South Essex Rapid Transit
Major Scheme Business Case

Appendix 4A
Environmental Appraisal

April 2010

Essex County Council

THURROCK COUNCIL

southend onsea BOROUGH COUNCIL

INTERREG IVB

BOOSTING ADVANCED PUBLIC TRANSPORT SYSTEMS

A partnership project between Essex County Council, Southend-on-Sea Borough Council and Thurrock Council

South Essex Rapid Transit (sert)

Appraisal of Environmental Effects

Final Report

March 2010

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1 Introduction

Project Context

1.1 This Report sets out the outcomes of an appraisal of the environmental issues likely to be associated with the construction and operation of the first phases of the proposed South Essex Rapid Transit (***sert***) network. The purposes of the appraisal are to:

- Highlight any key environmental risks or constraints that may significantly affect the development and implementation of the proposals;
- Provide the information on possible environmental effects required to allow the prioritisation of routes within the ***sert*** network; and
- Provide the inputs to the appraisal summary tables on environmental issues in a format consistent with DfT's Major Schemes Business Case (MSBC) assessment framework, and document the work that has supported this.

Scope of Appraisal

1.2 At this stage of project development, some of the detail necessary to carry out a full environmental assessment of the proposed ***sert*** alignments is not available. However, sufficient benchmark data exists on similar systems and for the local baseline environment to provide an appraisal review of the key issues as part of the MSBC.

1.3 The appraisal set out in this document is high-level and has been undertaken based on the preliminary designs developed to date, which have enabled the key areas of environmental risk to be identified, together with a broad indication of mitigation measures that might be implemented. Steer Davies Gleave has not carried out any detailed environmental modelling at this stage, although we believe that sufficient information is available to allow a preliminary estimation of the likely significant effects on the environment in qualitative terms.

1.4 The Appraisal includes:

- Identification of all the relevant environmental aspects of the proposed ***sert*** routes that are likely to impact upon scheme development;
- Establishing key issues to be addressed;
- Broad measures for environmental mitigation, including identification of those elements that could potentially be influenced by design changes;
- A broad indication of the likely environmental effects of the proposals, sufficient to provide the environmental inputs to the MSBC appraisal.

1.5 The appraisal has examined the details of the preliminary proposals for the ***sert*** network in terms of:

- The work undertaken by engineering consultants Mouchel on preliminary designs for the proposed ***sert*** routes.
- Future land use changes, as identified through the land use inputs to the OMNITRANS transport model (i.e. from TEMPRO), and taking account of the emerging local development frameworks and regeneration frameworks in the areas to be served by ***sert***. A key aspect of this work is the identification of potentially sensitive receptors (e.g. key buildings, residents, habitats etc.).
- The likely effects on accessibility and movement.

Methodology

1.6 The classification of likely environmental effects associated with the proposed ***sert*** network is potentially complex. However, a number of standard checklists exist, including those published by the Environment Agency[1], and NETREGS[2] (although these tend to be insufficiently detailed for individual schemes). These have been used to identify the key issues feeding into the development of evaluation criteria on environmental impacts and the MSBC.

1.7 The evaluation of the significance of potential impacts has been based primarily on local feedback and the expert knowledge of the environmental effects similar systems / projects gained by project team members through working on environmental impact assessments of public transport schemes in various cities in the UK, as well as projects overseas.

1.8 There are existing regulatory environmental standards for a number of categories of impact. These include:

- Air quality (through the application of National Air Quality Standards);
- Operational noise (through the application of the Noise Insulation Regulations); and,
- Water pollution (through standards established by the Environment Agency).

1.9 Baseline environmental information has been collated from published sources already available, most notably the Strategic Environmental Assessment Reports that were published with the Local Transport Plans of the three Highway Authorities within TGSE[3].

1.10 Environmental aspects were identified by team members with environmental expertise examining the likely effects of the proposed route alignments in detail, taking account of the information on the ***sert*** proposals provided from other

1 Environment Agency (2002) – **Scoping Guidelines for the Environmental Impact Assessment of Projects** – May 2002.

2 NETREGS website at www.netregs.gov.uk/netregs. See pages on "Road Transport" and "Construction".

3 i.e. Essex County Council, Thurrock Council and Southend-on-Sea Council.

workstreams, and published information on baseline environmental conditions in the route corridors.

Consultation

1.11 A copy of the draft environmental appraisal report was forwarded to the Statutory Environmental Bodies for comment in January 2010. Comments were received only from the Environment Agency. These comments have been taken on board and necessary amendments to the report made. The text of the response is attached to this report as **Appendix A**.

Structure of the Report

1.12 After this introductory section, the remainder of this Report is set out as follows:

- **Section 2** identifies the environmental aspects of constructing and operating the proposed ***sert*** routes;
- **Section 3** describes the proposed ***sert*** routes, associated infrastructure and service arrangements.
- **Section 4** examines the likely environmental effects that may occur during the construction and operation of the preferred ***sert*** route alignments to be taken forward in the MSBC; and
- **Section 5** examines the broad options for the mitigation of likely adverse environmental impacts.

2 Environmental Aspects

2.1 In very broad terms, the likely environmental aspects of building and operating the proposed ***sert*** routes are summarised in Table 2.1 below:

TABLE 2.1 ENVIRONMENTAL ASPECTS OF *sert* ROUTES

Category of Impact	Construction	Operation
Air quality and greenhouse gas emissions.	Dust generated from: ▪ Site clearance; ▪ Excavation and earthworks; ▪ Concrete batching and materials handling; ▪ Movement of plant and vehicles. Gaseous emissions from powered plant and vehicles.	Gaseous emissions from ***sert*** vehicles. Changes in air pollutant concentrations due to changes in traffic patterns and flows.
Noise	Site clearance and excavation; Piling; Materials handling; Compacting fill material; Operation of plant and equipment; and Movement of plant and vehicles.	Wheel/road interface. Engine noise from ***sert*** vehicles Re-radiated noise from structures. Activity at stops. Changes in ambient noise levels due to changes in traffic patterns and flows. Physical damage to structures from vibration.
Townscape and visual intrusion	Demolition or removal of key visual elements in landscape/townscape. Temporary presence of construction plant, equipment and materials stockpiles. Temporary lighting for construction works, especially in winter.	Introduction of new visual elements into landscape/townscape. Reductions of traffic flow due to modal shift. Improvements to streetscape associated with transit infrastructure.

Category of Impact	Construction	Operation
Heritage	Demolition or removal of archaeological resources or historic buildings. Physical damage to archaeology and historic resources.	Effects on the setting of historic buildings and public spaces from the presence of ***sert*** vehicles and other infrastructure. Physical damage to structures from vibration.
Ecology	Loss of, or damage to habitats during construction.	Damage to ecological habitats from noise or pollution during operation
Water environment	Contaminated run-off during construction works. Contamination of ground water resources during excavation/piling etc. Groundwater drawdown due to infiltration to excavation works. Disposal of contaminated water from dewatering of excavation works.	Increased contaminated run-off due to increases in areas of hardstanding.

3 Project Description

Overview

3.1 ***sert*** will be an innovative form of public transport that utilises a package of measures to give it priority over other traffic. ***sert*** will use modern, high quality, environmentally friendly vehicles, with level boarding, GIS and CCTV and, where necessary, will run on its own dedicated lanes. Vehicles will also have technology which sends a signal to traffic lights to change to green when ***sert*** approaches to ensure fast and reliable journey times. Services will be frequent so that passengers can just "turn up and go". There will be high quality, easily-identifiable ***sert*** stops, with real time information displays. Tickets will be purchased in advance to minimise delays at ***sert*** stops.

3.2 ***sert*** will have a control centre which will allow constant monitoring of the position of the vehicles and ensure they keep to schedule. It will also mean that adjustments can be made to the services in order to bring them back to schedule over the whole network, should any delays occur.

3.3 The ***sert*** network will essentially comprise a series of high quality corridors, which will be developed to a common level of service and marketed as a single entity and brand. A combination of regulation, partnerships and commercial ventures will provide rapid transit services that meet local needs and requirements and deliver consistently high service levels.

3.4 Reflecting the character of the area in Thames Gateway South Essex (TGSE) that it will serve, ***sert*** will be developed on a 'hub and spoke' basis. This means that initially ***sert*** will focus on serving centres within three key areas:

- Basildon;
- Southend-on-Sea; and
- Thurrock.

3.5 The first ***sert*** services will improve access to and from these areas. Later phases will link to other areas. The sert network will serve key existing rail and bus interchanges, so it is fully integrated with other public transport in South Essex.

Specification

Vehicles

3.6 The specific vehicles that will be used to provide the ***sert*** services have not been identified at this stage of scheme development. It is most likely that the vehicles will be provided by the private operators of the services, secured through a partnership agreement under powers available to the promoters through the Transport Act 2008. Within the terms of the agreement, bus operators will be able to use the infrastructure provided to give ***sert*** vehicles and other bus services priority over other traffic if the vehicles used meet certain standards to be

specified in the agreement. This specification is yet to be finalised, but present thinking by the promoters is that ***sert*** vehicles should have the following attributes:

- Be fully accessible, multi low floor entrances, the majority of seats step free, and wheelchair/pushchair spaces by doors.
- Have on-board 'bus stopping' illuminated sign, to indicate that the driver will be calling at the next bus stop.
- Have electronic and audible messages on board the bus to indicate the name of the next bus stop.
- Use up-to-date engine technology to ensure maximum fuel efficiency and lowest levels of noise and pollution, which is supported by the Environment Agency.
- Provide clear branding of the vehicles, using a bespoke livery/internal decor to allow passengers to distinguish the ***sert*** network from conventional bus services.
- Air conditioning and heating.
- Electronic information displays on the front, rear and side of transit vehicles, indicating the destination and the route the vehicle is serving.
- 'London Underground' style route maps provided inside the vehicle.
- Personal security in the form of on board CCTV.
- Vehicle dimensions most likely to be in the order of 10.4m length x 2.6m width minimum.
- GPS tracking linked to real-time information, traffic signals and control centre.
- Forward facing enforcement camera to capture traffic regulation infringements (depending on enforcement regime).

