Application Number 20161066
Land Adjacent to Hall Lane and School Road, Drayton
Development of up to 250 Homes, Allotments, Access, Public Open
Space and Associated Infrastructure (Outline)

BIRD HAZARD RISK ASSESSMENT AND BIRD HAZARD
MANAGEMENT PLAN

February 2017

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Additional
Information

BROADLAND
DISTRICT COUNCIL
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PLANNING CONTROL
# Table of Contents

Executive Summary.................................................................................................................. 2  
Introduction............................................................................................................................. 3  
  1. Airfield Wildlife Management Ltd (AWM) ....................................................................... 3  
  2. Background ....................................................................................................................... 3  
  3. Aerodrome Safeguarding Requirements ......................................................................... 4  
Bird Hazard Risk Assessment ............................................................................................... 6  
  4. Outline ............................................................................................................................. 6  
  5. Site Location .................................................................................................................... 7  
  6. Pre and Post-Development Bird Populations Within the Development Site Boundary .......... 8  
    6.1 Farmland Birds ......................................................................................................... 8  
    6.2 Woodland and Hedgerow Birds ................................................................................. 9  
    6.3 Water Birds ............................................................................................................ 9  
    6.4 Seasonality ............................................................................................................. 10  
    6.5 Numbers ................................................................................................................ 10  
  7. Bird Hazard Risk Assessment - Summary .................................................................... 11  
Bird Hazard Management Plan ............................................................................................ 12  
  8. Basis ............................................................................................................................... 12  
  9. Definition ....................................................................................................................... 12  
  10. Objective ..................................................................................................................... 12  
  11. Proposed Mitigation and Monitoring Measures ............................................................ 13  
  12. Waterfowl – Mitigation Measures (General) ................................................................ 13  
    Design............................................................................................................................. 14  
    Mitigation of Feeding Opportunities ............................................................................. 15  
    Mitigation of Nesting Opportunities ............................................................................. 15  
    Mitigation of Security .................................................................................................. 15  
  14. Means of Compliance ................................................................................................... 15  
    Targets: ....................................................................................................................... 15  
    Monitoring: ............................................................................................................... 15  
    Oversight: ................................................................................................................... 16  
    Dispute and Conflict Resolution: ............................................................................. 16  
  15. Conclusion .................................................................................................................... 16  

Appendix 1. Analysis of the Attenuation Basin Design and Performance by Kingdom TP .............. 17  

References............................................................................................................................. 20
Executive Summary

This bird hazard risk assessment and management plan is largely desk-based but is supplemented by a site visit, historical local knowledge of the area and involvement in the risk assessment and consequent design input into the Norwich Northern Distributor Road project (and particularly that development’s flood attenuation features) by the report’s author. This report examines any likely or possible changes in bird numbers, distribution and movements that could result from the proposed development and how these changes could affect the birdstrike hazard to aircraft operating at Norwich Airport. The second half of the report – the Bird Hazard Management Plan – describes the design features and additional mitigation measures that will be implemented to reduce any identified additional birdstrike risk to levels that are as low as is reasonably practicable. This report takes a cautious approach throughout and the aim is to deliver a scheme where Norwich Airport can be confident that there will be no measurable increase in the local birdstrike risk as a result of the proposed development.

The proposed development involves the creation up to 250 new homes on a site that is currently arable farmland on the edge of the village of Drayton. The site is less than 2.5km west of Norwich Airport and so is well within the airport’s 13km safeguarding consultation zone (measured from the Aerodrome Reference Point or ARP) for developments that have the potential to influence local bird or other wildlife hazards to aviation. Norwich Airport has objected to the application on the basis that the proposed attenuation basin on the south eastern boundary of the development site may have the potential to attract hazardous birds into a critical location. Norwich Airport have asked the Applicant, Drayton Farms Ltd., to produce a Bird Hazard Risk Assessment (BHRA) and a Bird Hazard Management/mitigation Plan (BHMP) to address these concerns, and AWM (Airfield Wildlife Management Ltd) has been engaged to carry out this work.

The BHMP addresses the identified potential risks associated with the proposed attenuation basin that were identified in the BHRA and proposes design, maintenance and monitoring systems to ensure that the development will have no adverse impact on the birdstrike risk to aircraft operating at and in the vicinity of Norwich Airport.
Introduction

1. **Airfield Wildlife Management Ltd (AWM)**

AWM was established in 1985 to offer wildlife management services to the aviation industry, including military aerodromes, civil airports, airlines and aircraft manufacturers in the UK and overseas. Since the company’s creation we have been engaged as contractors and consultants by the Royal Air Force, many UK airports (including the UK’s largest airport operating companies) and to regulators such as the UK Civil Aviation Authority (including the creation and amendment of policy documents). Planning and safeguarding advice to minimise birdstrike hazards is one of the core services that we provide, formerly under contract to the CAA and latterly as consultants to airports and planning applicants. The author of this report has an unmatched length and breadth of experience in this specialised field.

