

Opinion Statement on the Proposed New Saemangeum Airport

Dr Nial Moores, March 10th 2024

1.1 *Experience Relevant to the Opinion Statement*

The following opinion statement is based on several decades of personal experience conducting bird research and proposing measures to help reduce the impacts on birds and other biodiversity from infrastructural development projects, including full-time in the Republic of Korea (ROK) since 1998. During this period, I have worked with NGOs (since 2004 full-time with Birds Korea), with universities and on projects for government bodies and local governments. My qualifications include a Master's Degree in Environmental Design / Ecological Planning from Kyushu University, Japan and a PhD in the conservation of avian biodiversity from the University of Newcastle, Australia. Chapters in my doctoral thesis ⁽¹⁾ include an assessment of the impact of the Saemangeum reclamation on shorebirds at the site, sub-regional and national level.

I first surveyed the Saemangeum Estuarine System in 1998 ⁽²⁾; and have conducted counts of shorebirds and other waterbirds on probably 150-200 dates at Saemangeum and / or the Geum Estuary and on multiple dates along all three coasts of the ROK; as well as much less extensively elsewhere along the East Asian-Australasian Flyway, in e.g., the DPRK, PR China, Vietnam (for Wetlands International) and Australia.

I have published about the impact of reclamation on shorebirds at Saemangeum and the Geum Estuary in peer-reviewed literature ⁽³⁾; and also led or contributed to several publications relating to Saemangeum and the Geum Estuary, and to tidal flat conservation issues ranging in scale from the site level to the regional level (e.g., ^{4,5,6,7}). I have also contributed to several specialist papers and East Asian-Australasian Flyway Partnership Task Forces, Working Groups, and Single Species Actions Plans (e.g., ^{8,9,10}) which relate to several of the shorebird and waterbird species highlighted in the Strategic Environmental Impact Assessment of the proposed New Saemangeum Airport or EIASS ⁽¹¹⁾. I am also a member of the IUCN Species Survival Commission Group on threatened Wildfowl and have engaged in discussions with several IUCN experts involved in the Phase 1 designation of the Seocheon Getbol World Heritage Serial Property ("Seocheon Getbol").

1.2 *Major elements of the Opinion*

Through reference to published sources, including peer-reviewed literature on birds, the EIASS ⁽¹¹⁾, and guidance provided by the specialized United Nations agency, the International Civilian Aviation Organisation or ICAO ⁽¹²⁾, I will provide evidence to show that:

- (i) In spite of repeated assertions by development proponents that there would be few if any negative impacts on birds, the Saemangeum reclamation caused major declines in many tidal flat obligate species at the national level and in some species globally, especially between 2004 and 2015.
- (ii) Similarly, in spite of assertions in the EIASS that the proposed new Saemangeum airport will cause minimal impacts on biodiversity, ongoing construction for it has already and will continue to cause declines in nationally and internationally important biodiversity, including so-called legally-protected species;
- (iii) Although interesting to ornithologists, the research on birds conducted for the EIASS is wholly inadequate in scope and duration to fulfil the requirements of ICAO ⁽¹²⁾, especially as related to the bird strike risk.

- (iv) Based on detailed research conducted elsewhere, operation of the airport has a high probability of further negatively impacting biodiversity, mostly through increasing levels of noise in the Sura Wetland within 3km of the proposed airport and across the adjacent Seocheon Getbol.
- (v) The construction of the airport as proposed therefore falls outside of the spirit of the ROK's Fourth National Biodiversity Strategy and Action Plan ⁽¹³⁾, and ultimately challenges the Constitutional right of citizens to a healthy and pleasant environment.

1.3 Important Definitions and Historical Context for Understanding this Opinion

1.3.1 Definitions

Throughout, this opinion statement is written in accordance with the definitions and technical guidance provided by e.g., The International Civilian Aviation Organisation, the intergovernmental Ramsar Convention, texts related to Seocheon Getbol and its status as a World Heritage Property, and the ROK's Fourth National Biodiversity Strategy and Action Plan ⁽¹³⁾.

