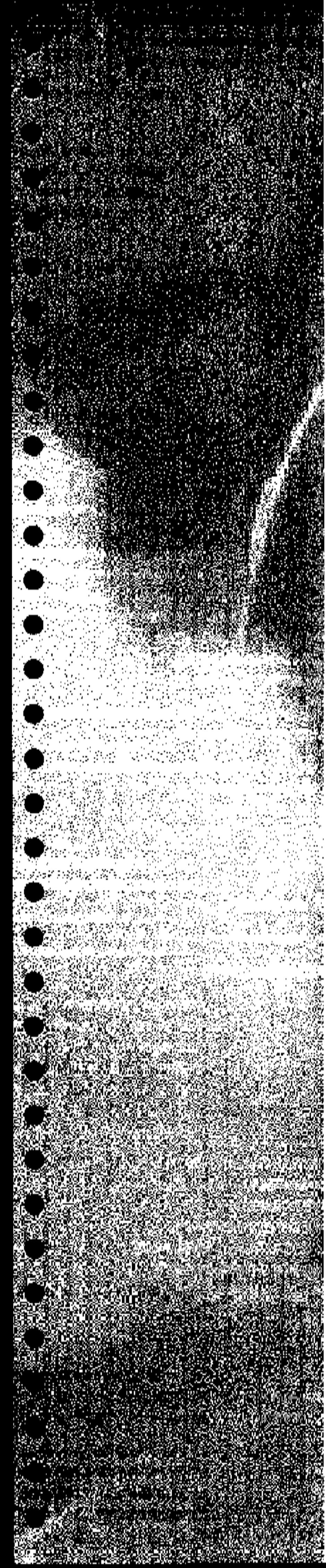

Air Quality Assessment

A228 Leybourne & West Malling Bypass
Environmental Statement
Volume 2 (part)

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July 1995

Kent County Council
HIGHWAYS & TRANSPORTATION

CONTENTS

1.0 INTRODUCTION

1.1 THE PROPOSED SCHEME

1.1.1 The proposed A228 Leybourne and West Malling Bypass forms part of Kent's north-south strategic primary road network linking the M2 at the Medway Towns with the M20 and A20 West of Maidstone and thence the West Kent towns of Tonbridge and Tunbridge Wells via the A20. North of Leybourne the A228 traverses and links with the M20 motorway which is the main motorway corridor across the County linking London and the M25 with the Channel Tunnel. Throughout it's length several substantial improvement schemes are planned for the A228. Furthermore, from the junction of the A228/A26 southwards to the A21 at Pembury, a number of highway improvement schemes have either been completed, or are the subject of current proposals.

1.1.2 This report considers the air quality implications of the improvement of a 4km section of the A228 between the M20 and the Kings Hill roundabout. The proposed improvements are shown on the plan attached in Appendix 1 and comprise a new bypass of Leybourne and the widening of the existing West Malling Bypass. The planned Bypass in conjunction with traffic calming measures would reduce the amount of traffic using the existing A228 Castle Way which bisects the community of Leybourne. South of the A20 the capacity of the West Malling Bypass would be increased by widening the existing single carriageway to a dual two lane carriageway standard.

1.2 AIR QUALITY ASSESSMENT

1.2.1 An Air Quality assessment has been carried out for the A228 Leybourne and West Malling Bypass based on the procedures set out in the Design Manual for Roads and Bridges (DMRB) Volume 11, Environmental assessment (published by the Department of Transport in 1993).

1.2.2 The estimation of the rates at which vehicles emit air pollutants, the rate of dispersal in the atmosphere and the resulting concentrations at particular locations is extremely complex. A simplified, general purpose procedure which is designed to over estimate likely pollution levels, is applied in accordance with DMRB Volume 11, as part of an initial assessment. If possible problem locations are identified from the initial assessment, a more detailed study is to be undertaken. In the case of this scheme a detailed study has not proved necessary.

1.2.3 The simplified method estimates the average peak hour levels of pollutants from the distance of the receptor from the road, the volume and speed of the traffic and the traffic composition in terms of light and heavy duty vehicles. Four main primary pollutants are considered, namely, carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NO_x) and particulate mater (PM).

1.2.4 A new road scheme will change traffic flows and speeds in a locality and give rise to changes in the pattern and concentrations of air pollutants. Properties on existing roads relieved by the scheme are likely to experience improvements. Where a scheme relieves congestion, the resulting increases in speed (up to moderate levels) cause vehicles to operate more efficiently and produce less pollution.

1.2.5 The limits on new vehicle emission levels have been reduced several times since the early 1970s. The latest 1993 standard represents an 80% reduction on the early 1970s levels. As new 'low-emission' vehicles replace older vehicles, future emission levels are predicted to decrease significantly, despite the expected increase in traffic.

1.2.6 Three future scenarios have been assessed, two for the anticipated opening year of 1998 and one for the design year of 2013 (15 years after opening). The 1998 Do Minimum scenario includes minor improvements to the M20/Castle Way and the A20/Castle Way roundabouts, whilst the 1998 Do Something includes the provision of the proposed road improvement scheme. A 2013 Do Something scenario assesses the air quality effects of the scheme 15 years after its opening. To aid the interpretation of the results and identify any potential problem locations, the estimates of pollutant levels are compared with the standards set by the Air Quality Regulations 1989.

1.3 Purpose and Scope of this Report

1.3.1 This report forms part of Volume 2 of the Environmental Statement for the A228 Leybourne and Wet Malling Bypass and records the air quality assessment carried out for the proposed road improvement scheme.

1.3.2 Following the introduction, Section 2 considers the sources of air pollution and its health and environmental effects. Section 2 also includes information on air quality standards and discusses the resulrs of existing air quality measurements from a site in Maidstone and from three monitoring sites in the Leybourne area. The methodology and results of the air quality assessment are reported in Section 3 whilst Section 4 considers the question of mitigation. A summary of the results of the assessment is provided by Section 5.

2.0 BACKGROUND TO THE ASSESSMENT

2.1 SOURCES OF AIR POLLUTION

2.1.1 Air pollution arises from a wide range of man-made and natural sources. Man-made sources include the burning of fossil fuels (eg. transport, power, industry and domestic hearths), industrial processes and incineration of wastes. Emissions from road traffic have increasingly been identified as a significant source of a range of pollutants such as carbon monoxide (CO), Nitrogen Oxides (NO_x), Hydrocarbons (HC), Particulate Matter (PM), known as primary pollutants, and Black Smoke and Carbon Dioxide (CO_2), known as secondary pollutants formed as a result of chemical reactions, between primary pollutants and compounds in the atmosphere.

2.1.2 Vehicle exhaust emissions are essentially the by-product of the combustion of hydrocarbon fuel and air and vary depending on the source of the fuel, the refining process, the type and condition of the engine, the use of emission control technology (ie. catalytic converters) and the mode of operation of the vehicle. If combustion and oxidation were complete in the engine, water and carbon dioxide would be the only by-products of the combustion of fuel. Diesel engines generally emit less HC, CO and NO_x than petrol engines due to the higher fuel to air operating ratio. However, particulate emissions arising from incomplete combustion can be a problem for diesel vehicles. Diesel fuel also contains roughly 1.5 times as much sulphur as petrol. SO_2 emissions are therefore higher than those from petrol engines.

2.1.3 Legislation will ensure that all new cars will be required to meet new exhaust emission standards, such that all new petrol driven cars sold within the EC will have to be equipped with catalytic converters. It is estimated that due to the turnover of the UK vehicle stock, a reduction in CO, HC and NO_x, emissions of between 50% and 90% will result within the next 20 years.

2.1.4 Dispersion modelling of vehicle emissions has shown that concentrations of vehicle-derived pollutants decrease rapidly with distance from the road and tend to approach background levels approximately 200m from the road. At this distance gaseous pollutants $<5\mu m$ such as CO, NO_x, HC and smaller particulate matter have dispersed into the atmosphere and larger particulate matter $>5\mu m$ have settled.

Carbon Monoxide (Primary Pollutant)

Most CO emissions in the UK come from petrol engines and are dependent upon driving mode and the efficiency of the engine. Average CO emissions are highest at low speeds, dropping to a low at 75km/hr and increasing again at higher speeds. Increased acceleration rates produce high pollutant emissions in terms of mass per unit time. CO emissions are further increased when petrol engines run below optimum temperature, such as during a cold start when the engine works at low efficiency and is often under choke conditions. Higher CO emissions are thus encountered during stop-go driving normal in urban areas.

Oxides of Nitrogen (Primary Pollutant)

Both NO and NO_2 are released during combustion, the concentration of NO being greater, They are formed from the oxidation of Nitrogen compounds contained in the fuel but also nitrogen naturally present in the air. During urban driving NOx pollution concentration within the air can increase. Average emission rates are at their lowest at speeds between 25–50km/hr rising with speed and rapid acceleration.

Hydrocarbons (Primary Pollutant)

The pattern of emissions of hydrocarbons from vehicles is very similar to that of CO, with driving mode, engine design and condition being very important. Hydrocarbons are also emitted through evaporation losses from fuel tanks and carburettors, combined with losses from crankcase blow-byes in older engines. Average gaseous Hydrocarbon emissions are typically high at low speeds falling to a minimum at about 100km/hr and stabilising at a slightly higher value with further increase in speed. They also increase during rapid acceleration, although as a general rule the highest values are found during idling and deceleration. Diesel engines produce lower hydrocarbon emissions than petrol engines because of their operating efficiency.

Particulate Matter (Primary Pollutant)

Atmospheric particulate matter contains a wide variety of solid particles and liquid droplets. This includes a range of substances and materials such as smoke, aerosols and metallic compounds. Smoke is defined as a suspended particulate air pollutants, with a diameter of less than 15μm, arising from the incomplete combustion of fossil fuels. Particles of this size are potentially more dangerous to human health than larger particles, as they remain suspended in air for long periods and can be inhaled. Motor vehicles also generate other ranges of particulate matter through the dust produced from brakes, clutch plates, tyres and indirectly through the resuspension of this matter from road surfaces through vehicle generated turbulence.

Particulate lead emissions have been shown to depend primarily on driving mode (Reference 1). Resuspension of lead particles within the exhaust system is believed to be responsible for the extremely high values. The source of atmospheric lead is diminishing in the UK due to the reduction in the lead content of petrol. Under EC directive 85/21-/EEC lead in petrol has dropped from 0.4g/l to 0.15g/l.

