



Appendix H-1 - Construction Dust Assessment

Introduction

The assessment of the air quality impacts associated with onsite activities during the construction phase of the proposed Scheme follows the Institute of Air Quality Management (IAQM) (2014) 'Guidance on the assessment of dust from demolition and construction'. Individual considerations for four activities are included in the guidance: demolition, earthworks, construction and track-out. The aim of the assessment is to determine the risk of dust impacts from each construction activity to identify the level of mitigation required.

The magnitude of dust emissions is primarily determined, based on various factors followed by the sensitivity of the area(s) surrounding the construction site to specific dust impacts. The magnitude and sensitivity factors are then combined to determine the overall risk of dust impacts, and determine the level of mitigation required.

Assessment Methodology

Four construction activities have been assessed on the basis of the area sensitivity and the emission magnitude. The dust emission magnitude is based on the scale of the anticipated works and is classified as Small, Medium, or Large. Dust emissions are defined according to the scale and nature of the work for each activity, as indicated in Table 1 below.

Table 1: Quantitative determination of the magnitude of dust emissions for each of the four demolition and construction activities.

Activity	Dust Emission Magnitude
Demolition	<p><u>Large:</u> Total building volume >50,000 m³, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;</p> <p><u>Medium:</u> Total building volume 20,000 m³ – 50,000 m³, potentially dusty construction material, demolition activities 10-20 m above ground level; and</p> <p><u>Small:</u> Total building volume <20,000 m³, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.</p>
Earthworks	<p><u>Large:</u> Total site area >10,000 m², potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonnes;</p> <p><u>Medium:</u> Total site area 2,500 m² – 10,000 m², moderately, dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m - 8 m in height, total material moved 20,000 tonnes – 100,000 tonnes; and</p> <p><u>Small:</u> Total site area <2,500 m², soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <20,000 tonnes, earthworks during wetter months.</p>
Construction	<p><u>Large:</u> Total building volume >100,000 m³, on site concrete, batching, sandblasting;</p> <p><u>Medium:</u> Total building volume 25,000 m³ – 100,000 m³, potentially dusty construction material (e.g. concrete), on site concrete batching; and</p> <p><u>Small:</u> Total building volume <25,000 m³, construction material with low potential for dust release (e.g. metal cladding or timber).</p>
Track-out	<p><u>Large:</u> >50 HDV (>3.5t) outward movements in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m;</p> <p><u>Medium:</u> 10-50 HDV (>3.5t) outward movements in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m; and</p> <p><u>Small:</u> <10 HDV (>3.5t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.</p>

Source: Institute of Air Quality Management (IAQM), Guidance on the assessment of dust from demolition and construction, February 2014.