The International Civilian Aviation Organisation or ICAO is a specialized United Nations agency which works under the banner of "Safe Skies. Sustainable Future." It provides clear guidance on the development of a Wildlife Hazard Management Plan for each airport (ICAO ¹²) and through its Strategic Objective on Environmental Protections, ICAO strives to "Minimize the adverse environmental effects of civil aviation activities. This Strategic Objective fosters ICAO's leadership in all aviation-related environmental activities and is consistent with the ICAO and UN system environmental protection policies and practices." ⁽¹⁴⁾

The ROK acceded to the Ramsar Convention in 1997. The Articles of the Ramsar Convention include Article 3, "The Contracting Parties shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory"; and Article 4, "Each Contracting Party shall promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not." Waterfowl, now called waterbirds, are defined by the Ramsar Convention as species of bird which are ecologically dependent on wetlands and include many of the species' groups listed in the EIASS which are central to this opinion on species declines and on bird-strike risk, including most especially Anseriformes (swans, geese, ducks), Charadriiformes (shorebirds, gulls and terns), Pelecaniformes (spoonbills) and Suliformes (cormorants).

This opinion is focused primarily on tidal flat obligate waterbirds, most especially shorebirds. Tidal flat obligate shorebirds are species which depend on tidal flats for feeding during a large part of their annual biological cycle. They feed on animals found within the tidal flats and along the tide edge, and because they do not swim well they concentrate together above the high tide mark at high tide, usually at preferred roost sites with specific, predictable conditions. Because of human-made changes to the landscape, there are few suitable roost sites so shorebirds will often fly several km to access and use them ⁽¹⁵⁾.

If referred to, the Global conservation status of each waterbird species in this opinion is used in full accordance with 2024 global assessments by BirdLife International on behalf of the IUCN in 2024 ⁽¹⁶⁾; and national conservation status is in full accordance with NIBR 2019 ⁽¹⁷⁾. In both assessments, threatened means either Critically Endangered, Endangered or Vulnerable.

To support decision-making by Contracting Parties, the Ramsar Convention has provided since 1990 nine criteria for identifying internationally important wetlands ⁽¹⁸⁾. Two of these criteria, set out in revised form in 2014 ⁽¹⁹⁾, are also central to this opinion: (i) Criterion 5: "A wetland should be considered internationally

important if it regularly supports 20,000 or more waterbirds”; and (ii) “A wetland should be considered internationally important if it regularly supports 1% of the individuals in a population of one species or subspecies of waterbird.” This opinion further follows guidance from the Ramsar Convention ⁽²⁰⁾ which states that percentages of a waterbird population need to be based on Waterbird Population Estimates provided by the international NGO Wetlands International ⁽²¹⁾.

1.3.2 Historical Context

A century and more ago, the Saemangeum Estuarine System, comprising the Mangyeung and Dongjin estuaries, was part of a tidal flat super-system that extended more or less unbroken along the west coast of modern-day ROK from Gyeonggi Bay to Shinan County. Similarly extensive tidal flats extended along the coast of modern day DPRK and even more extensive tidal flats extended along the east coast of China. These tidal flats along the coasts of the Yellow Sea have for millennia supported human communities and formed the heart of the East Asian-Australasian Flyway, depended upon by a huge number of migratory shorebirds and several additional tidal flat obligate waterbirds ⁽²²⁾, e.g. Saunders’s Gulls *Chroicocephalus saundersi* and Black-faced Spoonbills *Platalea minor* ⁽²³⁾.

Due to reclamation projects, defined as the conversion of natural wetland into dry land and artificial wetland by mechanical means, the natural tidal flat system has become increasingly fragmented with a decline in area of Yellow Sea tidal flat of more than 65% since the 1950s ⁽²⁴⁾. The decline in area and health of tidal flats in the Yellow Sea has had many negative impacts. According to an analysis conducted for the IUCN which also included a dedicated subsection on the Saemangeum reclamation, “Fisheries and vital ecological services are collapsing and ecological disasters increasing, with concomitant implications for human livelihoods. Observed rates of declines of waterbird species of 5–9% per year (and up to 26% per year for Critically Endangered Spoon-billed Sandpiper *Eurynorhynchus pygmeus*) are among the highest of any ecological system on the planet” ⁽⁷⁾. Separate research has also assessed Yellow Sea Tidal Flats as an Endangered habitat on the basis of IUCN criteria, because of, “widespread loss of areal extent, increasing frequency of algal blooms, hypoxic dead zones and jellyfish blooms, and declines of commercial fisheries and migratory bird populations” ⁽²⁵⁾. Scientific study after scientific study has linked declines in shorebird populations on the East Asian-Australasian Flyway to loss and degradation of tidal flats in the Yellow Sea e.g. ^(26,27). Currently many of the shorebird species most dependent on the Yellow Sea, in addition to species like the globally Vulnerable Saunders’s Gull *Chroicocephalus saundersi* and globally Endangered Black-faced Spoonbill *Platalea minor* ⁽¹⁶⁾, are globally threatened, i.e., are at risk of extinction.