Sulphur Dioxide (Primary Pollutant)	Sulphur Dioxide emissions from all classes of motor vehicles are considered negligible on a national sulphur emissions value but can be accountable for half of all roadside sulphur recorded. Sulphur emissions from motor vehicles are directly dependent upon the contents of fuel. This differs greatly from petrol to diesel.
Polycyclic-aromatic Hydrocarbons (PAH) (Primary Pollutant)	These are produced at high temperature during the incomplete combustion and pyrolysis of fossil fuels. With the reduction in the lead contents of petrol, the aromatic content has been increased in order to maintain octane levels. The major aromatic compounds present in petroleum are Benzene and Toluene. Exhaust emissions of PAH further depend on air/fuel ratio, type of lubricant and fuel, driving mode, age of vehicle, engine speed, load and torque.
Photochemical Smog (Secondary)	In the presence of sunlight, Hydrocarbons and NO_x react to form smog. Smog takes the form of Ozone (O_3) or Peroxyacetyl Nitrate (PAN) however, ozone can react with Nitric Oxide (NO) to produce Oxygen and more Nitrogen Oxide. Peroxy Radicals in the air can react with Nitric Oxide. This takes the available Nitric Oxide out of circulation therefore no further reactions can occur and ozone levels rise.

2.2 Environmental and Health Effects

2.2.1 Air pollution due to vehicle emissions has an effect on human health, climate, building material and ecology. Compounds which are thought to affect health are not only in the form of primary pollutants, that is, direct emissions from the vehicles, but also secondary pollutants, which are formed when primary pollutants react with elements in the atmosphere.

Carbon Monoxide	Carbon Monoxide, a colourless, tasteless and odourless gas has little affect on property, vegetation or materials at current ambient levels. At higher concentrations, it can seriously affect the human aerobic metabolism, owing to its high affinity for haemoglobin, the component of blood responsible for transport of oxygen. Carbon Monoxide thus reacts with the haemoglobin reducing the capability of the blood to carry oxygen. The absorption of CO by the body increases with CO concentration, exposure time and the activity being performed. Impaired reactions, decreased work capacity, aggravation of angina and in extreme cases death can occur due to CO. It also contributes indirectly to the greenhouse effect. Approximately 90% of the total UK emission of CO is from road vehicles.

Oxides of Nitrogen

Oxides of Nitrogen (NO_x) include six known gaseous compounds. Nitric Oxide (NO), Nitrogen Dioxide (NO_2), Nitrous Oxide (N_2O), Nitrogen Sesquioxide (N_2O_3), Nitrogen Tetroxide (N_2O_4), and Nitrogen Pentoxide (N_2O_5). The two oxides of Nitrogen of primary concern and those only emitted in significant quantities are Nitric Oxide (NO) and Nitrogen Dioxide (NO_2).

Nitric Oxide (NO) is only moderately toxic and like CO can combine with haemoglobin to reduce the oxygen carrying capacity of the blood. NO also readily oxidises to NO_2 which is an irritant to the lungs. There is no evidence that NO is damaging to plants, however, it contributes to photochemical smog formation and acid deposition. Some of the producers of reactions involving NO_x are powerful greenhouse gases. Road transport is responsible for around half of the NO_x produced in the UK.

Hydrocarbons

Road transport accounts for about a third of the HC produced in the UK. The term is used generally to include all organic compounds emitted from exhausts. Hydrocarbons are known to be carcinogenic and an irritant to throat and eyes in their primary state or their secondary state when they react with NO_x to form photochemical smog. They contribute directly and indirectly to the greenhouse effect. The composition of HC emissions is strongly influenced by the composition of fuel, so changes in fuel specification will modify its effect.

Particulate Matter

Road vehicles emit about a third of the particulate pollution in the UK. Diesel exhausts contain much higher concentrations than petrol exhausts. At high concentrations, suspended particulate matter poses a health hazard to humans, particularly those susceptible to respiratory illness. The nature and extent of the effects that may be linked to suspended particulates depends upon the concentration of particles, the presence of other atmospheric contaminants (notably sulphur oxides) and the length of exposure. The success or failure of the respiratory defence system depends, in part, upon the size of the particles inhaled and the depth of their penetration into the respiratory tract. Health problems associated with lead particles have been of special interest in recent years. The three systems in the body most sensitive to lead are the blood forming system, the nervous system and the renal system. Reproductive, endocrine, hepatic, cardiovascular, immunological and gastro-intestinal functions may also be affected by lead. Little information is available on the detrimental effects of particulate matter on vegetation. A dust coating on leaves in the presence of moisture can reduce photosynthesis and plug the stomata resulting in reduced plant growth. Roadside dust concentrations may further comprise particles from tyres, brakes and road surface wear combined with resuspended particles from all sources.

Sulphur Dioxide

Sulphur Dioxide tends to irritate the mucous membranes of the respiratory tract and foster the development of chronic respiratory diseases, particularly bronchitis and emphysema. Effects on plants are more pronounced at low levels over a long exposure period. Susceptibility will depend upon the plant species itself. Sulphur Dioxide (SO_2) can react with moisture in the air (H_2O) to form Sulphuric Acid (H_2SO_4) which readily attacks building materials, especially those containing carbonates such as marble, limestone and mortar.

Lead

Lead compounds mainly in the form of fine particles are emitted by petrol vehicles using leaded petrol. Lead is toxic and its concentration in air is limited by EC directives.

Carbon Dioxide

About 20% of the CO_2 produced in the UK is from road transport. It is a major product of the combustion of all carbon containing materials. It is the most abundant man-made greenhouse gas in the atmosphere.

2.2.2 It should be re-iterated that many of these pollutants have significant sources other than vehicle exhausts and consequently it is difficult to attribute health problems directly to road traffic. Within the indoor environment for example, cigarette smoking is a significant source of Benzene and Formaldehyde; gas cookers and paraffin heaters are a significant source of NO_2 and building materials and paints are significant sources of Toluene and Formaldehyde.

2.3 AIR QUALITY STANDARDS

2.3.1 Air quality standards in the UK are set by the Air Quality Regulations 1989, which implement the EEC Directives in setting air quality limits and guide values for SO_2 and suspended particulates (80/779/EEC), a limit value for Pb in air (82/884/EEC) and air quality standards for NO_2 (85/203/EEC). These standards are mandatory. The World Health Organisation also publishes guidelines for air quality in Europe. Standards set in the UK and by EC directives are incorporated in DMRB Volume 11. These are reproduced below.

Pollutants	Standard	Reference Period
CO	9ppm	Max 8-hour
HC	5ppb	Annual average Benzene
NO_2	105ppb	98 percentile of hourly NO_2
PM	150μg/m^3 300μg/m^3	Annual average standard 95 percentile of daily standard

Table 1 Air Quality Standards (reproduced from DMRB, Volume 11).

2.4 EXISTING AIR QUALITY

2.4.1 The assessment of air quality impacts from a proposed road development requires a review of existing air quality in the area. This allows the contribution of any significant background source to be added to the results of modelling to compare with air quality standards.

2.4.2 The proposed A228 improvements are situated on the edge of an urban development between two major roads, the M20 and the A20. There are no large industrial emissions of air pollutants in the area. Local air quality is therefore, likely to be dominated by emissions from the road network.

2.4.3 Information on existing air quality in the area is limited. A sub report (Reference 4)identified that a survey site was operated on behalf of Warren Spring Laboratory measuring daily average Sulphur Dioxide and smoke concentrations in Maidstone. Results for the period 1982–1991 are given in Table 2.

2.4.4 Warren Spring Laboratory also measured Nitrogen Dioxide concentrations in Maidstone in 1986 and 1991 using the diffusion tube technique. Results from these measurements shown in Table 3 indicate air quality in the area is relatively good. The measured values are well below UK air quality standards. Although the measured Nitrogen Dioxide values do not give a direct measurement of the 98th percentile value an estimate may be made by multiplying the average value by 2.5. This suggests the existing 98th percentile of Nitrogen Dioxide concentrations to be 153μg/m3 which is well below 200μg/m3 as the limit value set by EEC Directive 85/203EEC.

2.4.5 Three monitoring sites were also set–up to measure local air quality; one near to the M20 on Birling Road; one at Leybourne Primary School and one in Pump Close near to the A20. Each site was monitored for four weeks. Carbon Monoxide concentrations were measured continuously at each site for one week. Weekly average concentrations of lead and total suspended particulates were measured once at each site. Weekly average concentrations of nitrogen dioxide were measured for four weeks at each site.

2.4.6 Results from this monitoring are reproduced in table 4. Nitrogen dioxide measurements were similar to those determined by the Warren Spring Laboratory Survey. Both lead and TSP measurements were at low levels and well below UK standards. Average carbon monoxide concentrations at the sites were also low, however, the maximum eight hour average concentrations were considerably higher. This indicates that local roads are influencing air quality under certain traffic and meterological conditions. The maximum eight–hour average carbon monoxide concentration recorded was 5.8ppm below the 9ppm DoT standard. It can therefore be concluded that during this monitoring period pollutant concentrations in the area were below UK standards.

Table 2 Results of Sulphur Dioxide and Smoke Measurements of Maidstone From Warren Spring Laboratory

Year	Sulphur Dioxide Annual Mean (μgm3)	Smoke Annual Mean (μgm3)
1982	55	17
1983	63	16
1984	50	16
1985	48	13
1986	49	13
1987	38	13
1988	33	14
1989	38	13
1990	48	13
1991	53	10

Table 3 Results of Nitrogen Dioxide Monitoring at Maidstone (μgm3) From Warren Spring Laboratory

Year	July	Aug	Sept	Oct	Nov	Dec	Mean
1986	34	39	51	45	51	41	43
1991	81	45	60	68	62	70	64

Table 4 Results of Air Quality Monitoring for Nitrogen Dioxide, Lead and Total Suspended Particulates (TSP) Weekly Averages (μgm^{3}), 1992

Site	Bull Road			Leybourne Primary School			Pump Close		
Date	Nitrogen Dioxide	Lead	TSP	Nitrogen Dioxide	Lead	TSP	Nitrogen Dioxide	Lead	TSP
30/04/92 – 07/05/92	44	0.06	13	51	NM	NM	51	NM	NM
07/05/92 – 14/05/92	22	0.02	5	42	NM	NM	45	NM	NM
14/05/92 – 22/05/92	75	NM	NM	62	NM	NM	47	0.08	17
22/05/92 – 28/05/92	85	NM	NM	53	0.05	14	44	NM	NM

NM = Not Measured

Site	Bull Road		Leybourne Primary School		Pump Close	
Date	Weekly Average	Weekly Maximum 8–hour Average	Weekly Average	Weekly Maximum 8–hour Average	Weekly Average	Weekly Maximum 8–hour Average
7/5/92 – 14/5/92	0.16	1.9	NM	NM	NM	NM
14/5/92 – 22/5/92	NM	NM	0.83	5.8	NM	NM
22/5/92 – 28/4/92	NM	NM	NM	NM	0.32	4.5

NM = Not Measured

3.0 Air Quality Assessment

3.1 Method of Assessment

The method used for determining the impact of the proposed scheme on air quality is described in the DMRB, Volume 11, 1993. Based on these recommendations, emissions of CO, HC, NO, and PM are calculated for a.m. peak hour traffic flows, speeds and percentages of heavy goods vehicles.

Traffic data used in the assessment is based on studies undertaken by Peter Brett Associates and is detailed in a separate specialist report. Traffic flows used, along with percentages of heavy goods vehicles, and average speeds can be found in Appendix 2.

