) Bill are listed in Appendix D1 together with a note of any activities which might affect them.

Four areas of potential impact have been considered:

- demolition or temporary removal of designated buildings;
- effects of construction activity and permanent surface structures on the setting and amenity of buildings or features;
- disturbance of archaeological deposits during construction;
- damage to designated buildings as a result of settlement.

The last two items are considered in D1.4 and D1.5. The first two are reviewed below.

D1.3.2

Demolition or Temporary Removal of Designated Buildings

It is not currently anticipated that any Listed Buildings will be permanently lost or need to be temporarily moved or covered as a result of the revised surface works referenced in the 1990 (No.2) Bill.

D1.3.3

Temporary Disturbance during Construction

The Listed Buildings in areas which will be affected by construction activities were listed in the main ES (p163, etc.). Some of these may be further affected by the extended surface works. Additional care in the design and performance of these works will be required. Particular attention should be paid in the vicinity of St James' Church (Grade I) near Old Jamaica Road tunnelling site.

Three Conservation Areas are affected by the new surface works and particular care must be taken at these sites. They are:

- Southwark Station site approaching the Roupell Street Conservation Area;
- Southwark Street/Redcross Way site within the Borough High Street Conservation Area;
- Joiner Street, part of London Bridge Station works, within the Tooley Street Conservation Area.

D1.3.4

Impacts on Archaeology

The archaeological background and potential of sites which may be affected by the construction of the Jubilee Line Extension is examined in the Jubilee Line Extension Archaeological Assessment. Any discussion of the archaeological impact of the revised construction areas needs to be conducted in conjunction with that report.

The proposed groundworks for stations and shafts have the potential to impact upon buried archaeological remains; the ground treatment techniques may also prove destructive. Most of the new or extended sites have been identified as lying within archaeologically sensitive areas and so the recommendations of the Desk Study for early archaeological evaluation (on-site trial work) are extended to these.

The main area affected by the proposed revisions to the JLE is North Southwark. This was a centre of Roman, Saxon, medieval and later settlement and its importance is such that the London Borough of Southwark's Draft Unitary Development Plan identifies the area as an Archaeological Priority Zone.

Sites identified as having archaeological potential include:

Green Park to Waterloo

o Mepham Street

Recent archaeological excavations at nearby Addington Street have produced evidence of Mesolithic and Neolithic occupation which greatly increase the archaeological potential of the area within which these two sites are located.

Waterloo to London Bridge

The following sites may affect the Archaeological Priority Zone of North Southwark.

o Southwark Station

The large increase in groundworks at the site further emphasises the need for early evaluation (on-site trial work) as described in the Archaeological Assessment Desk Study.

o Southwark Street/Redcross Way

The proposed site occupies one of the most important archaeological areas in Central London with prehistoric settlement evidence and four centuries of Roman buildings as well as a large late Roman burial ground. Saxon and medieval remains are likely and there is a post-medieval burial ground to the south. A substantial portion of the site has been fully excavated and would be the most suitable area for shaft location. Any groundworks in this site could affect archaeological remains and early evaluation is necessary.

o London Bridge Station

The increase in groundworks at sites in this area further emphasises the need for early evaluation (on-site trial work) in such an archaeologically sensitive location.

o London Bridge BR Station/Bermondsey Street

The sites lie outside the main Roman settlement but documentary sources locate medieval tenement buildings on the site. If construction activities go ahead on this site early evaluation is recommended.

London Bridge to Canada Water

o Major Road/John Roll Way and Ben Smith Way

The increase in groundworks at these two sites further emphasises the need for early archaeological evaluation (on-site trial work) as described in the Archaeological Assessment.

Canary Wharf to Canning Town

o Canning Town Station

There is no potential for archaeological impacts arising from the proposed revisions at this site.

A number of the revised and additional sites have been identified as being of national importance in terms of their potential archaeological remains and their sensitivity. Early evaluation (on-site trial work) would be required on all of the sites to assess the nature and extent of these ancient remains. Further actions for preservation would depend on the results of these trials.

D1.4

Settlement

Underground excavation may cause some settlement of the overlying ground. This is caused by the removal of spoil and the lowering of the groundwater level. Sites referenced in the 1990 (No.2) Bill at which additional settlement may occur are Joan Street/The Cut and Southwark Park.

An assessment should be carried out at these sites to determine which, if any, buildings may be subject to settlement. The general measures to minimise settlement effects are listed in the main ES on page 154.

APPENDIX D1

**LISTED AND LOCALLY DESIGNATED BUILDINGS POTENTIALLY
AFFECTED BY REVISED/ADDITIONAL PROPOSALS**

Statutory Listed Buildings Potentially Affected by the Revised/Additional Proposals			
Location	Date/Listing	Use	Jubilee Line Extension Construction Activity
Waterloo - Southwark			
Waterloo Road Royal Waterloo Hospital	II		Revised Waterloo Station Works.
Waterloo Road St John's Church	II*		Revised Waterloo Station Works.
Roupell Street Terraced Houses (1-73)	II	Residential	Construction of pedestrian link.
Southwark - London Bridge			
Southwark Street central buildings (Hop Exchange)	II	Offices	Tunnelling site at Southwark Street/Redcross Way.
Stoney Street/Southwark Street Cannon Post between 1 and 2 Stoney Street	II		Tunnelling site at Southwark Street/Redcross Way.
Borough High Street: 32-34 (even)	II		Tunnelling site at Southwark Street/Redcross Way.
38-42 (even)	II		Tunnelling site at Southwark Street/Redcross Way.
50 and 52 Calvert buildings behind	II		Tunnelling site at Southwark Street/Redcross Way.
No. 50 of Borough High Street	II		Tunnelling site at Southwark Street/Redcross Way.
Borough High Street/Bedale Street Cannon at entrance to Bedale Street	II		Revised London Bridge Station Works.

Statutory Listed Buildings Potentially Affected by the Revised/Additional Proposals			
Location	Date/Listing	Use	Jubilee Line Extension Construction Activity
London Bridge - Bermondsey			
St Thomas Street	II*	Guy's Hospital	Revised London Bridge Station Works.
4-16 St Thomas Street (even)	II		Revised London Bridge Station Works.
St Thomas Street, Chapter House	II*		Revised London Bridge Station Works.
St Thomas Street Annex No. 9	II*		Revised London Bridge Station Works.
11 and 13 St Thomas Street	II*		Revised London Bridge Station Works.
15 St Thomas Street	II		Revised London Bridge Station Works.
St Thomas Street/London Bridge Station	II		Revised London Bridge Station Works.
Cathedral Street	I	Cathedral of St Saviour, Southwark	Revised London Bridge Station Works.
15-25 Tooley Street (odd)	II		Revised London Bridge Station Works.
29-33 Tooley Street	II		Revised London Bridge Station Works.
45-49 Tooley Street	II		Revised London Bridge Station Works.
51-67 Tooley Street	II		Revised London Bridge Station Works.
London Bridge Street rear of No. 4	II	Post Office	Revised London Bridge Station Works.

Statutory Listed Buildings Potentially Affected by the Revised/Additional Proposals			
Location	Date/Listing	Use	Jubilee Line Extension Construction Activity
Bermondsey			
St James' Church	I		Underpinning.
123-124 Jamaica Road (even)	C18 II		Revised Bermondsey Station Works.
Canada Water - Canary Wharf			
Renforth Street: pumping station	1836 II		Canada Water Works and Renforth Street Works.
Canning Town - West Ham			
Orchard Place: Jubilee Wharf	II		Revised Canning Town Station Works.