2. **Background**

A birdstrike is a collision between one or more birds and an aircraft, and more than 1,500 such incidents are currently reported involving civil aircraft each year in the UK. Although the vast majority of these incidents cause little or no damage to the aircraft involved, birdstrikes can on occasion cause serious damage to aircraft and the likely costs to the aviation industry in the UK runs into the tens of millions of pounds annually. On rare occasions birdstrikes have caused serious accidents and more than 200 civilian lives have been lost as a result of birdstrikes. Only three birdstrike related civil aircraft accidents that have occurred in the UK but one was at Norwich Airport (in 1973) when a Dassault Falcon 20 lost power to both engines after striking a flock of gulls on take-off. The crew were forced to make a crash landing in a field, but fortunately although the three crew of the aircraft were injured the passengers were unhurt.

There is particular concern about birdstrikes involving large birds such as geese (and this concern pre-dates the Airbus A320 accident at New York La Guardia Airport in January 2009 where the aircraft crash landed in the Hudson River). Feral greylag and Canada geese (in particular) are increasing in the UK (and in Europe and the USA), are poor at avoiding aircraft, are often seen and struck in flocks and are heavier than current aircraft and engine birdstrike certification standards. As a result of their behaviour, numbers and weight they carry a much higher risk of causing serious damage to aircraft than the majority of bird species that are commonly seen in the UK.

Considerable effort is devoted to combating the birdstrike hazard on UK aerodromes, with well-developed habitat modification techniques and the provision of manpower and equipment to detecting and dispersing hazardous birds from the aerodrome and its immediate environs. However, existing bird habitats or new developments beyond the aerodrome boundary may cause concentrations and/or movements of birds in the local airspace that are hazardous to aircraft but cannot be influenced by actions taken at the aerodrome.

The European Aviation Safety Agency (EASA) and the UK Civil Aviation Authority (CAA) require all airports to take appropriate measures to deter birds on and around airfields, as birdstrike is one of the main controllable hazards to aviation. Most birdstrikes occur on or near aerodromes, but as birds are highly mobile, bird-attractive features far beyond an aerodrome boundary have the potential to increase risk depending on how the local bird populations move through the local airspace.
3. Aerodrome Safeguarding Requirements

In response to this significant safety risk the International Civil Aviation Organization (ICAO) provides standards and recommended practices to member states. The UK, as a signatory to the Convention on International Civil Aviation, Chicago 1944, has adopted many of the provisions specified in Annex 14 to the Convention. Annex 14, published by ICAO, includes standards and recommended practices (SARPs) that address the risk of a birdstrike and a potential increase of the birdstrike risk due to the presence or development of bird-attractant features on, or in the vicinity of, an aerodrome (the term "in the vicinity" is taken to be land or water within 13km of the aerodrome). The following text is directly extracted from the current edition of ICAO Annex 14. In ICAO terminology, the use of the word “shall” indicates that the subsequent procedures are standards rather than advisory or recommended practices. Paragraph 9.4.4 is the key statement underpinning aerodrome policy with respect to potential wildlife (bird) hazards.

9.4.3 Action shall be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.

9.4.4 The appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.

As a signatory to the Convention on International Civil Aviation, 1944 (the Chicago Convention) the UK Civil Aviation Authority (CAA) is obliged to enforce this Standard. Because of this requirement Norwich Airport must carefully consider any application with the potential to attract hazardous birds and take all reasonable action to prevent their implementation unless it (and the CAA) is satisfied that there will be no net increase in the local birdstrike hazard to aircraft as a result of the development.

In order to comply with the international standards, in the UK a safeguarding consultation process exists as part of the planning process to address proposed developments with the potential to affect the safety of aircraft operations at certain civil and military aerodromes, designated by the Government as "officially safeguarded aerodromes". The consultation process includes a means to address potential bird attractant developments within a 13km radius circle of the aerodrome. Safeguarding maps are used to define the 13km radius circle and are lodged with local planning authorities. The 13km circle is based on a statistic\(^*\) that 99% of birdstrikes occur below a height of 2,000ft above ground level, and that an aircraft on a normal approach would descend into this circle at approximately this distance from the runway.

Norwich Airport is required to ensure that any development within a circle of 13km radius drawn from the Aerodrome Reference Point (ARP) does not increase the risk of a birdstrike to aircraft using the aerodrome\(^*\). The underlying regulatory framework for this requirement is described in: -

- i. International Civil Aviation Organization ICAO Annex 14, Volume 1, to the Convention on International Civil Aviation (see above).
- iii. The European Commission Implementing Rules ADR.OPS.B.020.
- iv. Detailed Regulatory guidance regarding wildlife hazards to aviation in the UK is provided by the UK Civil Aviation Authority as an Acceptable Means of Compliance (AMC) with the EC
regulations in their publication CAP 772 - *Wildlife Management at Aerodromes* (2013) and Chapter 5 of CAP 168 *Licensing of Aerodromes*.

v. The necessary mechanisms for aerodrome (including bird hazard) safeguarding are codified in UK planning regulations by ODPM/DfT Circular 1/2003 “*Safeguarding aerodromes, technical sites and military explosives storage areas.*”

Although virtually all land types and land uses (including natural habitats) attract birds in some way, safeguarding is intended to address developments that, whether individually or as part of a cumulative process, could become bird attractants with the potential to increase the birdstrike risk at an aerodrome.
Bird Hazard Risk Assessment

4. Outline

The Drayton Manor development is within the 13km radius Bird Hazard Safeguarding Zone for Norwich Airport and accordingly the Airport has a statutory requirement to ensure that new developments within its vicinity do not lead to any increase in the birdstrike risk for aircraft operating at and around the airport. The applicant has, therefore, commissioned AWM to conduct an independent Bird Hazard Risk Assessment to enable Norwich Airport and the council’s planning department to fully assess any potential that the proposed development may have to increase the birdstrike risk at and in the vicinity of the airport.