The assessment initially involved the identification of all sites within 200m either side of the highway proposals where the users are likely to be sensitive to air pollution and where exposure may be extensive, for example over an 8 hour working day. Once identified the calculation of peak hour pollutant concentrations of CO, HC, NO, and PM was undertaken for three scenarios: 1998 Do Minimum, 1998 Do Something and 2013 Do Something.

The year 1998 is anticipated to be the programmed year of opening of the improvement and is represented by the 1998 Do Something situation. The 1998 Do Minimum situation demonstrates the effects that would be experienced at the same year if only limited improvements are carried out to the existing highway network. The 2013 Do Something situation corresponds to 15 years after opening of the improvement.

Calculations were undertaken for all properties identified within the 400m band for the 1998 Do Something situation. From this, sites considered to be representative of several properties, were used to for calculating concentrations for the other two scenarios identified.

The calculation of pollutant concentrations in future years, both 1998 and 2013, take into account the expected reduction in pollutant emissions per vehicle due to legal vehicle emissions limits and the rate of turnover of the UK car fleet. The correction factors used are drawn from DMRB Vol 11.

3.2 Sites Sensitive to Air Pollution

There are a large number of houses considered to be sensitive to air pollution, particularly around Leybourne. Several rural properties along the proposed route together with More Park School and the Hermitage are also considered to be sensitive .

3.3 Results

The results of the Air Quality assessment for the three scenarios described are reproduced in Appendix 3.

1998 Do Minimum

3.3.1 In general results for the 1998 Do Minimum scenario indicate that, as expected, the properties adjacent to the more heavily trafficked routes such as the M20 and Castle Way and A20 would experience the higher concentrations of traffic related pollutants. In most cases the levels are well below the standards detailed in Table 1. However, the congestion at the A20/Castle Way roundabout would result in two of the sites investigated having CO (Carbon monoxide) levels just above the standard.

1998 Do Something

3.3.2 Complex changes to the pattern of air quality would be brought about by the Do Something in 1998. The changes result from the introduction of new lengths of road, the modification of existing lengths and the resulting changes in traffic flows and speeds. Interpretation of the results is complicated further by the different ways the levels of the primary pollutants vary in relation to the distance from the highway and the traffic flows and speeds.

3.3.3 Properties within 200 metres of the proposed modifications at the M20 and at the start of the Leybourne Bypass (including the new M20 junction) would in general experience increases in the levels of primary pollutants although they would remain below standard levels. These properties would include Spiders Hall, those in Bull Road/Birling Road and the properties closest to the scheme in Park Road. The properties closes to Park Road, however, would experience significant reductions in primary pollutants. Properties along Castle Way, including the church and school, would also benefit from major improvements in air quality.

3.3.4 The effects in the A20/Pump Close area would be particularly complex, with increases and decreases in pollutant levels depending on the precise position of each property relative to the main traffic links in the Do Minimum and Do Something scenarios. The two sites adjacent to the A20/Castle Way roundabout, identified in the Do Minimum as having CO levels above standard would also experience higher than standard levels in the Do Something. Apart from these instances, primary pollutant levels in the A20/Pump Close area would be below standard.

3.3.5 Primary pollutant levels would increase, but remain below standard, at the Hermitage and the adjacent church as a result of the proximity of the new bypass and junction. Levels would rise slightly at More Park School but changes little at West Malling Station. Similarly, there would be only slight changes affecting the properties within 200 metres of West Malling Bypass in the Lavenders Road area.

2013 Do Something

3.3.6 For all receptors in 2013 the predicted pollutant concentrations are generally well below the 1998 values, despite the expected increase in overall traffic levels. This is mainly due to the expected reduction in vehicle pollutant emissions resulting from legal requirements.

4.0 Mitigation Measures

4.1 Reduced Congestion and the Removal of Through Traffic

4.1.1 Improvements in air quality can be achieved by:

i) A reduction in congestion and stop–start traffic which would minimise the emission of CO, CO_2 & HC;

ii) Relocation of A228 through traffic flow away from the residential area of Leybourne;

iii) Design of free flowing junctions, unhindered by congestion and

iv) Changes in fuel standards.

A reduction in congestion and the relocation of through traffic away from the main areas of existing housing would be achieved by the construction of the proposed scheme.

4.2 Improved Emission Standards

4.2.1 The most important fuel change to date, has been the limiting of lead in leaded petrol and the introduction of unleaded petrol. Sales of unleaded petrol in 1992 were more than half the total. The average lead content in leaded petrol has fallen from 0.55g/l to 0.15 g/l.

4.2.2 As older vehicles are replaced by new 'low-emission' vehicles conforming to higher standards, future pollutant levels will be significantly reduced even through traffic volumes will continue to increase.

4.3 Mitigation During Construction

4.3.1 During construction poor air quality may arise due to congestion of traffic at peak periods and an increase in dust and fumes from the Contractors plant. Mitigation therefore consists of measures to limit, as much as possible, the degree of congestion to road works as well as measures such as wetting soil to limit dust and ensuring that effective exhaust systems and silencers are fitted to the contractors plant.

5.0 SUMMARY

5.1 EXISTING AND 1998 DO MINIMUM AIR QUALITY ASSESSMENT

5.1.1 Measurement of existing air quality in this area indicates that it is relatively good. An assessment of predicted future air quality, has been carried out in accordance with guidelines in DMRB Volume 11. This indicates that a number of properties close to the A20 roundabout would experience poor air quality based on expected pollutant concentrations during 1998 with minimal improvements to the existing road network.

5.2 PROPOSED SCHEME AIR QUALITY ASSESSMENT

5.2.1 With the construction of the proposed scheme levels of congestion and traffic along parts of the existing network will be reduced as traffic transfers to the new road.

5.2.2 As a result properties in the Castle Way corridor in particular and at the eastern end of Park Road would experience significant reductions in the levels of primary pollutants. Other properties, near the M20 in the Birling Road/Park Road area and in the Pump Close/A20/Hermitage area would experience some increases. Some properties adjacent to the A20/Castle Way roundabout would continue to experience relatively high concentrations of pollutants, particularly CO, after the opening of the scheme. Despite the predicted increase in traffic by 2013, due to the replacement of older vehicles by new 'low-emission' vehicles, the levels of the primary pollutants are predicted to decrease significantly.