Locally Designated Buildings Along the Route				
Location	Use	Jubilee Line Extension Construction Activity		
Westminster - Waterloo				
No locally Listed Buildings identified				
Waterloo - Southwark				
No locally Listed Buildings identified				
Southwark - London Bridge				
15 Southwark Street	Currently empty	Tunnelling site at Southwark Street/Red Cross Way.		
54 Borough High Street		Tunnelling site at Southwark Street/Red Cross Way.		
56 Borough High Street		Tunnelling site at Southwark Street/Red Cross Way.		
George Inn Yard	Public House	Revised London Bridge Station Works.		
London Bridge - Bermondsey				
No locally Listed Buildings identified				
Bermondsey - Canada Water				
No locally Listed Buildings identified				
Canary Wharf - Canning Town				
No locally Listed Buildings identified				

D2. NOISE AND VIBRATION

D2.1 Introduction

This section deals with the noise and vibration impacts which are predicted to occur during the construction and operational phases of the revised design. Potential impacts addressed in this chapter are additional to those examined in the March 1990 Environmental Statement and the May 1990 Addendum.

The effects at each of the surface sites as a result of the revised proposals are outlined in Section D2.3. Results are summarised in tabular form in Table D2.3.

D2.2 General Construction Site Noise and Vibration Impacts

D2.2.1 Predictions of Construction Noise Levels

Construction noise levels have been predicted based on best estimates of:

- site inventory;
- site layout;
- noise levels of individual plant items.

Estimates are based on a knowledge of the types of operation that are expected at different work sites. In addition, they are based on observations of activities associated with similar projects. Results can be found in tabular form in Appendix D2.

D2.2.2 Piling

Although exact locations have not been identified at this stage, it is possible that piling operations may be required at some of the major work sites. Quieter, bored piles will be used where possible. Where no alternative exists, percussive techniques will be necessary. Percussive piling may provide a noise disturbance

which would be limited to day-time hours. A sound power level of 105 to 125dB(A) for 50% of the time has been used in calculations.

D2.2.3 Predictions of Construction Vibration Levels

Vibration from heavy construction plant and machinery is likely to be perceptible within a radius of 20m. This disturbance may increase however, if amplification occurs within a building structure. Vibration experienced from piling will be dependent upon the following factors.

- o Methodology:
 - percussive or bored;
 - mechanical condition of equipment, the dolly, height of drop, weight of hammer.
- o Soil type.
- o Response of structure.

Vibration levels are unlikely seriously to affect structures. Potential concerns may be addressed by carrying out structural surveys of both old and Listed Buildings before the commencement of percussive piling.

D2.2.4 Mitigation Measures

Mitigation measures proposed in the March 1990 Environmental Statement remain valid.

D2.3 Specific Construction Site Noise and Vibration Impacts

A summary of noise and vibration impacts at all revised surface sites is provided in Table D2.3.

Table D2.3:	Noise and Vibration Impacts at all Revised Surface Sites
Location	Impacts
Waterloo (Mepham Street)	Work in Mepham Street will be screened from areas such as St. John's church by archways on either side of the street. Although significant disturbance is considered unlikely, some properties opposite the eastern end of Mepham Street may be affected.
Southwark Station Sites	Cut and cover work on Isabella Street, where current background levels are about 65dB(A) (day) and 45dB(A) (night) will, at times of peak noise, result in disturbance at the surgery and public house on Hatfields. This may occur during the preliminary works such as site clearance. However, when station works move below the surface, street noise levels should fall to just within acceptable day-time levels. Potential for disturbance will occur when work is undertaken at night. The nearest residential dwellings, such as Styles House, may be affected.
Hatfields	Noise levels during preliminary works may give rise to some disturbance at the northern end of Tait House. When work moves underground acceptable levels should prevail. A similar situation will exist at the Coral Day Nursery on Wootton Street.
Blackfriars Road	Underpinning work involving the use of percussive drilling techniques is likely to cause some short term disturbance in offices on either side of the bridge fronting the road. Any night-time work would cause disturbance at residential properties in Scoresby Street unless activity is well screened.
Southwark Street/Redcross Way	Current background noise levels are about 60dB(A) (day) and 50dB(A) (night). At times of peak noise, offices overlooking the site on the eastern borders may experience some disturbance during early work on the site. Where lecture rooms of the Price Waterhouse Training Centre overlook the site, speech interference may occur. Disturbance at residential properties in Redcross Way could be significant at night.
Joiner Street	Offices border the work site and, where windows are not sealed or double glazed, noise disturbance is possible in rooms overlooking the site. This will be at a maximum on lower floors.
London Bridge Station	Screening protection will be necessary to reduce noise levels at Philip Harris House, a part of Guy's Hospital now under construction. Underpinning of buildings using rotary percussive drilling techniques will give rise to short term disturbance in office premises overlooking the work site. Noise should not affect clinical areas of Guy's Hospital.
Bermondsey Street	As most of the work will probably be performed within the railway arches, no significant noise disturbance to adjacent properties is anticipated.

Table D2.3 (Continued):	Noise and Vibration Impacts at all Revised Surface Sites
Location	Impacts
Stainer Street	The probable use of pneumatic drills and hammers during initial works is likely to cause some disturbance at offices on the north side of Tooley Street. Potential for disturbance should diminish as work continues.
St Thomas Street	<p>The installation of piles to facilitate the construction of an 'umbrella' at the St Thomas Street Borough High Street road junction will be carried out at night and at weekends when disturbance to offices should not be a problem. No residential properties likely to be significantly affected have been identified.</p> <p>Ground treatment involving the use of percussive rotary drilling will give rise to some disturbance in offices bordering St Thomas Street for a relatively short period as work progresses along the roadway. Due to the close proximity of Guy's Hospital, work may be limited to day-time operation only. At the eastern end of the road the proximity of a new building, Philip Harris House due to be completed in 1993, will make day-time operation more likely.</p>
Old Jamaica Road	Current day-time background noise levels are of the order of 50dB(A). The use of rotary percussive drilling techniques is likely to result in day-time noise disturbance at residential properties on the north side of Old Jamaica Road, west of Rouel Road. No night-time drilling is foreseen at this time. Noise levels at St. James's School from this work should be within acceptable levels.
Major Road	Background noise levels vary to some extent around the site, quieter areas experiencing about 55dB(A) (day) and 45dB(A) (night). Those in properties fronting Jamaica Road vary between 55dB(A) and 50dB(A). Predicted noise levels indicate that significant disturbance is possible at residential properties around the site. This is especially noticeable to the west where lorry movements are planned.
Ben Smith Way	Ground treatment involving the use of rotary percussive drilling plant will cause short term day-time disturbance at properties in Ben Smith Way and John Roll Way. No night-time working is envisaged at this site.
Southwark Park	Ground treatment involving the use of rotary percussive drilling plant on the west side of the Park is likely to cause disturbance in dwellings closest to the work. Disturbance will diminish as work moves across the Park; acceptable day-time levels should be achieved when the work moves 30 metres or so from dwellings. Only day-time drilling is envisaged.
Renforth Street	Present day-time background noise levels are around 50-55dB(A). The use of rotary equipment at this location is likely to result in significant noise disturbance. However, drilling operations will be limited to day-time hours and should be of relatively short duration (4-6 weeks).
Canning Town	Noise levels are not expected to cause significant disturbance.