Research at the turn of this century by the ROK Ministry of Environment estimated that 330,000-573,000 migratory tidal flat obligate shorebirds were supported by Saemangeum during their long migrations between northern breeding and more southern wintering areas each year ^(28,29). This meant that Saemangeum was by far the most important shorebird site in South Korea in terms of numbers and in terms of the number of shorebird species found in concentrations of 1% or more of a population. Measured by the metric of numbers alone, Saemangeum was also the most important known site for shorebirds in the whole of the Yellow Sea at that time. It supported c. 30% of the global breeding population of Great Knot *Calidris tenuirostris* on northward migration and the Yellow Sea’s largest known concentration of the now Critically Endangered Spoon-billed Sandpiper *Calidris pygmeus* on southward migration ⁽³⁰⁾. The Saemangeum area in its natural state was clearly internationally important as defined by Ramsar Convention criteria. The decision not to conserve the wetlands and waterbirds – and to reclaim them instead - was a political one that ran counter to Articles 3 and 4 of the (legally non-binding) Ramsar Convention.

In 2003, prior to seawall closure, many international bird experts and bird conservation organisations expressed their strong concerns to the ROK government about the Saemangeum reclamation, e.g. ⁽³¹⁾,

hoping to influence decision-makers during a period when the legality of the reclamation project was being argued in the courts.

One formal response by reclamation proponents was to post a long defence of the reclamation project in English on the website of the Ministry of Agriculture and Forestry in 2003. This claimed that the reclamation project would be “environmentally friendly”; and that shorebirds would simply move their habitat to the adjacent Gomso Bay and Geum Estuary so there would be minimal impacts. Although the original post is no longer online, an expert rebuttal to it was posted in September 2003, with input from several leading shorebird experts and wetland managers from the UK, the USA, Malaysia, Australia and New Zealand. The rebuttal predicted with high confidence, based on multiple examples from across the world, that the reclamation of Saemangeum would instead cause massive declines in shorebirds, perhaps so severe in some species that it would cause their global population to decline ⁽³²⁾.

Regrettably, it seems that none of these independent experts were invited to provide evidence to the courts in the ROK, in a similar way that the EIASS in 2021 fails to include any review by independent experts from outside of the ROK to help assess the potential impacts of airport operation on the Seocheon Getbol World Heritage Serial Property. This is even though both BirdLife International and the IUCN are referred to by name in the opinion of the Environment Division of Seocheon County (EIASS, p. 274).

In April 2004, the General Secretary of the Ramsar Convention visited the ROK, and was told formally by central government officials that the reclamation was needed to provide agricultural land and water for agriculture; and that it would be environmentally friendly ⁽³³⁾.

In 2005, growing international concern and mistrust of the project’s aims subsequently resulted in Ramsar Resolution 9.15 (Paragraph 10), which requested "the government of the Republic of Korea (to) advise the Secretary General of the current situation concerning the sea-wall construction and reclamation of the Saemangeum coastal wetlands, and the impact of the construction work undertaken to date on the internationally important migratory waterbird populations dependent upon these wetlands." To the best of my knowledge, no response was ever included in any subsequent Ramsar materials, suggesting that no detailed response was ever provided.

Instead, in April 2006 the outer dyke was completed and tidal flow into Saemangeum was greatly reduced. Subsequently, the need for agricultural land as mandated by the Public Waters Reclamation Act was soon given up and a Special Law was passed instead, to help, in the words of a Reuters article, to “turn coastal tidelands that are key feeding areas for globally threatened birds into land for factories, golf courses and water treatment plants” ⁽³⁴⁾.

In an effort to assuage persistent concerns, the Ministry of Environment then held the first “International Conference on Saemangeum and Environment”, November 19-20 2009, to discuss ecological restoration and eco-tourism in the reclamation area ⁽³⁵⁾. However, even those and subsequent discussions did not result in any areas being restored or managed for biodiversity. Instead, there has been a gradual reduction in size of the area initially given over to ecology and wetlands (suggested as 17% of the reclamation area in EIASS figure 10.1 - 8). More recent proposals for this area that are incompatible with biodiversity conservation include solar power farms and Option 3 for the location of the new airport (EIASS).

2.1 Impacts on Shorebirds and other Tidal Flat Obligate Waterbirds caused by the Saemangeum reclamation

Contrary to repeated claims by reclamation proponents, the Saemangeum reclamation has already caused major declines in many tidal flat obligate species at the national level and in some species globally.