References

1. TRRL

   Air Pollution from Road Vehicles — Watkins

2. Environmental Engineering — Peavy, Rowe, Tchebanoglous

3. Design Manual for Roads and Bridges, Vol 11 1993 — Department of Transport

4. A228 Castle Way/West Malling Bypass Air Quality Report 1992 — Ashdown Environmental Ltd

APPENDIX 1

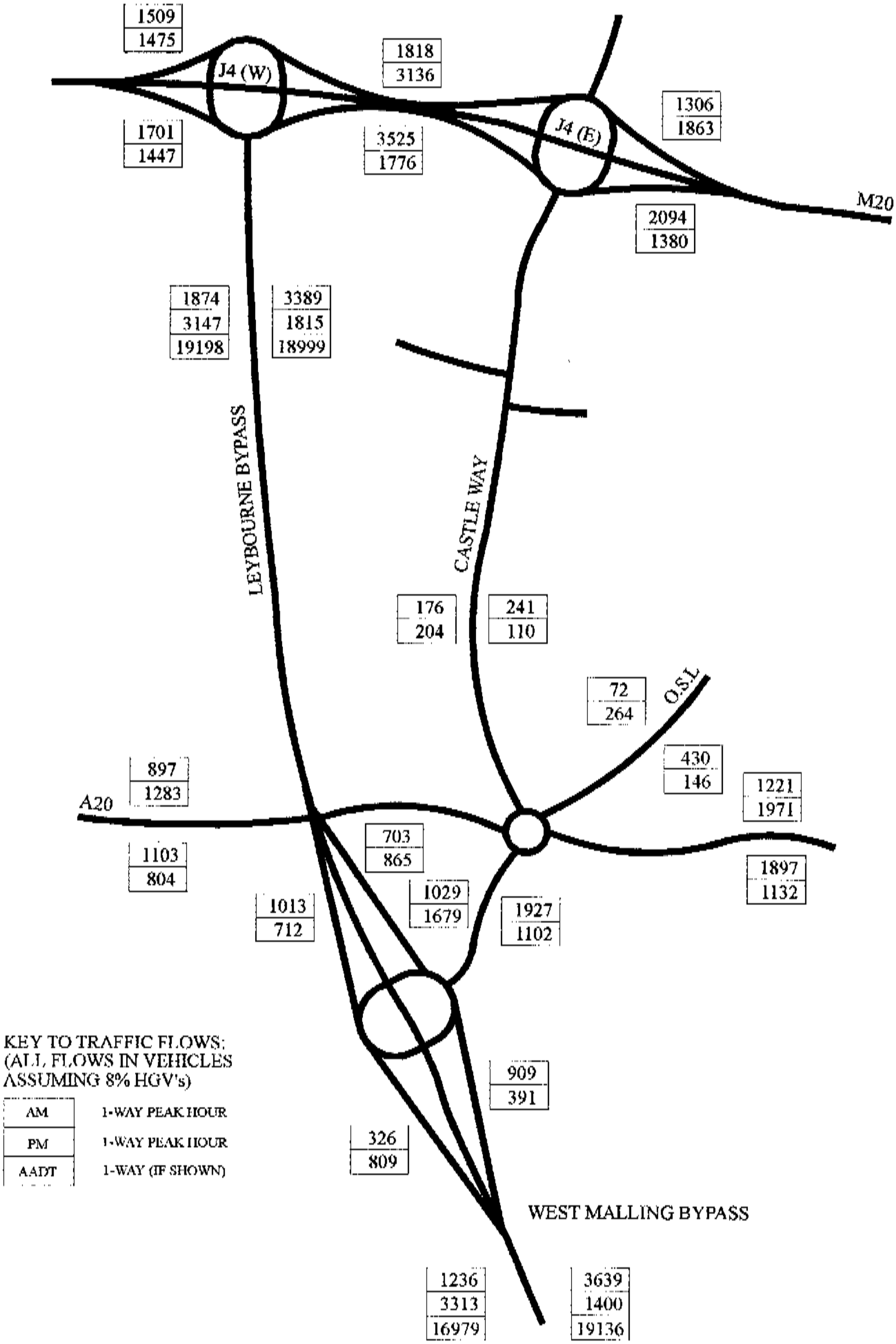
LOCATION PLAN

SCHEME PLAN

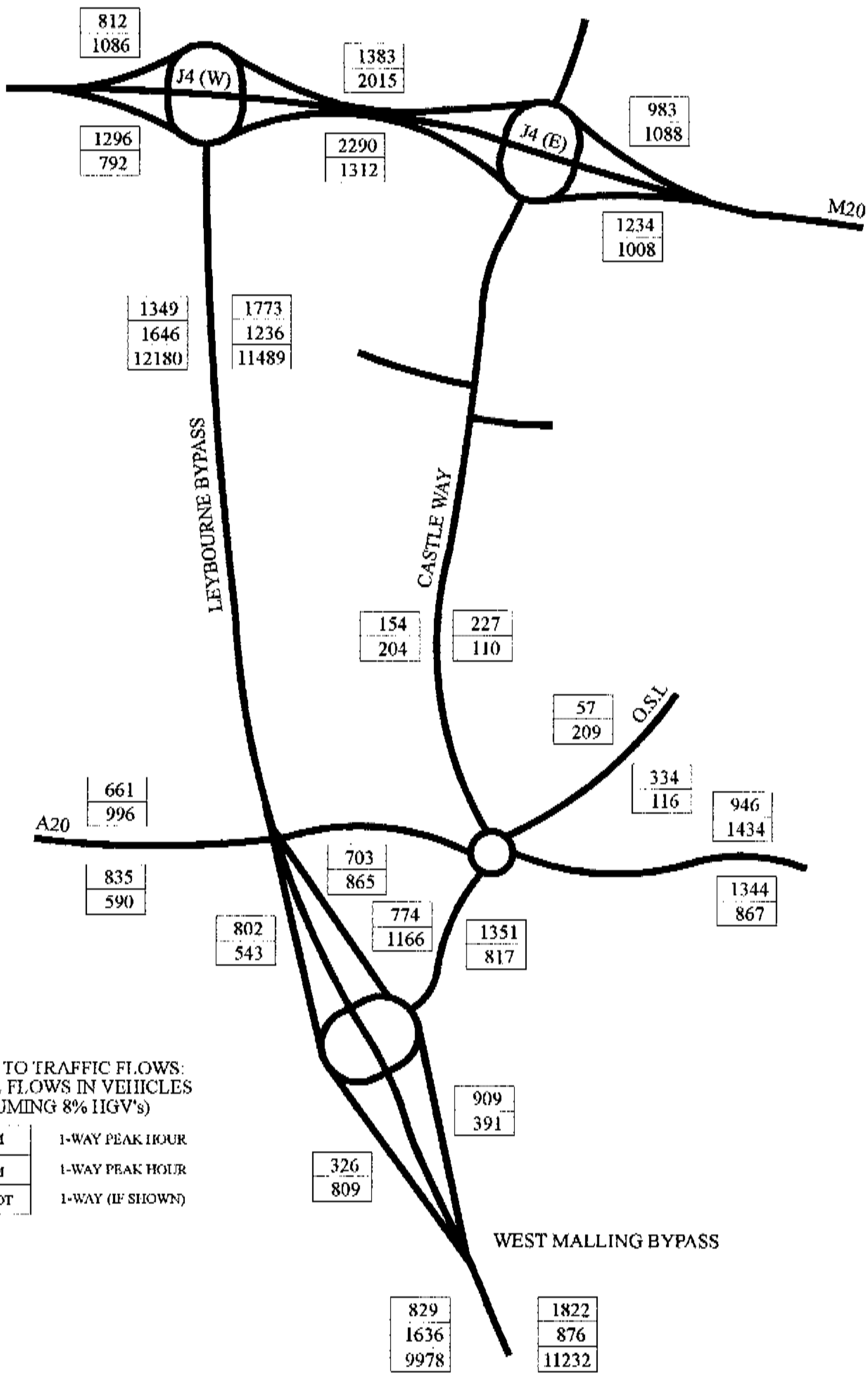
APPENDIX 2

TRAFFIC DATA

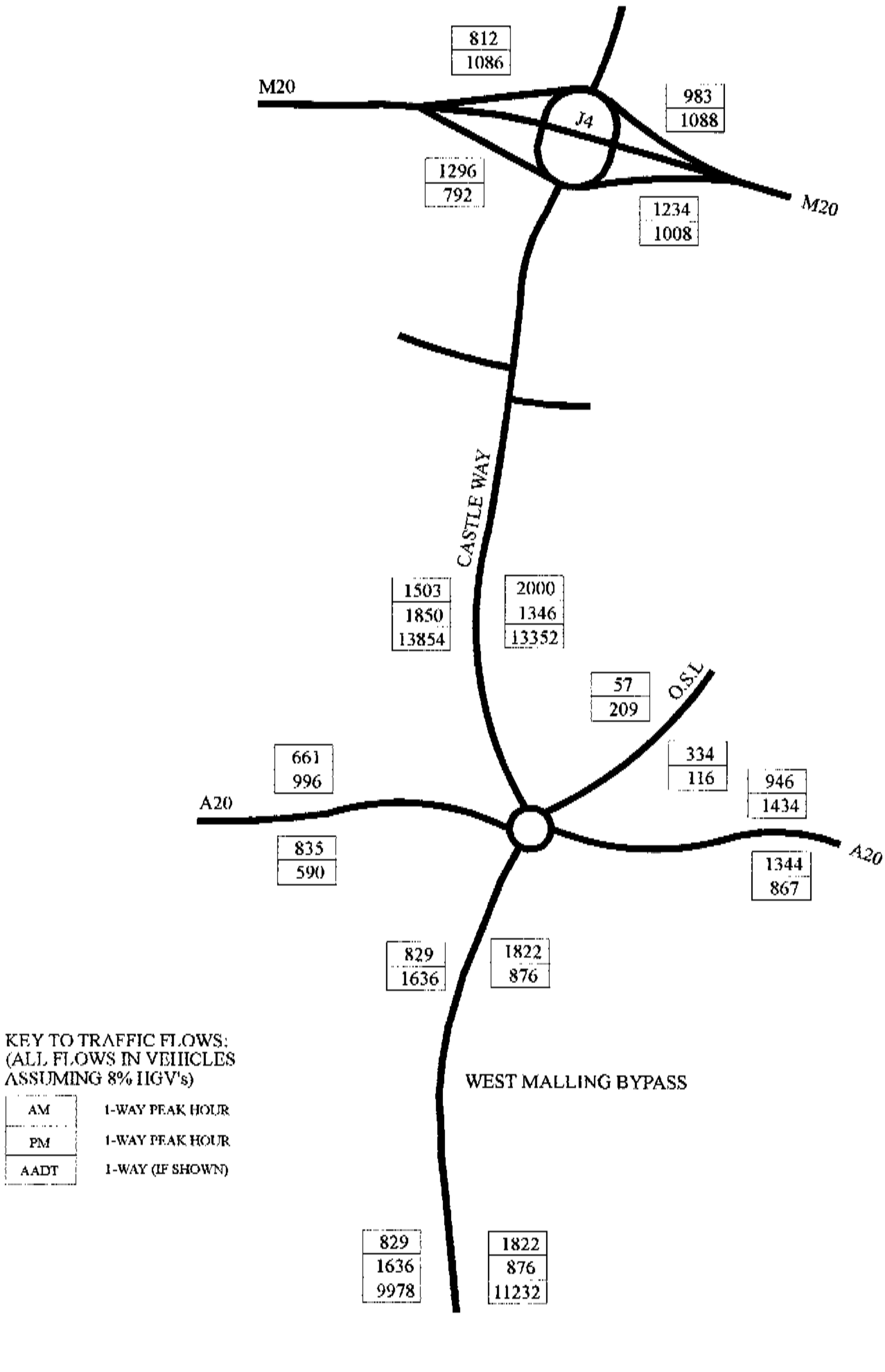
LEYBOURNE AND WEST MALLING BYPASS
2013 FLOWS - FULL DEVELOPMENT - (LOW GROWTH - 1991 BASE)



LEYBOURNE AND WEST MALLING BYPASS
FORECAST FLOWS 1998 - (LOW GROWTH - 1991 BASE)

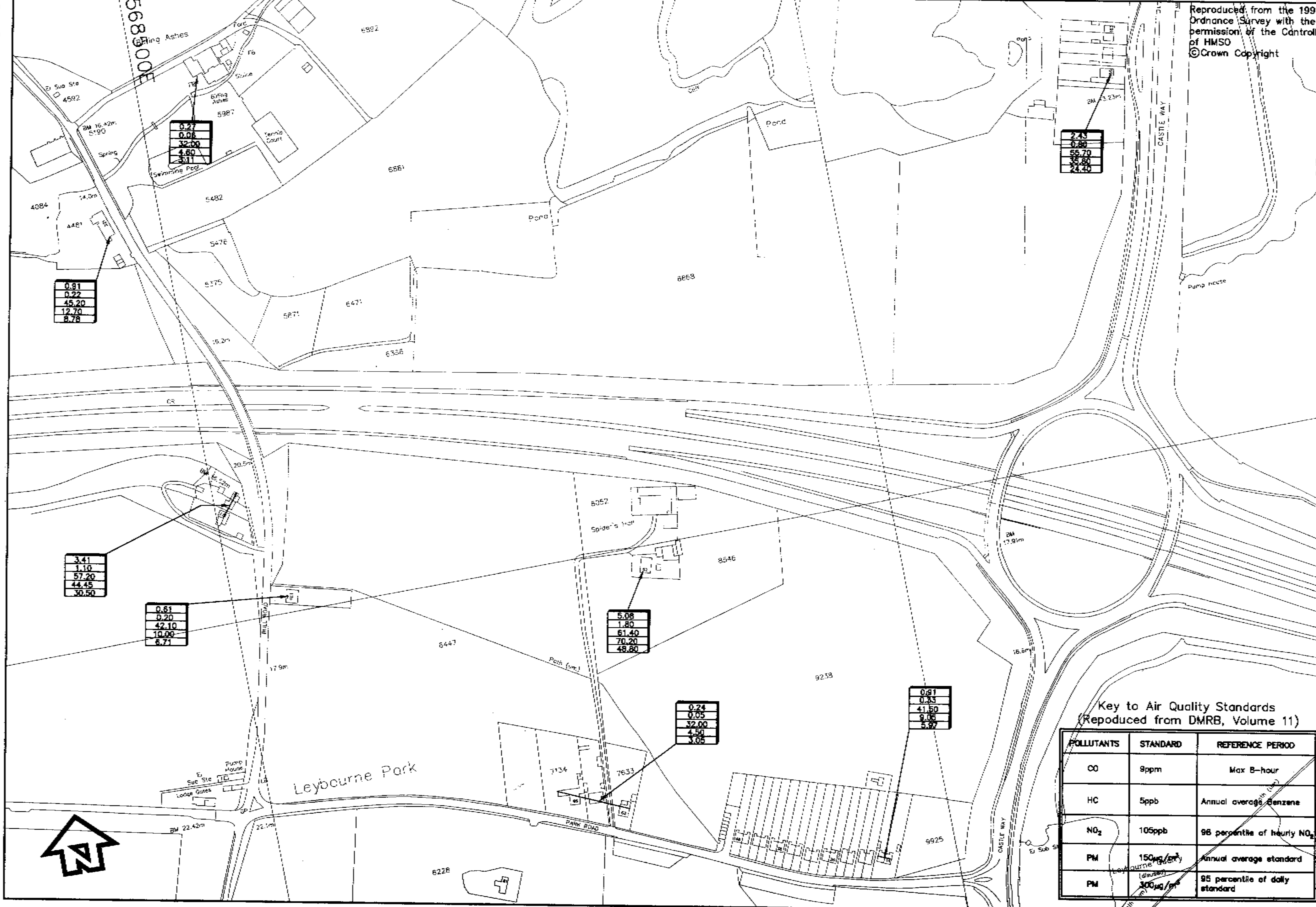


LEYBOURNE AND WEST MALLING BYPASS
1998 FLOWS - DO NOTHING - (LOW GROWTH - 1991 BASE)