The following factors are taken into consideration when assessing the potential change in birdstrike risk:

i. the numbers, including seasonal variations, and types of birds that may be attracted to the development;
ii. any proposed landscaping or habitat designs;
iii. the distance from the aerodrome;
iv. the location of the development relative to aircraft arrival and departure flightpaths and within the visual circuit;
v. bird movements in relation to the aerodrome; for example, waterfowl move primarily between wetlands and along watercourses.

In terms of potential risk to aircraft, the primary concerns are the size (weight), numbers and flocking behaviour of birds that could be attracted into airspace around Norwich Airport at heights and in locations that would be likely to cause conflict with aircraft movements. Although small birds (in this context, birds of less than 100g) cause many birdstrikes, with the exception of starlings (which often form very dense flocks) they are not considered hazardous to aircraft.

Norwich airport has objected to the planning application as a result of concerns over one aspect of the proposed design and layout of the site – a large (but smaller than the lagoons proposed in Option 2 of the Norfolk County Council Surface Water Management Plan\textsuperscript{\textregistered}) attenuation basin with a proposed capacity of 20,000m\textsuperscript{3} designed to capture water runoff of a 1 in 100 year flood event (with 30% capacity added for climate change). The size and location of this basin are dictated by an obligation placed on the developer to mitigate the existing flood issues in Drayton village which originate in part from land directly to the north (and east) of the development site rather than to only manage rainwater runoff from the proposed development. The draft design of this attenuation basin considers all currently identified and anticipated worst case requirements and is referred to hereafter as “the design.”
5. Site Location

The site of the proposed attenuation basin under discussion is 2.4km west of the airport boundary and 2.74km from the runway 09 threshold (RWY 09 THR). The main potential birdstrike risk associated with the attenuation basin’s location would be to aircraft on approach to RWY 09, which would closely overfly the site at below 600ft (presuming a 3 degree approach angle). Most aircraft departures and arrivals use RWY 27, when departing aircraft would usually be above 1,000ft above ground level as they pass near the basin site, reducing the risk of encountering birds.

Figure 1. Site Location With Respect to the 13km Bird Safeguarding Circle

Figure 2. Development Site (Yellow Shading), Proposed Basin (Blue shading) and Lakes to the West of the Airport.
6. Pre and Post-Development Bird Populations Within the Development Site Boundary

Any assessment of the birdstrike hazard associated with a development should take into account the pre-development bird populations of the site, the anticipated post-development bird populations of the site and the likely net changes in the populations and movements of hazardous birds through the critical airspace over and around the airport. This evaluation should include consideration of likely or possible interactions with known “bird sites” in the local area. If a development has the potential to create an increased local birdstrike hazard as a result of increased local populations of hazardous species (or the creation of hazardous bird traffic between the development site and other local sites) then the potential hazards should be identified, quantified where possible and mitigated to a level that is as low as is reasonably practicable.

6.1 Farmland Birds

The land within the development boundary is currently under arable rotation and has the typical bird populations of such an environment with woodpigeons, corvids, starlings and gulls often present in significant numbers (hundreds of birds) and occasionally exceeding 1,000 birds within or immediately adjacent to the site boundaries depending on time of year, weather conditions and agricultural activity. When autumn and winter ploughing is taking place hundreds of gulls and corvids may be present within the development boundary for a short period and this represents the pre-development peak in the birdstrike hazard associated with this site.

Post development, the populations of the potentially hazardous open farmland species listed in the paragraph above will fall significantly within the site boundary and the high peaks in hazardous bird numbers associated with ploughing activity (and the traffic of gulls between the broadland roosts to the east of the airport to this site) would be expected to be reduced proportionately to the area of arable
farmland being lost. Although there would be some replacement of these open country species with woodland/garden species, typical garden birds are insignificant in UK birdstrikes.

6.2 Woodland and Hedgerow Birds

Most bird species typical of woodland and hedgerow are insignificant in terms of birdstrike risk, but populations of woodpigeons, corvids and starlings, which are a potential hazard to aircraft, can all be affected by the size (area), height, species mix and location of woodland and hedgerow. The proposed development site is largely open ground, the only unusual feature being hedgerows (immediately to the west and north of the proposed lagoon location) that have a high conifer content and are becoming tall enough to hold nesting and roosting woodpigeons. Tall conifer hedgerows of comparable size often hold starling roosts elsewhere in the UK and at this location a significant starling roost could constitute a considerable hazard to Norwich Airport. There are extensive hedgerows, rows of trees, copses and areas of woodland adjacent to the site, particularly to the west, south and south-east (including woodland under the extended runway centreline 1.7km from the touchdown point for RW 09). Although the final landscaping plan has not been presented, the indicative landscaping proposals’ suggest that there will be some new tree planting associated with the development. Provided that this planting is consistent with the local species mix and remains open in aspect then there should be no measurable change in the birdstrike hazard associated with the comparatively minor tree and shrub distribution changes that are indicated.