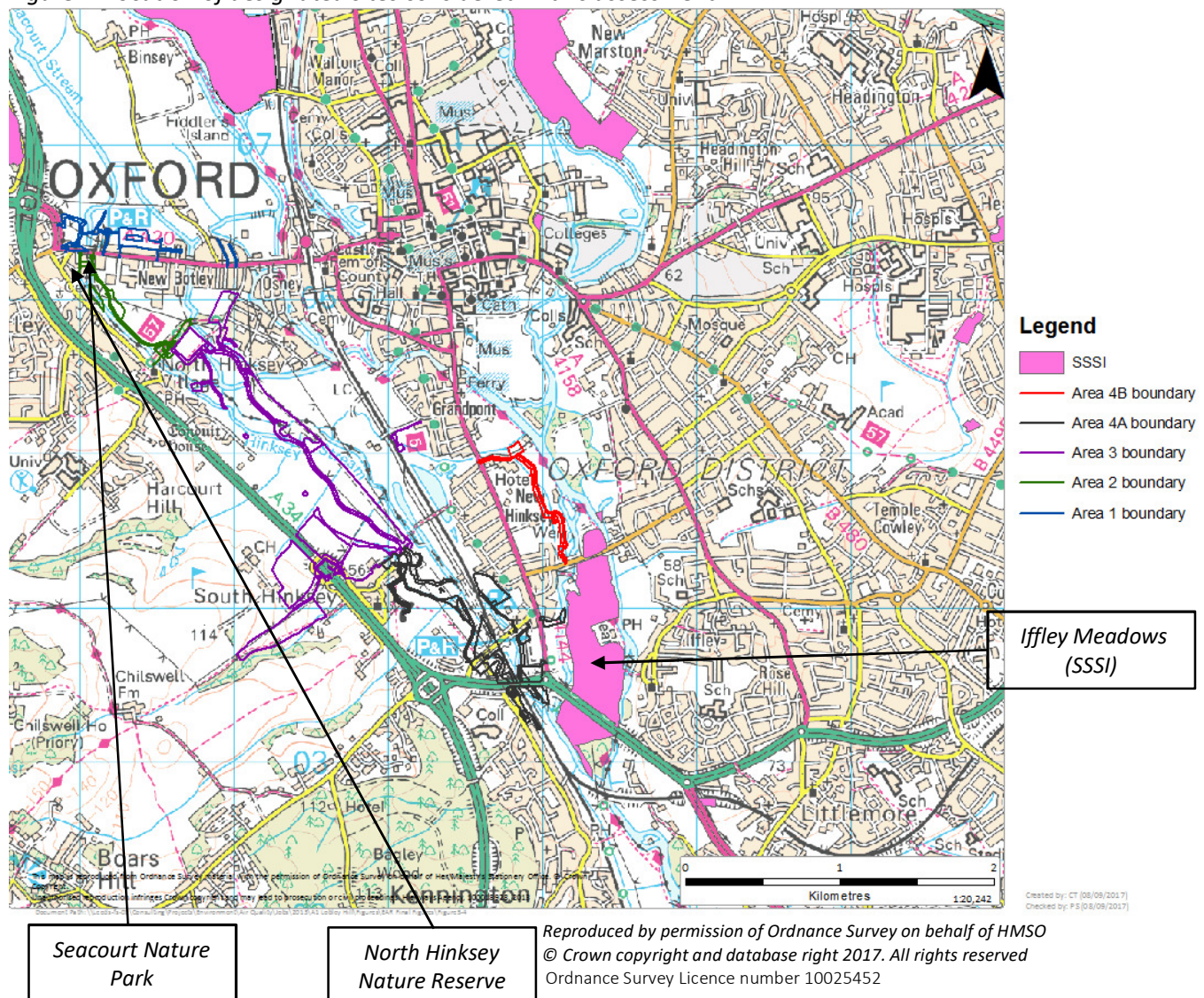
There are two types of sensitive receptors, human and ecological, that may be impacted by dust from construction activities, as defined by IAQM (2014). These are defined as, “a location that may be affected by dust emissions during demolition and construction. Human receptors include locations where people spend time and where property may be impacted by dust. Ecological receptors are habitats that might be sensitive to dust” (IAQM, 2014, pg.7).

The guidance refers to human receptors as those properties that may be subject to adverse impacts of dust or PM₁₀ over a time period relevant to the air quality objective. Specific properties include, dwellings, cultural heritage collections, food manufacturers, etc. According to IAQM (2014) a single dwelling is classified as one receptor, whereas a school counts as 100. In addition, relevant designated (ecological) sites and their sensitivity to dust impacts, have been also considered.

Construction areas have been divided into four key areas, based on a design brief document, featuring detailed descriptions of Scheme-wide activities, including Area 1 – North of Botley Road, Area 2 – Botley Road to Willow Walk North, Area 3 - Willow Walk to Devil’s Backbone, Area 4A - Devil’s Backbone to the junction with Hinksey Stream and River Thames (South Hinksey) and Area 4B - Devil’s Backbone to the junction with Hinksey Stream and River Thames (New Hinksey).