FIGURE 3.1 ARTIST'S IMPRESSION OF POSSIBLE *sert* VEHICLE

Infrastructure

3.7 The infrastructure that will be provided by the promoters to give priority for sert vehicles (and buses providing other services that meet the specified performance standards) will include the following:

- Dedicated transit lanes or segregated transitway provided wherever needed, with non-segregated sections having, where possible, 'red-route' type waiting and loading controls, where existing restrictions or non-compliance will introduce unacceptable delays.
- High-quality, high-visibility surface materials on new sections of transitway to maximise passenger comfort and minimise noise and vibration.
- Minimum lane width 3.5m.
- If cycle ways are included into the transitway design, this minimum should be increased to 4.75m.
- Pavement width preferably 4.0m at stops, to allow free passage for boarding and alighting and through movement along the pavement, although reduction of this may be allowable in physically-constrained locations.
- Stop length to accommodate 10.4m vehicles, although extension to accommodate additional vehicles stopping should not be precluded.
- Distinctive stops with shelters, seats and lighting provided to a common, high quality standard.

- All stops named and clearly identified.
- Standard level of information provision including 'London Underground' style route map, information on other public transport services, and area map with local information at all stops.
- Raised kerbs for close, level and swift boarding, integrated into footway using high quality paving materials to identify stops. Drainage designed to prevent water build up near to stops.
- Real time information provided by electronic displays and for RNIB key fob holders, indicating when the next two services are due and if service disruption has occurred.
- Passenger help points at main stops (provided in the longer term).
- Cycle parking provided at main stops and interchanges where appropriate.
- CCTV surveillance for safety and security where this can be provided effectively.

Operations and Control Centre

3.8 The operation of the sert services will have the following features:

- To ensure reliability and punctuality, the ***sert*** services will be directed from a control centre with GPS tracking of all vehicles and CCTV coverage, linked to real time information and signal priority.
- Static and on-vehicle CCTV enforcement.
- High frequency service throughout the day (e.g. typically a 10-minute frequency except 20 minute frequency early morning and evenings and 15 minute frequency on Sundays/Bank Holidays.).

Routes

3.9 The ***sert*** routes for which funding is being sought from the Regional Funding Allocation through the MSBC are:

- Route T1: Basildon Hospital to Lakeside via A13 and Grays;
- Route S1: Progress Road industrial Estate to Seaway Car Park, Southend, via Prittlewell Chase, Victoria Avenue and Chichester Road; and
- Route B1: Eastmayne (south of A127) to Basildon Hospital via Festival Leisure Park and Basildon Town Centre.

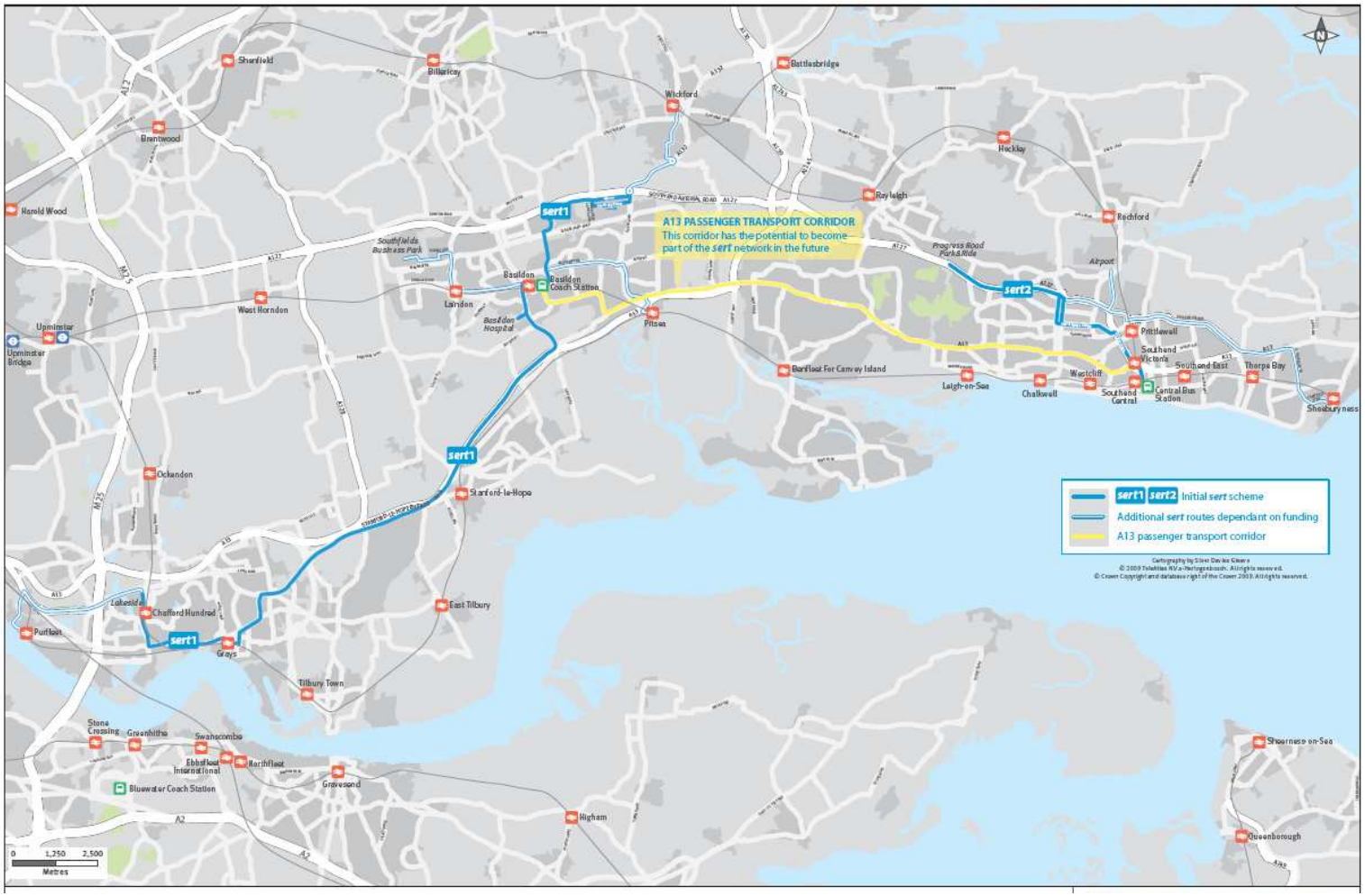
3.10 These routes are illustrated in **Figure 3.2** following.

Programme

3.11 Presently, it is anticipated that ***sert*** services will come into operation in late 2012. Following approval of funds from the Regional Funding Allocation, and when the other funding sources are in place, infrastructure contracts will be put out to

tender, and agreements reached with the companies that will operate the ***sert*** services during 2010/11. It is anticipated that construction work for the ***sert*** infrastructure should take about a year.

FIGURE 3.2 *sert* ROUTES TO BE INCLUDED IN MAJOR SCHEME BUSINESS CASE



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4 Likely Environmental Effects

Introduction and Summary of Effects

4.1 In this section, the likely environmental effects of building and operating the ***sert*** services are identified and evaluated for their significance. The effects are considered under the following headings:

- Greenhouse gas emissions;
- Local air quality;
- Waste Management;
- Noise;
- Townscape and landscape;
- Heritage of historic resources;
- Ecology and biodiversity; and
- Water environment.

4.2 **Table 4.1** following sets out the Appraisal Summary Table (AST) for the likely environmental effects of the proposed ***sert*** routes:

TABLE 4.1 ASSESSMENT SUMMARY TABLE FOR ENVIRONMENTAL EFFECTS OF *sert*

Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
Greenhouse Gases	Negligible increase in emissions due to construction. Small increase in emissions due to operation of vehicles. Small decrease due to mode shift of passengers from cars to ***sert*** services. Small net reduction in emissions likely overall.	Present emissions of CO_2 from traffic estimated at 900,000 tonnes p.a. ***sert*** services estimated to add a maximum of 4,500 tonnes $CO_{2\text{-eq}}$ per year (<0.5%).	Slight beneficial effect
Local Air Quality	No additional delays for general traffic and modal shift to ***sert*** from car will mean that overall changes in the levels of local air pollutant emissions are not likely to be significant, and in turn will not have any significant effect on local air pollution. However, the mode shift from car to public transport may assist local air quality, particularly where ***sert*** runs through AQMAs.	Not applicable at this stage	Slight beneficial effect
Waste Management	Measures to minimise waste during construction and to ensure collection and disposal of waste in environmentally-friendly manner during operation of ***sert*** will be in place	Not applicable at this stage	Neutral effect
Noise	During construction, some significant noise impacts may occur temporarily where works are in close proximity to residential areas. CCP mitigation and statutory noise controls will apply.	Not applicable at this stage	Moderate adverse effect

Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
	sert vehicles likely to be quieter than existing vehicles and add a negligible amount of traffic to existing flows.	Not applicable at this stage	Slight beneficial effect
Townscape and Landscape	During construction, there may be removal of elements in the landscape/townscape, and temporary presence of construction plant (especially cranes), equipment and materials stockpiles, fencing and lighting. However, there typically is sufficient space available within the existing highway limits to accommodate this.	Not applicable	Slight adverse effect
	Introduction of new visual elements into landscape/ townscape, although typically only a minimal impact chiefly relating to additional road markings. However, the works could provide opportunities for improvements to the streetscape associated with ***sert*** infrastructure and the treatment of urban spaces.	Not applicable	Neutral effect
Heritage of Historic Resources	Likelihood of direct loss of or damage to historic resources is small during construction. During operation, effects on the setting of historic buildings and public spaces and physical damage to structures from vibration are not likely to be significant.	Not applicable	Neutral effect

Sub-Objective	Qualitative Impacts	Quantitative Assessment	Assessment
Biodiversity	Limited landtake required for the construction of ***sert*** infrastructure, mostly within existing highway limits. Preferred ***sert*** routes presently identified are not in close proximity to sensitive ecological resources. Potential for damage to ecological habitats from noise or pollution during operation of ***sert***. However, this is unlikely to be significantly different to any effects associated with the existing road network presently.	Not applicable	Neutral effect
Water Environment	Contamination of watercourses or groundwater by run-off will be avoided through good construction management. During operation, risks of contaminated run-off entering local watercourses will be avoided by incorporation of traps to ensure that spilled fuel and other similar substances do not enter the drains or sewers.	Not applicable	Neutral effect

Greenhouse Gas Emissions

Baseline Conditions

4.3 Greenhouse Gas emissions from traffic, notably carbon dioxide (CO_2) cannot be measured directly, and all published figures are estimates based on emission factors applied to statistics on levels of road traffic. Taking this approach, estimates of CO_2 emissions for local authority areas in TGSE are as follows:

TABLE 4.2 ESTIMATES OF CO_2 EMISSIONS ('000 TONNES)

	'000 t	% total	t per capita
Basildon	298.35	24.3%	1.8
Southend-on-Sea	160.11	16.6%	1.0
Thurrock	458.59	25.7%	3.1
Total	917.05		1.9

Source: National Statistics and Department for Energy and Climate Change - 2007 UK carbon dioxide emissions for Local Authority areas, 17 September 2009: statistical release.