APPENDIX D2

ESTIMATED CONSTRUCTION SITE NOISE LEVELS

This Appendix presents information on existing and predicted future noise levels in the vicinity of each proposed construction site. Predictions are given for two cases:

- the mean case when equipment is distributed around the site;
- the worst case when equipment is concentrated at the boundary nearest to the receptor.

Table 1: Main Construction Work Sites													
Site and Site Use	Neighbouring Land Uses	Distance from site (m)	Period of Work (years)	Approx. Background Noise Level Day/Night dB(A)	Estimated Facade Noise Levels (Period L _{eq} dB(A))								Filing Period Leq (max)
					Typical				Worst Case				
					Phase				Phase				
					1	2	3	4	1	2	3	4	
Southwark Station/Hatfields	Surgery Public House	0	3.5	64/45	75	75	68	68	86	86	73	72	80-100
		0	4		74	74	67	67	81	81	73	69	
Southwark St/Redcross Way	Offices/training centre Residential Club	0	3.5 4	60/50	69	67	65	62	77	75	73	70	75-95
		6			71	69	67	64	75	73	71	68	75-95
		18			66	64	62	59	70	68	66	63	70-90
London Bridge Station/Joiner Street Courtyard	Offices Future Philip Harris House (part of Guy's Hospital)	0	2	60/53	85	84	79	76	85	84	79	76	N/A
		45			61	60	55	52	66	65	60	57	
Phase 1 - site clearance and preparation Phase 3 - main construction		Phase 2 - preliminary works Phase 4 - main construction (no lorries)											
(1) The noise levels shown result from calculations based on equipment noise levels as given in BS 5228 with, where appropriate, corrections for estimated on-time and screening by a site hoarding. The use of further mitigation measures such as acoustic enclosures, screens and additional silencing would result in reduced noise levels. Actual levels will then depend upon the degree of noise control employed and the precise layout of plant within sites.													
(2) Typical noise levels represent those anticipated with site plant distributed around the site centre. "Worst Case" noise levels represent those anticipated with plant located towards the perimeter of the site nearest the noise sensitive location.													

Table 1 (Continued): Main Construction Sites													
Site and Site Use	Neighbouring Land Uses	Distance from site (m)	Period of work (years)	Approx. Background Noise Level Day/Night	Estimated Facade Noise Levels (Period L_{eq} , dB(A))								Piling Period L_{eq} (max)
					Typical				Worst Case				
					Phase				Phase				
					1	2	3	4	1	2	3	4	
Bermondsey Street (Substation Shaft Site)	Works Offices	10 15	2	60/53	Work to be undertaken within viaduct arches so that impact on surrounding areas is taken to be negligible								N/A
Major Road/John Rolt Way (Station Work Site)	Residential	5	3.5	55/45	76	80	77	68	79	81	79	69	75-95
		9	4		70	72	66	65	76	77	71	71	75-95
		14			68	68	65	64	75	74	68	68	70-90
Canning Town Station (Station Work site)	Residential	30	3.5-4	58/50	69	69	66	62	73	73	69	66	N/A

Table 2: Secondary Construction Work Sites				
Location	Activity	Adjacent Land Uses	Approx. Distance	Estimated Noise Levels
Mepham Street	Access to work site possible Road Lowering	Shops and offices on east side of Waterloo Road	30m	Maximum noise levels are predicted to occur during the breaking up of existing road surfaces with pneumatic or hydraulic hammers. Levels on the east side of Waterloo Road may peak at 73dB(A) (Period L_{eq}). Typically however, levels well below 70dB(A) are predicted at this location. 24 hour working is probable here.
London Bridge Street	Underpinning	Offices	0	Noise levels in confined spaces during percussive rotary drilling are predicted to be about 90dB(A) at facades. 24 hour working is possible at this site.
Stainer Street	Widening of Junction	Offices Shops	0	Noise levels when pneumatic/hydraulic hammers are used to break hard surfaces are predicted to be about 90dB(A) L_{eq} at adjacent offices on Tooley St. Levels should fall to 75dB(A) or so after initial breaking out period. 24 hour working probable here.
Blackfriars Road	Underpinning of bridge supports	Offices Residential	0 25m	80-85dB(A) L_{eq} (facade) 65-75dB(A) L_{eq} (facade) Possible 24 hour working
St Thomas Street	Installation of "Umbrella" over road junction	Shops Offices	0 0	The installation of piles prior to erection of the umbrella is likely to result in noise levels of about 80-90dB(A) at 10 metres from the piling activity (expressed as period L_{eq} facade). Installation of the umbrella would probably be a weekend activity with noise levels at building facades on the Junction estimated at 80dB(A) (Period L_{eq}).
St Thomas Street	Ground Treatment	Offices Future Philip Harris House	0 35m	It is assumed that treatment will be carried out with plant 6m from office facades. Predicted maximum L_{eq} levels are 85-90dB(A) Peak L_{eq} levels 70-75dB(A) when work is at junction with Joiner St, otherwise less than 70dB(A) facade. 24 hour working only likely if noise levels at clinical hospital premises are acceptable.
Ben Smith Way	Ground Treatment	Residential	0	Worst case predicted to be 85-90dB(A) L_{eq} at closest properties. This is assumed to be 6m from point of work. Estimated average level throughout work 75-80dB(A) L_{eq} . Only day-time working envisaged.
Southwark Park	Ground Treatment	Residential	10m	Noise level variable as work proceeds across park. Peak L_{eq} at facades 85-90dB(A), at 25m 75-80dB(A) facade, at 100m 65-70dB(A) facade (three drill rigs assumed). Only day-time working envisaged.
Old Jamaica Road	Ground Treatment	CU Mission Residential School	0 0 100m	Noise levels at 5m from rig 86-91dB(A) L_{eq} (facade). Only day time working envisaged. Variable noise levels will be experienced as work moves along street e.g. 70-75dB(A) at 30m, 65-70dB(A) at 50m.
Renforth Street	Ground Treatment	Residential Residential (High Rise)	0 10m	Noise levels at 5m from rig 86-91dB(A) (facade); 10m from rig 80-85dB(A) (facade). Only day-time working envisaged.

D3. TRAFFIC AND TRANSPORT

D3.1 Introduction

This section of the report discusses the impacts on traffic and transport predicted to arise as a result of construction activity associated with the proposed revisions to the Jubilee Line Extension work sites.

There are six work sites which are predicted to impact upon local road networks in terms of either a diminution of access or due to the generation of additional vehicle movements (and thereby associated disbenefits such as increased congestion, traffic noise and lorry disturbance).

These work sites are:

- Mepham Street;
- Joan Street/The Cut;
- Southwark Street/Redcross Way;
- Joiner Street;
- Major Road/John Roll Way;
- Canning Town.

D3.2 Road Vehicle Numbers

The number of additional lorry movements predicted at each site as a result of the revised/additional works is given in Table D3.2. Calculations were based on the assumption that lorries will carry loads of around 20 tonnes. It is understood that at some sites access for large lorries may be restricted and therefore more movements of smaller vehicles will be required.

