FACT SHEET ON WESTERN SYDNEY AIRPORT – AIR QUALITY & EMISSIONS

Air Quality and Emissions

Executive Summary

The approach to study air quality in the EIS conforms to the bare basic requirements of an air quality study and is found to be inadequate for a project of such a magnitude. The estimates are overly focused on deriving emissions of the airport itself, rather the more important holistic approach that considers sustainable living in the area and the Sydney Basin in general.

The Sydney Basin in itself is prone to poor air quality and the development in and around the airport will amplify this effect.

Perhaps the "elephant in the room" is the fact that the EIS studies future scenarios of air quality using present day meteorological conditions. Given observed local and global warming trends, these assumptions are utterly invalid. Indeed studies that rely on regionally downscaled future scenarios portray a different, more severe, picture.

The EIS does not attempt to quantify uncertainties associated with air quality. We note that uncertainties in future changes in precipitation are likely to have severe impacts on air quality in the basin as well as the susceptibility of fires in the Blue Mountains National Park.

1. Meteorological Basis

1.1 The Sydney Basin

Sydney is located in a geographic basin with the very clearly demonstrated characteristic of retaining air pollutants generated within that basin. Exhaust emissions from motor vehicles have been shown to be the primary contributor to air pollution within the Sydney basin.

The governing sea-breeze regimes, along with the blocking effect of the mountains are key factors that amplify air pollution. Indeed, daytime pollution tends to flush westwards making ambient air in Western and Southwestern Sydney, the regions within the basin with the poorest air quality year after year. These depend on precipitation and other mechanisms to be driven away from the basin.

Air pollution in the basin is also governed by heat waves and temperature inversions close to the surface. That is, the increase of temperature with altitude which acts as a seal trapping pollution.

Air quality in the basin, and in general, is defined by two key measures- primary emissions and chemical reactions. Primary emissions refer to emissions such as car emissions and ozone, which generally arrive from a single source. Secondary chemical reactions refer to mixing of air pollution from different sources, which may create new chemical substances with varying degrees of toxicities.

For example, sea salt may mix with car emissions and serve as a carrier of car emissions. Another example is forest aerosols that may interact with industrial emissions - yet another governing factor of air quality in the west.

1.2 Badgerys Creek (airport location)

Key finding:
Even without the airport, Badgerys Creek and surrounding suburbs face serious meteorological and climatological challenges, with vast implications to humans and the environment.

The proposed airport location at Badgerys Creek is among the hottest and most polluted spots in the Sydney Basin. Proposed development around the airport, including airport facilities, tarmac and transportation, and associated emissions will amplify this feature.

The site is also subjected to frequent fog events throughout most of the year as seen in the figures below. The EIS states that:

> *"fog occurs approximately 30 times more often at Badgerys Creek than at Sydney KSA"* (WSA Draft EIS Vol4 Appendix D, 2015, p. 33)

Figure 1. Monthly Bar Graph of Number of Days with Visibility<1000m at Camden Airport