4.4 On this basis, it is estimated that the overall annual CO_2 emissions from traffic in the TGSE area presently is slightly lower than in 2007. This reflects a slight downward trend in the level of emissions in recent years of about 1%p.a. in Basildon and Southend, although emissions in Thurrock have been increasing by about 0.5%p.a. This, and the much higher per capita emissions observed in Thurrock are likely to be due to the larger amount of commercial and freight traffic and proximity to major A-roads and the M25.

Impacts during Construction

4.5 Greenhouse gas emissions will occur from the operation of vehicles and plant during the construction phase. It is anticipated that the construction period for ***sert*** would last for approximately 12 months. At this stage of scheme development, it is not possible to be specific about where construction works will occur and what plant will be present on site. However it is not anticipated that this will lead to any significant increase in greenhouse gas emissions in the area overall during the period of construction work for ***sert***.

Impacts during Operation

4.6 The level of greenhouse gas emissions in TGSE may change due to changes in traffic flows arising from the introduction and operation of ***sert*** services. The ***sert*** vehicles themselves will emit greenhouse gases during operation. However, it is not anticipated that this will lead to a significant increase in emissions above the 'do-minimum' baseline, and indeed may lead to a relative decrease depending on

the level of mode shift and changes in traffic patterns that result from the introduction of ***sert***.

Local Air Quality

Baseline Environmental Conditions

Overview

4.7 Under the Environment Act 1995 and the subsequent National Air Quality Strategy (NAQS) and Air Quality Regulations (1997, 2000, 2002), Local Authorities have a duty to review and assess local air quality in their area, and to update this over time. The Government has set the objectives for air quality, the most relevant of which are:

- **NO_2:** 200ug/m3 (105ppb) not to be exceeded more than 18 times a year, 1 hour mean, 31st December 2005; and 40 µg/m^3 21ppb NO_2 Annual mean by 31st December 2005.
- **PM_{10}:** 40 ug/m3 Annual mean 31 December 2005 and; 50ug/m3 not to be exceeded more than 35 times a year as a 24 hour mean by 31st December 2005.

All the material on air quality in South Essex has been based on the assessments undertaken by the various local authorities in the area to meet these requirements.

4.8 Overall, air quality in Thames Gateway South Essex typically is good. The only area with significant air quality problems is Thurrock, which has 15 Air Quality Management Areas (AQMAs) that have been designated, where action is required to meet the objectives set by the NAQS. Elsewhere, there are only a couple of sites in Rayleigh which are being specifically monitored to ensure that air quality stays within acceptable limits. Emissions from road traffic are clearly the most prevalent source of air pollution in the area, and the air quality issues in Thurrock are clearly linked to levels of traffic and congestion on the M25 and A13 particularly, and also the A1306 north of Chafford Hundred, and the B186 near Lakeside.

Thurrock

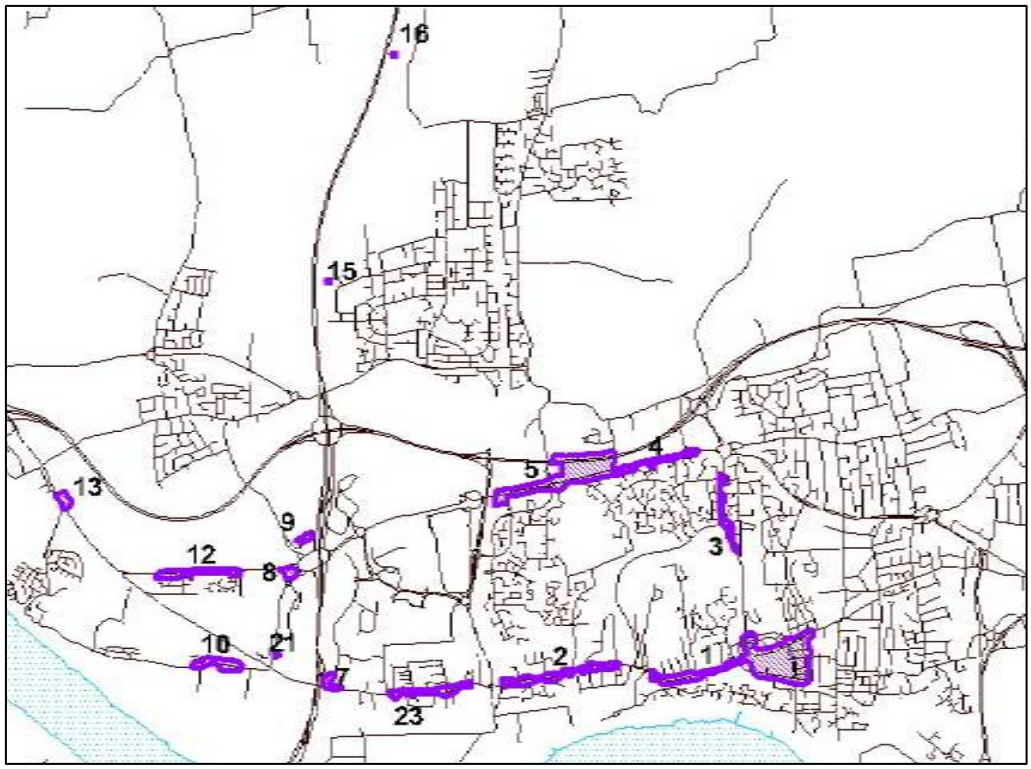
4.9 In Thurrock, the SEA for the LTP2[4] identified that monitoring has indicated that for both NO^2 and PM_{10}, the NAQS objectives were exceeded, specifically the annual mean objective for NO^2 and the 24-hour mean objective for PM_{10}. The areas predicted to exceed are mainly adjacent to major roads across the borough. On this basis, 20 separate AQMAs were identified after public consultation, although after further review and assessment this has now decreased to 15. These are identified in Table 4.3 and illustrated in **Figure 4.1** on the following pages:

[4] Steer Davies Gleave (2006) – **Environmental Report for Thurrock's Local Transport Plan II** – Thurrock Council, February 2006, p.16.

TABLE 4.3 AQMAS IN THURROCK

Area No.	Description	Pollutant
1	479 properties in Grays town centre and London Road, Grays	NO2
2	220 properties on London Road South Stifford and adjoining roads	NO2
3	60 properties on the east side of Hogg Lane and Elizabeth Road	NO_2
4	56 properties to the west of Chafford Hundred Visitor Centre.	NO_2
5	65 properties surrounding Warren Terrace, A13 and A1306	NO_2 / PM_{10}
7	2 hotels next to M25	NO_2 / PM_{10}
8	1 hotel next to Junction 31	NO_2 / PM_{10}
9	1 hotel next to Junction 31 of the M25	NO_2
10	76 properties on the London Road, Purfleet near to Jarrah Cottages	NO_2
12	15 properties on Watts Road estate next to A1306	NO_2 / PM_{10}
13	15 properties on London Road, Aveley, next to A1306	NO_2
15	1 listed building near to M25 on edge of Irvine Gardens, South Ockendon.	NO_2
16	1 Cottage next to M25 off Dennis Road	NO_2
21	1 hotel on Stonehouse Lane	NO_2
23	115 properties next to London Road, West Thurrock	NO_2

FIGURE 4.1 AIR QUALITY MANAGEMENT AREAS IN THURROCK



4.10 A high percentage of air pollutants in Thurrock come from transport. Overall, 56% of NO_x comes from road transport, but this rises to 83% in the worst locations. Between 33% and 63% of this is attributed to emissions from heavy goods vehicles (HGVs). For PM_{10}, at the worst locations, between 25% and 34% of total particulates come from road transport. Between 7.1 µg/m^3 and 10.3µg/m^3 comes from HGVs[5].

4.11 As may be seen from **Figure 4.1** above, a good deal of the ***sert*** options identified in Thurrock run through the AQMAs, particularly in Grays town centre and along London Road.

Basildon

4.12 In Basildon District, emissions from road traffic including Nitrogen Dioxide (NO_2) and particulate matter (PM_{10}) on the A127, A13 and A129 are the principal source for poor air quality in the District. Table 4.4 on the following page illustrates the results from the air quality monitoring station from 2000-2005[6].

5 Local Air Quality Action Plan: www.thurrock.gov.uk/environment/pdf/air_quality_plan.pdf

6 Basildon District Council measure air quality in the district using an automatic air quality monitoring station on Upper Mayne close to Gloucester Park in Basildon. The site has been

TABLE 4.4 AIR POLLUTION LEVELS IN BASILDON 2000-2005

Pollutant	Statistic	2000	2001	2002	2003	2004	2005
NO_2	Annual mean ($\mu g/m^3$)	33.8	40.7	37.7	37.1	40.1	39.3
	Max 1 hour mean ($\mu g/m^3$)	157	232	190	142	155	-
	Exceedences of 1 hour mean objective	0	4	0	0	0	-
PM_{10}	Annual mean ($\mu g/m^3$)	-	36.3	39.3	-	42.9	-
	Max 24 hour mean ($\mu g/m^3$)	-	88.3	105.5	-	87.1	-
	Exceedences of 24 hour mean objective	-	39	64	-	55	-

Source: Basildon District Council (2005) – **Local Air Quality Management Progress Report** – April 2005.

4.13 For NO_2 the national air quality strategy (NAQS) objective for annual mean concentrations ($40\mu g/m^3$) was exceeded in 2001 and 2004. In 2004 the particle matter was also in exceedance of the objective level ($40\mu g/m^3$). By 2005 the District Council expected that concentrations of both oxides of nitrogen (NO_x) and PM_{10} will meet targets. A daily objective is also monitored, and in 2004 and 2002 PM_{10} exceeded the daily mean objective ($50\mu g/m^3$) 55 times in 2004 and 64 times in 2002. The District Council believes this confirms that there are air pollution problems within the District for around 20% of the year. However, overall the Council has indicated that although the situation should be monitored, but that there is no immediate need to introduce any Air Quality Management Areas (AQMAs) in Basildon District.

operating since March 2000 and is classified as a roadside monitor. It measures concentrations of oxides of nitrogen and PM_{10}.