In order to provide an independent, real-time assessment of impacts on shorebirds following seawall closure Birds Korea (a newly-formed NGO) partnered with the Australasian Wader Studies Group (a specialist part of BirdLife Australia) to conduct intensive counts of shorebirds at Saemangeum and the adjacent Geum Estuary and Gomso Bay, in April and May 2006, 2007 and 2008. This research program (the Saemangeum Shorebird Monitoring Program or SSMP) entailed multiple counts by multiple count teams through each spring high tide series^(1,3). In all, more than 70 people with experience of shorebird counts joined the SSMP (including at least 10 professional researchers), with 40-50 dates of shorebird counts in each of the three years. In addition, a survey of all the major shorebird sites in the ROK was conducted (in May 2008); and this overlapping count effort in the ROK was designed to link into an ongoing long-term monitoring program in Australia, the destination for many of the shorebirds which migrate through Korea, called Monitoring Yellow Sea Migrants in Australia^(1,3,36).

Because of the quality of data generated, the SSMP was able to show that there were massive declines in many tidal flat obligate shorebirds as a result of the reclamation process. Although some shorebirds were able to relocate to the adjacent Geum Estuary and Gomso Bay, by 2008, 100,000 shorebirds had been “lost” to the three sites (Saemangeum, the Geum Estuary and Gomso Bay), including 80% of the Great Knot *Calidris tenuirostris*. The SSMP also found no evidence that birds lost from Saemangeum were able to relocate to other sites in the ROK. Instead, the numbers of Great Knot *Calidris tenuirostris* wintering in Australia also decreased very rapidly during the same period^(1,3,36). BirdLife International on behalf of the IUCN therefore re-assessed the Great Knot *Calidris tenuirostris* as globally Endangered, because: “following the reclamation of the tidal flats at Saemangeum (South Korea), c. 90,000 non-breeding individuals disappeared from the area. Surveys elsewhere in South Korea confirmed they had not been displaced, and a decline of the same magnitude and timing in Australia suggests that individuals previously using Saemangeum have died”⁽³⁷⁾.

The SSMP only looked at the impacts of reclamation on the numbers of shorebirds during northward migration between 2006 and 2008. An analysis of counts suggested that a reduction in tides had already driven massive declines in most shorebirds in the years before seawall closure⁽¹⁾. A separate study, involving researchers from the National Institute of Biological Resources within the Ministry of Environment, also found remarkable declines in shorebirds during both northward and southward migration periods as a result of the Saemangeum reclamation. They found a 74% reduction in peak numbers of shorebirds between 2004 and 2013 in Saemangeum and the Geum Estuary; and within Saemangeum itself, declines of approximately 95% and 97.3% during the northward and southward migrations during the same 10-year period. Although they found that shorebird numbers in the Geum Estuary did increase by 5% and 20% during the northwards and southward migrations respectively, these increases failed to offset the reduction in shorebird abundance in Saemangeum; and overall, shorebird abundance at Saemangeum and the three adjacent sites in the Geum Estuary instead declined markedly between 2004 and 2013⁽³⁸⁾.

In 2004, 535,000 shorebirds were estimated to stage during northward migration at the eight most important shorebird sites in the ROK (including Saemangeum and the Geum Estuary); in 2008, the SSMP national survey recorded ~291 000 shorebirds at 17 sites (again including Saemangeum and the Geum Estuary); and in 2014, a survey of all known important shorebird sites nationwide found a peak count of only 216,000

(3,29, 39). There is no evidence of any subsequent recovery in numbers following the closure of the Saemangeum seawall in 2006.

2.2 Ongoing construction of the Saemangeum airport has already and will continue to cause declines in nationally and internationally important biodiversity including so-called legally-protected species

Although numbers of waterbirds, especially tidal flat obligate species, supported by Saemangeum have declined tremendously since reclamation, the Ministry of Environment Simultaneous Winter Bird Census or Winter Census ⁽⁴⁰⁾ confirms that Saemangeum is still internationally important for waterbirds as defined by Ramsar Convention criteria.

The outer part of the Dongjin River held a 5-year geometric mean of 36,731 wintering waterbirds between 2018 / 2019 and 2022 / 2023; and 1% or more of eight species of waterbird have been recorded by the Census since 2020. The lower Mangyeung River, including wetland areas close to the proposed new airport, held a 5-year geometric mean of 32,754 wintering waterbirds between 2018/2019 and 2022 / 2023; and 1% or more of eight species of waterbird have been recorded by the Census since 2020 ⁽⁴⁰⁾.