Designated sites include nature sites that have special status as protected areas because of their natural importance. In particular, Iffley Meadows (SSSI) and North Hinksey Nature Reserve have been considered in the assessment. Seacourt Nature Park, identified by Oxford City Council, located on the east bank of Seacourt Stream/Wytham Stream, south of Botley Bridge on West Way has been included as an additional ecological receptor in this assessment (Figure 1). The Seacourt Nature Park is within 50 m of construction Areas 1 and 2, and therefore could potential be impacted on, during the construction phase of the proposed Scheme.

Figure 1: Location of designated sites considered in this assessment





Receptor sensitivity is defined by a number of factors including:

- specific sensitivities of those receptors;
- number of receptors;
- proximity to construction site(s);
- background PM₁₀ concentrations; and
- site-specific factors.

The sensitivity of key receptors to each construction-related activity is determined for each of the following dust impacts:

- dust soiling;
- human health impacts; and
- impacts on ecological receptors.

The sensitivity of an area to the potential impacts of each activity is defined at various distances from the work site depending on the sensitivity and number of receptors. IAQM categorises these into several distance bands for different impacts at 20, 50, 100, 200 and 350 m. Receptor sensitivity to dust soiling is assessed for only four IAQM distance bands, whereas sensitivity to human health impacts is assessed for all five. Table 2, Table 3 and Table 4 define the levels of sensitivity of areas at different distances for each of the impacts listed above.

Table 2: Area sensitivity to the effects of dust soiling

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Source: Institute of Air Quality Management, Guidance on the assessment of dust from demolition and construction, February 2014.

The sensitivity of the area to human health impacts is determined not only by the number of receptors within various distance bands from the site, but also by background PM₁₀ concentrations.

Estimated PM₁₀ concentrations were obtained using Defra background maps for 2016 (Base Year). Background concentrations representative of future years have not been used. Instead, following a conservative approach, 2016 concentrations have been adopted to represent the background conditions at the time of the construction phase. Background concentrations were cross-referenced with local monitoring data, the closest monitoring station being Oxford St Ebbe's, located 500m north-east of the Scheme. Annual mean PM₁₀ concentrations of recorded at the monitoring station (15 µg/m³) were in line with the concentrations predicted by the Defra background maps.

Table 3: Area sensitivity to human health impacts

Receptor Sensitivity	Annual Mean PM ₁₀ Concentrations	Number of receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
High	>32 µg/m ³	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32 µg/m ³	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28 µg/m ³	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24 µg/m ³	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low



Receptor Sensitivity	Annual Mean PM ₁₀ Concentrations	Number of receptors	Distance from the Source (m)				
			<20	<50	<100	<200	<350
		1-10	Low	Low	Low	Low	Low
Medium	-	>10	High	Medium	Low	Low	Low
	-	1-10	Medium	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Source: Institute of Air Quality Management, Guidance on the assessment of dust from demolition and construction, February 2014.

Ecological impacts of construction activities are considered for designated sites within 20 and 50 m from the works following the guidance presented in Table 4. Construction and demolition impacts on designated sites may include physical changes that can affect photosynthetic processes, or chemical changes to the soil that may lead to plant loss. Impacts are often reversible after work ceases. Designated sites near the scheme have been identified and impacts considered.

Table 4: Area sensitivity to ecological impacts

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)	
		<20	<50
High	>100	High	High
	10-100	High	Medium
	1-10	Medium	Low
Medium	>1	Medium	Low
Low	>1	Low	Low

Source: Institute of Air Quality Management, Guidance on the assessment of dust from demolition and construction, February 2014.

The two parts of the construction assessment, dust emissions magnitude and area sensitivities, will be combined in order to determine the overall risk of impacts with no applied mitigation, for each construction activity within each construction area. Table 5 below provides a view of the levels considered. The level of risk determined by this table will determine the level of mitigation to be followed at the construction site.

Table 5: Risk of impacts from each activity

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
Demolition			
High	High Risk	Medium Risk	Medium Risk
Medium	High Risk	Medium Risk	Low Risk
Low	Medium Risk	Low Risk	Negligible
Earthworks			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Construction			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible
Trackout			
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

Source: Institute of Air Quality Management, Guidance on the assessment of dust from demolition and construction, February 2014.