Southend-on-Sea

4.14 In Southend-on-Sea, the SEA undertaken for the second Local Transport Plan[7] indicated that no AQMAs have been declared in the borough and monitoring has shown considerable reductions in pollutant levels. PM_{10} concentrations fell by on average by 22% (from 26µg/m^3 to 20µg/m^3) over the period 2001/02 – 2004/05, and NO_2 concentrations fell by 26% (from 32µg/m^3 to 24µg/m^3). Data on air quality shows that within the urban area the average measurement of PM_{10} and NO_x are below the NAQS objectives.

Impacts during Construction

4.15 During the construction works to provide the infrastructure necessary for ***sert*** operation, the key impact is likely to be the effects of dust generated from:

- Site clearance;
- Excavation and earthworks;
- Concrete batching and materials handling;
- Movement of plant and vehicles; and.
- Gaseous emissions from powered plant and vehicles.

Of these, it is the excavation and earthworks which is likely to have most potential to lead to significant impacts. This will particularly be the case if there is significant removal of material due to regrading the profile of embankments (e.g. at existing grade-separated junctions).

4.16 The extent and magnitude of air quality impacts will depend significantly on the selected location of worksites. There is no information available on the precise location of these, or the working methods that would be adopted, at this time. However, many of the proposed ***sert*** route corridors are in close proximity to residential areas, and consequently it is likely that the mitigation of potential significant impacts from dust generation will be required.

4.17 Gaseous emissions from plant, equipment and construction vehicles are unlikely to have a significant adverse effect on local air quality. However, if significant removal of spoil, and/or importing of material for infilling disused cuttings, is required, it is likely that specific routes for construction traffic to adhere to will need to be identified in order to keep environmental effects associated with this to a minimum.

Impacts during Operation

4.18 Air quality impacts may potentially arise from the operation of the proposed ***sert*** services from:

- Exhaust emissions from ***sert*** vehicles; and

[7] Atkins (2006) - **Environmental Report: 2nd Local Transport Plan 2005/6 -2010/11 (LTP2)** - Southend-on-Sea Borough Council, March 2006, pp. 4-4.

- Changes air pollutant concentrations due to changes in traffic patterns and flows.

4.19 The vehicles that will be used to operate the ***sert*** services will be required to meet the most stringent standards available in terms of air pollutant emissions. Emissions standards for new buses are specified in European directives, usually known as 'Euro' standards. These (and the dates they came into force as a type approval) are set out in **Table 4.5** below[8]. Vehicles complying with the latest Euro standards typically enter service around 12 months later. All new vehicles procured for use in providing the ***sert*** services for the first tranche of routes, due to being operating late 2012, will be compliant with the Euro V standard. When vehicles are renewed, or new sert routes come into operation at a later date, the Euro VI standard may well apply.

TABLE 4.5 EU EMISSIONS STANDARDS FOR HEAVY DUTY DIESEL ENGINES (g/KWh)

Tier	Date [a]	Oxides of Nitrogen	Particulate Matter (PM_{10})	Carbon Monoxide	Hydrocarbons
Euro I [b]	Oct 1992	8.0	0.36	4.5	1.1
Euro II [b]	Oct 1996	7.0	0.25	4.0	1.1
	Oct 1998	7.0	0.15	4.0	1.1
Euro III	Oct 2000	5.0	0.16	5.45	0.78
Euro IV	Oct 2005	3.5	0.03	4.0	0.55
Euro V	Oct 2008	2.0	0.03	4.0	0.55
Euro VI [c]	Jan 2013	0.4	0.01	4.0	0.16

Notes:

a) Date for new type approval. Entry into service usually one year later.

b) Euro I and II were based on a different test cycle to subsequent standards

c) Proposal 16.12.2008

4.20 The consideration of traffic impacts of the proposed ***sert*** routes has not included detailed modelling of the changes in traffic flows at this time. However, there will be no reduction in road capacity, and so delays for general traffic will be no greater than they otherwise would be should the ***sert*** routes not be implemented. It is also anticipated that there will be some modal shift as some ***sert*** passengers will have previously made the same journeys by car. Overall, Steer Davies Gleave

[8] Air Quality Consultants (2009) - **Review of Bus Fleet Compositions and Implications for Emissions Reduction Strategies** – Table 2, p.6. DEFRA, March 2009.

anticipates that these changes are not likely to be significant, and in turn will not have any significant effect on local air pollution. However, the mode shift from car to public transport may assist local air quality, particularly where the ***sert*** route run through AQMAs. Overall, it is considered there will be a slight beneficial effect of operating the ***sert*** routes in terms of local air quality.

Waste Management

Impacts during Construction

4.21 The promoters of ***sert*** will seek to ensure that waste is managed sustainably during the construction phase. The Environment Agency has noted that regeneration of the Thames Gateway will generate a large quantity of waste and place additional pressure on waste infrastructure. The demolition, excavation and construction of new development alone will generate an additional 70 million tonnes of waste. Therefore, it is important that during the construction of ***sert***, measures are put in place to ensure that the waste generated is minimised, where generation of waste and spoil is unavoidable that it is reused on site or recycled for use elsewhere, and that is it only disposed to landfill where there is no other option available. On this basis, the specification for ***sert*** and the tenders for construction will, as far as practicable, be designed to:

- Retain and refurbish rather than rebuild;
- Be easily adapted to future changing uses;
- Enable reuse and recycling at least 90% of demolition and construction waste;
- Minimise over-ordering and damage of materials;
- Use standard components; and
- Have a recycled content of at least 30%.

4.22 In evaluation of tenders for construction, the promoters will seek to ensure that all proposals should demonstrate how they meet the above waste minimisation and management objectives.

Impacts During Operation

4.23 Waste will be generated during the operation of **sert** in terms of:

- Solid waste (newspapers and other litter) collected from passengers; and
- Solid and liquid wastes from vehicle maintenance and repair.

4.24 Identifying the arrangements for the collection and disposal of these wastes in a manner that minimises their environmental effects will be the responsibility of the operators of the ***sert*** services. These are most likely to be one or more of the main public transport operating companies already running bus services in Thames Gateway South Essex, and these companies now take these responsibilities very seriously and many have operate or are developing environmental management systems accredited to ISO 14001 standards. It is therefore anticipated that there is

unlikely to be any additional significant environmental effects occurring as a result of the operation of ***sert*** in this respect.

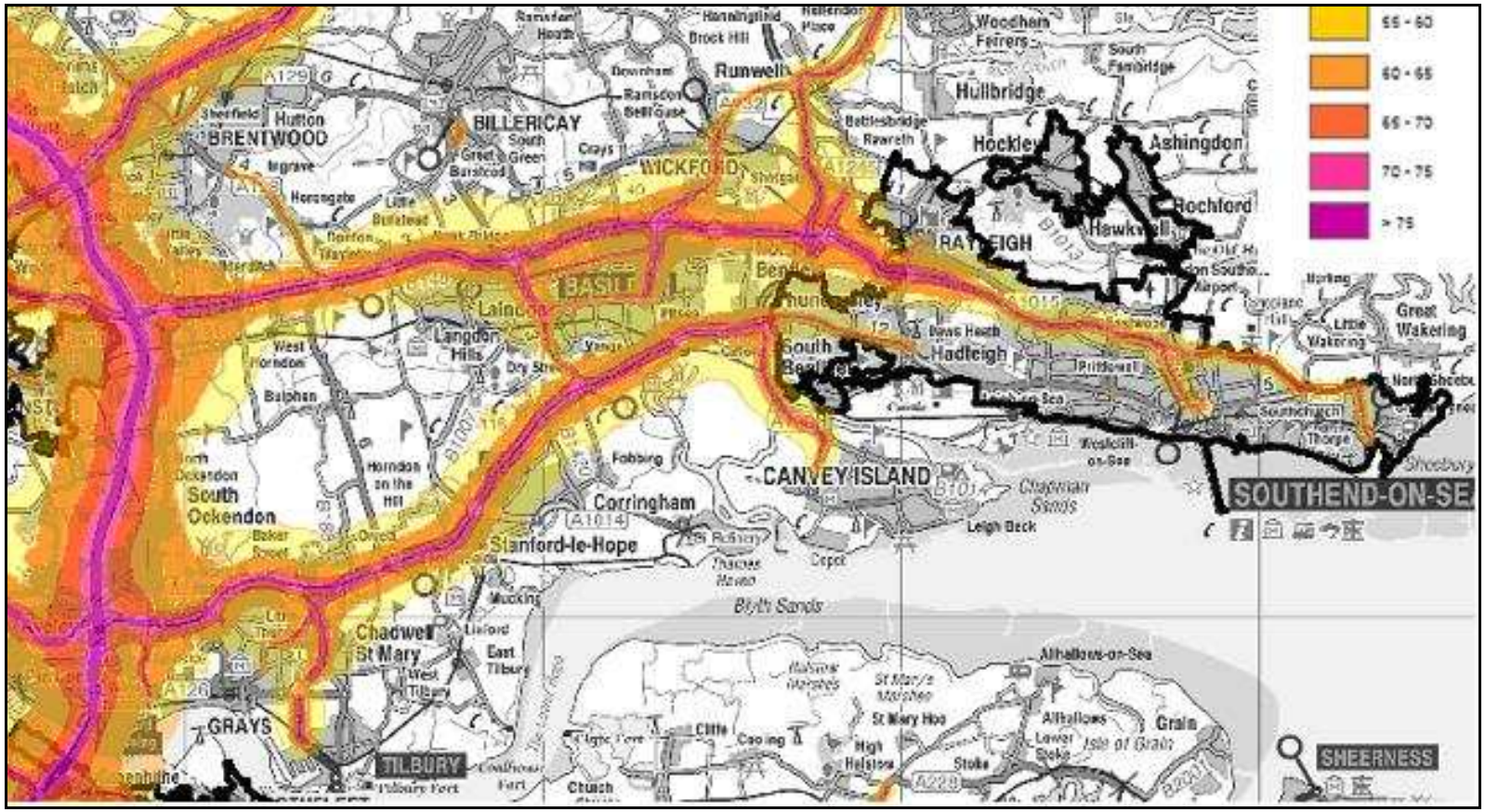
Noise

Baseline Environmental Conditions

Overview

4.25 **Figure 4.2** on the following page indicates the estimated levels of noise from road traffic in Thames Gateway South Essex generally. This clearly indicates the extent to which traffic on the major roads is a primary source of noise in the area, and

FIGURE 4.2 ROAD TRAFFIC NOISE LEVELS IN THAMES GATEWAY SOUTH ESSEX[9]



9 The noise levels are expressed in Lden, which is a logarithmic composite of daytime, evening and nighttime levels weighted towards the evening and nighttime values.

that all the areas that would be served by the ***sert*** services already experience relatively high levels of noise. As traffic flows increase in the future, the noise environment in Thames Gateway South Essex will decline further.