In Tables 11.1.1 – 51 and 11.1.1-52 (pp. 490- 506) the EIASS presents counts of birds by month into bands of distance from the proposed airport (within 3km of the proposed airport; 3-8km range; and 8-13km range). In six out of 10 months, the highest bird abundance among these bands was within 3km of the airport (p. 485). Counts of Great Cormorant *Phalacrocorax carbo*, a large-bodied, freshwater-preferential waterbird, reached 13,330 in November and 16, 353 or >16% of the Flyway Population ⁽²¹⁾ in July within 3km of the airport. Internationally important counts of waterbird species within 3km of the proposed airport presented in the same tables include e.g., 12,776 Bean Goose *Anser fabalis* (equivalent to 15% of the recognized “Korea Non-Breeding Population” of *serrirostris* Bean Goose), 2,260 Grey Plover *Pluvialis squatarola* (almost 3% of the Flyway Population ⁽²¹⁾), 12,880 Dunlin *Calidris alpina* (either 1% of subspecies *sakhalina* or 3% of subspecies *arctica*), 110 Black-faced Spoonbill (2% of the global population) and 1,039 Little Terns *Sternula albifrons* (1% of the subspecies population ⁽²¹⁾).

The EIASS claims throughout that there will be few impacts. However, the EIASS itself confirms the presence of several nationally threatened species and National Natural Monuments within the new airport area (11.1.1.1 – 100, on p. 651); and Table 11.1.1.1 - 50 (p. 488) even identified the globally Vulnerable ⁽¹⁶⁾ and Nationally Vulnerable ⁽¹⁷⁾ Saunders’s Gull *Chroicocephalus saundersi* as the dominant species within 3km of the airport area in the months of April and May 2021.

The Saunders’s Gull nests on the ground in among low-growing saltmarsh vegetation, and typically lays eggs in May ^(23,41). The species is very sensitive to disturbance from people, and only one colony was thought to remain in the ROK in 2014 ⁽⁴¹⁾. The Saemangeum breeding colony has for now effectively been destroyed by construction work for the airport, although c. 40 birds were counted within 3km of the proposed airport in 2023 by Oh Dong-Pil (unpublished data). Similarly, in May 2023 I saw large numbers of Nationally Vulnerable ⁽¹⁷⁾ Little Tern *Sternula albifrons* trying to nest in areas that were being actively bulldozed as part of reclamation activities ⁽⁴²⁾. This seems to contradict the statement on p. 833 of the EIASS that “construction will be stopped immediately when a legally protected species is found during monitoring and the construction will resume after establishing appropriate measures through expert advice”.

After 25 years of working for bird conservation in the ROK, I remain puzzled by the frequent use of the term “legally protected species” in discussions about the impacts on biodiversity to be caused by specific development projects. This is because it appears that the documented presence of such species, even by

researchers conducting an EIASS, is insufficient to result in any modification of the original development plan. Options to modify or stop harmful development are clearly provisioned by Article 14 of the Act on the Conservation and Use of Biological Diversity, yet seem to be very rarely enacted. Article 14 allows for designated entities to “take measures to avoid or mitigate a drastic depletion of biodiversity” when “a breeding ground or wildlife habitat is at risk of being damaged in a large scale due to the implementation of development project, etc,”⁽⁴³⁾. Clearly, such is the case with the current proposed location of the new airport.

It also important to note the EIASS states that there are no wetland protected areas close to the proposed airport so special measures are not required. However, based on data in the EIASS and in the Winter Bird Census, the area in the immediate proximity of the airport is clearly still internationally important for waterbirds as defined by Ramsar Convention criteria. It is again entirely because of political decisions, not ecological values, that this area has not been designated as a Wetland Protected Area and as a Ramsar site but has instead been targeted for development as an airport.

Clearly too, if construction and operation of the airport proceeds, measures will need to be taken to reduce bird strike, presumably including bird-scarers, deliberate nest destruction and even shooting of some species as I personally witnessed in the past at the Incheon International Airport. Harassment or killing of globally threatened bird species would seem to run strongly counter to the environmental protection objective set out by ICAO⁽¹⁴⁾.

2.3 Although of interest to ornithologists, the research on birds conducted for the EIASS is inadequate in scope and duration to fulfil the requirements of ICAO

ICAO’s prime concern is securing the safety of commercial aircraft, including the risk posed to aircraft by collisions with wildlife (including “bird strike”). Bird strikes (collisions between birds and aircraft) are a widespread problem that entail financial loss to commercial, civil, and military fleets worldwide as well as being a source of mortality for birds and more rarely for people^(44,45). Research related to bird strike therefore forms an essential component of the development of airport Wildlife Hazard Management Plans, as mandated by ICAO⁽¹²⁾.