Emissions from construction vehicles is also considered as they are a potential source of both NO₂ and PM₁₀. According to the IAQM guidance, where high numbers of vehicle movements, especially HGVs, are expected to be generated over a long period of time (i.e. one year or more) in the same location, the impact of construction phase traffic should be also considered and assessed using the same methodology described for operational impacts.

Potential effects

Construction activities related to the Scheme include the construction of flood walls, bridges, weirs and permanent vehicle access tracks. There will be extensive earth movement activities associated with the clearance of existing channels and the creation of new earth embankments. Existing features such as weirs will be demolished and replaced. The Scheme will also involve the removal of local vegetation, although tree planting will also occur throughout.

Receptor Sensitivity

The receptor sensitivity was individually assessed for each construction area, for dust soiling, human health and ecological impacts based on Table 2, Table 3 and Table 4. The sensitivity of the area to human health impacts was also defined taking into account the Defra annual average background PM₁₀ concentrations for 2016 (Base Year).

More than 100 'high' sensitivity receptors were identified within 20 m from the dust generating activities for Areas 1,3 and 4A. This is a result of the residential properties, commercial activities and schools located within proximity to the Scheme. There were no high sensitivity receptors identified within 20 m of Area 2, although there were >100 high sensitivity receptors noted within 50 m of Area 2. For Area 4B, there were high sensitivity receptors located close to the scheme, though >100 of these are located further away, within the 200 m of the Scheme.

The 2016 average Annual PM₁₀ concentrations for OCC is approximately 15 µg/m³. As reported in Table 3, for receptors of high sensitivity, where the assumed background level on PM₁₀ is below 24 µg/m³, the sensitivity of receptors for human health is defined as 'Low', except in cases when the number of receptors closer than 20 m from the source of emission is greater than 100. For receptors of medium sensitivity, regardless of the background PM₁₀ levels, if there are more than 10 receptors within 20 m of the source of emissions, the sensitivity of receptors for human health is defined as 'High'. If there are between 1-10 medium sensitivity receptors within 20 m, the sensitivity of receptors for human health is defined as 'Medium'. For receptors of a low sensitivity, the sensitivity of receptors for human health is defined as 'Low', regardless of background PM₁₀ levels or the number of receptors within each distance band.

Considering these factors, the resulting sensitivity of all construction areas (1,2,3,4A and 4B) for Human Health is defined as 'Medium'.

For dust soiling effects, the sensitivity is based solely on the number of receptors within each of the distance ranges. High sensitivity receptors include properties such dwellings, care homes, hospitals and schools. Medium sensitivity receptors include hotels, offices/places of work, supermarkets and parks. Low sensitivity receptors include playing fields, farmlands, public footpaths, car parks and roads.

There are three designated sites located in proximity to the Scheme. Table 6 provides the area sensitivities to ecological impacts from construction. The ecologically sensitive areas listed below host features that may be adversely affected by dust deposition. However, no specific dust sensitivities for habitats within this site are available and it is therefore assumed that potentially affected habitats are not highly sensitive to dust deposition.

The sensitivity of each designated site is defined in Table 6, based on the guidance from IAQM (2014).



Table 6: The estimated area sensitivity of designated sites near each Area

Receptor	Sensitivity	Distance from Site (m)	
		20	50
Area 1 – North of Botley Road			
Seacourt Nature Park	Medium	-	Low
Area 2 – Botley Road to Willow Walk North			
Seacourt Nature Park	Medium	Medium	-
North Hinksey Nature Reserve	Low	Low	Low
Area 3 – Willow Walk to Devil’s Backbone			
No Ecological features identified within 50 m of Area 3			
Area 4A – Devil’s Backbone to the junction with Hinksey Stream and River Thames (South Hinksey)			
Iffley Meadows (SSSI)	Medium	Medium	Low
Area 4B - Devil’s Backbone to the junction with Hinksey Stream and River Thames (New Hinksey)			
Iffley Meadows (SSSI)	Medium	-	Low

The highest sensitivity to construction impacts was used to determine the overall sensitivity of each area, for each of the four construction activities; as shown in Table 7. All construction areas are expected to have a high sensitivity to dust soiling and a medium sensitivity with respect to human health. Based on the proximity of the construction areas to sensitive ecological sites, Areas 1 and 4B are expected to have a low sensitivity to ecological impacts, whereas Areas 2 and 4A are expected to have a medium sensitivity. There were no ecological receptors located within 50 m of Area 3.