Thurrock

4.26 In Thurrock, many residents have seen noise levels increase significantly from previous levels[10]:

- In the Hamble Lane and Humber Avenue areas of South Ockendon, measured noise levels of 60dB(A) have been recorded which are estimated to be at least 10 dB(A) above the previous noise levels taken shortly after the A13 trunk road extension opened in 1999. However, $L_{10(18\ hour)}$ levels would be significantly lower.
- Rural areas are also exposed to elevated noise levels again up to 10 dB(A) higher than previously recorded. Evening background noise levels in Orsett and North Stifford were found to be in the region of 42 – 44 dB(A) compared to 30 – 32 dB(A) before the opening of the A13 extension.

4.27 However, it should be noted that even after some increases, ambient noise levels due to traffic may not be considered excessively high.

Basildon

4.28 In common with most areas with a relatively high degree of urbanisation, the main source of ambient noise in the areas that ***sert*** will service is road traffic. Consequently, the highest noise levels will occur closest to the most heavily used roads. Along the A127 close to Basildon, for example, daily traffic flows regularly exceed 70,000 vehicles per day. This results in $L_{10(18\text{-hour})}$ traffic noise levels in excess of 68 dB(A) occurring up to 500m from the carriageway.

4.29 In Essex, there is no available general data on ambient noise levels. However, the SEA for the Essex LTP refers to a transport noise complaints database compiled by the Highways and Transportation Department, which may provide data in future.

Southend-on-Sea

4.30 In Southend, the ambient noise conditions are characterised as 'poor' and 'declining'[11]. This is chiefly because traffic volumes on major routes are increasing and are expected to rise in line with national rates of 20% in the next 10 years; therefore it can be assumed that the level of noise, vibration and pollution will increase in line with traffic volumes.

[10] Thurrock State of the Environment Report 2000.

[11] Atkins (2006) - **Environmental Report; 2nd Local Transport Plan 2005/6 – 2010/11 (LTP2) Strategic Environmental Assessment** - Southend-on-Sea Borough Council, March 2006, pp. 4-8.

Impacts during Construction

4.31 Any construction project necessarily involving the use of heavy plant and machinery will cause nuisance from noise to a greater or lesser degree. Clearly, until the route alignments for ***sert*** are chosen, and the precise design of the infrastructure required has been determined, it will not be possible to identify the working methods, site activities, plant and equipment required or programmes and timescales for construction works.

4.32 However, it is likely that the key sources of noise from the construction works necessary for ***sert*** would be associated with:

- Site clearance and excavation;
- Piling (where necessary);
- Materials handling;
- Compacting fill material;
- Operation of plant and equipment;
- Movement of plant and vehicles; and
- Nuisance to people from vibration.

4.33 At this stage of scheme development, there is obviously no available information on likely construction methods and programme. However, given the close proximity of residential areas of many parts of the potential ***sert*** routes already identified, there is a strong likelihood that significant noise impacts may occur.

4.34 Mitigation measures to avoid significant noise impacts during the construction works are almost certainly likely to be necessary. This might include, for example, restrictions on working hours and providing acoustic screening of noisy plant and equipment. Codes of Construction Practice will be developed and enforced through contracts for each individual ***sert*** route, which will include measures to mitigate noise impacts.

Impacts during Operation

4.35 The key noise impact will be from the operation of ***sert*** vehicles. The main sources of noise impacts during ***sert*** operation will be:

- Engine noise;
- Noise from vibration of body panels; and
- Wheel/road interface.

4.36 There may also be lesser effects associated with:

- Changes ambient noise levels due to changes in traffic patterns and flows;
- Re-radiated noise from structures Activity at and around ***sert*** stops; and
- Public address systems and other audible signals (if used).

4.37 Individual ***sert*** vehicles are likely to be less noisy than existing conventional buses. This is not only because these will be newer and inherently quieter, but also because they will have greater passenger capacity. However, the ***sert*** vehicles are likely to run at a much greater frequency than presently operated by conventional bus services. This means that although a single passing ***sert*** vehicle may be quieter than a single passing conventional bus, there may be little difference in average noise levels overall, and indeed the ***sert*** services could have a minor adverse noise impact in some instances. This is more likely to be the case where new services are introduced on routes not presently operated.

4.38 Implementation of ***sert*** will involve relaying of road surfaces, or creation of new dedicated busways. This will provide the opportunity to improve the road surface, and consequently, the passage of ***sert*** vehicles is likely to be quieter compared with conventional buses on existing road surfaces.

4.39 A review of conventional bus technologies has indicated that these have a typical noise level of about 75dBA for conventional buses[12]. However, many alternative fuelled road vehicles can offer a reduction in noise and vibration over this. Electric and hybrid-electric vehicles are extremely quiet, but gas powered vehicles (with dedicated internal combustion engines) also offer noise and engine vibration reductions, of about 4-8 dB quieter than conventional diesel buses in urban areas [13, 14]. Engine noise levels of biogas buses can be half of the diesel equivalent[15]. However, on inter-urban routes, average speeds are higher, therefore tyre noise and wind resistance become the dominant noise factors. This has the effect that there is hardly any difference in perceived noise level between the various propulsion and fuel systems. Of course, this holds true for busways and bus lanes. For guided buses, noise levels are said to be perceptibly lower on the guideway than on normal streets[16].

4.40 It should also be noted that the total number of additional vehicles that ***sert*** services would add to overall traffic flows on the routes that it will serve will be no greater than 20 vph, even where two routes may share a common section. This

[12] Brand, C. and Preston, J (2001) - **Tools for Evaluating Strategically Integrated Public Transport: Work Package 1** – Working Paper 1: Technical and Financial Characteristics of Public Transport Systems - Transport Studies Unit, University of Oxford, funded by DTLGR and the EPSRC. – pp.57.

[13] Cleaner Vehicles Task Force (CVTF) (2000) - **An Assessment of the Emissions Performance of Alternative and Conventional Fuels** - CVTF Alternative Fuels Group, the Stationary Office, London.

[14] Hass-Klau, C., et al (2000) - **Bus or Light Rail: Making the Right Choice** - Environmental and Transport Planning, Brighton.

[15] Smith, A. (2001) - **Cleaner Vehicles in Cities: Guidelines for Local Governments** - UTOPIA project deliverable 19. European Commission, DG-TREN, Brussels.

[16] Read, M.J. et al (1990) - **The Potential for Guided Busways** - Traffic Engineering and Control, 31, 580-587

would not significantly increase traffic flows overall, and would have no effect on subsequent traffic noise levels.

4.41 On this basis, it is considered that the net effect on traffic noise levels from the operation of ***sert*** will be a slight beneficial effect.

Townscape and Landscape

Baseline Environmental Conditions

General

4.42 The landscape of the TGSE area is characterised by extensive open spaces dominated by the sky within a predominantly flat, low-lying landscape. The proposed ***sert*** routes principally serve the urban areas within TGSE. Both Thurrock and Southend developed primarily in the late 19th Century, and there are extensive areas of Victorian terraced housing. Both areas were extended significantly in the 1930's, and also there was much redevelopment in the 1960's. Basildon was primarily developed during the 1960's, although there are pockets of development dating from much earlier periods.

4.43 Present day soils in the TGSE area are derived largely from intertidal alluvial muds which give rise to stoneless, clayey, silty and loamy soils. This drift geology overlays the extensive London Clay. The present day soils have been extensively drained to give fertile arable land.

Thurrock

4.44 The built up areas of Thurrock vary quite considerably, including turn of the century development, related to the Borough's early commercial growth; inter-war and post-war suburban housing schemes; many riverside developments of an industrial nature and major new housing and retail schemes in West Thurrock. The process of upgrading formerly derelict areas, which had detracted considerably from the Borough's image, was begun in the 1980's, with urban regeneration continuing throughout the 1990's[17]. More recently, the concepts of 'urban renaissance' have contributed to this process.

4.45 The landscape of the Borough of Thurrock divides roughly into industrial/urban land south of the A13 and mixed urban, village and rural land to the north of the A13. 60% of the Borough consists of open countryside. However, the proposed ***sert*** route in Thurrock is entirely restricted to the urban areas of Grays and West Thurrock, and to the A13 corridor between Grays and Basildon.

4.46 Approximately 60% of Thurrock is designated as Green Belt land[18], and there are 2 Special Landscape Areas (SLAs), 14 Landscapes of Local Importance (LLIs) and 58% of the local authority area is designated as Landscape Improvement Areas (LIAs) to

17 Unitary Development Plan, Thurrock Council www.thurrock.gov.uk/planning/strategic/pdf/udp_p2_c03.pdf

18 Local Plan, Thurrock Council: www.thurrock.gov.uk/planning/strategic/pdf/udp_p2_c05.pdf

protect and enhance attractive and traditional landscapes, while improving areas of poor landscape.

Basildon

4.47 The landscape of Basildon District is dominated by urban development. However, there are extensive areas of arable farming and permanent grazing with scattered trees, hedgerows, and woodland, together with outlying areas of low density development within the Green Belt and large areas of marshland. These landscapes make a valuable contribution to the identity of the District. They contain areas which are important as wildlife habitats and natural vegetation, and can be a source of informal recreation.

Southend-on-Sea

4.48 The foreshore covers approximately seven miles, including areas of environmental significance, a nature reserve and a SSSI.

4.49 Most of Southend comprises dense urban development, of mixed character with a dominant grid pattern of streets and a dense urban form. The central area, along the main north-south axis from the seafront along High Street and Victoria Avenue was subject to major re-development during the 1960's and 1970's, although most of the inner areas date back to Victorian times. Beyond these, much of the rest of the area comprises 1930's suburban development, characterised by relatively wide avenues with broad grass verges and trees in most instances. Several areas of the town have been identified as 'landscape improvement areas' in the Local Development Framework, and there is intense development pressure on the urban fringes. The town has 13 parks ranging from nature reserves to formal gardens, five of which have obtained green flag awards; namely Chalkwell Park, Priory Park, Southchurch Park, Belfairs Park & Nature Reserve and Shoebury Park. There are also 18 allotment sites in Southend-on-Sea.