6.3 Water Birds

This grouping includes ducks, geese and swans, but also moorhen, coot, grey herons and cormorants. In the context of this proposal, herons and cormorants can be omitted from consideration as the attenuation basin will be unable to sustain populations of fish or amphibians on which these birds can feed. Moorhen and coot are harmless to aviation and can also be discounted.

The nearest populations of waterfowl to the development site are the lakes and ponds at Taverham (large lake) and Costessey Pits (a complex of large and smaller lakes and ponds) just over 2km south-west of the proposed attenuation basin. There are further lakes and ponds immediately to the west of Taverham in the loop of the River Wensum. Although long-term bird counts for these sites are not available, these water bodies hold populations of wildfowl including mute swans, greylag and Canada geese and an assortment of duck species. Duck numbers on the lakes and gravel pits are higher in the winter months, but goose populations seem to be resident, with the highest numbers seen in late summer (parents accompanied by goslings). At the present time Norwich Airport does not consider the bird populations of these lakes to be high enough to warrant regular monitoring. To the east of the airport the only significant water bodies before the nearest part of the Broads (Wroxham and Overton Great Broads) are Dobbs’ Beck Lake and the Springs, 3.7km west of the touchdown point for RW 27 and under the extended centreline. These lakes hold at least two pairs of mute swans, and on 6th December 2016 there were five Canada geese on Dobbs’ Lake and 21 mallard spread between the two lakes. Five cormorants were perched in a dead tree in Dobbs’ Lake, and I was told that these birds were “actively managed.” In summary, there are very large waterfowl populations within the sections of the Norfolk Broads within Norwich Airport’s 13km safeguarding circle to the east, and smaller populations of waterfowl including tens (on occasion exceeding 100 birds in total) of Canada geese and greylag geese closer to the airport, mainly based on the lakes and ponds created by flooded mineral workings to the west of the airport.

It should be noted that the birdstrike hazard associated with water birds such as swans, geese and ducks is generated by their movements between water bodies or between water bodies and terrestrial feeding sites such as arable stubbles, winter oilseed rape, etc., rather than by their presence on the water. At this location waterfowl movements between the basin and the lakes immediately to the west would be expected to be at low altitude due to the short distances to be travelled. If, however,
waterfowl traffic between this site and site to the east of the airport were to occur then these birds could fly through the airport or its vulnerable airspace.

If the proposals for the hydrology of the attenuation basin are delivered (1/100 year storm, 14 days to drain, annual storm 1-4 days) then freshwater flora and fauna will not develop in the attenuation basin and it will not be colonised by water birds. In the absence of aquatic flora the only feeding opportunities for feral greylag and Canada geese would be the bankside areas which will be significantly sloped (1:4) and the immediate surroundings. The likelihood that geese would attempt to feed in such a location is very low given the availability of numerous better options nearby (larger water areas, more open aspects, aquatic and bankside feeding readily available) and can be mitigated even further by careful choice of the grass varieties to be planted, maintenance and the planting of screening vegetation trees that could limit flight paths into and out of the attenuation basin The most likely waterfowl use of the basin would be visits by mallard, which are quick to exploit even very small areas of temporary flooding. Mallard are likely to visit flashes or pools with persistent water in small numbers either by day or by night, often using larger permanent water bodies by day and visiting smaller or more exposed sites in the security of darkness.

It is important to note that the attenuation basin is designed to mitigate flooding that currently occurs in Drayton Village adjacent to the application site (the Environment Agency states that more than 300 homes are at risk of flooding in Drayton). The current pattern of flooding generates much larger areas of open water than the proposed attenuation basin would represent even if it were filled to capacity. The proposed attenuation basin is also very significantly smaller than the flood storage lagoons mooted by Option 2 of the Norfolk County Council Norwich Urban Area Surface Water Management Plan for Drayton”.

6.4 Seasonality

Feral geese, mute swans and mallard are present year-round but are more often seen in groups or flocks from late summer until the beginning of the next breeding season when the flocks break up (typically from February inward in the case of mallard).

6.5 Numbers

Given its size, the proposed attenuation basin could hold tens of feral geese and mallard and a small number of mute swans if it were to hold a significant volume of water for extended periods, particularly if this occurred with sufficient frequency to allow the establishment of wetland flora. The basin would have negligible potential to hold wildfowl until the water depth exceeded 30cm (because water this shallow offers no security from predators and the banks would conceal any approaching danger) and the maximum attraction to wildfowl would only be reached if/when the water level was near the top of the banks (which would allow the birds open lines of sight to detect approaching danger). Although the likely numbers of birds are small even in the worst-case scenario, greylag and Canada geese and mute swans are so large that even single birds have the potential to cause serious damage to aircraft, including the larger commercial transport types. They should, therefore, be treated as high risk birds and as a general principle any development with the potential to bring even small numbers into close proximity with aircraft requires careful evaluation and robust mitigation measures where necessary.
7. Bird Hazard Risk Assessment - Summary

The bird hazard risk assessment for the proposed development is summarised in the table below.