APPENDIX 3

RESULTS

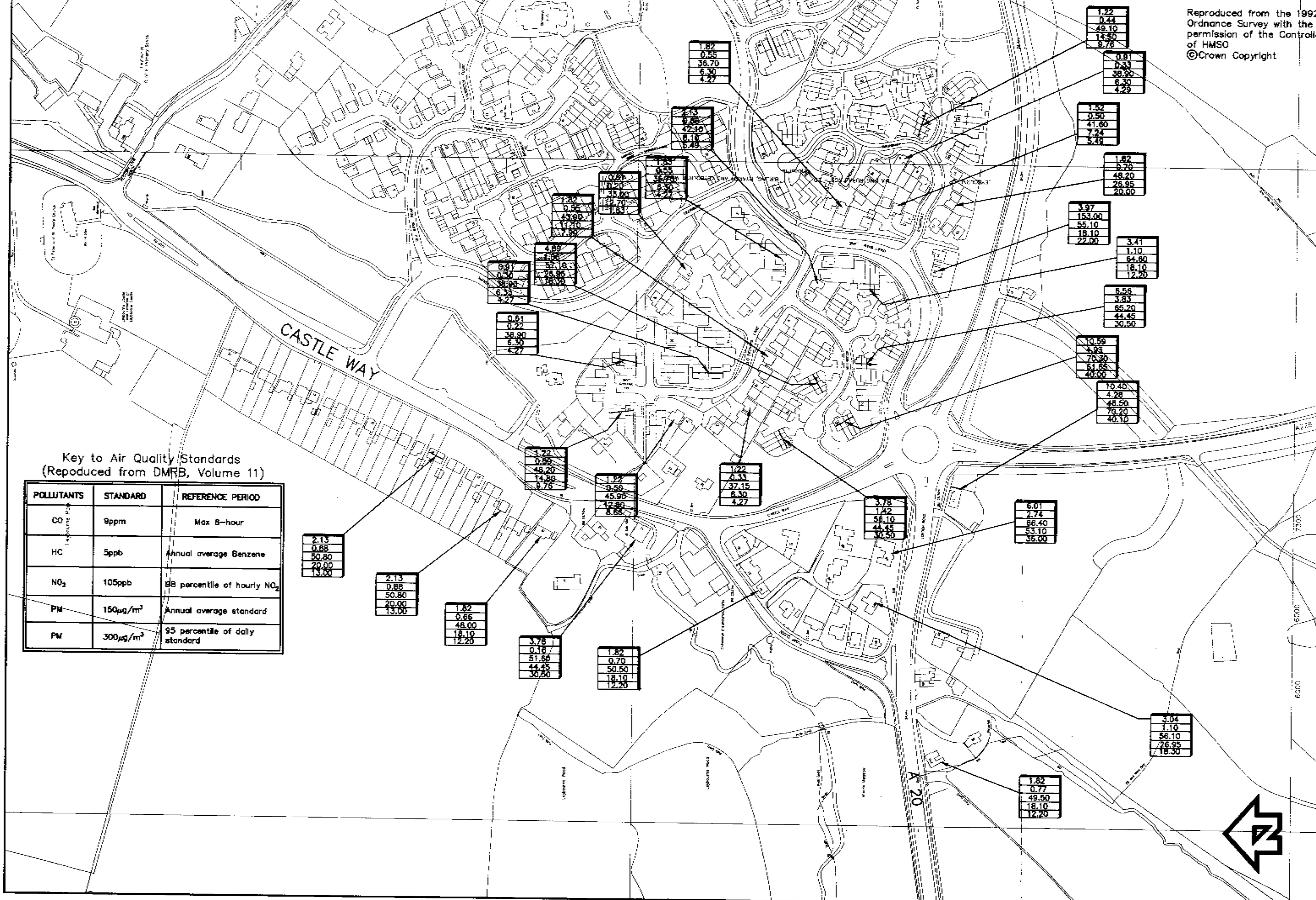


Key to Air Quality Standards
(Repoduced from DMRB, Volume 11)

POLLUTANTS	STANDARD	REFERENCE PERIOD
CO	9ppm	Max 8-hour
HC	5ppb	Annual average Benzene
NO_2	105ppb	98 percentile of hourly NO_2
PM	150µg/m³	Annual average standard
PM	300µg/m³	95 percentile of daily standard

A228 LEYBOURNE AND WEST MALLING BYPASS PREDICTED AIR QUALITY CONCENTRATIONS
1998 DO MINIMUM

scale: 1/2500



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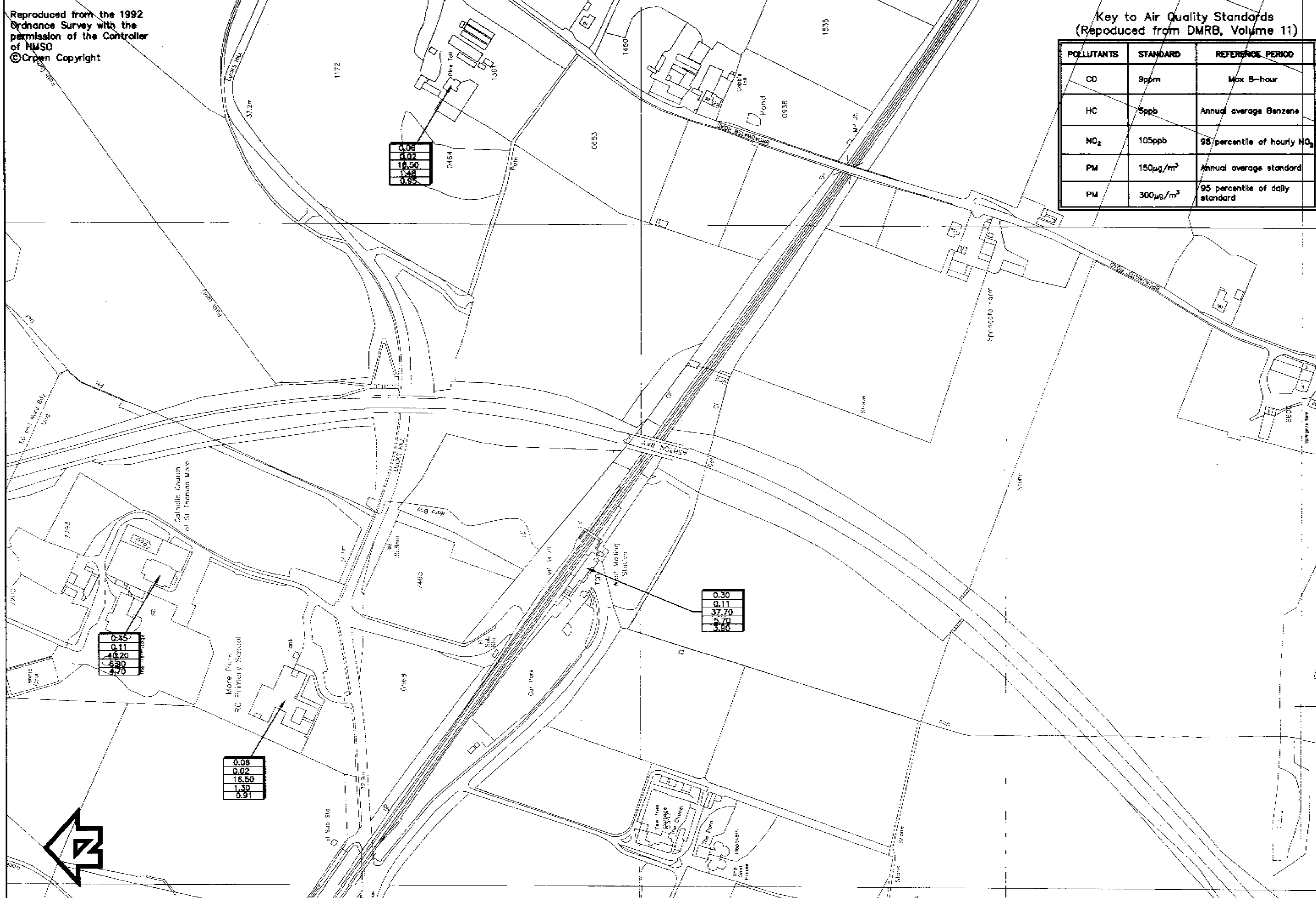
1998 DO MINIMUM

scale: 1/2500



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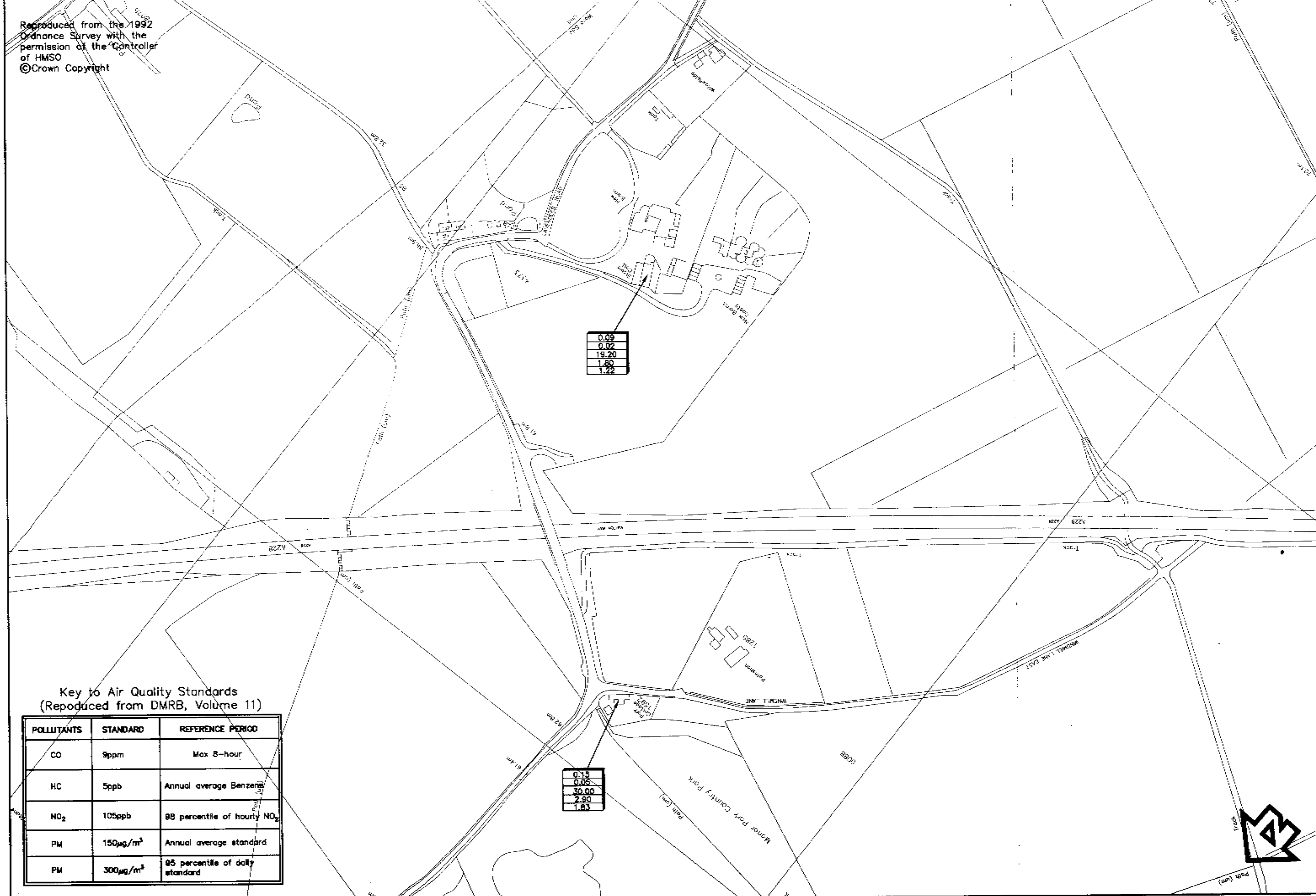
A228 LEYBOURNE AND WEST MALLING BYPASS PREDICTED AIR QUALITY CONCENTRATIONS
1998 DO MINIMUM