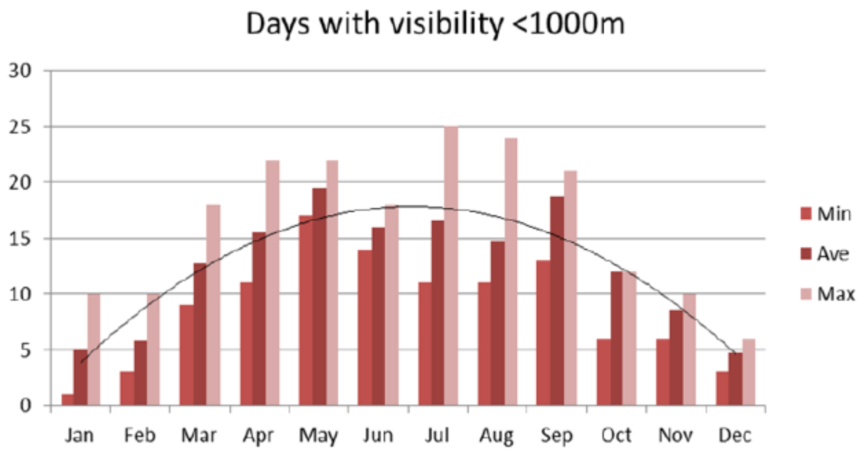
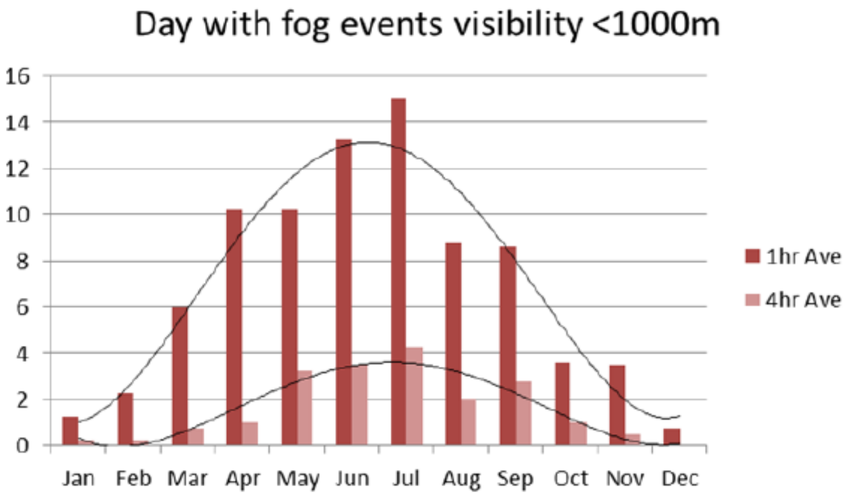


Figure 2. Monthly bar graph of number of days with Fog Events at Camden Airport



(Bureau of Meteorology, 2015)

We note that that fog was never measured at the proposed airport location. The EIS relies on measurement taken at Camden airport. The document states that:

> *"senior meteorologists experienced in forecasting for the Sydney Basin suggest that fog at Badgerys Creek is likely to occur more often than fog at Camden Airport. However without adequate instrumentation it is impossible to confirm the frequency of fog at Badgerys Creek."* (WSA Draft EIS Vol4 Appendix D, 2015, p. P36)

In about half of the year, significant one hour fog events at Camden Airport occur in about 15 days a month. Likewise, 1-4 hour fog events occur in about 5 days every month.

The EIS states that fog will not cause issues for landings in Badgerys Creek. However, the author notes that closures due to fog occur on a yearly basis in KSA. For example,

- SMH: "Surprise fog creates delays at Sydney Airport" (Kembrey, 2014).
- SMH: "Dense fog covers Sydney, flights delayed" (Lucy Cormak, 2014).
- Daily Telegraph: "Ground fog day as mist rolls into Sydney for third consecutive day" (Nicole Cridland, 2013).

In fact, given the future added human activity in the area, visibility in the region is likely to deteriorate. Thus, given the above statistics, it is valid to assume that airport closures due to fog are likely to occur in WSA 30 times more compared to KSA.

The question, in this case, is: Where the planes would go in a 1-4 hour fog event? In other words, does a no curfew airport in WSA mean no curfew, at all, in the Sydney Basin?

The EIS is also dismissive of fog as a risk factor, noting that automatic instruments should be installed to collect more data in the meantime and recommends the use of Runway Visual Range system (RVR) for assistance in landing in low visibility and fog.

However, there are contingencies here that have not been addressed. Most airports use the ILS system and in order to use the RVR, the pilot has to have valid certification, the necessary equipment must be on board and the RVR must be above the specified thresholds for the plane that is landing. (Development, 2015)

This is especially relevant considering that the only viable final approach to the airport that is considered includes a 270 degrees turn at a low altitude over the Warragamba dam and other sensitive facilities of national significance.

1.3 The Lower Blue Mountains, Blaxland and the Proposed Flight Path

Key finding:
Blaxland and the lower Blue Mountains are prone to nocturnal temperature inversions, associated with extreme air pollution. Air quality and emissions associated with the flight path are not detailed in the EIS. Alternate flight paths and associated air quality are excluded altogether from the EIS.

The implications of the flight path and its merge point over Blaxland and the Blue Mountains National Park south of Glenbrook are noted in the EIS in a very dismissive manner. The EIS does not detail the flight path and derived air quality. There are no details of meteorological conditions of the lower Blue Mountains and long term effects of these are not studied at all. Known trends and climatological context is of course omitted.