Table 7: Area sensitivity to impacts of each construction activity

Potential Impact	Overall Sensitivity of the potentially impacted area			
	Demolition	Earthworks	Construction	Trackout
Area 1 – North of Botley Road				
Dust Soiling	High	High	High	High
Human Health	Medium	Medium	Medium	Medium
Ecological	Low	Low	Low	Low
Area 2 – Botley Road to Willow Walk North				
Dust Soiling	High	High	High	High
Human Health	Medium	Medium	Medium	Medium
Ecological	Medium	Medium	Medium	Medium
Area 3 – Willow Walk to Devil’s Backbone				
Dust Soiling	High	High	High	High
Human Health	Medium	Medium	Medium	Medium
Ecological	N/A	N/A	N/A	N/A
Area 4A – Devil’s Backbone to the junction with Hinksey Stream and River Thames (South Hinksey)				
Dust Soiling	High	High	High	High
Human Health	Medium	Medium	Medium	Medium
Ecological	Medium	Medium	Medium	Medium
Area 4B - Devil’s Backbone to the junction with Hinksey Stream and River Thames (New Hinksey)				
Dust Soiling	High	High	High	High
Human Health	Medium	Medium	Medium	Medium
Ecological	Low	Low	Low	Low

Professional judgement has been used to determine the dust emission magnitude of each construction activity. This judgement is based on detailed descriptions of Scheme-wide activities, provided to CH2M personnel at the time of this assessment. The combination of emissions magnitude and the overall sensitivity of the area allow to classify the risk of impacts with no mitigation applied. The points below provide justification of the magnitude chosen for each construction activity.

- **Demolition** works are expected to be limited throughout of areas of the Scheme. Information on the total volumes to be demolished/removed was not available at the time of this assessment.



Dust emissions may arise from the demolition of structures and the use of HGVs. These structures include bridges and existing weirs. However, it is expected that such activities will be very minimal and the total volume of demolished material would fall below the 20,000 m³ threshold (medium). Therefore the magnitude of dust emissions resulting from demolition is expected to be small.

- **Earthworks:** There will be a significant amount of earthworks activity throughout all areas of the Scheme. The soil type is unknown, but expected to be moderately dusty. Considering the size of the Scheme, works will not occur simultaneously, in order to minimise local traffic interference. For all construction areas of the Scheme, the magnitude of dust emissions from earthworks is considered to be large.
- **Construction:** Construction activities will include construction of flood walls, bridges, weirs and permanent vehicle access tracks. The total building volume is unknown, although it has been estimated for each area of the Scheme, based on a detailed description of the Schemes activities. Areas 1, 2 and 3 are expected to consist of less than 25,000 m³, therefore the magnitude of dust emissions from construction is considered to be small. Areas 4A and 4B are expected to exceed the 25,000 m³ threshold but will fall below 100,000 m³. Therefore, the magnitude is considered to be medium.
- **Track-out:** Every stage of construction activity will include the need for HGVs to haul various materials to and from sites. Based on the Scheme's Scoping Report, the number of HGV movements to and from each area of the Scheme was determined. 459,000 m³ of material needs to be excavated of which 391,000 m³ will be moved along the highway. Based on a 440-working day construction period, site restricted to off peak periods, there will be a need to remove 890 m³ per day - equivalent to 148 m³ per hour. Given a typical three axle HGV can carry 8 m³ of material per load, this would equate to 111 HGVs per day (19 per hour) would enter/exit the site. Below is a breakdown of expected HGV movement for each area:
 - Area 1: 6.9% of HGV movements = 8 one way (16 two way)
 - Area 2: 17.7% of HGV movements = 20 one way (40 two way) (50% via Botley Road and 50% via the A34 at South Hinksey)
 - Area 3: 44.8% of HGV movements = 50 one way (100 two way)
 - Area 4A: (Devil's Backbone/Old Abingdon Road) 24.2% of HGV movements = 27 one way (54 two way)
 - Area 4B (Abingdon Road) 6.4% of HGV movements = 7 one way (14 two way)