scale: 1/2500



Key to Air Quality Standards
(Repoduced from DMRB, Volume 11)

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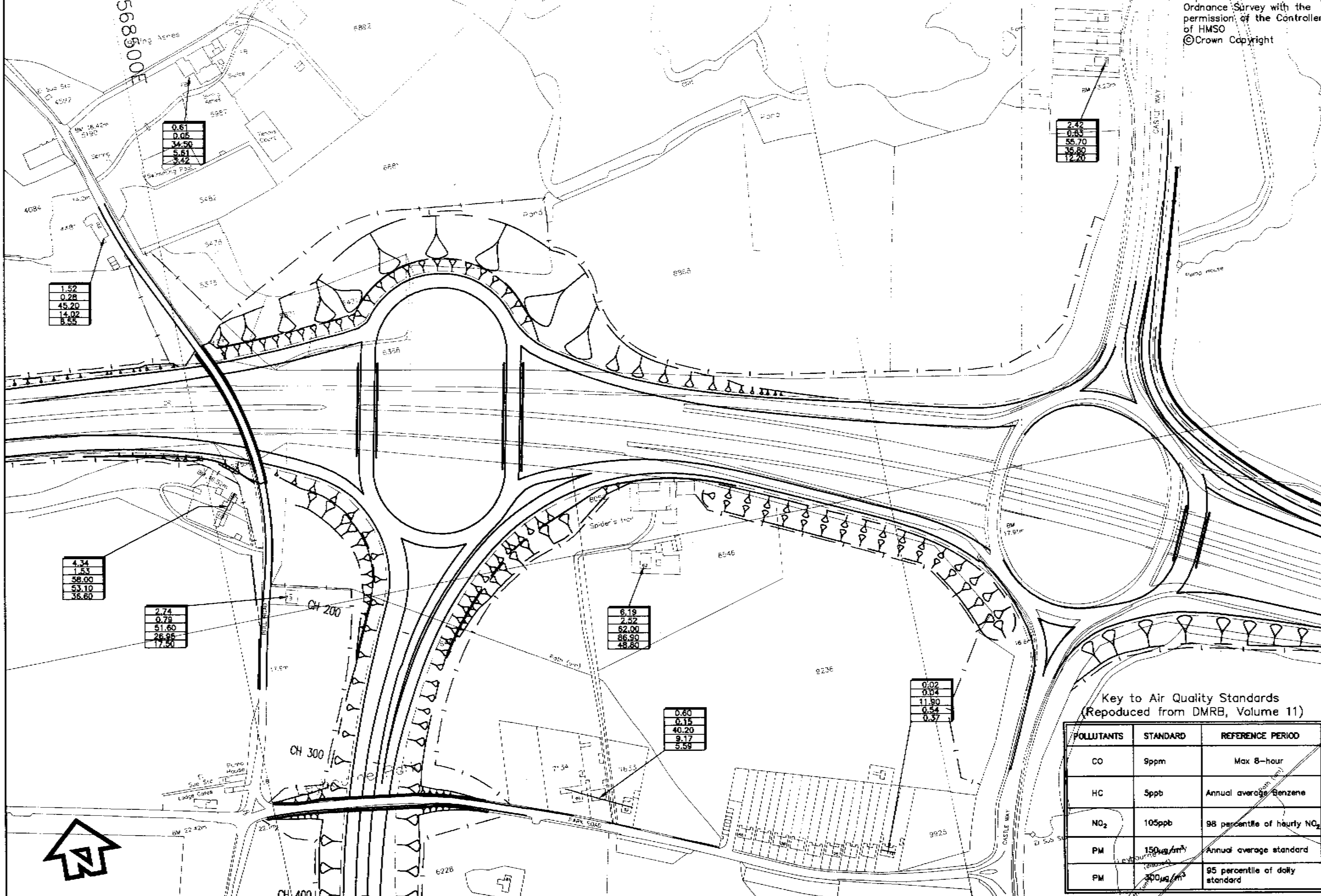

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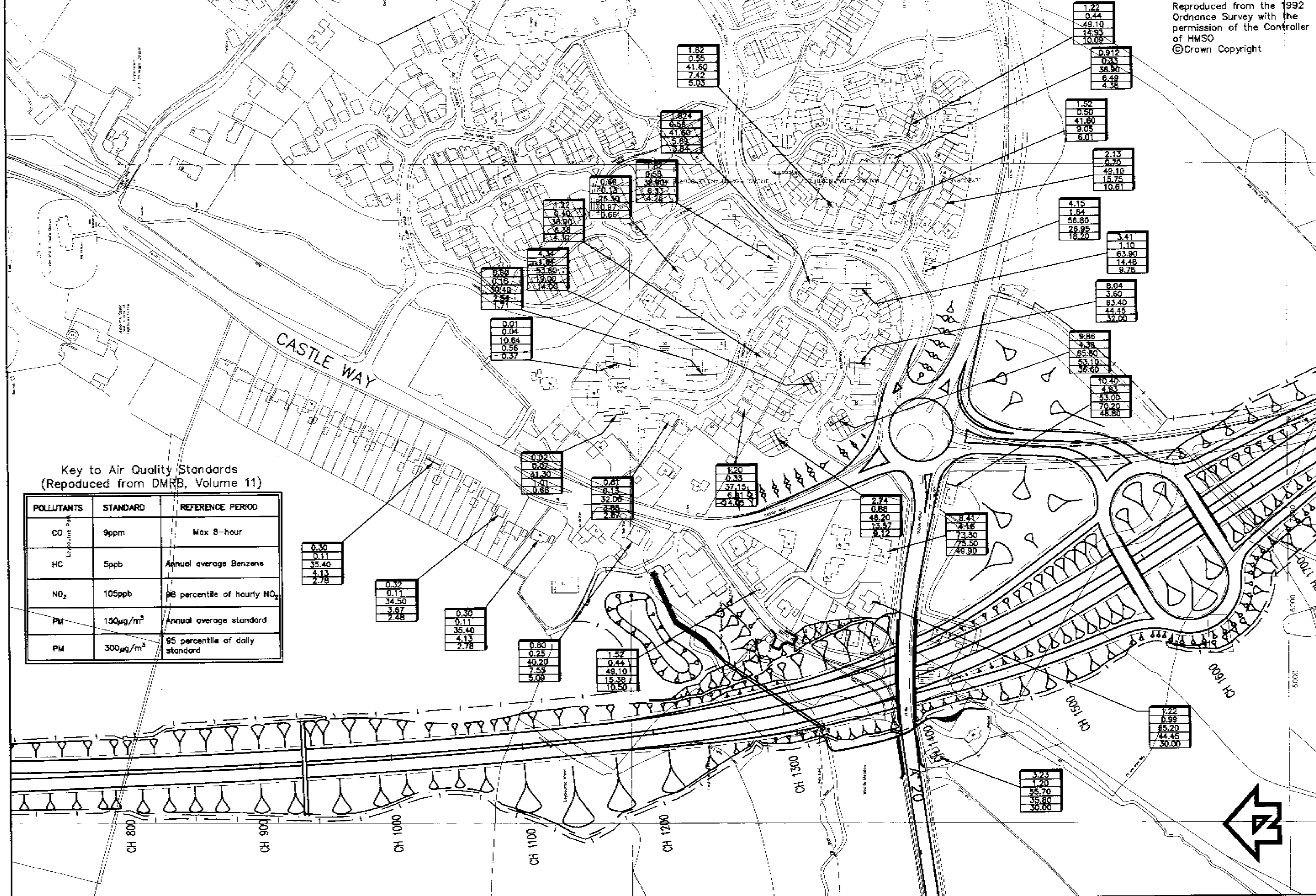
A228 LEYBOURNE AND WEST MALLING BYPASS PREDICTED AIR QUALITY CONCENTRATIONS
1998 DO SOMETHING