4.50 A Study of Open Space and Recreation in Southend was undertaken in August 2004 which concluded that the most central urban wards such as Kursaal, Victoria and Westborough wards have 0.31 hectares or less of open space per 1000 population. Large areas in the central part of the borough do not have an open space within realistic walking distance. However, the eastern part of the area does contain some remote coastal wetlands, and the tranisiton to these from the urban areas is rapid, despite their close proximity.

Impacts During Construction

4.51 During construction of the ***sert*** alignments, impacts on the townscape and visual quality of the corridors in which ***sert*** will run may occur from:

- Demolition or removal of key elements in the landscape/townscape;
- Temporary presence of construction plant (especially cranes), equipment and materials stockpiles, fencing; and
- Temporary lighting for construction works, especially in winter.

The presence of construction plant is unlikely to lead to significant visual impacts, as there is sufficient space available within the existing highway limits to accommodate this, and provided that standard good practice of site management is followed. The overall effect is likely to be a slight adverse impact in visual terms.

Impacts During Operation

4.52 The key impacts during operation of ***sert*** routes extension potentially will be the introduction of new visual elements into landscape/townscape, such as new dedicated ***sert*** busways where these are proposed, and the infrastructure provided at ***sert*** stops. Where ***sert*** routes are to run on dedicated lanes on the existing highway, or share roadspace with other traffic, there is likely to be only a minimal impact, chiefly relating to additional road markings, although even these relatively minor changes could have an significant effect in specific particularly sensitive areas, such as Conservation Areas or areas within the setting of listed buildings.

4.53 However, the works within the existing highway, and the provision of new ***sert*** dedicated busways would provide opportunities for improvements to the streetscape associated with ***sert*** infrastructure and the treatment of urban spaces.

Heritage of Historic Resources

Baseline Environmental Conditions

Thurrock

4.54 Thurrock has 242 listed buildings of special architectural value or historic interest. Of these, 12 are Grade I listed, of which all are churches. There are 17 Grade II* buildings, where they are of more than special interest. The remaining 213 buildings are Grade II and are of special interest. Sixteen of these listed buildings have been identified as being 'at risk'[19].

4.55 In addition to these listed buildings there are 7 designated conservation sites as can be seen in **Table 4.6** below:

TABLE 4.6 CONSERVATION AREAS IN THURROCK

Location	Area (Ha)
Horndon	4.2
Corringham	6.5
Orsett	5.7
Fobbing	13.4

[19] Listed Buildings And Building Conservation: www.thurrock.gov.uk/planning/strategic/content.php?page=factsheet_06

Location	Area (Ha)
Purfleet	10.4
West Tilbury	45.5
East Tilbury	30.0

4.56 There are 14 Scheduled Ancient Monuments (SAMs) and 620 unscheduled monuments and archaeological areas within the Borough of Thurrock. Behus Park is the only historic park in the Borough.

Basildon

4.57 In Basildon District there are 127 listed buildings, the highest concentration of which is in Billericay High Street, which includes a number of examples of timber-framed buildings. Two buildings in Basildon have Grade I status, the churches of St Mary Magdalene, in Great Burstead and St Nicholas Church in Laindon. There are also a few examples of listed post-war structures in the District, such as Brooke House in Basildon Town Centre and the former Barstable Grammar School building in Basildon. Basildon District also includes four Conservation Areas:

- **Billericay High Street:** This includes 35 listed buildings as well as a number of protected trees and listed telephone boxes.
- **Little Burstead:** Located on the outskirts of Billericay, including 5 listed buildings and listed street furniture.
- **Great Burstead:** Focusing on a small cluster of weather-boarded buildings and cottages that gather around the Grade I listed church of St Mary Magdalene.
- **Noak Bridge:** This was one of the final phases of Basildon New Town to be built during the 1980's. The conservation area was designated because the street layout and buildings are an example of design by Basildon Development Corporation based the Essex Design Guide.

Southend-on-Sea

4.58 Within Southend-on-Sea, there are 13 Conservation Areas, 75 listed buildings and churches, two of which are Grade II* and three Grade I, and another 150 locally listed buildings. There are five Scheduled Ancient Monuments (SAMs) in the borough:

- **Prittlewell Camp:** a univallate hill fort found 500 metres east of Sutton Crematorium dating back to prehistoric Bronze Age;
- **The Danish Camp:** defended prehistoric settlement at Shoeburyness dating from the Iron Age;
- **Prittlewell Priory:** remains dating from circa 1000;
- **Southchurch Hall:** moated site circa 1300; and

- **Cold War Defence Boom:** this boom, built in the 1950s stretches out into the Thames Estuary and is the only example of this type of structure of this period in Britain.

4.59 There is one building in Southend placed on the 'Buildings at Risk' register (Manor House on Suttons Road) and a protected area of greenbelt covering Bournes Green. Southend Pier also is a notable feature, at over 2 kilometres long and dates from 1889, when work started. It was completed in its current form by 1929.

Impacts During Construction

4.60 The potential impacts on heritage resources during construction of the ***sert*** alignments will be likely to arise from:

- demolition or removal of archaeological resources or historic buildings;
- physical damage to archaeology and historic resources;
- visual effects on the setting of listed buildings, historic monuments and Conservation Areas;
- indirect impacts on the environment of archaeological resources, such as dewatering due to excavations and draining of works, which may compromise the integrity of these.

4.61 Although the proposed ***sert*** alignments may run through, or are in close proximity to, heritage designations in some areas, the likelihood of direct loss of or damage to historic resources is small. Most of the area has been subject to development within the last century or so, and the extent and nature of the proposed works is not likely to have a significant adverse effect on any resources that may be present in the area, and these are most likely to be neutral.

Impacts During Operation

4.62 The potential impacts on heritage resources during operation of the ***sert*** routes will arise from:

- Effects on the setting of historic buildings and public spaces from the presence of ***sert*** vehicles and other infrastructure.
- Physical damage to structures from vibration.

4.63 However, it is anticipated that these effects are not likely to be significant, and again are most likely to be neutral.

Ecology and Biodiversity

Baseline Environmental Conditions

4.64 The TGSE area typically has degraded and fragmented natural habitats. Ecosystems have been impoverished and the once-common plants and animals have become less common and less widespread. There are, however, some areas of ecological and biological merit, chiefly in designated areas of protection for nature conservation interest. These include:

- Three Ramsar sites (wetlands of international importance designated under the Ramsar Convention[20]), covering the Thames Estuary and Marshes, Benfleet and Southend Marshes: and Foulness (Mid-Essex Coast Phase 1). All these areas are also designated as Special Protection Areas under the EU Birds Directive[21], which affords protection rare or vulnerable species specified in Annex 1 to the Directive.
- The Leigh National Nature Reserve, designated by Natural England[22] to protect one of the most important areas of wildlife habitat and geological formations in Britain, and as a place for scientific research.
- 19 Sites of Special Scientific Interest (SSSI), identified as the best examples of our natural heritage of wildlife habitats, geological features and landforms, and are designated by Natural England[23]. Within the TGSE area, there have been designated due to their important habitats or geology and are identified in **Table 4.7** below[24]:

TABLE 4.7 SSSIs DESIGNATED IN TGSE

Location	Condition
Basildon Meadows	100% area unfavourable recovering
Benfleet and Southend Marshes	5% meets PSA target. 95% area unfavourable declining
Canvey Wick	100% of area meets PSA target and classed as favourable
Foulness	78% of area meets PSA target and classed as favourable. 21% is unfavourable declining and 1% unfavourable with no change

20 The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention or Wetlands Convention) was adopted in Ramsar, Iran in February 1971 and came into force in December 1975.

21 Council Directive 79/409/EEC on the Conservation of Wild Birds, implemented through the Wildlife & Countryside Act 1981 (as amended) and The Conservation (Natural Habitats, etc.) Regulations 1994 (as amended),

22 Using powers granted under National Parks and Access to the Countryside Act 1949.

23 An SSSI is an area that has been notified as being of special interest under the Wildlife and Countryside Act 1981.

24 Data from Natural England, although still presently available at : www.english-nature.org.uk

Location	Condition
Garrold's Meadow	42% of area is classed as unfavourable and recovering. 16% is unfavourable with no change. 42% is unfavourable declining
Globe Pit, Grays	100% of area classed as favourable
Grays Chalk Pit	87% of area is classed as unfavourable declining, 13% unfavourable recovering
Great Wood and Dodd's Grove	100% of area meets PSA target. 89% of area is classed as favourable and 11.1% Area unfavourable recovering.
Hangman's Wood and Deneholds	100% area favourable
Hockley Woods	100% area favourable
Hole Haven Creek	100% area favourable
Inner Thames Marshes	8% area favourable, 23% unfavourable recovering, 19% unfavourable no change, 51% unfavourable declining
Lion Pit Grays	100% of area classed as favourable
Mucking Flats and Marshes	94% area favourable, 6% area unfavourable, no change
Purfleet Chalk Pits	45% of areas classed as destroyed, 32% no change, 23% area favourable
South Thames Estuary and Marshes	96% of area meets PSA target. 87% classed as favourable. 10% classed unfavourable recovering. 2% classed unfavourable no change 2% classed unfavourable declining
Thundersley Great Common	100% area classed unfavourable no change
Vange and Fobbing Marshes	62% area favourable, 38% area unfavourable, no change
West Thurrock Lagoon and Marshes	100% area unfavourable, declining

- Sites of Importance for Nature Conservation (SINCs) have also been designated in Thurrock. These sites have been identified by Essex Wildlife Trust as being of value for nature conservation in a County-wide or local context. They have

been split up into 6 characteristic habitat types. The following table summarises these.

TABLE 4.8 SITES OF IMPORTANCE FOR NATURE CONSERVATION IN THURROCK

Type	Number of sites	Area (ha)
Woodland	23	126.6
Grassland	18	721.2
Mosaic	6	152.2
Fresh water	4	52.2
Coastal	1	-
Geological	4	-

- Thurrock also at present has 2 Local Nature Reserves (LNRs), namely Linford Wood and Grove House Wood. Furthermore there are 193 hectares which have been designated as Areas of Local Nature Conservation Significance (ALNCs). In addition to this Thurrock has 10 ecological corridors totalling 67km.

4.65 Overall, it should be noted that the proposed ***sert*** routes do not encroach on any of the designated areas of protection identified above.