<table>
<thead>
<tr>
<th>Bird Populations</th>
<th>Status Quo</th>
<th>Post Development</th>
<th>Forecast Change</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmland</td>
<td>Arable farmland with associated woodpigeon, gull, corvid and starling populations. Large flocks at certain times during the agricultural cycle.</td>
<td>Residential development and attenuation basin.</td>
<td>Reduction in farmland bird numbers proportionate to area of arable land developed.</td>
<td></td>
</tr>
<tr>
<td>Woodland and Hedgerow</td>
<td>Tall conifer hedgerow within and adjacent to development site hold roosting and breeding woodpigeons and has potential to hold roosting starlings.</td>
<td>Some additional tree planting to landscape development. Existing hedgerows to be retained.</td>
<td>Negligible. Additional tree planting insignificant compared to extent of woodland, etc., closer to the airport.</td>
<td>Nesting woodpigeon numbers could be reduced and roosting by this species and, potentially, starlings could be eliminated by reducing the hedge height to around 2m.</td>
</tr>
<tr>
<td>Lakes and Ponds</td>
<td>Complex of lakes and ponds within 5km east of the airport and two further lakes c.3.5km east of the airport. Mute swans, feral geese and other waterfowl present.</td>
<td>If the attenuation basin were to hold persistent or permanent water then there is potential to bring some waterfowl (and only Mute swan, geese and mallard are of concern) closer to Norwich Airport and to generate new flight paths between local water bodies.</td>
<td>A permanent or persistent water body of the size proposed for the attenuation basin could lead to an increase in the population of large and hazardous birds in close proximity to the airport.</td>
<td>Dependent on a number of factors including how often, and for how long, the basin would hold water, feeding opportunities within the basin and its immediate vicinity and whether lines of flight and sight (security and access) around the basin are open or restricted.</td>
</tr>
</tbody>
</table>

In conclusion, the only identified bird hazard that could be increased as a result of the development would be the use of the proposed attenuation basin by wildfowl such as swans, geese and ducks. Even in the very worst case scenario the number and variety of wildfowl that could visit the site will be very low compared to the nearby permanent water bodies created from flooded mineral workings, but Drayton Farms Ltd recognizes the necessity to carefully consider all potential risks to air safety and to mitigate them to levels that are as low as is reasonably practicable. The thorough mitigation of the potential risks identified above is therefore, the focus of the Bird Hazard Management Plan (BHMP) that follows.
Bird Hazard Management Plan

8. Basis

Norwich Airport is required to ensure that any development within a circle of 13km radius drawn from
the Aerodrome Reference Point (ARP) does not lead to any increase in the birdstrike hazard to aircraft
operating at the airport or within its critical local airspace. The underlying regulatory framework for this
requirement is described in:

- International Civil Aviation Organization ICAO Annex 14, Volume 1, to the Convention on International
  Civil Aviation (“the Chicago Convention”).


- The European Commission Implementing Rules ADR.OPS.B.020.

Detailed Regulatory guidance regarding wildlife hazards to aviation in the UK is provided by the UK Civil
Aviation Authority as an Acceptable Means of Compliance (AMC) with the EC regulations in their
publication CAP 772 - Wildlife Management at Aerodromes (2013) and Chapter 5 of CAP 168 Licensing
of Aerodromes.

9. Definition

The following Bird Hazard Management Plan (BHMP) is a scheme agreed between Drayton Farms Ltd
and Norwich Airport dated February 2017 and designed to minimise populations of hazardous birds at
the site.

10. Objectives

The purpose of this document is to ensure compliance with the current International, European and UK
regulatory framework by ensuring that no increase in bird hazards to aircraft operating at and in the
vicinity of Norwich Airport is permitted as a result of this development. In the context of this specific
planning application the priority species identified as representing the highest potential risk are greylag
goose *Anser anser*, Canada goose *Branta canadensis* and mute swan *Cygnus olor*. These birds are
prioritised “highest risk” because:

- They are water birds that have been known to use borrow pits, balancing ponds and flooded
  attenuation lagoons elsewhere.

- They are susceptible to involvement in birdstrikes.

- They are already resident in the local area on lakes, ponds and broads.

- Their weight exceeds current transport aircraft engine certification standards and as a result
  they have the potential to erode stringent aviation safety margins by causing significant damage
to commercial aircraft.

Mallard *Anas platyrhynchos* are also identified as a risk species that meet criteria a) – c) above, but they
are given a lower risk priority because their average weight (<1.2kg) is within current commercial
aircraft engine certification standards.
11. Proposed Mitigation and Monitoring Measures

Having identified the primary species of concern, a comprehensive range of measures is proposed below to minimise the potential attraction of the attenuation basin to water birds, to monitor the performance of these mitigation measures and to communicate with Norwich Airport.