The author notes that the EIS does not consider alternative flight paths and associated impacts (in this context air quality and emission scenarios). This is of particular importance in places where prevailing temperature inversions exist and where the flight altitude is well within the surface boundary layer (as is the case in the lower Blue Mountains).

Nocturnal temperature inversions occur in Blaxland and in the lower Blue Mountains in general, as frequently as 15 days a month.

This is attributed to the fact that the temperature above the plains below cools down faster than the surface slopes of the mountains. It is a well-established fact that temperature inversions close to the surface are associated with severe pollution events. This is a key mechanism driving severe pollution events in the Sydney basin and, in this case, the lower Blue Mountains.

Furthermore, during daytime, the planned merge-point occurs at an altitude that is close enough to the surface to attract small yet cumulative amounts of pollution - much like a power station stack. Despite the differences in height, the analogy to a power station stack is indeed valid, since at night time the atmospheric layer close to the surface contracts from up to 6000 feet down to as low as 100 feet. Combined with poor ventilation, due to nocturnal temperature inversion, this effect will act as a focal lens of pollution over the lower mountains. Yet, as opposed to a power station stack or a major road, the spread of the emissions in this case will be far greater.

Future climatological trends of the Blue Mountains suggest that the region faces serious challenges. The author suggests that a key proxy to model these events is the forest fire danger index (FFDI), which combines temperature, precipitation and forest fuel load. Future projections of FFDI are available at AdaptNSW. (Metro SydneyClimate Change Downloads)

2. Regional Air Quality

We note that there is no mention in the text of a peer review process that would validate the methods and the adequacy of the approach for a project of such a magnitude.

2.1 General comments about the approach

The approach included primary emissions: nitrogen oxides (NOx), volatile organic compounds (VOCs) and carbon monoxide (CO). Secondary emissions include the impacts of ozone alone and from stationary sources (primary emissions of precursor gases).

We note that there is no mention of secondary organic aerosols. This is especially important given the proximity to the national park and the fact that the bulk of the current pollution in Badgerys Creek arrives from non-local sources. Aerosols from industrial and natural sources are likely to mix and generate a chain of chemical reactions with varying levels of toxicities. The proximity of the airport to natural sources as well as future development plans for the area around the airport suggests that this may be substantial.

2.2 Emissions scenarios, trends and climate change

Key finding:

Air quality in the EIS relies on present climate conditions and does not take into account known regional and global warming trends, and uncertainties in precipitation changes. Indeed the future climate of the region is likely to exhibit substantial increase in the frequency and duration of temperature inversions (associated with extreme pollution events).

According to the EIS, during summer months, Sydney has, in eight of the last ten years exceeded the standard for levels of both 1hr and 4hr ozone production. That means that the Sydney regional air quality already fails to meet the standard for production of ground level ozone. (WSA Draft EIS AppendixF2, 2015)

The emission scenarios do not take into account regional and global trends. That is, known warming of Sydney's west and climate change in general. Future scenarios such as the ones listed in

(AdaptNSW) must be factored in (NSW Department of Environment and Heritage). This must include uncertainties concerning precipitation changes (a primary mechanism that modulates pollution in the basin).

In particular, we note that the models used to produce meteorological observations (i.e. TAPM) were forced with present day observations. This is true for future scenarios of stage 1 and long term development of the airport. Arguably, this is a misleading approach. The study should have used a data such as the AdaptNSW NARCliM data set, which samples the uncertainty of future changes due to climate change (The NSW and ACT Regional Climate Modelling (NARCliM) Project, 2011).

For example, Ji et al. (2015) show that

> *``there is substantial increase in frequency and duration of temperature inversions and a decrease in the intensity of the temperature inversion for most simulations for Southeast Australia. The largest differences between simulations were associated with the driving GCMs, suggesting that the large scale circulation plays a dominant role in forming and sustaining low level temperature inversions. ``*

Recent research overseas has identified ozone exposure as harmful to human health (U.S. Environmental Protection Agency Integrated Science Assessment for Ozone and Related Photochemical Oxidants, 2013. EPA/600/R-10/076F., 2013) There is a cause for concern with regard to the effects of climate change and the expected increase in ozone emissions connected with WSA.