Impacts During Construction

4.66 The key potential impact on ecology during the construction of ***sert*** is the loss of, or damage to habitats and species, particularly where changes made to existing highway alignments may involve significant land-take and/or earthworks such as the re-grading of the embankments. The main potential for damage arises from:

- Occupation of land for construction works, etc.; and
- Disturbance to plant and animal communities from dust, release of effluents, noise, vehicle movements and the presence of construction workers.

4.67 The main categories of likely impact from linear developments such as ***sert*** are:

- **Loss of natural features:** direct loss of habitats, geological exposures or geophysical features;
- **Impacts on hydrology:** changes in groundwater levels due to excavations or pollution in site runoff;
- **Consequent effects on wildlife:** such as reduction in breeding success and barrier effects.

4.68 Great care will be required, and specific surveys undertaken, to ensure that no specifically significant species of flora or fauna (e.g. protected species potentially

present may include bats, badgers and Great Crested Newts as well a flora) are present on land required within the proposed ***sert*** corridors.

4.69 At present, it is envisaged that there will only be limited landtake required for the construction of the ***sert*** infrastructure as this will mostly be provided within existing highway limits. It is also not apparent that any of the preferred sert routes presently identified are in close proximity to sensitive ecological resources (either protected by statutory designations or not). It is therefore considered that the construction of the identified ***sert*** routes is likely to result in significant adverse effects

Impacts During Operation

4.70 There is the potential for damage to ecological habitats from noise or pollution during operation of ***sert***. However, this is unlikely to be significantly different to any effects associated with the existing road network presently.

Water Environment

Baseline Environmental Conditions

Thurrock

4.71 Thurrock is located on the Thames, and the only other significant watercourse is Mar Dyke, which has poor water quality. Thurrock has no designated bathing beaches along the Thames, though Grays Beach and Coalhouse Fort are used for recreational purposes and have exceeded the EU quality guidelines for bathing waters on occasion.[25]

4.72 There are also a number of disused quarries such as Stanford Warren, Lion Gauge and Warren Gauge. These sites have been classed as Sites of Important for Nature Conservation (SINCs).

4.73 Grangewaters, situated in South Ockendon, is the main water sports centre for Thurrock. The area is near to a reclaimed tip, where it is possible for water to pass through to the lake containing high concentrations of some chemicals. However, because the lake covers a large area the chemicals are diluted, the Environment Agency regularly samples the chemical quality of the water.

South Essex

4.74 Key water resources in South Essex include the Rivers Crouch and Roach, the drainage network within Canvey Island, and numerous smaller rivers, many of which drain directly to the sea or the Thames Estuary.

4.75 Much of the land is relatively low lying (<60m AODN). Water courses in the area respond rapidly to rainfall due to the impermeable nature of the London Clay subsoil which underlies much of the area. Minor sand and gravel aquifers provide limited baseflow to the area. The principal underlying aquifer is the chalk.

[25] Thurrock State of the Environment Report 2000

4.76 The estuarine waters of the Thames, Crouch and Roach support a wide range of recreational activities and wildlife habitats. Large sections of the coast are designated internationally important sites as candidate Special Areas of Conservation (cSACs), Special Protection Areas (SPAs) and Ramsar sites.

4.77 Agricultural land use accounts for 70% of the area. The principal land use along Thames-side is industrial. Water abstraction from ground and surface water sources support a number of uses, including public water supply, industry and agriculture.

Southend-on-Sea

4.78 River water quality in Southend-on-Sea is mainly of grades C to E. Although river quality in the area is improving, the Environment Agency has not rated any main water course surveyed in the area higher than a grade C from the period 1988-2002. In comparison, the national average for water quality in 2003 was 96% and 95% of river lengths to be of good or fair (grades B-D) biological and chemical quality respectively.

Impacts During Construction

4.79 During the construction works to provide ***sert*** infrastructure, the key impacts on water quality are potentially:

- Contaminated run-off entering watercourses;
- Contamination of ground water resources during excavation;
- Groundwater drawdown due to infiltration to excavation works, if these go below the water table; and
- Disposal of contaminated water from dewatering of excavation works.

4.80 In terms of flood risk, the Environment Agency has recommended that as the development type is classed as "Essential Infrastructure" under the principles of Planning Policy Statement 25 (PPS25) then it should be set at/above the 1 in 1000 year (0.1%) level inclusive of climate change.

4.81 The design of ***sert*** infrastructure will take account of Environment Agency recommendations that the surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management, usually termed “Sustainable Urban Drainage Systems” (SUDS).

4.82 The following drainage principles should be embedded within the destiled design work for the ***sert*** proposals:

Hierarchy of systems for Attenuation of Excess Flows:

4.83 Traditional balancing ponds and infiltration basins are tried and tested methods to limit the rates of discharge at existing outfalls. In locations where balancing ponds cannot be provided, due to constraints on available land, alternative facilities will be required to provide the functions that would otherwise have been provided by a balancing pond. Options for attenuation of flows are (in the order preferred by the Environment Agency):

- Conventional balancing ponds;
- Infiltration basins;
- Linear oversized pipes as part of the drainage network;
- Linear open channels along the base of embankments (linear open channels in cuttings are deemed inappropriate on geotechnical grounds);
- Open 'U' shaped reinforced concrete channels along the base of embankments or in cuttings; and
- Underground tanks below the verge, embankment, cutting or edge of carriageway.

Hierarchy of systems for the treatment of excess flows

4.84 In developing the detailed design for ***sert*** infrastructure, the proposals will seek to reduce the current impact of highway drainage on water quality of receiving waters, either in watercourses or groundwater, even if the overall volume of runoff is increased as a result of any highway widening. Overall, the Environment Agency has indicated that it expects no water body is expected to receive a greater pollutant load than occurs under current conditions.

4.85 Consequently on watercourses where the risk rating is medium or high or where soakaways discharge to groundwater protection zone, a form of treatment for routine run-off will be required on part or all of the drainage system. Alternatives are (in the order preferred by the Environment Agency):

- Wetlands constructed within balancing ponds or in linear channels along the base of embankments or cuttings, where geotechnical solutions can create the necessary land;
- Grassed infiltration basins;
- Grass lined channels;
- Bio-retention;
- Filter Drains; and
- Reed Beds.

4.86 Where the proposed ***sert*** route cross existing watercourses, under the terms of the Water Resources Act 1991, and the Land Drainage Byelaws, the prior written consent of the Environment Agency is required for any proposed works or structures, in, under, over or within 9 metres of the top of the bank of the above watercourses designated a 'main river'.

4.87 Elsewhere, erection of flow control structures or any culverting of a watercourse requires the prior written approval of the Environment Agency under s.23 of the Land Drainage Act 1991 or s.109 of the Water Resources Act 1991. The Environment Agency resists culverting on nature conservation and other grounds

and consent for such works will not normally be granted except for access crossings.

4.88 Overall, it is anticipated that these potential effects would be effectively managed by being taken into account during the detailed design of ***sert*** infrastructure and implementation of a code of construction practice as part of the contracting process, and therefore a neutral effect is predicted.

Impacts During Operation

4.89 The key likely impact from the operation of the ***sert*** routes in the risk of contaminated run-off entering local watercourses, particularly in the case of accidents or spillages. Contamination can occur chiefly from the spillage of fuels and lubricants from ***sert*** vehicles. However, standard drainage systems for highways and similar infrastructure now typically incorporate traps to ensure that such substances do not enter the drains or sewers, and there is also little risk of other watercourses becoming polluted from this source as a consequence.

5 Options for Mitigation

Introduction

5.1 At this stage of the development of the ***sert*** proposals, there is not sufficient information or detail available to ensure that all likely significant environmental effects will be identified. Consequently, it also is not possible to identify all the necessary mitigation measures that will be required to make sure that all significant environmental impacts of the proposals can be avoided, or reduced to an acceptable level.

5.2 In developing options for mitigation, a number of categories of measures have been identified as follows:

- Where a specific impact can be identified on the basis of the information presently available, and engineering design or environmental management measures to avoid or reduce these impacts also may be identified, these are recommended;
- Where engineering design or environmental management measures may be required to mitigate effects that cannot be fully identified at this stage, due to lack of information and detail, the options for these measures are discussed, and actions to be taken at a later stage are recommended; and
- In relation to environmental management measures during the construction and operational phases that may need to be implemented by construction or operating contractors, the likely contractual arrangements that may be necessary have been identified.

Greenhouse Gases and Local Air Pollutant Emissions

5.3 As indicated in **Chapter 4**, it is not anticipated that there will be little adverse greenhouse gas emission or air pollution impacts resulting from the operation of the proposals; in fact, a reduction in the total pollutant emissions may be expected. Thus, mitigation measures relating to air quality in the operational phase are likely not to be required. However, the most effective way to ensure that adverse impacts on local air quality (and indeed to avoid increases in greenhouse gas emissions) would be for ***sert*** vehicles to use non-fossil fuels. The feasibility of this should be carefully reviewed at the time of developing the detailed specification for ***sert*** vehicles prior to procurement.

5.4 In order to minimise the nuisance caused by construction dust, particularly to nearby receptors, a series of good site practices for management of construction sites should be adopted during construction of ***sert*** routes. Mitigation measures could include:

- Covering (sheeting) of vehicles removing material from the site;
- Sheeting of stockpiles on site;

- Wheel-washing facilities for vehicles leaving construction sites;
- Road wetting where necessary;
- Limitation of vehicle speed on unhardened roads and surfaces to less than, say, 30 km/h; and
- Routeing vehicles away from sensitive sites, where possible.

Noise

Construction Phase

5.5 During the construction works, the following mitigation measures may be required to ensure that noise from construction work for ***sert*** routes is maintained at an acceptable level:

- Restricting working hours so that no work is carried out in the evenings, night-time and at the weekends.
- Fencing all construction sites with appropriate hoardings, including acoustic baffles where necessary.
- Positioning gates and openings away from sensitive locations.
- Specific screening or enclosure of fixed plant such as pumps, compressors, and ventilation fans.
- Locating noisy plant as far away as possible from residential premises.
- Using "quiet" and "low vibration" piling methods where feasible.
- Carrying out unavoidably noisy operations (such as piling) at times that do not conflict with the neighbouring land uses.
- Using electronically-powered plant in preference to diesel-powered where available and feasible.

5.6 In extreme cases, it may be necessary also to:

- Completely enclose noisy works; or
- Provide secondary glazing to residential properties in close proximity to construction works.