It is not known at this stage if any additional employees will be required, however, the impact of additional employee vehicle movements on existing traffic flows is likely to be insignificant.

Additional ventilation shafts (e.g. at the back of St Thomas Street) have not been included in the table as it is predicted that their traffic impact will be minimal. At these sites total movements per day associated with spoil and material transport are likely to be in the order of 5-15 lorry movements per day and 10-20 employee movements per day.

The most significant number of additional vehicle movements likely to be generated during the construction activity associated with the proposed amendments are at the following sites.

o Joan Street/The Cut Work Site

Peak construction activity at this work site is to occur during cut and cover excavation at Isabella Street. As demonstrated in Table D3.2, total lorry movements at this site during peak construction are predicted to be in the order of 96 per day (or 48 trips).

Local roads providing access to this site are to be Blackfriars Road, Scoresby Street, Hatfields, Joan Street and The Cut.

Table D3.2 : Estimated Lorry Movements at Peak Construction¹			
Site	Estimated Spoil Trips (Per Day)²	Estimated Material Trips (Per Day)	Estimated Total Lorry Movements (Per Day)
(a) TUNNELLING SITES			
Redcross Way ³	36	10	92
(b) STATION SITES			
Joan St/The Cut ⁴	38	10	96
Major Road/John Roll Way ⁵	44	10	108
London Bridge Station (Ticket Hall) at Joiner Street	8	18	52

¹ Actual numbers and locations will depend on the contractor's chosen working methods.

² Based on the use of 20 tonne lorries with a 13m³ capacity and assuming a 7 day working week, but no lorry movements on Sundays.

³ Peak construction activity expected during excavation of running tunnels.

⁴ Peak construction activity expected during cut and cover tunnelling at Isabella Street (other sites tunnelling).

⁵ Peak construction activity expected during station box construction.

o **Redcross Way Work Site**

Peak construction activity at the Redcross Way work site is to take place during the excavation of the running tunnels, when total lorry movements generated are predicted to be approximately 92 per day (or 46 trips per day).

This is a new work site for the Jubilee Line Extension. Originally the tunnelling sites for this section of the line were to be at the London Bridge and Ewer Street work sites. Although lorry movements generated at the Redcross Way work site are likely to constitute a noticeable change in terms of lorry disturbance, noise and possible congestion on roads in the immediate vicinity (i.e. Southwark Street and Redcross Way), the overall effect of changing the location of the tunnelling site is expected to ease congestion in the London Bridge area.

o **Joiner Street Work Site**

As Table D3.2 demonstrates, a total of only 52 lorry movements per day are predicted to be generated by the works associated with the construction of the ticket hall at Joiner Street. Therefore, the impact of additional lorries will not be significant.

It is anticipated that access to this work site will be from St Thomas Street.

o **Major Road/John Roll Way Work Site**

At this work site, peak construction is to occur during the construction of the Bermondsey Station box. It is predicted that a total of 108 lorry movements per day (54 trips) will be generated during this period.

Access to this work site is from Jamaica Road via Major Road.

D3.3

Impacts on Local Roads Near Construction Sites

Due to the lack of information on existing traffic flows on local roads in the vicinity of the work sites, it has not been possible to superimpose predicted traffic generation on existing flows and thereby establish percentage changes in traffic flows on many of the roads which are to provide access to the works sites.

Forecasted traffic flows for 1991¹ are only available for the following roads:

- A201 Blackfriars Road (Joan Street/The Cut);
- A200 Tooley Street and Borough High Street (Joiner Street).
- A200 Jamaica Road (Major Road/John Roll Way);

By applying the predicted construction traffic generation at Joan Street/The Cut, Joiner Street and Major Road/John Roll Way work sites to the existing flows on the above roads respectively, it is predicted that the impact would not be significant, with traffic flows likely to increase by only 0.5% on Blackfriars Road and on Jamaica Road and by less than 1% on Tooley Street and Borough High Street during the peak construction period.

From observations of current traffic flows and environmental conditions in the vicinity of the proposed work sites, it has been possible to estimate the significance of predicted impacts. Table D3.3 summarises the impacts likely to be caused by construction traffic.

¹ Based on the DTp AADF figures and factored using National Road Traffic Forecast.

Table B3.3: Local Impacts Caused by Construction Traffic			
Site	Local Access Roads	Local Land Uses	Comments
(a) TUNNELLING SITES			
Redcross Way	Southwark Street Union Street	Residential Commercial	Existing traffic flows quite high on Union St. but very low on Redcross Way. Environmental conditions are good. Increases in traffic noise and congestion are likely to be noticeable.
(B) STATION SITES			
Waterloo Station:	York Road Directly from Waterloo BR	Commercial	Existing traffic flows are quite high (with a high content of taxis) and environmental conditions are poor. Temporary additional congestion on York Road and Waterloo Road Roundabout may arise during the lowering of Mepham Street.
- Mepham Street			
Southwark Station:	The Cut Blackfriars Road Scoresby Street Cornwall Road Windmill Street Meymott Street	Commercial Residential Community facilities (Nursery)	Existing traffic flows are very low on the local roads (with the exception of The Cut and Blackfriars Road). Noticeable increases in traffic noise and lorry nuisance are likely. No significant impacts are predicted on Blackfriars Road or The Cut as existing traffic flows are high.
- Brad Street			
- Wootton Street			
- Greet Street			
- Hatfields			
- Joan Street			
- Isabella Street			
London Bridge Station (Ticket Hall):	St Thomas Street Tooley Street	Commercial Guy's Hospital	Existing flows relatively heavy due to gyratory system in St Thomas St. and lorry content currently high. Increases in congestion likely to be noticeable especially at the junctions at St Thomas St/Joiner Street and at Tooley St/Stainer Street during works on Joiner Street and junction improvements on Stainer Street.
- Joiner Street			
- Stainer Street			
Bermondsey Station:	Trinton Road	Residential	Existing flows very low and environmental conditions good. Noticeable increases in traffic noise and congestion due to lorries are predicted.
- Major Road/John Roll Way			
- Keeton's Road			
- Ben Smith Way			

Table D3.3 (Continued): Estimated Lorry Movements at Peak Construction			
Site	Local Access Roads	Local Land Uses	Comments
Canning Town Station: - Victoria Dock Road - Woodstock Street - Sabbartin Street - Hallsville Road - Brunel Street	Silvertown Way	Commercial	Existing traffic flows very low, but high lorry content due to commercial premises. Adjacent Silvertown Way has heavy traffic flows. Changes in traffic flows and environmental conditions likely to have a negligible impact.
(C) OTHER Ventilation shaft Back St Thomas Street (off Joiner Street)	Joiner Street	Commercial	Flows generated by construction of ventilation shaft will be negligible. No significant additional impacts.
Ground Treatment - Back St Thomas Street - Blackfriars Road - Old Jamaica Road - Renforth Street	London Bridge St The Cut Union St Abbey Street Albion Street	Residential Commercial	Flows generated by ground treatment activity will be negligible. No significant additional impacts.

From observations of current traffic flows and environmental conditions in the vicinity of the proposed work sites, it has been possible to estimate the significance of predicted impacts. Table D3.3 summarises the impacts likely to be caused by construction traffic.