Wildfowl (ducks, geese and swans) and other waterfowl (e.g. cormorants, grebes) use water bodies to provide a range of key requirements. The components and relative importance of these requirements vary between species but the common factors can be summarised as: -

- Feeding Opportunities (aquatic or marginal vegetation in the case of the target species)
- Nesting opportunities (islands or dense bankside vegetation)
- Security

For the target species “security” is provided by: -

- Long lines of sight
- Water deep enough to deter predators from wading
- Sufficient area of water to provide a “safe distance” from the shore (protection from predators, shooting, etc.)

The proposed mitigation measures are, therefore, targeted at reducing, compromising or removing these key requirements thus making the attenuation basin unsuitable for the target species.

12. Waterfowl – Mitigation Measures (General)

The creation of permanent or persistent open ponds of sufficient size to attract waterfowl close to a civil airport is likely to be considered unacceptable, particularly in an area with high existing local waterfowl populations. There is a very clear correlation between waterfowl strikes and the presence of open water habitats nearby, and the resulting birdstrikes have caused massive damage to commercial aircraft in the UK. Rapidly draining swales may not fall into this higher risk category, and there is little doubt that, in the context of this application, the best mitigation measure is a high degree of confidence that aspirations for drainage times are realistic and achievable.

Active bird dispersal is not sufficiently effective against waterfowl to reduce the hazard associated with permanent water bodies to an acceptable level, and the only recommended mitigation measures for permanent or persistent water bodies are passive bird exclusion systems. Netting systems (see fig. 4) are the primary method in current use in the UK, but long-term maintenance can be problematic. Plastic “Bird Balls” are likely to be equally effective and require less maintenance, particularly in this context. Effective bird exclusion is recommended (CAA are likely to regard it as a requirement) for any open ponds/swales that persistently hold water, particularly when close to the airport, but the design of the attenuation basin proposed here would render such measures unnecessary provided that, as is fully expected by the applicant, it operates according to its design criteria.
13. Mitigation Measures for the Proposed Attenuation Basin

The most important consideration in this specific case is that the proposed attenuation basin would, for the great majority of the time, contain no open water and therefore there will be few opportunities for the target species to use this feature at all. The proposed basin is a “dry” feature that is designed to capture water in conditions that could lead to a local flooding and to discharge this water in a controlled manner, protecting Drayton village from the existing flood risk. The following mitigation measures are designed to reduce the already very low potential of the attenuation basin to attract the target species still further to the point where Norwich Airport can be confident that there will be no increase in the local birdstrike risk as a result of this development.

Design

As stated above, the basin is designed as large grass-lined rectangular depression that only holds water temporarily after particularly heavy rainfall. A detailed analysis of the local rainfall and drainage condition has been conducted by Kingdom TP (Consulting Engineers and Flood Risk Specialists) in support of this project and is attached at appendix 1. This study has concluded that in typical conditions of heavy rainfall water levels in the basin will rarely exceed 50mm, which will discharge within hours. Water at this level will be partially or wholly obscured by the grass that lines the basin and unless the floor of the basin is perfectly flat (which is unlikely) any water that accumulates in the basin will initially form a series of puddles rather than a continuous sheet of open water. The final design and gradients can be controlled by the local planning authority in consultation with the local lead flood authority and NIA.
Mitigation of Feeding Opportunities.

Mute swans, Canada and greylag geese and mallard are vegetarian species that feed on aquatic vegetation and/or may graze on adjacent grasses or feed more widely on arable crops. Because the basin will be dry for the great majority of the time there will be no development of aquatic vegetation and therefore the only remaining food source will be the grasses and other terrestrial vegetation lining the basin and in its vicinity. Feeding opportunities will be reduced by seeding the basin and the adjacent area with a grass seed mixture containing a high proportion of tall fescue that is unpalatable to wildfowl due to its high silica content. This grass will be maintained as “meadow grassland” with occasional cutting during the main growing season rather than closely mown, which further reduces its attractiveness to feeding wildfowl.

Mitigation of Nesting Opportunities

There is no likelihood that the target species would nest within the basin structure or compound (there will be no islands, reedbeds, etc. that would be suitable) but the grassland vegetation within the structure will be maintained to prevent scrub or other deep cover from forming.

Mitigation of Security

Because of the basin’s depth, any birds that settle inside the basin will have very limited lines of sight unless the water levels are very high (near the top of the bank), and this will severely impede the birds’ ability to detect approaching threats. This insecurity will be further increased by the planting of a belt of trees around the basin perimeter that will block the lines of sight in all directions at all times while also providing cover for predators. Once established this tree screen will also severely impede the ability of waterfowl to fly into or out of the basin and would in all likelihood make access impossible for swans and very difficult or impossible for geese.

Wildfowl, particularly the larger species, also require sufficient area and depth of open water to protect them from predation. Even after prolonged rainfall any standing water in the basin will usually be insufficiently deep or extensive to provide security.

14. Means of Compliance

Delivery of the basin design and landscaping measures described on drawings/plans on the illustrative drawings accompanying the application for planning permission, together with the FRA, appendix to this BHMP and implementation of the monitoring and control measures described in the proposed Bird Hazard Management Plan will be secured by a Planning Condition. The final detailed design of the attenuation and basin will require approval by the local planning authority in liaison with the LLFA and Norwich International Airport (NIA).