Note that the figures above exclude worker movements to and from site and the delivery of specialist equipment.

The surface of the surrounding roads and work site access points are expected to be mostly paved, though there are some gravel access roads that will be used. Based on the 'two way' HGV movement estimations above, the magnitude of dust emissions from track-out for Areas 1,2 and 4B are considered to be medium. Areas 2 and 3 will have considerably more HGV movements per day, therefore the magnitude is considered to be large.

Table 8 provides the overall risk of dust impacts associated with each construction activity for all five areas.



Table 8: Overall risk of dust impacts from each construction activity

Potential Impact	Overall Risk of Dust Impacts			
	Demolition	Earthworks	Construction	Trackout
Area 1 – North of Botley Road				
Dust Soiling	Medium Risk	High Risk	Low Risk	Medium Risk
Human Health	Low Risk	Medium Risk	Low Risk	Low Risk
Ecological	Low Risk	Medium Risk	Low Risk	Low Risk
Area 2 – Botley Road to Willow Walk North				
Dust Soiling	Medium Risk	Low Risk	Low Risk	Medium Risk
Human Health	Low Risk	Medium Risk	Low Risk	Low Risk
Ecological	Low Risk	Medium Risk	Low Risk	Low Risk
Area 3 – Willow Walk to Devil's Backbone				
Dust Soiling	Medium Risk	High Risk	Low Risk	High Risk
Human Health	Low Risk	Medium Risk	Low Risk	Medium Risk
Ecological	Negligible	Negligible	Negligible	Negligible
Area 4A – Devil's Backbone to the junction with Hinksey Stream and River Thames (South Hinksey)				
Dust Soiling	Medium Risk	High Risk	Medium Risk	High Risk
Human Health	Low Risk	Medium Risk	Medium Risk	Medium Risk
Ecological	Low Risk	Medium Risk	Medium Risk	Medium Risk
Area 4B - Devil's Backbone to the junction with Hinksey Stream and River Thames (New Hinksey)				
Dust Soiling	Medium Risk	High Risk	Medium Risk	Medium Risk
Human Health	Low Risk	Medium Risk	Medium Risk	Low Risk
Ecological	Negligible	Low Risk	Low Risk	Low Risk

Emissions from HGVs

The construction of the Scheme may also affect air quality due to tailpipe emissions from HGVs. According to the IAQM guidance, where high numbers of vehicle movements are expected to be generated over a long period of time (i.e. one year or more) in the same location, the impact of construction phase traffic should be considered. The assessment should be carried out using the same methodology described for operational impacts. A detailed description of the methodology for the screening analysis of HGV movement is presented within the body of the report (13.2.2).

Overall Impact from Construction activities

Following IAQM guidance for the assessment of impacts associated with the different construction phases of the Scheme, the significance of impacts is considered to be Medium to Negligible during Demolition, High to Low during Earthworks, Medium to Low during Construction and High to Low during Trackout.

Although multiple receptors were identified within proximity of the Scheme construction areas, assuming best practice and standard dust mitigation measures are put in place prior to the commencement and during the construction phase, short-term impacts can be avoided, and no residual effect is anticipated from the temporary construction works. In terms of traffic during the construction phase, residual effects are considered as not significant as there are no exceedances directly linked to the Scheme.

Suitable mitigation measures for both onsite activities and traffic is presented within the body of the main report (13.3).