It is anticipated that increases in traffic flows and consequently traffic noise and lorry disturbance will be most noticeable in the vicinity of Joan St/The Cut, Redcross Way and Major Road/John Roll Way work sites.

The increase in congestion on local roads is predicted to be most significant in the vicinity of the work sites at London Bridge Station (e.g. on St Thomas Street) and the Major Road/John Roll Way work site (Jamaica Road).

D3.4 Impacts on the Primary Road Network

It is anticipated that the magnitude of changes in traffic flows associated with the amendments will not be sufficient to produce noticeable changes in traffic flows or lorry disturbance on the primary road network.

D3.5 Road Closures

Information on road and footpath closures is set out in Appendix D3, together with comments on the effects of the changes on road users and pedestrians. Any possible alternative routes are also given. In total, 20 roads and/or footpaths will be affected by some form of temporary closures associated with the amendments during the construction phase, most of which are predicted to result in some additional delays and possibly localised diversions to road users. No other significant effects are predicted to occur.

The most noticeable effects, in terms of additional congestion on the surrounding road network, are likely to be associated with the works at London Bridge Station, particularly in St Thomas Street, Joiner Street and London Bridge Street.

The only permanent road closures are to be at Mitre Court and Canning Town Station (a section of Victoria Dock Road and sections of four adjoining side roads). At Canning Town, Victoria Dock Road currently only provides access to the rear of commercial and industrial premises which front onto Silvertown Way. These premises are to be taken to accommodate the realignment of BR tracks. No significant traffic impacts are predicted to occur.

D3.6 Operational Period

It is predicted that the amendments to the Jubilee Line Extension will not create any additional operational phase traffic impacts over-and-above those set out in the March 1990 E.S. (Section B3.2).

APPENDIX D3

ROAD AND FOOTPATH CLOSURES

This Appendix presents information on temporary and permanent changes in roads and footpaths resulting from the proposals. The effects of these changes on traffic and road access are noted.

Temporary and Permanent Closures of Roads and Pedestrian Access		
Road/Street	Description of Closure/Narrowing	Effects of Change
Mepham Street, SE1	Whole street between York Way and Waterloo Road to be closed for several days at the beginning of the construction period to allow the street to be lowered and ramped to provide access to construction sites at Waterloo.	Localised diversion of traffic, especially taxis, on to York Road and Waterloo Road roundabout which may temporarily increase congestion, especially in peak hours. Pedestrian access will be maintained.
Brad Street, SE1	Possible lane closures for ground treatment between Windmill Walk and Greet Street for a period of about 4 to 10 weeks.	Possible temporary disruption for residents accessing rear of properties which front onto Roupell Street. No significant impacts are predicted.
Wootton Street, SE1	Possible lane closures for ground treatment between Windmill Walk and Greet Street for a period of about 4 to 10 weeks.	Possible temporary disruption for those accessing the flats and nursery on the southern side of the street. No significant impacts are predicted.
Greet Street, SE1	Possible lane closures for ground treatment between Brad Street and Wootton Street for a period of about 4 to 10 weeks.	No significant impacts.
Hatfields, SE1	Possible lane closures for ground treatment between Joan Street junction and Isabella Street for a period of about 4 to 10 weeks.	Possible temporary disruptions to through traffic. No significant impacts are predicted.
Mitre Court, SE1	Permanent closure of this courtyard to accommodate the construction of Southwark Station.	No significant impacts are predicted.
Joan Street, SE1	Temporary closure of a section of the street from the railway arch to south of the Joan Street/Isabella Street junction during construction of Southwark Station.	Some localised diversion of traffic and pedestrians. Potential for significant effects on pedestrian journey times.
Isabella Street, SE1	Temporary closure of whole street during construction of concourse and ventilation shafts at Southwark Station.	Localised diversion of pedestrians and traffic possibly on to Joan Street, The Cut and Hatfields. Potential for significant effects on pedestrian access and journey times.
Blackfriars Road, SE1	Temporary closure of outer lanes (3-6 weeks) at the beginning of the construction period to stabilise the bridge.	Additional traffic congestion likely especially at peak times. Some pedestrian inconvenience likely.
St Thomas Street, SE1	Temporary lane closures at the western end due to the extension of the Borough High Street "umbrella". Temporary closure of some lanes during construction between the museum and Joiner Street junction to allow ground treatment.	Possible traffic disruptions and diversions (including 4 bus routes) and pedestrian inconvenience. Alternative vehicular route possibly via Long Lane. Alternative pedestrian route possibly via Newcomen Street, Snowfields and Weston Street. Additional traffic congestion likely on surrounding road network, especially Borough High Street.

Temporary and Permanent Closures of Roads and Pedestrian Access (Continued)		
Road/Street	Description of Closure/Narrowing	Effects of Change
Properties Back St Thomas Street, SE1 (adjoining London Bridge Street)	Temporary landtake in a courtyard to strengthen the ground under adjacent buildings.	Temporary disruption of access for small numbers of vehicles and pedestrians. No significant effects.
London Bridge Street, SE1	Temporary closure of a central section of the street during construction for ground treatment.	Temporary diversion of vehicles and pedestrians. Alternative route possibly via Railway Approach. Significant additional congestion for vehicles leaving London Bridge BR (including buses).
Joiner Street, SE1	Permanent closure to through traffic and pedestrianisation of the northern end. The south end will remain open to vehicles for local access.	Pedestrian route maintained. Alternative vehicular route for through traffic to be via Stainer Street. Possible additional congestion.
Joiner Street Courtyard, SE1	Temporary closure of a courtyard during construction to allow a ventilation shaft to be installed.	Temporary loss of pedestrian access to rear of adjacent buildings. No significant effects.
Old Jamaica Road, SE16	Temporary closure of a 40m section of this road. One lane to remain open during ground treatment.	No significant effects.
Ben Smith Way, SE16	Temporary closure for ground treatment during construction. One lane to remain open.	Significant disruption for local residents as no alternative vehicular access routes are available.
John Roll Way, SE16	Temporary blockage of half of road for ground treatment and to accommodate extension of work site for Bermondsey Station.	No alternative routes exist therefore traffic disruption for local residents likely.
Major Road, SE16	Temporary closure of road for an extension of Major Road/John Roll Way work site.	Loss of vehicular access. No alternative routes exist. Traffic disruption likely to be experienced by some local residents.
Keeton's Road, SE16	Temporary closure of one lane between Jamaica Road and John Roll Way for extension of Major Road/John Roll Way work site.	Alternative route via Drummond Road and Trinton Road. Disruption to local residents.
Jamaica Road, SE16	Temporary closure of southern footpath between Major Road and Keeton's Road for extension of Major Road/John Roll Way work site.	North footpath remains open. No significant effects.
Renforth Street, SE16	Temporary closure of southernmost section of street for ground treatment.	No significant effects.
Victoria Dock Road, E16	Permanent closure of a section of the road between Brunel Street and Woodstock Street to accommodate Canning Town Station.	Access to remaining properties east of Victoria Dock Road will be blocked, so alternative access is essential.