ICAO⁽¹²⁾ provides clear guidance on the kind of research that is required. Section 2.2.4.6 clarifies that, “Wildlife surveys should cover the entire year to account for seasonal changes and should also consider different phases of the day. The survey should also consider aircraft movements, runways in use and wildlife behaviour”; Section 2.2.4.3, calls for research on “the type of wildlife activity and movements (for example: direction and altitude)”; and Section 3.2.3 states, “where good quality strike data is not available, it is important to consider the potential risk of collision determined by the existence of wildlife and their movements on and in the vicinity of the aerodrome.”

To assist in planning, ICAO advises the construction of a damage risk matrix, in which “Different biological and behavioural characteristics of wildlife species can help classify them in specific risk Levels”. As noted in ICAO Section 3.3.2, “the severity scale will depend essentially on the size of the animal and its tendency to flock or congregate. Generally, heavier wildlife and greater flock size increases the probability of damaging an aircraft and impacting its flight performance. Flocking behaviour could include multiple impacts or increase the probability of a strike.”⁽¹²⁾

Bird research for the EIASS was conducted in only ten months (October 2020-July 2021); and appeared to be conducted largely by five counters, who apparently tried to survey 52 areas (at furthest >13km from the airport), over only 30 days in total (EIASS, p. 405). Three nocturnal surveys were also conducted. Although valuable in establishing baseline data on abundance, distribution and species richness, the research effort is inadequate to assess the risk of damage by bird strike.

In addition to a greater frequency of counts, additional methods are required.

ICAO Section 3.1.2 states that, “The first step in a safety risk assessment of wildlife hazards is to define the area that will be assessed. This should include the entire aerodrome and its vicinity, in particular aircraft approach and take-off.”⁽¹²⁾

A meta-analysis of bird strikes globally found that 57% of all documented strikes happened during take-off and landing, 39% during climb and approach and approximately 1% during *en route* flight for the observed period. The remaining 3% of all strikes happened during taxi and parking⁽⁴⁶⁾.

The survey work for the EIASS did not appear to include any fixed points of birds flying over the proposed aircraft approach and runway area to be used during take-off. Frequently conducted fixed point counts overlooking the proposed runway area throughout a whole annual cycle are urgently needed to document the numbers of birds overflying the proposed runway area, with individuals identified to species (important in estimating the mass of each individual); and detailed notes taken of flock size and direction of flight.

Instead of fixed point counts over the proposed runway area, the EIASS depended on wildlife camera traps (which cannot capture flocks of birds in flight) and GPS telemetry or a similar method of remote tracking (EIASS Section 11.1.1.1 – 54). Only 27 birds were tagged for the EIASS. None were captured within 3km of the proposed airport. Instead, based on coordinates, they were tagged 4.66km-12.5km from the proposed runway area, so if tagged in preferred habitat might reasonably be expected to remain largely in that area, and away from the proposed airport area.

Fortunately, ten Great Cormorant *Phalacrocorax carbo* were tagged. The EIASS contains flight lines of five Great Cormorant directly across the proposed airport area, presumably between feeding and breeding sites. Great Cormorant has a mass of 2.6–3.7 kg⁽²³⁾ and often forms flocks of thousands. The table on page 501 of the EIASS lists counts of 13,330 Great Cormorant in November and 16,353 in July within 3km of the proposed airport, and Oh Dong Pil reports that he has counted 38,000 (unpublished data). Bird strike involving a flock of Great Cormorant *Phalacrocorax carbo* and a military aircraft has also already been documented, on October 5th 2021 at 35.92976111, 126.60893611 (within approximately 700 m of the proposed runway). The species therefore poses an obvious very high safety risk to aircraft. Remarkably, however, generalized descriptions of safety risk posed by different species groups given in the EIASS (pages 830 onwards) exclude cormorants.

Although the risk of bird strikes with geese seem to be expected in the EIASS, especially at dawn and dusk (p. 830), the meaning of the section on shorebirds is harder to determine. The EIASS acknowledges that during very high tides (“spring high tides”) flocks of shorebirds fly from the Geum Estuary, where all main roost sites are submerged, to roost in the Sura Wetland. The counts in the EIASS of more than 2,000 Grey Plover, each weighing up to 395 g⁽²³⁾ and more than 12,000 Dunlin, each weighing 48–64 g⁽²³⁾ flying to within 3km of the proposed airport provide evidence to support this. The EIASS suggests that if spring high tide times and flight times overlap there is a heightened risk of bird strike which then needs to be mitigated. The only obvious measure that can be taken to discourage large flocks of shorebirds flying from the Geum Estuary to the Sura Wetland at high tide would be to create more viable roost sites within the Geum Estuary itself.