Figure 3. Impacts of Ozone Exposure on Human Health

EPA Concludes Ozone Pollution Poses Serious Health Threats

•Causes respiratory harm (e.g. worsened asthma, worsened COPD, inflammation)

•Likely to cause early death (both short-term and long-term exposure)

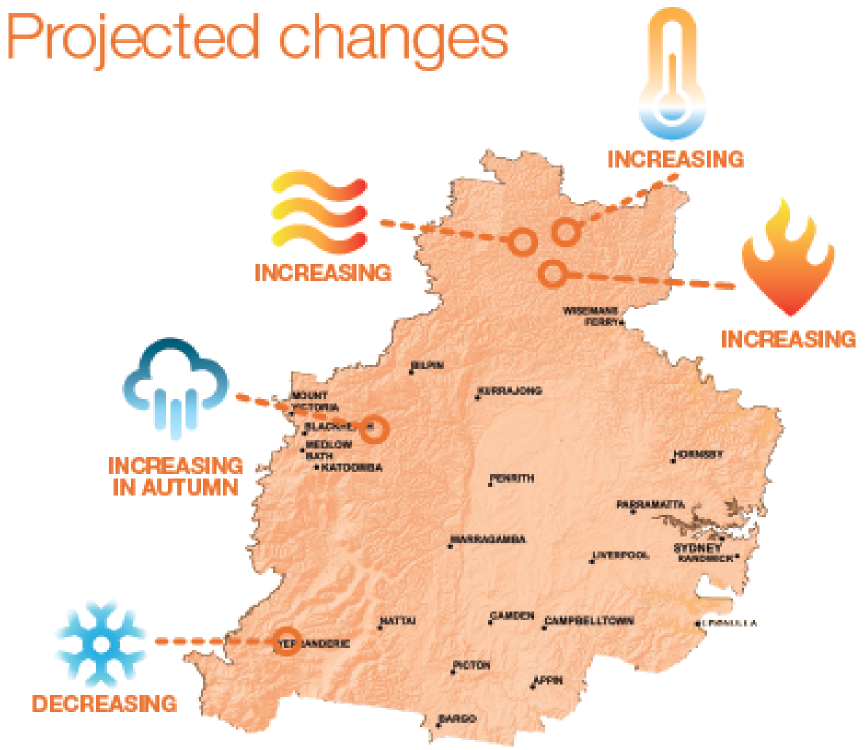
•Likely to cause cardiovascular harm (e.g. heart attacks, strokes, heart disease and congestive heart failure)

•May cause harm to the central nervous system

•May cause reproductive and developmental harm

Even with the omission of regional and global trends, the EIS identify exceedances in ozone in the first stage of operations of the airport. To this end, it is unclear to me if the EIS factored in the fact that the area surrounding the airport is designated for accelerated development. In any case, the analysis needs to place an emphasis on the holistic approach, rather than consider the impacts of the airport alone. In other words, it should answer the question; *"Will the area be suitable for humans to live in in 2080?"* This question is especially important for the long term operation of the airport, which was not studied in depth. (Ji et al, 2015)

Figure 4. Overview of Metropolitan Sydney Region climate change



Projected temperature changes	
Maximum temperatures are projected to increase in the near future by 0.3–1.0°C	Maximum temperatures are projected to increase in the far future by 1.6–2.5°C
Minimum temperatures are projected to increase in the near future by 0.4–0.8°C	Minimum temperatures are projected to increase in the far future by 1.4–2.5°C
The number of hot days will increase	The number of cold nights will decrease
Projected rainfall changes	
Rainfall is projected to decrease in spring and winter	Rainfall is projected to increase in summer and autumn
Projected Forest Fire Danger Index (FFDI) changes	
Average fire weather is projected to increase in spring by 2070	Severe fire weather days are projected to increase in summer and spring by 2070

(Office of the Environment and Heritage, 2014)

2.3 Trends in Background Ozone

(Adopted from BMCC WSA EIS submission)

Key finding:

Even without taking into account regional trends and climate change, as was done in the EIS; the EIS miscalculates regional trends of ozone concentrations.