Temporary and Permanent Closures of Roads and Pedestrian Access (Continued)		
Road/Street	Description of Closure Narrowing	Effects of Change
Brunel Street, E16	Temporary closure between Victoria Dock Road and Silvertown Way during construction of Canning Town Station.	Access to remaining properties must be provided.
Woodstock Street, E16	Permanent closure between Victoria Dock Road and Silvertown Way to accommodate Canning Town Station.	Access to remaining properties must be provided.
Sabbarton Street, E16	Permanent closure between Victoria Dock Road and Silvertown Way to accommodate Canning Town Station.	Access to remaining properties must be provided.
Hallsville Road, E16	Permanent closure between Victoria Dock Road and Silvertown Way to accommodate Canning Town Station.	Access to remaining properties must be provided.

D4. SPOIL DISPOSAL AND SOIL CONTAMINATION

D4.1 Introduction

This section discusses the generation and disposal of spoil arising from the addition of various proposed work sites along the Jubilee Line Extension. It also considers further environmental risks if contaminated soils are encountered during the construction.

There are five additional work sites which could possibly encounter or disturb contaminated land in the Jubilee Line Extension. These are:

- Southwark Station/Hatfields;
- Southwark Street/Redcross Way;
- Bermondsey Street;
- Joiner Street Courtyard;
- Major Road/John Roll Way.

D4.2 Spoil Disposal

This section of the report considers only the extra spoil arising from the additional work sites along the Jubilee Line Extension. The spoil types and options for use as disposal are as originally defined in Section B4.2 of the Main Environmental Statement which also details the Impacts of Disposal and the Mitigation Measures.

D4.2.1 Additional Spoil Quantities

All of the six additional work sites covered in this section of the report will produce extra spoil for disposal but at two sites, Bermondsey Street traction substation and Joiner Street ventilation shaft, these are not significant.

At the other work sites slightly more spoil will be produced through increased construction activities. At Major Road/John Roll Way cut-and-cover operations are to be carried out. Opposite Isabella Street in the Hatfield construction site, ventilation, escalator and escape shafts will be sunk and at Southwark Street site a new ticket hall is to be constructed. At Redcross Way more spoil will be produced from the development of the new site as well as an increase in spoil removal from tunnelling activities. Table D4.2 presents the revised spoil volumes associated with the additional work sites.

Table D4.2: Revised Spoil Quantities from the Amended Working Sites

Work Site	Construction Activity	Spoil Volume (m ³)
Hatfields	Waterloo East Pedestrian Link	3,000
	Shafts	5,400
Joan Street/The Cut	Cut and Cover Works	18,700
	Tunnelled Station	7,000
	Shafts	3,100
Redcross Way	Tunnelling	27,000
Bermondsey Station	Cut and Cover Works	39,000
Joiner Street Courtyard	Shaft	3,500

D4.3 Soil Contamination

D4.3.1 Introduction

During the course of the assessment we have identified those sites involved in construction of the additional work sites which in the past have supported activities liable to result in soil contamination. We have considered the relative likelihood of the presence of contamination. The measures available to avoid or minimise potential health and safety or disposal related impacts which may arise if such material is encountered are described in the original Environmental Statement (Section B4).

D4.3.2 Identification of Potentially Contaminated Sites

Contamination rarely affects soils beyond about 5m in depth. The main source of potentially contaminated soil will therefore be the material encountered during surface works and shallow excavations at construction sites along the route. This material may have been contaminated over the years by:

- the storage and use of raw materials, such as metal ores, additives, coal/coke, etc.;
- spillage and leakage of solids (during handling) and of liquids (from pipes, drums, tanks, etc.);
- waste disposal; since this has only recently been regulated, waste materials, particularly in large, open areas, were frequently left on site either as surface deposits or buried. In addition, sites which became vacant were frequently used by neighbouring industries as waste dump sites;
- filled areas; again, low lying areas were frequently infilled with locally available waste material;
- migration of pollutants from adjacent contaminated sites.

The significance of contamination depends on the intended after-use of the site. Stricter standards would normally apply to 'soft' end uses such as houses and gardens and allotments, than to 'hard' uses such as housing or industrial developments. In this project the proposed after-uses are generally 'hard'.

The additional work sites are located in the areas which have been the subject of intensive and changing use throughout London's history. Several of the surface sites which will be excavated may have been occupied by industrial and other activities which have perhaps left behind soils contaminated with potentially toxic and noxious materials in the near surface layers. In order to ascertain whether the additional work sites have any potential contamination associated with them, a historical survey of each development area was carried out. The list of additional work sites, their historical/present day uses and any potential contamination is presented in Table D4.3.

Additional work sites to be located on BR land may encounter contamination problems due to wastes arising from past BR operations. The only other former industrial activities are located at the Southwark Station and Redcross Way sites, which have historical associations with soap/candle works and iron foundries respectively. It should be emphasised that the site history information only indicates that there is potential for contamination at the above sites. It does not prove its presence or indicate the degree of contamination. The Potential Impacts or Mitigation of Potential Impacts are as originally documented in Section B4.3 of the main ES.

Table D4.3 Additional Work Sites, Historical Uses and Potential Contaminants 1870-1940				
Site	Use	Past Uses	Risk of Contamination	Possible Contaminants
Southwark Station	Pedestrian Link	Majority BR Land, Soap and Candle Works	Medium	Oils, Coal Residues, Waxes, Fats
Hatfields	Shafts	BR Viaduct Arches	Low-Medium	Oils, Coal Residues
Redcross Way	Tunnelling	Residential, Warehouses, Iron Foundry	Low-Medium	Coal Residues, Metals
Bermondsey Street	Shaft	BR Land	Low-Medium	Coal Residues, Oils
Joiner Street Courtyard	Shaft	BR Land	Low-Medium	Coal Residues, Oils
Major Road/John Roll Way	Operations for Cut and Cover	Residential Land	Low	---

D5. ATMOSPHERIC IMPACTS

The new and revised construction sites are potential sources of dust for the reasons outlined in the main Environmental Statement (Section B5, pages 215-216).

On-site surface works such as surface preparation, removal of existing buildings and earth moving operations, tend to generate dust, as does the removal of spoil associated with tunnelling, creation of ventilation shafts and the cut and cover approach to station construction. Ground treatment and underpinning may give rise to dust emissions where these activities are carried out on hard surfaces, roads, for example. Traffic movement may exacerbate the problem.

The additional sites at which potential dust generating activities take place are:

- Southwark Station (Hatfields and Joan Street/The Cut);
- Southwark Street/Rodcross Way;
- Major Road/John Roll Way.

The extent of dust generation on site and its subsequent transport and deposition is entirely dependent on the control measures taken.

Necessary control measures were outlined in the main Environmental Statement. The most relevant of these in the context of the additional works are:

- hard surfacing of areas where regular movements of heavy vehicles are likely to occur;
- wheel washing facilities for vehicles leaving the major sites;
- sheeting of loads on vehicles;

- on-site speed restrictions for construction traffic where appropriate;
- design controls for construction equipment to minimise dust release where movement or disturbance of materials takes place;
- enclosure and dampening of dusty materials where these are stored in stockpiles;
- regular cleaning of roads on which heavy deposits are likely to occur.

Spoil removal and handling will not usually be the cause of dust emissions directly, unless spoil is allowed to dry out.

Construction dust is potentially an issue of nuisance rather than a risk to health. Deposition of dust, where it occurs, will take place very close to the construction activities and therefore those receptors most at risk are those immediately adjacent to, or close by, the construction sites. Particular attention to dust suppression measures will be required where residences are in the immediate vicinity of construction sites. The work sites at Major Road/John Roll Way and Hatfields are such a site and therefore identified as areas requiring particular attention.