There are at least three major challenges to mitigation:

First, as proposed, the projected flight path of aircraft would take aircraft directly across the main areas currently used by roosting shorebirds on neap and lower high tides in the Seocheon Getbol.

Second, movements of shorebirds within the Geum Estuary / Seocheon Getbol in response to tide heights are remarkably complex with birds flying in multiple directions as tides ebb and flow; and the location of roosts can shift depending on wind-driven changes in tide heights of only a few cm ⁽⁴⁷⁾.

Third, especially when aerial predators are nearby, some shorebirds appear to stay in flight throughout the high tide period, as documented elsewhere ^(48, 49). On multiple occasions I have observed flocks of several hundred or thousand Great Knot *Calidris tenuirostris*, each weighing up to 248g ⁽²³⁾, Bar-tailed Godwit *Limosa lapponica*, with largest individuals weighing up to 720g ⁽²³⁾, and Far Eastern Curlew *Numenius madagascariensis*, each weighing up to 1350g ⁽²³⁾, appearing to remain in flight throughout all or much of the high tide period close to the Geum River Channel, within about 7km of the northern end of the proposed runway. At times, these flocks can reach several hundred meters above sea level (no attempts to measure height have been taken).

If the airport is constructed as proposed, and the flight path on arrival and after take-off is as proposed, then the risk of a collision between large flocks of shorebirds and aircraft during the main migration periods seems likely to be high for several hours each 24-hour period. If larger flocks of heavier species like godwits or especially Far Eastern Curlew were involved in bird strike, this would presumably cause catastrophic consequences for the aircraft and also potentially result in high levels of mortality of an already globally Endangered species.

2.4 Operation of the airport has a high probability of negatively impacting biodiversity further, mostly through increasing levels of noise in the Sura Wetlands and in the adjacent Seocheon Getbol World Heritage Site.

ICAO ⁽¹²⁾ state that 95% of bird strikes occur below 2,000 ft (=610m) and call for Wildlife Hazard Management Plans out to 13km from the airport, because on a normal approach aircraft descend below 610m approximately 13 km from the runway. Aircraft can therefore be expected to fly regularly at heights similar to the height of flight of many shorebirds, especially across the southern tidal flats and river channel in the Seocheon Getbol.

In addition to the heightened risk of bird strike, noise levels would increase greatly, not only within 3km of the airport but also across parts of or much of the Seocheon Getbol.

The EIASS provides a detailed analysis of the potential impacts of additional noise on local communities living along the proposed flight paths of aircraft using the new airport. However, there appears to be no consideration of the potential impacts of noise on birds presented in the EIASS.

Experimental research in Europe found that 5–47% of waterbirds showed a strong negative response to impulsive (sudden changes in) noise levels at 55 db ⁽⁵⁰⁾; and 47% - 80% of waterbirds showed a strong negative response to noise levels in excess of 65 db ^(50,51).

Using data on shorebird abundance, distribution, conservation importance of species (based on global conservation status and the percentage of Flyway Population that might be impacted), researchers in Portugal conducted very detailed analyses of the likely impacts of noise from aircraft flying to and from a newly approved airport. Their research suggested that the flight paths of aircraft will likely result in major

declines in numbers of birds within the estuary, and potentially even at the population level because of bird avoidance of disturbed areas, lower feeding performance and increased energy expenditure due to escape flights. In combination, these could potentially drive population declines ⁽⁵²⁾.

As proposed the northern end of the airport runway is located c.6-7 km from the southern boundary of the Seocheon Getbol World Heritage Property; and flight cones of the aircraft will cross along a north-south axis, directly over the Property, when most aircraft are expected to be flying below 610m.

Following the Saemangeum reclamation, the Seocheon Getbol World Heritage Property became by far the most important remaining shorebird site in the ROK ^(3,38,39). As stated in the nomination text, the Seocheon Getbol is, “characterized by its high capacity to support 22 endangered waterbird species, including the spoon-billed sandpiper (CR on the IUCN Red List) on the East Asian-Australasian Flyway (EAAF). The various habitats in the property provide the food and space that is much needed for all waterbirds. This strongly testifies to the essential values embodied by the property” ⁽⁵³⁾. In turn, these birds, combined with the sight and sounds of the tidal flats, form the focus of a growing interest in eco-tourism in Seocheon County.