5.7 The specific mitigation measures that will be required at individual locations will need to be defined once the design of the proposals has been agreed, the appointed construction contractor's work programme and construction methods have been established, and a detailed noise assessment has been carried out as part of the environmental management system relating to the construction works.

Operational Phase

5.8 Mitigation measures that may be considered for tracked elements of the proposals may include:

- Setting challenging noise performance standards in the detailed specification for ***sert*** vehicles prior to procurement;
- Specification of low-noise surfaces for ***sert*** routes; and
- Maximising the distances between ***sert*** route alignments and the location of sensitive receptors.

5.9 Measures should also be adopted to reduce the noise impacts from ***sert*** stops, such as:

- Use of floor surfaces that reduce noise from passenger footfall; and
- The use of visual travel information systems rather than audible messages.

Heritage

5.10 If investigations undertaken prior to commencement of construction works indicate a significant risk of harm to archaeological or historic resources, it may be necessary to require the construction contractor to engage a specialist archaeological advisor to keep a watching brief on archaeological resources and historic buildings during the course of the construction works.

Townscape and Visual Impacts

5.11 At present, there is no information available on the detail of likely visual impacts arising from the construction and operation of ***sert***. However, the specification of high quality design and materials for the ***sert*** infrastructure and vehicles from the very start will be vital to ensure that the schemes are properly integrated with their environment, adverse visual impacts are avoided and the opportunities that ***sert*** will present to secure improvements to the public realm are realised. To this end, the ***sert*** specification will be developed over time to incorporate design guidance for the infrastructure elements of the schemes.

Water Environment

5.12 All possible mitigation measures will be required to ensure that there is no contamination of underground water resources, particularly for any schemes for which excavation is extensive, as well as to ensure that drainage moved underground is not adversely impacted. However, it should be noted that the preferred options for attenuation of flows hierarchy indicated by the Environment Agency and mentioned in **Paragraph 4.85** above, recommends a range of measures that should be implemented before consideration is given to moving drainage underground.

5.13 The options for mitigation will tend to focus on the details of the road or busway drainage system design, for example, the incorporation of appropriate pollutant traps. The Environment Agency has recommended that the hierarchy approach indicated in **Paragraph 4.85** above underpins this.

5.14 Any works involving excavation, piling, or general earthworks for construction of *sert* infrastructure has the potential of disturbing contaminants within the soil and

groundwater. The Environment Agency has advised that prior to any construction works, a thorough desk study is carried out to identify all the risks to controlled waters. This would include identifying all possible source-pathway-receptor linkages. For areas of the development where historic and current uses may have given rise to contamination then a full site investigation would be undertaken from which subsequent remediation may be required to ensure that linkages are broken and any resultant impact to controlled waters is low.

APPENDIX

A

CONSULTATION RESPONSE FROM THE ENVIRONMENT AGENCY

(by e-mail)

Mr Chris Ferrary

Steer Davies Gleave

28-32 Upper Ground

London, SE1 9PD

Our ref: AE/2010/109861/01-L01

Your ref: *

Date: 19 February 2010

Dear Mr Ferrary

SOUTH ESSEX RAPID TRANSIT (SERT) - APPRAISAL OF ENVIRONMENTAL EFFECTS.

We have been approached by Steer Davies Gleave consultants to review and offer comments on the 'South Essex Rapid Transit (sert): Appraisal of Environmental Effects – Draft Report, dated January 2010' which has been provided.

It is our understanding that Essex County Council, Thurrock Council and Southend-On-Sea Council are to submit a Major Scheme Business Case to the Department for Transport in March 2010 in order to secure funding for the scheme detailed above.

An appraisal of the environmental impacts will be included when the scheme is formally submitted. We have reviewed the report and offer the following comments which should assist in this appraisal:

Project Description

We support the specification on Page 8 that the new fleet will use up-to-date technology to ensure fuel efficiency and lowest levels of pollution.

We support the proposals to increase uptake on Page 8 (GPS tracking linked to real-time information) and Page 10 (Real time information provided by electronic displays and for RNIB key fob). We also recommend that the consultants look at the Bridge Development in Dartford where this technology has been displayed in businesses and new homes.

Waste Management

We would like to see a section ensuring waste is managed sustainably during the construction of the SERT proposals. The regeneration of the Thames Gateway will generate a large quantity of waste and place additional pressure on waste infrastructure. The demolition, excavation and construction of new development alone will generate an additional 70 million tonnes of waste.

Development should be designed to:

- retain and refurbish rather than rebuild;

- be easily adapted to future changing uses;
- enable reuse and recycling at least 90% of demolition and construction waste;
- minimise over-ordering and damage of materials;
- use standard components; and
- have a recycled content of at least 30%.

All development proposals should demonstrate how they meet the above waste minimisation and management objectives.

Water Environment / Drainage

We should recommend that as the development type is classed as "Essential Infrastructure" under the principles of Planning Policy Statement 25 (PPS25) then it should be set at/above the 1 in 1000 year (0.1%) level inclusive of climate change.

We recommend that the surface water run-off should be controlled as near to its source as possible through a sustainable drainage approach to surface water management (SUDS). SUDS are an approach to managing surface water run-off which seeks to mimic natural drainage systems and retain water on or near the site as opposed to traditional drainage approaches which involve piping water off site as quickly as possible. SUDS involve a range of techniques including soakaways, infiltration trenches, permeable pavements, grassed swales, ponds and wetlands. SUDS offer significant advantages over conventional piped drainage systems in reducing flood risk by attenuating the rate and quantity of surface water run-off from a site, promoting groundwater recharge, and improving water quality and amenity.

The variety of SUDS techniques available means that virtually any development should be able to include a scheme based around these principles.

We offer further advice and comments relating to the water environment which we raised for the M25 Widening project, and which are also relevant to the SERT proposals.

Page 39, paragraph 4.62 identifies the issue of potential changes made to existing highway alignment and new infrastructure. The document looks at the potential pollution impacts of runoff but does not look at the issue of attenuation of excess flows/increased risk of flooding.

The following drainage principles should be embedded within the SERT proposals:

(1) Hierarchy of systems for attenuation of excess flows

Traditional balancing ponds and infiltration basins are tried and tested methods to limit the rates of discharge at existing outfalls. In locations where balancing ponds cannot be provided, due to constraints on available land, alternative facilities will be required to provide the functions that would otherwise have been provided by a balancing pond.

Options for attenuation of flows are (in preferred order):

- Conventional balancing ponds;

- Infiltration basins;
- Linear oversized pipes as part of the drainage network;
- Linear open channels along the base of embankments (linear open channels in cuttings are deemed inappropriate on geotechnical grounds);
- Open 'U' shaped reinforced concrete channels along the base of embankments or in cuttings; and
- Underground tanks below the verge, embankment, cutting or edge of carriageway.

(2) Hierarchy of systems for the treatment of excess flows

The aim of SERT proposals should be to reduce the current impact of highway drainage on water quality of receiving waters, either in watercourses or groundwater, even if the overall volume of runoff is increased as a result of widening. Overall, no water body is expected to receive a greater pollutant load than occurs under current conditions.

Consequently on watercourses where the risk rating is medium or high or where soakaways discharge to groundwater protection zone, a form of treatment for routine run-off will be required on part or all of the drainage system. Alternatives are (in preferred order):

- Wetlands constructed within balancing ponds or in linear channels along the base of embankments or cuttings, where geotechnical solutions can create the necessary land;
- Grassed infiltration basins;
- Grass lined channels;
- Bio-retention;
- Filter Drains; and
- Reed Beds.

CIRIA Report C609 gives guidance on the design of various alternative systems and provides significant information on the likely performance of different systems by reference to many examples.

We recommend that the above hierarchy approach underpins the Water Environment Mitigation mentioned in paragraph 5.13 on Page 45. Please note, the options for attenuation of flows hierarchy mentioned above, recommends a range of preferred options before moving drainage underground, as mentioned section 5.12 Page 45.

Consenting Requirements

From the details provided the SERT route appears to cross the following rivers:

- Main Rivers Crossings (SERT 1)

- The route crosses Horndon Brook at Horndon.
- Nevendon Bushes Brook and Jolly Cricketers Ditch at River Basildon.
- Main River Crossings (Sert 2)
- The route crosses River Crouch, Nevendon Brook and Eastwood Brook at Rayleigh.
- The route crosses Prittle Brook at Southend.

Under the terms of the Water Resources Act 1991, and the Land Drainage Byelaws, the prior written consent of the Environment Agency is required for any proposed works or structures, in, under, over or within 9 metres of the top of the bank of the above watercourses designated a 'main river'.

Non-main river crossings:

Erection of flow control structures or any culverting of a watercourse requires the prior written approval of the Environment Agency under s.23 of the Land Drainage Act 1991 or s.109 of the Water Resources Act 1991. The Environment Agency resists culverting on nature conservation and other grounds and consent for such works will not normally be granted except for access crossings.

Contamination

Any works involving excavation, piling, or general earthworks as described has the potential of mobilising contaminates within the soil and groundwater. We would therefore advise that prior to any development of the scheme a thorough desk study is carried out to identify all the risks to controlled waters. This should include identifying all possible source-pathway-receptor linkages. For areas of the development where historic and current uses may have given rise to contamination then a full site investigation should be undertaken from which subsequent remediation may be required to ensure that linkages are broken and any resultant impact to controlled waters is low.

Ecology and Biodiversity

The report confirms in paragraph 4.61 that the proposed SERT route does not encroach onto any designated areas for protection. Based upon the findings we have no significant issues from a biodiversity perspective.

I hope the comments offered above assist you in your proposed scheme.

Yours sincerely

Mr Neil Dinwiddie

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CONTROL SHEET

Project/Proposal Name	South Essex Rapid Transit (sert)
Document Title	Appraisal of Environmental Effects
Client Contract/Project No.	
SDG Project/Proposal No.	2214191-01

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Issue No.	Date	Details
1	11 January 2010	First draft to client for review and to statutory environmental bodies for consultation
Final	3rd March 2010	Incorporating Environment Agency Comments

REVIEW

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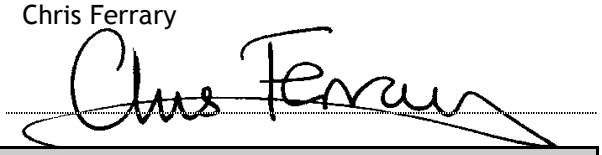
	Sign	

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