D6. VISUAL IMPACTS

D6.1 Visual Intrusion during the Construction Period

It is only where sites are new or are considerably extended from those originally proposed, that visual intrusions significantly greater than those envisaged in the main ES are predicted. The intrusion caused by the presence of construction plant and materials, and night-time lighting, is expected to be large, but must be considered against the background of other developments within a generally built-up environment.

Sites within historic/tourist or recreational areas which may be considered particularly sensitive to visual intrusion include Southwark Park.

Sites in close view of residents and passers-by include:

- Southwark Station/Hatfields;
- Southwark Street/Redcross Way;
- Old Jamaica Road;
- Bermondsey Station;
- Canada Water.

In addition, ground treatment activities are expected to be visually intrusive, albeit for a relatively short time.

General measures that should be adopted to mitigate the visual impacts of construction sites include:

- retention of existing trees and other features;
- erection of suitably decorated screen hoarding;
- control of night-time lighting;
- full restoration of sites where appropriate.

D6.2 Visual Impacts of Permanent Structures

New permanent features that could cause some visual intrusion include the following:

- surface structures associated with ventilation and escape shafts, and traction sub-station;
- escalators and, possibly, a footbridge at Hatfields;
- surface structures at Canning Town Station.

All practicable steps to avoid visual intrusion should be taken in the design and location of shafts, traction sub-stations, escalators and footbridges at:

- Southwark Station;
- Joiner Street Courtyard;
- Southwark Street/Redcross Way;
- Bermondsey Station.

No more significantly intrusive impacts from those outlined in the main ES are envisaged at Southwark and Bermondsey Stations.

D7.

URBAN ECOLOGY

The survey of ecological habitats reported in the main ES (Section B7) established that there were no natural or semi-natural wildlife habitats along the route of the Jubilee Line Extension. There are, however, "man-made" habitats which support communities of plants and animals which may be of ecological interest and/or amenity value. These are of three main types:

- wasteland sites, mostly former dockside and railway lands, supporting ruderal (living on waste land) plant communities, in some cases developing towards more established communities, e.g. rough grassland, secondary woodland;
- artificially created wildlife habitats;
- formal green space of various kinds with limited wildlife interest.

Only one of the revised/additional work sites was found to have potential impacts on such a site; the ground treatment in Southwark Park.

Southwark Park contains London Plane trees which are up to 150 years old and of considerable local value. Ground treatment could damage these in two ways:

- the entry of large drilling rigs into the park could damage the canopies of trees lining the route;
- the boreholes for the injection of grout could damage the roots of the trees.

Impacts could be avoided by angling the rigs on entry to the park and by selecting the locations of the boreholes with care to avoid tree roots.

Grout will be injected at a depth of about 12 metres; this is well below the rooting zone of the trees.

There will therefore be no significant impacts.

D8. IMPACTS ON THE AQUATIC ENVIRONMENT

D8.1 Introduction

This section of the report reviews the impacts of waste water emissions arising as a result of the revised works. Impacts on the quality of groundwater and surface water resources have been examined.

D8.2 Groundwater Contamination

Groundwater contamination may arise through the following:

- o By leakage of materials used during ground treatment into perched aquifers; these materials include cement, bentonite, chemical grouts, and lubricants from the grouting plant.
- o By site water contacting contaminated alluvium/surface soil and percolating through to the clay layer as a result of vertical shaft construction. The additional/revised works include proposals for shafts as follows:
 - ventilation shafts at Hatfields and Joiner Street Courtyard;
 - emergency escape shafts at Hatfields and London Bridge Station;
 - shafts for traction sub-stations at Southwark Street/Redcross Way or Bermondsey Street and the escalator shafts at Hatfields.

Virtually all of the water will remain trapped in the clay layer and therefore pose no threat to groundwater supplies.

- o By infiltration of contaminated surface drainage into water bearing strata.

As no groundwater abstraction points have been identified in the immediate vicinity of the Extension Route, only low levels of contamination may arise from these sources. These levels are unlikely to affect sources of drinking water or other supplies. In addition, as all activity is taking place in the clay layer, it is unlikely that contaminated water will travel to the chalk aquifer below.

Good standards of housekeeping during shaft construction and on surface construction sites, including use of bunds and drip trays for material stores, will minimise risks of contamination from these sources. No measures additional to those outlined in the March 1990 ES are envisaged.

D8.3

Disposal of Shaft Seepage and Site Drainage

Shaft seepage and site drainage will be collected and discharged to sewers or directly to surface watercourses. As detailed in the March 1990 ES, these effluents may be contaminated by:

- suspended solids from soils, grouting and lining materials;
- oils and lubricants from machinery and stores;
- trace pollutants released from disturbance of contaminated soils.

Good construction practice should be adopted to ensure that discharge consent conditions imposed by the National Rivers Authority Thames Region are met. Once again, this is likely to include provision of settling lagoons and oil interceptors at station sites. If these consent conditions are met, no significant adverse effects on receiving waters are predicted.

ANNEX I

THE PROJECT TEAM

PROJECT TEAM

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ENVIRONMENT & LANDSCAPE
Environmental Statement

18/04/2001 15:05:49

**JUBILEE LINE EXTENSION, 1990 (NO.2) BILL
ENVIRONMENTAL STATEMENT ADDENDUM
02/91**



MHA 44/27/691\$ 1*

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Construction Areas for Revised/Additional Works

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- | | |
|----------------------------------|-----------------------------|
| 1. Waterloo Station | 6. Ben Smith Way |
| 2. Southwark Station | 7. Major Road/John Roll Way |
| 3. Southwark Street/Redcross Way | 8. Southwark Park |
| 4. London Bridge Station | 9. Canada Water |
| 5. Old Jamaica Road | 10. Canning Town Station |

- Southwark Station;
- London Bridge Station;
- Bermondsey Station (Major Road/John Roll Way);
- Canning Town Station.

o Additional or Modified Shafts from the Surface to the Underground Tunnels

The proposed revisions include additional or enlarged ventilation shafts, escape shafts and two shafts through which electricity can be provided to the underground lines. These will be formed at the following construction areas:

- Southwark Station (several locations);
- Southwark Street/Redcross Way;
- London Bridge Station;
- Bermondsey Street;
- Ben Smith Way.

o Ground Treatment and Underpinning

In areas where the nature of the ground is not ideal for tunnelling or station construction, the underground material requires "ground treatment". This involves boring a series of holes approximately fifteen centimetres in diameter and one metre apart to a depth of about thirty metres, and injecting consolidating fluids and hardening agents. Underpinning is a similar procedure but has the purpose of strengthening the ground beneath surface structures to prevent settlement.

The revised proposals envisage some ground treatment or underpinning at the following construction areas:

- Waterloo Station (Mepham Street);
- Southwark Station (Blackfriars Road);
- London Bridge Station (several locations);

- Old Jamaica Road;
- Ben Smith Way;
- Major Road/John Roll Way;
- Southwark Park;
- Canada Water (Renforth Street).

o Tunnelling Site

It is proposed to use the development site at the junction of Southwark Street and Redcross Way as an additional tunnelling access shaft site. A tunnel boring machine will be inserted down the shaft and spoil will be removed.