As stated in Article 2 of the World Heritage Convention, Natural World Heritage Properties contain, “natural features consisting of physical and biological formations or groups of such formations, which are of outstanding universal value from the aesthetic or scientific point of view; geological and physiographical formations and precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation; natural sites or precisely delineated natural areas of outstanding universal value from the point of view of science, conservation or natural beauty.” ⁽⁵³⁾

Inclusion of the Seocheon Getbol World Heritage Property in the World Heritage List is a clear acknowledgement of the area’s outstanding universal value and irreplaceable quality which has been formally recognized both by the government of the ROK and also by the UNESCO World Heritage Committee. It seems reasonable to infer that if the new airport is constructed as proposed in the EIASS, then the outstanding universal value (OUV) of the Seocheon Getbol will be degraded by increased levels of noise and the impacts of noise on waterbirds, further endangering the Property’s ecological integrity.

In 2021, the IUCN already expressed multiple concerns about the “ecological integrity” of Korean Getbol, including Seocheon Getbol, in its formal evaluation on behalf of UNESCO, stating that, “there are significant issues with the nomination in that it does not meet the requirements of integrity...The Saemangeum Reclamation Project and other large infrastructure projects (e.g. bridges and ports) have also affected parts of the nominated property. These limit the wholeness and intactness of the ecological and biological processes compared to the original natural state...” ⁽⁵⁴⁾

In response to the IUCN’s evaluation, the ROK responded unambiguously in Section 7D (toward the end of the Supplementary Details) that, “The central and local governments will work together to block any development that might damage the OUV of the nominated property.” ⁽⁵⁵⁾

The proposed airport is expected to damage the OUV of the Seocheon Getbol. As such, central and local governments should work together to block it.

2.5 The construction of the airport as proposed falls outside of the spirit of the ROK's Fourth National Biodiversity Strategy and Action Plan and ultimately challenges the Constitutional right of citizens to a healthy and pleasant environment

As stated in the Fourth National Biodiversity Strategy and Action Plan (NBSAP), an NBSAP is a legal strategy to ensure the conservation of biodiversity and its sustainable use⁽¹³⁾. NBSAPs cover a wide range of inter-related environmental themes because global understanding of environmental protection has expanded out from a historically relatively narrow scope of earlier legislation on e.g., pollution, consumption and the designation of protected areas, into the wider framework of the Sustainable Development Goals and UN Conventions. Environmental protection now incorporates e.g. climate mitigation, biodiversity conservation and sustainability. This reality is expressed clearly through the duties and brief of the Ministry of Environment of the ROK. The Ministry of Environment is the focal point for the intergovernmental Ramsar Convention, and with Changwon City supported the hosting of the Ramsar Convention COP in 2008 under the slogan of “Healthy Wetlands, Healthy People”; the Ministry of Environment is also the focal point for the Convention on Biological Diversity. The Ministry of Environment is also responsible for assessments for the ROK national Red List of species and for the legally protected status of species and freshwater Wetland Protected Areas. The Ministry of Environment is also the lead agent of a proposed No-net-loss Natural Resources Policy presented in the Fourth National Biodiversity Strategy and Action Plan.

That strategy included three principles of potential relevance to this opinion: “Principle 1 Ensure the conservation of quality ecosystems that cannot be replaced or restored (avoid their use in development areas); Principle 2 Replace or restore to an equivalent or improved condition where damage is unavoidable (using inside/surrounding areas of the project site, different or alternative sites). And Principle 3 Reject project permit requests or impose restoration fees where restoration or alternative measures are not possible” (p. 39).

It is my honest opinion, based on my own research and all the scientific evidence that has been made available to me, that if permitted the construction and operation of the proposed Saemangeum New Airport would inevitably lead to a further loss of biodiversity within Saemangeum and would in all probability result in substantially increased damage to the ecological integrity and Outstanding Universal Value of the Seocheon Getbol World Heritage Site. It would result in a higher risk of damaging bird strikes; and would cause irreparable damage to the health of the environment, contrary to commitments made through the ROK's accession to international conventions, and expressed through Article 35 of the National Constitution and the Principles of the proposed No-net-loss policy.

Inevitably, it would also do damage to the ROK's international image and credibility, at least among those engaged in relevant conventions and conservation fields.

A proper EIASS needs to be conducted, with research methods fitting the construction and operation of an international airport within an internationally important wetland and in close proximity to the Seocheon Getbol Natural World Heritage Property. If declines in legally protected species can be expected, then the development proposal should be rejected.

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