Targets: The site owner commits to a target number of zero resident or persistent swans or geese either on the water of the attenuation basin or on its banks. Resident or persistent swans or geese would comprise those that are either feeding or nesting on the site and “persistent birds” are birds present on two consecutive visits. Because mallard are more numerous locally, and often visit ephemeral water bodies, the target number for mallard will be zero resident birds and less than 4 birds present for two subsequent visits. Swans, geese and ducks that are flying over the site are beyond the control of the management of the site itself and are therefore not considered as part of the target figures. If these stated targets are exceeded, the necessary additional control measures will be discussed and agreed with Norwich Airport, initiated and sustained until the targets are achieved.
**Monitoring:** A representative of the developer or NIA will be appointed to ensure that the water levels and bird populations of the basin are closely monitored, with inspection visits initially occurring twice monthly or following each incidence of local rainfall exceeding 10mm over a period of 6 hours or an average rainfall of 3.5mm per day over 5 consecutive days. The inspection frequency may be varied in consultation with Norwich Airport if the records collected over an extended period show that the initial frequency is unnecessarily high or too low to ensure that the target species are not present on the attenuation basin. An appointed member of staff will be responsible for the ongoing monitoring and management of birds on site and will be the point of contact for the airport. He/she will be responsible for ensuring that the reporting of bird numbers on site is shared with the airport at regular (initially quarterly) intervals for the first two years. If monitoring over this two year period (and spot checks by NIA) demonstrates that the basin does not attract hazardous birds then the requirement for further monitoring will cease.

**Oversight:** Spot checks (which may be either pre-arranged or unannounced) by NIA will be permitted and facilitated by the (nominated point of contact TBD), in order to verify that standards and obligations are being maintained. The (nominated point of contact) will be notified of the name(s) of those personnel authorised to conduct these spot checks and appropriate photographic identification will be carried during site inspections.

**Dispute and Conflict Resolution:** In the event of any dispute between the site operator and Norwich Airport regarding the implementation of any aspect of the Bird Management Plan, site landscaping and maintenance, monitoring and reporting or site access then any grievance should be raised by the aggrieved part at the earliest opportunity with a view to achieving a mutually acceptable resolution. If a resolution to a dispute cannot be achieved by direct discussion between the site operator and Norwich Airport then a suitably qualified and experienced (and recognised as such by both parties to the dispute) third party shall be appointed by the site operator to offer an independent view.

**15. Conclusion**

It is the opinion of Airfield Wildlife Management Ltd that the proposed attenuation basin described in the proposals and at Appendix 1 represents a very low birdstrike risk due to the infrequency with which it will hold standing water and the lack of security and feeding opportunities. Any residual risk can be mitigated by the landscaping, maintenance and monitoring measures proposed above to the point where it can be stated that the attenuation basin would provide neither food, security or breeding opportunities for swans, geese or ducks and their access would be severely impeded by a screen of trees. In the unlikely event that monitoring of the attenuation basin revealed that performance targets for hazardous birds were being exceeded then the site owner commits to discuss and agree additional mitigation measures with Norwich Airport and to implement any measures that are necessary to ensure that the targets are met. On this basis we conclude that the attenuation basin can be constructed and maintained with no increase in the local birdstrike hazard provided that the measures described above are implemented and sustained.
16. Appendix 1. Analysis of the Attenuation Basin Design and Performance by Kingdom TP

Surface Water Design Philosophy

The surface water drainage design for the proposed development is divided into two parts, onsite and offsite. Usually only an onsite system is provided for a development to collect and appropriately discharge surface water arising from rainfall on the development area. In this case work undertaken by Norfolk County Council to investigate surface water drainage and flooding across the Norwich area in the late “noughties” identified that an overland flow path is located in the area of the site which during high rainfall events (storms) contributes to flooding in Drayton. This work culminated in a recommendation that any development in the area should look to reduce the overland flow. This has resulted in the inclusion of an offsite drainage strategy as part of the planning application.

Onsite Drainage Strategy

This system serves the proposed highways, roofs and other impermeable areas within the development site. As outlined in the FRA accompanying the application, it is proposed these areas will drain to local underground soakaways, discharging by infiltration. No surface features will be required.

Offsite Drainage Strategy

The Offsite strategy only serves to intercept and discharge surface water runoff from the upstream catchment area associated with the overland flows. The strategy is to intercept any flows and transfer them via ditches to the infiltration basin (lagoon) to prevent onward flow which creates flooding in Drayton Village. The basin is designed to discharge the flows by infiltration and is basically a large soakaway. With any soakage feature the rate of outflow (infiltration) depends on the level of water and during significant rainfall events the rate of flow into the basin will be greater than the outflow leading to a rise in water level in the basin. The preliminary design to demonstrate the feasibility of the strategy has used the most onerous data to size the basin and potentially this volume could be reduced as part of the detailed design.