scale: 1/2500

sheet 1 of 4



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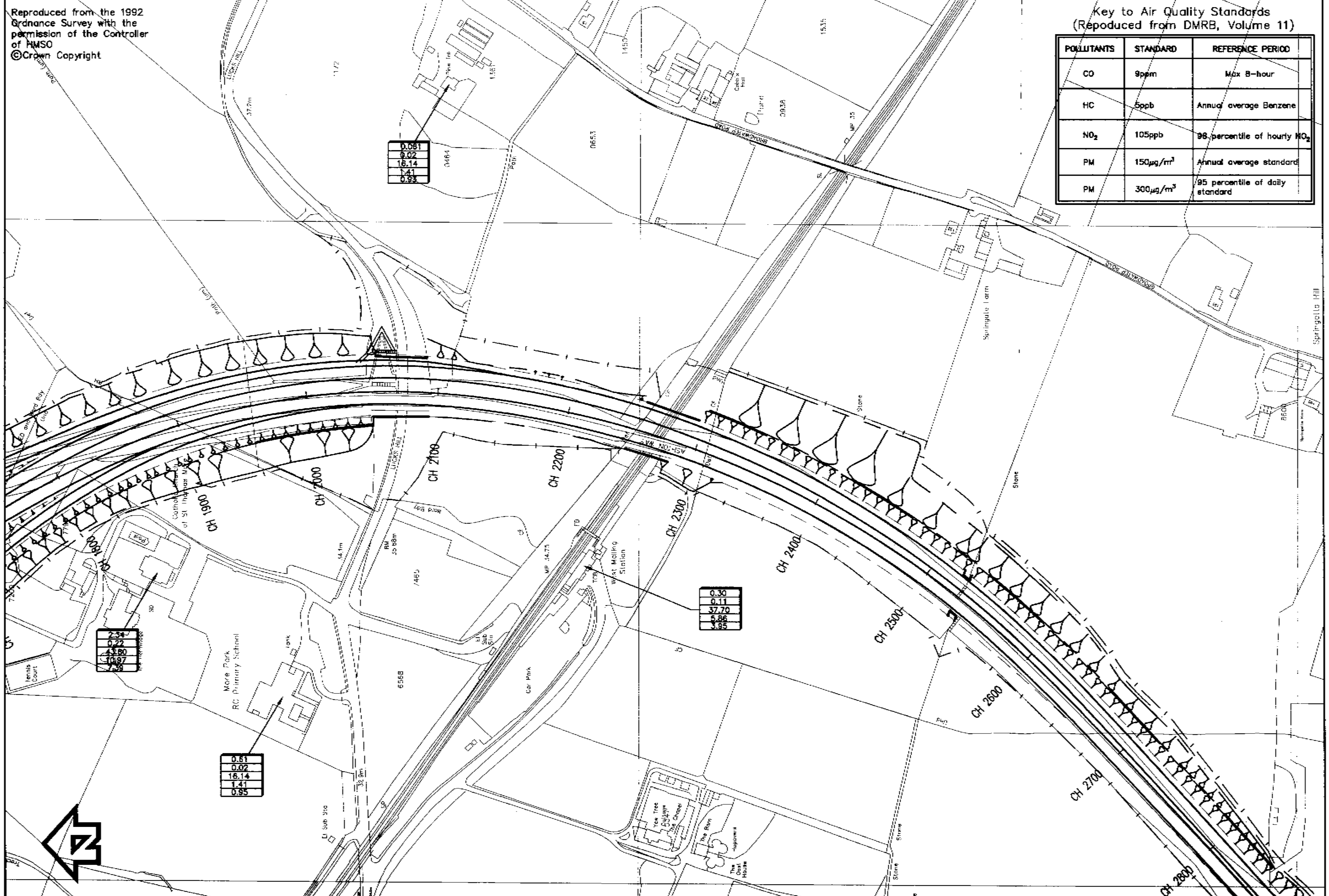

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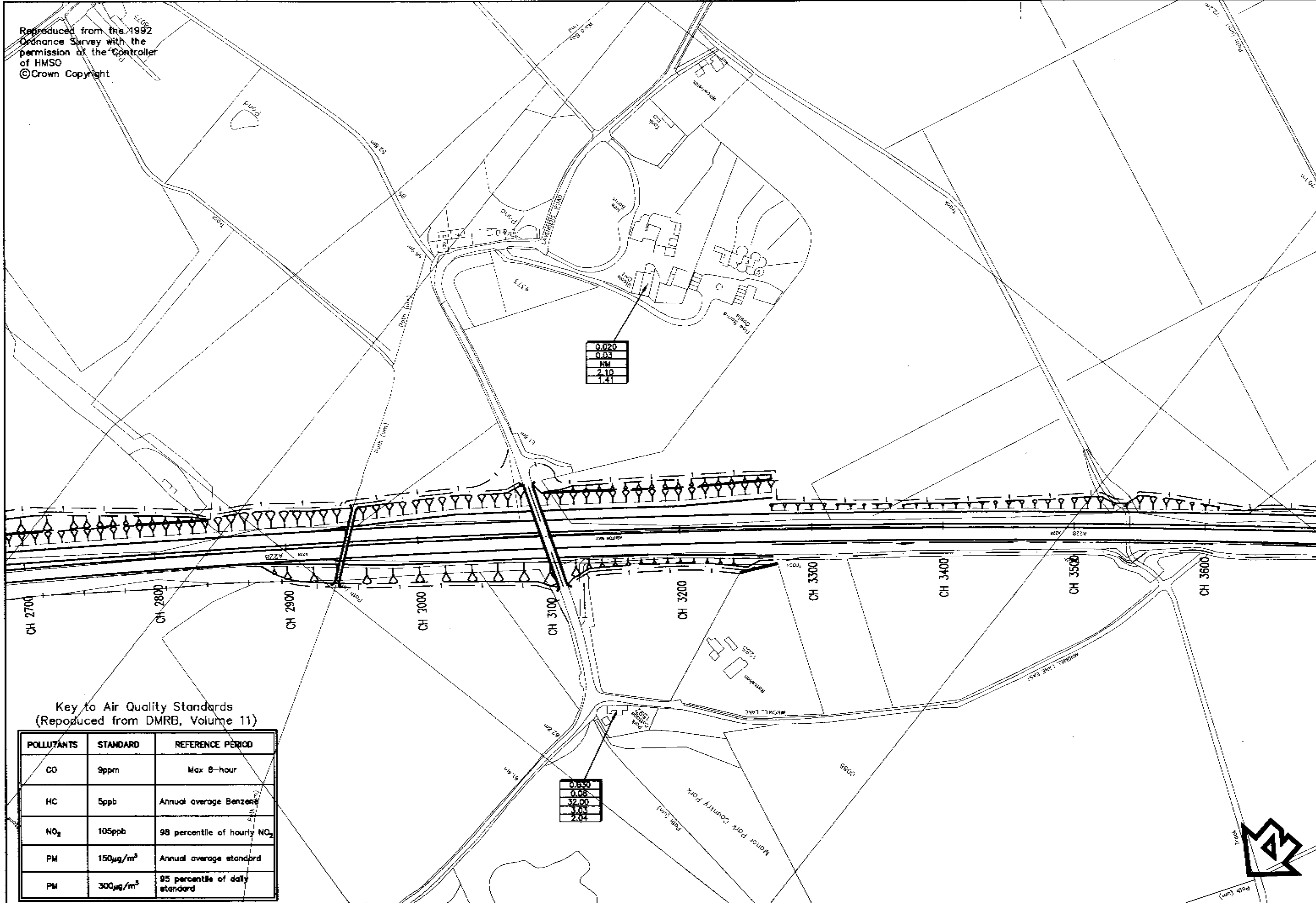

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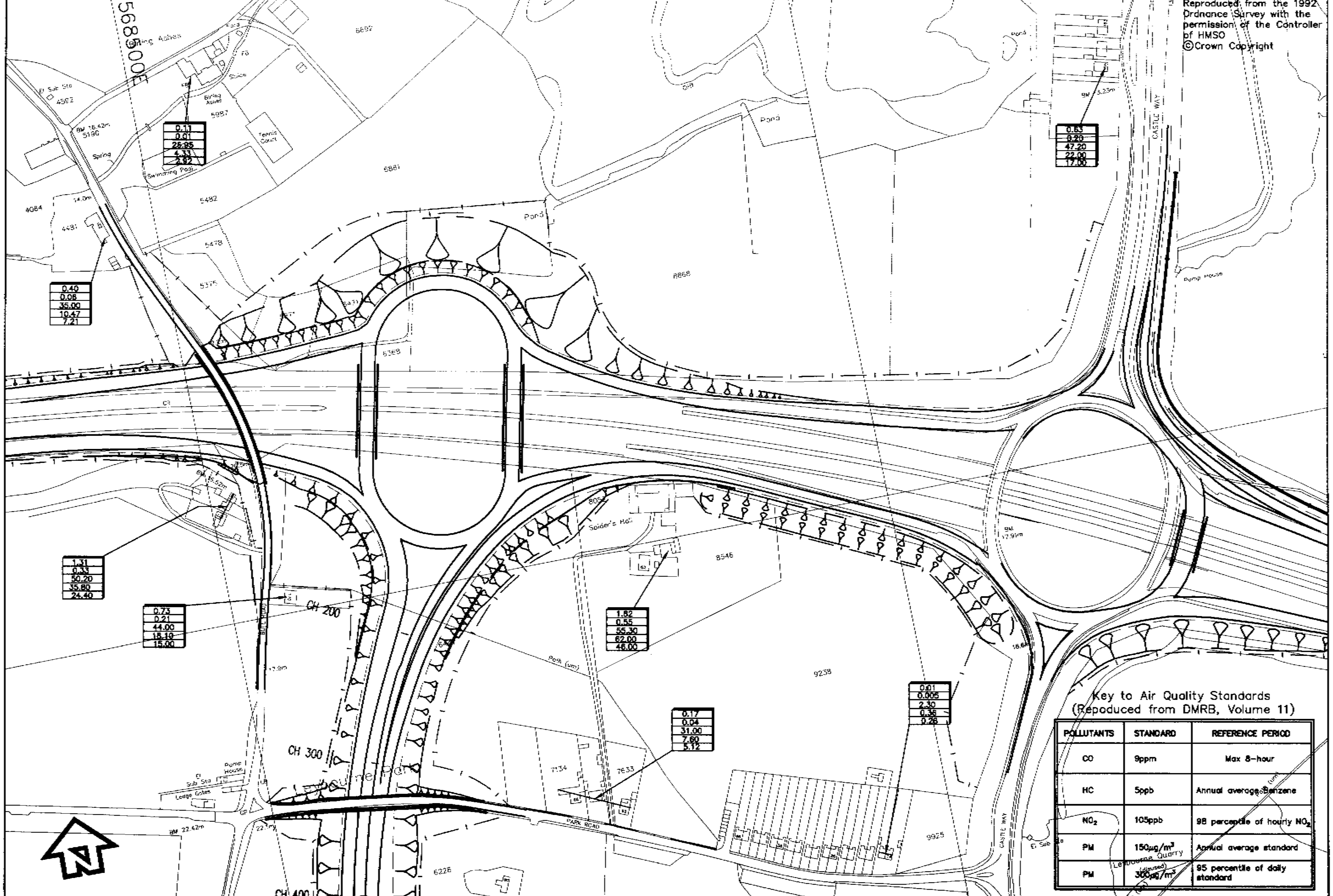