The following text is from the NSW Environment, Climate Change and Water document entitled:

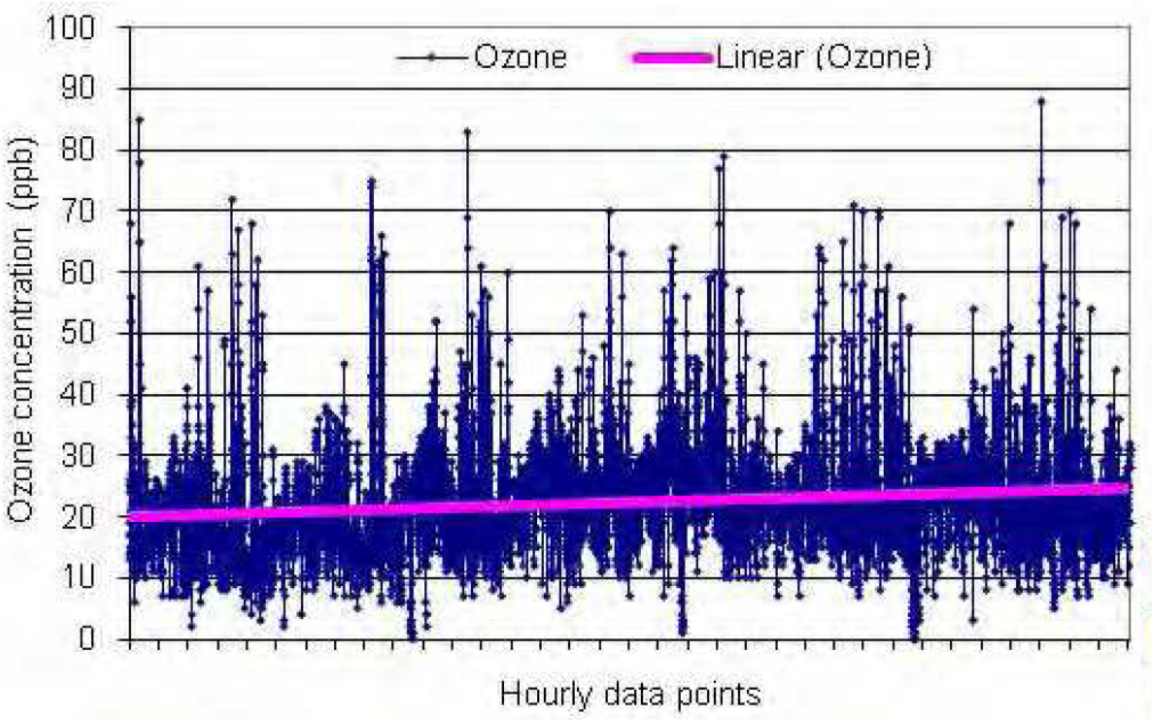
"Current air quality in New South Wales - A technical paper supporting the Clean Air Forum 2010"

Duc and Azzi (2009) have examined the trend in background ozone concentration, defining 'background ozone' as ozone occurring without photochemical production. They determined that no photochemical production is occurring if nitrogen dioxide concentration is zero for two consecutive hours. This led to using ambient ozone concentrations overnight, from 7 pm to 8 am.

Their analysis shows there is a clear upward trend in the period 1998 to 2005 for nearly all monitoring sites in Sydney.

Figure 5 shows this trend for one site in western Sydney. An upward trend in surface ozone concentration has also been reported for the United States (P GSimmonds, R G Derwent, A.L. Manning, G. Spain, 2004) and Europe Jaffe and Ray suggest increasing global emissions as one possible explanation for these observed trends. (D. Jaffe, J. Ray, 2007)

Figure 5. Upward Trend for Surface Ozone



An upward trend in background ozone increases the difficulty for a single jurisdiction to take effective action to meet its air quality standards.

Duc and Azzi (2004) also found this statistic varies within the Sydney Basin, being lowest at sites in the south-west, slightly higher at sites in the north-west and highest for sites in the east of the region.

The median concentrations varied from 15 to 21 ppb.

3. Greenhouse Gas Emissions

3.1 Emissions estimates in the EIS

The EIS provides predicted levels of greenhouse gas emissions from four sources in relation to the airport's Stage 1 operations:

- Scope 1: direct emissions from those sources controlled and owned by the airport (Western Sydney Airport Draft Environmental Impact Statement, Vol. 2 Stage 1 Development [EIS Vol. 2], p. 112, 2015).
- Scope 2: indirect emissions produced during generation of energy bought by the airport (EIS, Vol. 2, p. 112).
- Scope 3: emissions produced by activities performed by entities other than those controlled or owned by the airport, which occur as a result of the airport, such as aircraft flights (EIS Vol. 2, p. 112).
- Construction emission estimates (EIS Vol. 2, p. 160).

Predicted annual emissions according to the EIS Vol. 2 (pp. 160-61) are as follows:

- Scope 1 (excluding Construction): 0.022,483,300 Mt CO2-e.
- Scope 2: 0.106,977 Mt CO2-e.
- Scope 3: 2.524,504 Mt CO2-e.
- Construction: 0.071,851 Mt C02-e.

3.2 Gaps

The problem with this approach is that the only Scope 3 emissions calculated are those resulting from the use of 'in flight aviation fuel' for the complete flight of departing planes (EIS Vol. 2, p. 161). A reason put forward is concerns about the double counting of emissions according to international protocols, but this concern seems unnecessary when the document is primarily designed to provide information to members of the Australian public who will be affected by the airport, not international calculations of emissions. Scope 3 emissions should not be limited in this way because it limits the ability of the public to examine the full impact of the emissions. It is recommended that Scope 3 emissions should be recalculated to include emissions from:

1. Arriving planes: emissions from the complete flight.
2. Jet fuel owned by airlines.
3. Privately owned vehicles which travel to the airport and back again.
4. Taxis.
5. Business travel by employees.
6. Cargo trucks.
7. Waste disposal performed offsite.
8. Public transport providing transportation to the airport and back again (Western Sydney Airport EIS – Local Air Quality and Greenhouse Gas [EIS LAQGG], p 40, 2015).

Longer term development Stage estimation of CO_2 emissions gives a more accurate picture of the impact the airport could have on greenhouse gas emissions in Australia because it look at the emissions during the Longer Term Development Stage in 2063. These Longer Term Development Stage emissions according to the EIS LAQGG (pp. 103-4) are:

- Scope 1 and 2 (excluding Construction): 0.816,430 Mt $C0_2$-e.
- Scope 3: 20.570,033 Mt $C0_2$-e.
- Construction: 0.357,676 Mt $C0_2$-e

To put this in context the total NSW emissions for reference year 2011-12 was 154.7 Mt CO_2-e and the Longer Term Development Stage emissions from the airport will increase this by 21.7 Mt $C0_2$-e annually by 2063 according to the EIS figures - if you included arriving plane emissions it could increase by a further 20.570,033 Mt CO_2-e (EIS LAQGG, p. 105). That is about 42.2 Mt CO_2-e added annually to worldwide carbon emissions due to the airport and represents almost 10% our 2030 emissions target, which is 441-453 Mt CO_2-e.

4. General Comments

4.1 Neutral or Beneficial Test

When developing land within the Sydney Drinking Water catchments, developers are required to pass a 'Neutral or Beneficial Effect' test on water quality. In short, if a development is to be approved, it must either not degrade water quality, or improve it.

A similar test should now be applied to all Federal Government projects in terms of Air Quality Effect.

The Federal Government should not be proposing, building or authorising any project that will degrade Air Quality, for citizens or for wildlife, either locally or globally. The recent Paris Climate Change Agreement requires us to reduce our net emissions of Greenhouse Gases to zero by 2050.

An Airport that produces 21 million tonnes of Greenhouse Gases cannot be allowed under this agreement.

4.2 Cumulative effects

Air quality in the EIS considers the major pollution sources only. While adequate in itself, such a minimalistic approach is not suitable for a project of this magnitude. This is especially true for aerosols that are undetected on a sub year basis but accumulate over time.

For example, it is a well-known fact that some suburbs in the Sydney basin have soil lead levels that match Broken Hill. This type of pollution is extremely hard to ameliorate. The main source of the lead in the soil is lead petrol from nearby traffic that accumulated over time and is still a problem despite lead additives in petrol being phased out about 30 years ago.

In the case of WSA, we note that these types of emissions will be directly introduced to Sydney's water supply as well as the Blue Mountains National Park.

Recommendations

- Clearly an airport in Sydney West will be a poor choice in terms of air quality.
- The EIS should repeat its estimate using meteorological conditions taken from the 12 scenarios and future periods described in the AdaptNSW, NARCliM dataset.
- Secondary organic aerosols aside from ozone must be studied, as well as cumulative emissions of constituents such as lead.
- The long term effects and emissions associated with the flight path must be detailed.
- Alternative flight paths and associated pollution must be detailed (it is unlikely that an airport of this magnitude will have a single viable flight path).

Acknowledgements

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