The design analysis has been undertaken using standard design parameters to enable the basin to accommodate flows which would arise from a rainfall event that statically will only occur once in 100 years, (1 in 100 year event). An allowance for climate change has been included and also a factor of safety on the infiltration rate. This has identified that the proposed basin is sufficient to accommodate the event with a maximum depth of 2 metres. The analysis identifies that half of this volume will discharge in 15 hours, with the remainder discharging in around one to one and a half days.

Basin Water levels

On a day to day basis any water entering the basin will depend on rainfall and in particular the amount and duration of the rainfall on the upstream catchment. Average monthly data for the area shows that typically it rains on between 16 and 23 days a month (depending on which month), with monthly averages between 38 and 67mm. The majority of the rainfall is classified as light to moderate, usually falling over several hours in the day.

The upstream catchment is about 100 hectares and is almost entirely arable farm land. The infiltration characteristics of the soil and underlying geology are good, with the majority of rainfall discharging by infiltration. As is typical with this type of land use and infiltration properties, almost all the surface water from small rainfall events will infiltrate at the point of falling, either immediately or after being held in local puddles and ruts. It is only during heavier or prolonged rainfall that surface runoff will
occur which leads to the identified issues with flooding in Drayton and to which this strategy has been designed to address.

Industry standard data for the catchment has been used with MicroDrainage, (industry standard software), to analysis the runoff from the catchment. This has identified that runoff will be limited to around 7% for events with a probability of occurrence of once a year, rising to around 14% for lesser probability events, (1 in 30 year) and potential as high as 37% for 1 in 100 year plus events.

The amount of rainfall for a 1 in 1 month event will depend on duration, however the longer the event duration is, the lower the intensity of rainfall. For this catchment a once per month event will have 4mm of rainfall for a 30 minute duration event, rising to 10mm for a 6 hour event. The peak intensity of the storms will vary from 37mm/hour to approximately 3.5mm/hour. The 6 hour duration is generally accepted as a good indicator for the volumes produced as events of longer duration are infrequent and the intensity of them is so low that it generally produces very little, if any, runoff.

Assuming a runoff of 7%, the two storm durations would result in water levels in the basin of 39mm and 97mm respectively, assuming no infiltration occurs, however in reality water will infiltrate as soon as it reaches the basin and the actual depth of water will be less. A number of infiltration tests undertaken in the vicinity of the basin have given a lowest value of $2.6 \times 10^{-5}$ m/s. In the analysis for the basin design a factor of safety has been applied to this value, however in simple terms this rate of infiltration equates to lowering the water level by 93mm per hour. In reality higher water levels enable infiltration through the sides and base, where this only assumes it’s through the base, however this shows the total volume from a once a month event would completely drain within approximately 1 hour.

From the rainfall records below in can be seen that September has the highest average daily rainfall of approximately 65mm over 20 days giving an average of 3.25mm of rainfall. From the analysis above, this would give a total depth of 32mm and would in reality infiltrate almost as quickly as it flows in to the basin.

![Average Rainfall for Norwich, United Kingdom](image)

Note: The data for charts above are taken from year 2000 to 2012.
Summary

KindomTP have investigated the anticipated depths of water that are likely to occur in the infiltration basin on a day to day basis. The work has considered the average monthly rainfall for the area and the peak rainfall likely to occur from a rainfall event which statically occurs once a month. The investigation has concluded that the majority of rainfall occurring during typical weather conditions will infiltrate at the point of falling and will not reach the basin. Flows that do reach the basin will infiltrate quickly resulting in only minor depths of water, typically less than 50mm, which will discharge within a couple of hours, usually less.

In addition to the high frequency and typical weather event discussed above, the results from design events between 1 in 1 year and 1 in 100 year probabilities are provided below. These have been analysed as part of the basin design and include an allowance for climate change and a factor of safety

1 year probability event – max water depth of 0.53 metres. Empty time 12 to 15 hours
2 year probability event – max water depth of 0.68 metres. Empty time 14 to 16 hours
30 year probability event – max water depth of 1.46 metres. Empty time 24 to 36 hours
100 year probability event – max water depth of 2.00 metres. Empty time 36 to 48 hours

Due to the low frequency of occurrence of the design storms it is considered they are not typical of water levels likely to be experience in the basin.
17. References

i http://www.caa.co.uk/Data-and-analysis/Safety-and-security/Datasets/Birdstrikes/


iv Manor Park, Hall Lane, Drayton. *Flood Risk Assessment and Drainage Strategy*. May 2016. KingdomTP, Saffron House, Lopham Road, East Harling, Norfolk, NR16 2PX.

v Drawing No. 4542 – 53 Rev G. *Outline Site Plan with Landscape*. 8th June 2016. Chaplin Farrant Ltd, 51 Yarmouth Road, Norwich NR7 0ET.


Figure D133930-CDA01-003 Drayton - Option 2: Flood storage (pdf - 612kb)

vii http://www.euro-matic.co.uk/technical-balls/self-filling-cover-balls/
http://www.euro-matic.co.uk/technical-balls/bird-balls/
http://www.awtti.com/armor_balls_cover.php

viii https://www.germinal.com/amenity/shop/product/54/airport-birdstrike-mixture