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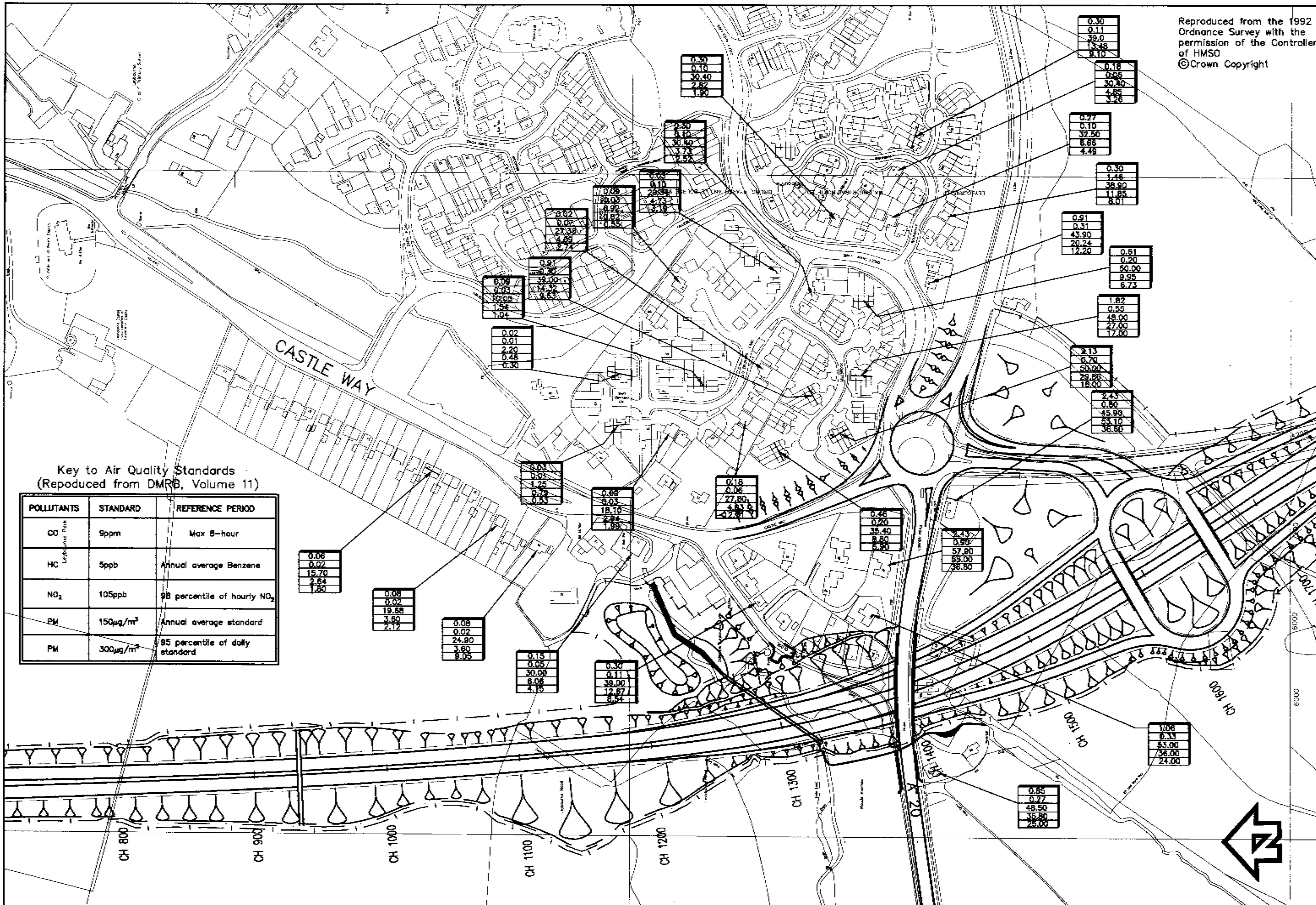

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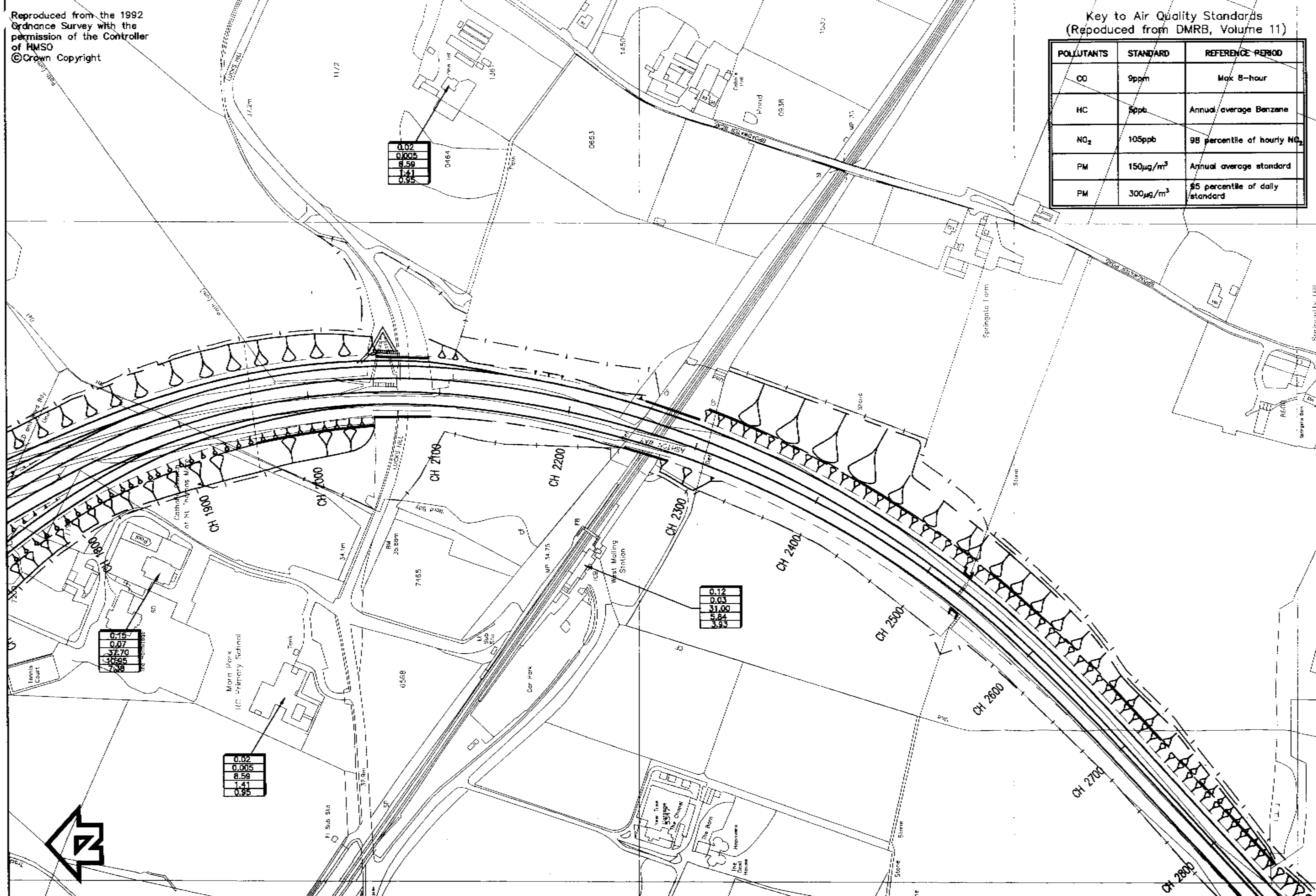

A228 LEYBOURNE AND WEST MALLING BYPASS PREDICTED AIR QUALITY CONCENTRATIONS
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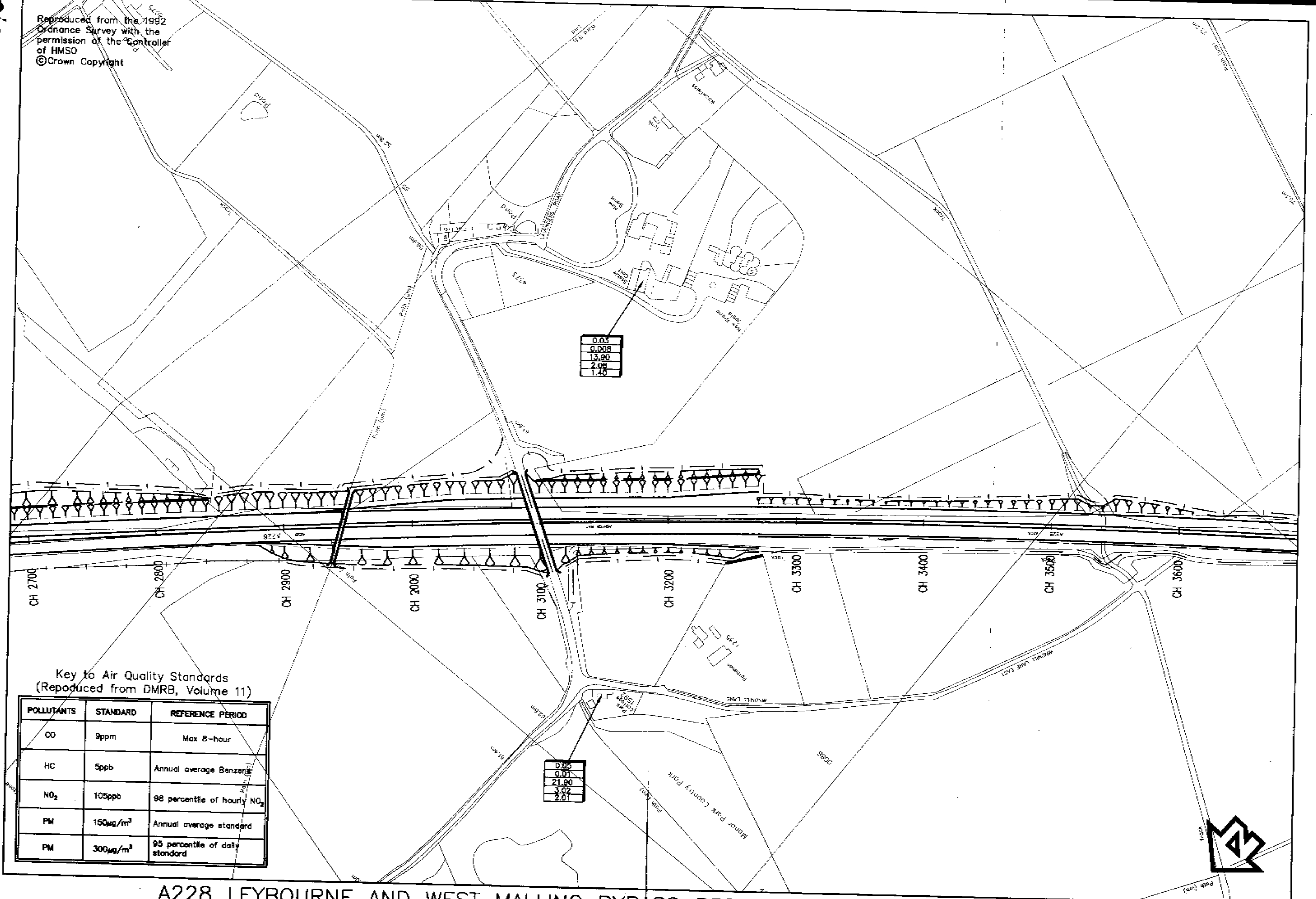

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TOLLGATE HOUSE

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ENVIRONMENT & LANDSCAPE
Environmental Statement

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A228 LEYBOURNE & WEST MALLING BYPASS – ENV. STATEMENT VOLUME 2 – AIR QUALITY ASSESSMENT 07/95

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