The locations of these construction areas are shown in the diagram on the following page.

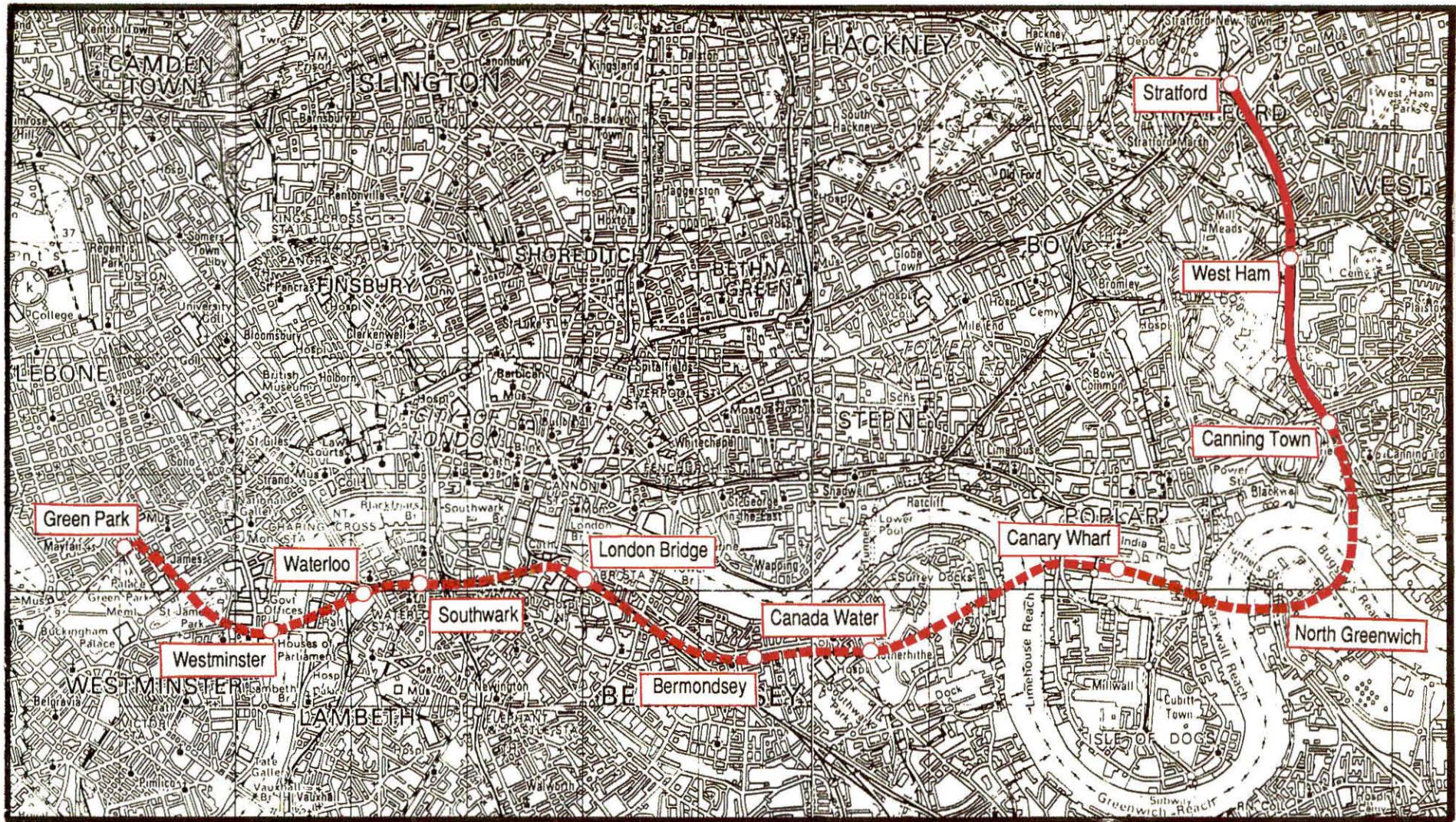
The Environmental Assessment of the Proposed Revisions

The Environmental Assessment of the 1990 (No.2) Bill follows the methodology and procedure established in the Assessment of the original scheme reported in the main Environmental Statement.

There were two principal aims.

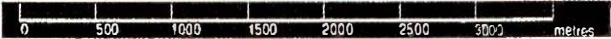
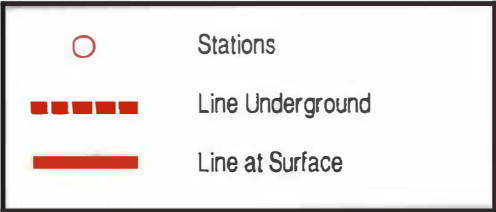
- o To identify the nature and scale of the environmental effects that are likely to result from the revised construction proposals under the 1990 (No.2) Bill.
- o To identify any specific measures that should be taken to minimise those effects or any particular features which may require attention beyond the general mitigation measures outlined in the main Environmental Statement.

The issues addressed included the following potential impacts during construction and operation.



Jubilee Line Extension Route

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Introduction

In November 1989 a proposal to extend the Jubilee Line from Green Park to Stratford was submitted to Parliament, in the form of a Private Bill, by London Underground Limited (LUL) and London Transport.

Environmental Resources Limited (ERL) was commissioned by London Underground to carry out an independent Environmental Assessment on the impact of the proposed scheme.

Environmental Assessment is a procedure recently introduced into the UK planning system as a formal requirement for any development which may have significant effects on the environment. However, the report (or Environmental Statement) on the study carried out for London Underground was issued in March 1990, ahead of any legal requirements to publish such a report for a Private Bill.

In May 1990 an Addendum to the Environmental Statement was released, entitled the North Greenwich Addendum. This was published to cover an alteration to the route, which is now intended to run via the Greenwich Peninsula, rather than via the Brunswick area north of the Thames.

The present proposed route described in the main Environmental Statement, as amended by the Greenwich Addendum, runs from Green Park Station via Westminster, Waterloo, London Bridge, Canary Wharf and North Greenwich to Stratford. The route is shown in the diagram on the following page.

As the design of the Jubilee Line Extension was refined, revisions and additions to the original scheme were included, some of which would require additional and different legal powers before they could be implemented. In November 1990 London Underground therefore deposited a second Private Bill (No.2) in Parliament requesting supplementary powers to carry out the amendments. Once again, Environmental Resources Limited was commissioned to provide an independent assessment of the environmental implications of proposals described in the Bill, in the form of Addendum No. 2 to supplement the original Environmental Statement (plus Addendum) drawn up for the 1989 Bill.

The Environmental Statement and North Greenwich Addendum as a whole provided a full analysis of the potential construction and operating effects of the Jubilee Line Extension, and details the general measures for mitigation in each technical impact area, whilst Addendum No.2 details the specific impacts predicted at each revised work site arising from the 1990 (No.2) Bill and, if necessary, the specific mitigation measures required. Addendum No. 2 does not otherwise update the earlier Statements.

The proposed revisions to the original scheme fall into four main categories.

o Revised Station Construction

There are proposed revisions to four of the stations on the Extension requiring increasing landtake and work site areas to allow for improved passenger facilities and safety standards. Construction areas at which additional landtake is required are: