

Avian Study for incorporation into AA & Ecology EIA

*As per ERA requirements for the Planning Application of proposed
Thermal Treatment Facility (TTF) within the ECOHIVE complex at
Magħtab (PA 6096/23; EA/00020/22)*

Technical Report

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1.0 Methodology

1.1 Avian study – methodological overview

The study at hand considers populations of wild birds, in particular populations of protected species and of species of conservation concern as relevant sensitive receptors.

The primary Area of Influence for the avifauna assessment of the proposed development, from here onwards referred to as **Aoi-1**, consists of the actual footprint area of the proposed TTF development and a 0.1 km buffer zone around this area (Figure 1). Impacts expected in the Aoi-1 are expected to include displacement, direct loss of habitat, disturbance from noise and vibrations, etc.

The additional potential impact of the proposed development on avifauna receptors in the wider area (e.g. caused by light pollution, pollutants in the stack plume etc.), is assessed in a secondary Area of Influence. It consists of a 5.0 km buffer around the site area of the proposed development, referred to as **Aoi-2** from here onward (Figure 2).

The assessment of potential impacts of the proposed TTF on avifauna receptors in the identified Aois is performed through a literature review.

The main references considered are:

- » Malta Breeding Bird Atlas 2008 (BirdLife Malta 2009)
- » Malta Breeding Bird Atlas 2018 (Epsilon 2019)
- » The Breeding Birds of Malta (Sultana et al. 2011)
- » European Breeding Bird Atlas 2: Distribution, Abundance and Change (Keller, Herrando, Vorisek, et al. 2020)
- » Malta Marine IBA Inventory Report (BirdLife Malta 2015)
- » MSFD second assessment report (ERA 2020)
- » BirdLife International (2020) IUCN Red List for birds (<http://www.birdlife.org>)
- » Bird species of Annex I of the Birds Directive (Last updated: 14/09/2020)
- » Draft Guidelines for the Reduction of Light Pollution in the Maltese Islands (Environment and Resources Authority 2020)
- » Project Description Statement, AIS Ref. no: PRJ-ENV598, Client Ref. no: ENV333102/A/20, version 8 (21 February 2024)



Figure 1: Proposed TTF site (outlined red) with 100m buffer AoI-1 (outlined blue). Figure taken from AIS document PDS-V8 (21-02-2024).

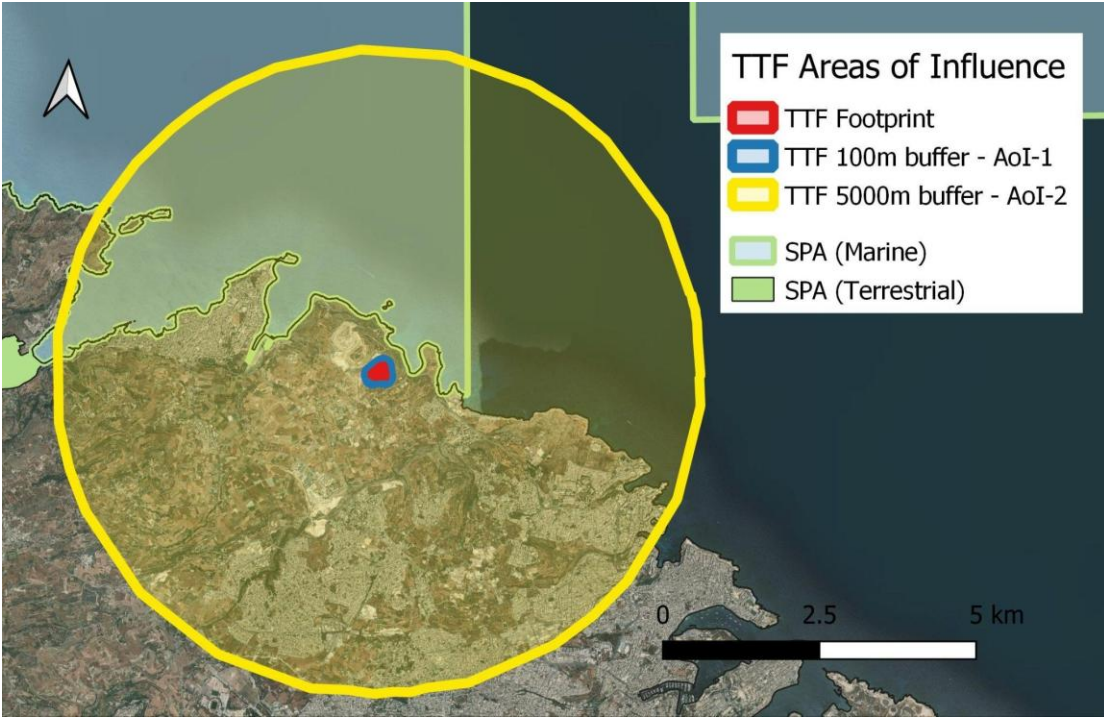


Figure 2: Proposed TTF site with 5000m buffer, AoI-2; marine and terrestrial SPAs.

2.0 Baseline Study

2.1 Desktop review

Approximately 400 bird species have been recorded in the Maltese Islands and its FMZ (25 NM). Slightly more than half of them occur in the Maltese Islands regularly¹. Close to 50 bird species have been recorded breeding on the Maltese Islands, of which 23 are regular breeders from wild populations². Three species, all pelagic seabirds, hold significant breeding populations in the Maltese islands from an EU, European and global perspective. These three species are listed under Annex I of the EU Birds Directive³. Information regarding the species' conservation status, population numbers, trend and range presented below are taken from BirdLife International's Data Zone⁴ and from the European Breeding Bird Atlas-2⁵. All information regarding species listed in Annex I of the EU-Birds Directive were obtained from the Environment, Nature and Biodiversity site of the European Commission⁶.

The baseline study intends to inform in general which bird species have been recorded or can be expected to occur in the Aol-1 and Aol-2 including in the above listed protected areas (Natura 2000 sites) in relevant numbers, thus expected to be sensitive receptors for the proposed TTF.

2.1.1 Breeding land birds within the Aol-1

Five bird species have been reported breeding within the Aol-1 or its direct vicinity according to the Malta Breeding Bird Atlases of 2008⁷ and 2018⁸, considering the breeding seasons 2008, 2017 and 2018. None are listed under Annex I of the EU Birds Directive and none have an unfavourable conservation status in Malta, the EU, or globally. None of the five species hold significant breeding populations in the Aol-1, and none are specifically sensitive to infrastructure such as the planned development, aside from the effects of habitat loss. Three of the five species regularly choose anthropogenic structures as nest sites.

¹Bonavia et al. (2005): *Systematic list 1996-1999, Il-Merill 31, 1-34.*

Bonavia et al. (2010): *Systematic list 2000-2005, Il-Merill 32, 55-109.*

²Epsilon Malta Ltd, Nature Conservation Consultants (2019). *Malta Breeding Bird Atlas 2018. Malta: Wild Birds Regulation Unit, Ministry for the Environment, Sustainable Development and climate Change*

³Maltese Environment and Resources Authority - ERA (2020): Update of Articles 8, 9 and 10 of the Marine Strategy Framework Directive (2008/56/EC) in Malta's Marine Waters. Second Assessment Report, pp.321-344.

⁴BirdLife International (2020) *IUCN Red List for birds*. Downloaded from <http://www.birdlife.org> on 17/07/2024.

⁵Keller, Herrando, Vorisek, et al. (2020): *European Breeding Bird Atlas 2: Distribution, Abundance and Change*

⁶https://ec.europa.eu/environment/nature/conservation/wildbirds/threatened/index_en.htm

⁷Raine, A., Sultana, J., and Gillings, S. (2009) *Malta Breeding Bird Atlas 2008. Malta: BirdLife Malta*

⁸Epsilon Malta Ltd, Nature Conservation Consultants (2019). *Malta Breeding Bird Atlas 2018. Malta: Wild Birds Regulation Unit, Ministry for the Environment, Sustainable Development and climate Change*

Table 1: List of breeding bird species in the Aol-1 and their status

Species	Breeding status in Aol-1	Abundance status	Trend in Malta	Trend in Europe	Conservation status	Annex I (EU Birds Directive)
Common Swift <i>A. apus</i>	Probable	Scarce	Increasing	Stable	Least Concern	No
Blue Rock Thrush <i>Monticola solitarius</i>	Possible	Frequent	Stable	Unknown	Least Concern	No
Sardinian Warbler <i>Curruca melanocephala</i>	Probable	Common	Decreasing	Stable	Least Concern	No
Zitting Cisticola <i>C. juncidis</i>	Probable	Abundant	Stable	Increasing	Least Concern	No
Spanish Sparrow <i>Passer hispaniolensis</i>	Confirmed	Abundant	Stable	Decreasing	Least Concern	No

2.1.2 Maltese seabirds utilising the Aol-2

Three pelagic seabird species from the order Procellariiformes – the Yelkouan Shearwater *Puffinus yelkouan*, Scopoli's Shearwater *Calonectris diomedea*, and Mediterranean Storm-petrel *Hydrobates pelagicus melitensis* – nest on the Maltese Islands and inhabit Maltese waters in significant population numbers from a global and European population perspective. All three species are listed in Annex I of the EU Birds Directive. One of them, the Yelkouan Shearwater, is listed as Vulnerable on the IUCN's Redlist. In addition to these, Malta hosts a breeding population of Yellow-legged Gulls *Larus michahellis*, not listed in Annex I of the EU Birds Directive. The designation of the marine SPA Żona fil-baħar madwar Għawdex (MT0000112), partially overlapping with the Aol-2, was triggered by two of the above-mentioned species: The Yelkouan Shearwater and the Scopoli's Shearwater.

Scopoli's Shearwater *Calonectris diomedea* – Least Concern, Annex I

The Scopoli's Shearwater is currently listed as Least Concern by the IUCN. It is listed under Annex I of the EU-Birds Directive. The species is endemic (breeding) to the Mediterranean basin, with major colonies in the Central Mediterranean. The global population size was last estimated in 2013 at 28500 – 446000 mature individuals equating to 142478 – 222886 breeding pairs, showing a decreasing trend. For the Maltese islands, the total population estimate in 2018 was 2670 – 3605 breeding pairs according to Malta's second assessment report for the MSFD, roughly equating to around 1.6 – 1.9 % of the global breeding population. Previous figures reported in 2013 had estimated the total Maltese population to be 3046 – 3962 breeding pairs. The available data suggests a decreasing population trend. Birds only approach land to breed, entering and leaving the colonies under the cover of darkness. Adults in and near the colonies and fledglings are sensitive to light pollution⁹. The closest breeding

⁹Rodríguez et al. (2017). Seabird mortality induced by land-based artificial lights. *Conservation Biology*, 31(5), 986-1001.

colony to the proposed development is Irdum tal-Madonna (SPA MT0000009) – this is not expected to be impacted directly by noise and sound pollution from the development.

The Scopoli's Shearwater inhabits Maltese waters from February to November, with the highest activity at and in front of the colonies mainly from March to October. The species is strictly pelagic, foraging frequently together in large numbers on shoaling fish and squid by plunge-diving and pursue-diving, up to 15m deep. During the breeding period, Scopoli's Shearwaters congregate in large flocks, sitting on the water's surface exhibiting 'rafting' behaviour within a 4 km radius in front of the colonies in the evenings¹⁰, as described by Sultana et al. 2011. GPS-tracking of individuals from Maltese colonies during the chick-rearing period (July - October) shows that Scopoli's Shearwaters utilise at-sea areas relatively close to shore, also within the Aol-2. The partially coastal distribution of foraging Scopoli's Shearwaters has furthermore been confirmed by shore- and boat-based counts. Up to 7300 individuals of the species make regular use of the SPA MT0000112, Żona fil-Baħar madwar Għawdex during the reproductive season as foraging ground and rafting areas in front the colonies. Frequent passage occurs through the SPA by birds commuting between breeding grounds and foraging areas. While Scopoli's Shearwaters have not been reported breeding inside the Aol-2, they make regular use of the marine part of the Aol-2.

Yelkouan Shearwater *Puffinus yelkouan* – Vulnerable, Annex I

The IUCN lists the Yelkouan Shearwater as Vulnerable. It is furthermore listed under Annex I of the EU-Birds Directive. The Yelkouan Shearwater is endemic to the Mediterranean basin. The global population size, estimated in 2011, is 15337 – 30519 pairs, roughly equating to 46000 – 92000 individuals, although the quality of this estimate is moderate due to data gaps. According to the IUCN the global population trend is decreasing. The latest total population estimates of Yelkouan Shearwaters for the Maltese Islands (2016 - 2018) is 1795 – 2635 breeding pairs, roughly equating to 10 % of the global breeding population. While previous figures reported in 2013 in the initial MSFD report suggest a short-term increase for Maltese population, the report stresses the fact that the apparent short-term increase of the Maltese Yelkouan Shearwater population is rather a result of intense research in recent years with the result of higher monitoring capacity rather than an actual increase in population numbers¹¹. The long-term trend indicates a stable population. By-catch is likely to be responsible for low adult survival rates¹² as shown for Maltese Yelkouan Shearwaters. Birds only approach land to breed, entering and leaving the colonies under cover of darkness. Adults and fledglings are sensitive to light pollution¹³. The largest Yelkouan Shearwater colony in Malta is situated at Irdum tal-Madonna (MT0000009), well outside the Aol-2. The colony closest to the planned

Crymble et al. (2020): *Identifying light-induced grounding hotspots for Maltese seabirds. II-Merill 34, 23-43.*

¹⁰BirdLife International (2010). *Marine Important Bird Areas toolkit: standardised techniques for identifying priority sites for the conservation of seabirds at sea. BirdLife International, Cambridge UK. Version 1.2: February 2011.*

¹¹Maltese Environment and Resources Authority - ERA (2020): *Update of Articles 8, 9 and 10 of the Marine Strategy Framework Directive (2008/56/EC) in Malta's Marine Waters. Second Assessment Report, pp.321-344.*

¹²Oppel et al. (2011): *Is the Yelkouan shearwater Puffinus yelkouan threatened by low adult survival probabilities? Biological Conservation, 144(9), 2255-2263.*

¹³Crymble et al. (2020): *Identifying light-induced grounding hotspots for Maltese seabirds. II-Merill 34, 23-43.*

development is situated on Selmunett (MT0000022), within the 5 km radius of the Aol-2. This colony is currently estimated at 45 to 70 breeding pairs.

The Yelkouan Shearwater inhabits Maltese waters, including the SPA MT0000112. It can be found in the colonies from October to July. Outside the breeding season, the birds disperse more widely across the Central Mediterranean and a significant part of the population migrates East to the Aegean and into the Black Sea¹⁴. Yelkouan Shearwaters are strictly pelagic, foraging frequently together in flocks of shoaling fish and squid mainly by pursuit-diving, up to 50m deep. Like Scopoli's Shearwaters, Yelkouan Shearwaters congregate in flocks exhibiting rafting behaviour within a 7 km radius in front of the colonies in the evenings, according to GPS-tracking data. The individual rafts tend to be further out at sea than those of the Scopoli's Shearwaters and made up of fewer individuals.

GPS-tracking of individuals during chick-rearing from the two main Maltese colonies (2012 - 2014)¹⁵ suggests that Yelkouan Shearwaters forage predominantly in waters further offshore and partially outside Maltese waters. Like other shearwater species, Yelkouan Shearwaters avoid crossing over land. The Yelkouan Shearwater is one of the trigger species for the designation of the marine SPA at hand (MT0000112). 3270 - 4650 individuals of the species make regular use of this SPA during the reproductive season as foraging ground and rafting areas in front of the colonies. Frequent passage occurs through the SPA by birds commuting between breeding grounds and foraging areas. To summarise, Yelkouan Shearwaters are breeding inside the Aol-2, are expected to be passing through the marine part of this area regularly and can be expected to also forage and rest/ raft there.

Mediterranean Storm-petrel *Hydrobates pelagicus melitensis* – Least Concern, Annex I

The Mediterranean Storm-petrel *Hydrobates pelagicus melitensis* is a Mediterranean subspecies, clearly separated both genetically¹⁶ and morphologically¹⁷ from the Atlantic breeding population of the European Storm-petrel. Neither IUCN/BirdLife International nor the EU-Birds Directive has assessed this taxonomic unit separately. The IUCN lists the species overall as Least Concern. It is listed under Annex I of the EU-Birds Directive. The Mediterranean subspecies *H. pelagicus melitensis* is endemic to the Mediterranean basin and therefore has a relatively restricted distribution range. The global estimated population size of the entire species is 430000 – 519999 mature individuals. However, the data quality is poor (estimated in 2015). The most recent population size estimates for the Mediterranean subspecies are 8500 – 15200 pairs, roughly 2 – 3 % of the global population. While the global population trend is unknown, the population trend of Mediterranean sub-species is decreasing according to EU Birds Directive. The closest breeding colony to the proposed

¹⁴Raine, A. F., Borg, J. J., Raine, H., & Phillips, R. A. (2013): Migration strategies of the Yelkouan Shearwater *Puffinus yelkouan*. *Journal of Ornithology*, 154(2), 411-422.

¹⁵ Metzger, B., Opper, S., Carroll, M., Meirinho, A., Dias, M. P., Barbara, N., & Lago, P. (2015). Malta Marine IBA Inventory Report. https://birdlifemalta.org/wp-content/uploads/2018/03/LIFE10NATMT090-MSP-A8_mIBA_Report_final.pdf

¹⁶Cagnon et al. (2004): Phylogeographic differentiation of storm petrels (*Hydrobates pelagicus*) based on cytochrome b mitochondrial DNA variation. *Marine Biol.* 145(6): 1257–1264.

¹⁷Lalanne et al. (2001): Morphological differentiation between European Storm-petrel subspecies: new results regarding two Mediterranean populations. *Alauda* 69(4): 475–482.

development is Irdum tal-Madonna (MT0000009) – this is not expected to be impacted by noise and light pollution from the planned development.

This most recent population assessment through capture mark recapture led to an overall population size estimate of 8575 breeding pairs, around 7 % of the estimated global population of the species and at least 56 % of the entire population of the Mediterranean subspecies. The short-term trend (2008 - 2018) and the long-term trend (1980 - 2018) for the Maltese population (2008 - 2018) are both reported to be stable¹⁸.

The species is found in the Maltese FMZ year-round and in the colonies from February to October. It is by far more commonly seen in Maltese waters during the breeding season, and more frequently and in higher numbers southeast and south of Malta. Adults and fledglings are sensitive to light pollution¹⁹.

The 70 % KDE of seven Storm-petrels from the Filfla colony GLS-tracked during the breeding season indicate that the birds make use of the entire Maltese FMZ, but also of areas further offshore between Malta and Libya.

Despite not being a trigger species for the designation of the marine SPA MT0000112, Storm-petrels are commonly making use of this area year-round, and more so during the breeding season. During the day, the species is mainly found far offshore, but especially with high wind velocities directed towards the shore, birds can be observed passing relatively close to the coast. Furthermore, Storm-petrels are known to forage close to coast during the night²⁰. While Storm-petrels have been observed in the Aol-2, foraging in and travelling through MT0000112 and prospecting potential breeding sites on Selmunett (MT0000022) at night (B. Metzger, pers. observations), they have not been confirmed breeding inside the Aol-2.

Yellow-legged Gull *Larus michahellis* – Least Concern

The IUCN lists the Yellow-legged Gull as Least Concern with an increasing population trend. The Global population numbers are unknown. The European population is estimated at 409000 – 534000 pairs equating to 819000 - 1070000 mature individuals, with an increasing trend. The latest assessment of the Maltese YLG population for Malta's Article 12 reporting to the EU²¹ lists 250 breeding pairs for the Maltese islands with an increasing trend. The largest colony, approximately 202 ± 24 apparently occupied nests (5-year mean) is located on Filfla. Similar numbers have been reported from Filfla before. Smaller colonies at Ta' Ċenc, Dingli and Wardija might have expanded in the last years and the species has established new breeding locations such as Comino, Għarb and Selmunett (MT0000022) recently²².

¹⁸Maltese Environment and Resources Authority - ERA (2020): Update of Articles 8, 9 and 10 of the Marine Strategy Framework Directive (2008/56/EC) in Malta's Marine Waters. Second Assessment Report, pp.321-344.

¹⁹Crymble et al. (2020): Identifying light-induced grounding hotspots for Maltese seabirds. *II-Merill* 34, 23-43.

²⁰D'Elbee, J. & Hemery, G. (1998) Diet and foraging behaviour of the British Storm Petrel *Hydrobates pelagicus* in the Bay of Biscay during summer. *Ardea* 86:1-10

²¹https://circabc.europa.eu/sd/a/4e807e1b-8aa1-4ede-ac48-a13cdd32889f/MT_A12NatSum_20141031.pdf

²²Crymble et al. (2020): New breeding sites of Yellow-legged Gull around the Maltese Islands. *II-Merill* 34, 72-80.

Western to Central Mediterranean populations are mainly sedentary and dispersive but some populations are partially migratory. In the Maltese Islands a large number of non-breeders are present year-round. Ring recoveries show that birds ringed on Filfla as chicks utilise other locations in Malta and abroad, mainly Sicily and Southern Italy²³. Yellow-legged Gulls are highly opportunistic feeders and benefit from human activities, such as fishing, discard from fisheries and other vessels, food-waste, landfills, aquaculture and agriculture. In the Maltese islands, they occur in their highest densities and largest abundances in the harbour areas, around the largest colony (Filfla), around areas with large aquaculture facilities, especially tuna pens such as in the vicinity of St Paul's Island and the wider area off Selmun. Large numbers can be observed circling in/above the Aol-1. In the Aol-2 up to a couple of thousands can be observed feeding at the Magħtab landfill. Large numbers regularly make use of the adjacent land and sea areas in the Aol-2 for feeding, resting, roosting, preening etc. including the SACs MT0000002 (L-inħawi ta' Pembroke), MT0000007 (Is-Salini), MT0000008 (L-Għadira s-Safra u l-Iskoll tal-Għallis), MT0000022 (Il-Gzejjer ta' San Pawl - Selmunett) and the SPA MT0000112 (Żona fil-Baħar ta' madwar Għawdex).

2.1.3 Other avian species expected within the considered protected areas

Many other avian species make use of the Aol-1 and/or Aol-2. Annex A lists all these species that have been recorded or can be expected to occur regularly in the Aol-1 and Aol-2, including their status. It is not expected that any of these species listed in Annex A will reach threshold levels of the population sizes being impacted by the proposed development.

²³ Sultana et al. (2011): *The Breeding Birds of Malta*. Birdlife Malta. Malta.

3.0 Impact Assessment

3.1 Construction phase

3.1.1 Temporary disturbance and reduction of habitat in the Aol-1

The TTF site will be a source of noise and light pollution (emergency night-time activities and security lighting) as well as vibrations, dust and direct disturbance during the construction phase. Noise and light pollution are expected to negatively affect the terrestrial avian assemblages in the immediate vicinity of the development significantly (Aol-1)²⁴. Overall, the proposed development will result in a temporary loss of potential breeding habitat for up to 5 terrestrial bird species within the Aol-1. While the proposed development, including the Aol-1, are not situated inside Natura 2000 sites, the habitats disturbed during the construction phase including the buffer area set at 0.1 km around the proposed development provide nesting territories for some land birds^{25, 26}. Furthermore, the roads leading to the construction site will experience higher traffic volume of heavy machinery, creating additional disturbance, light and noise pollution, dust, vibration and direct disturbance. Material from excavation and construction will need to be stored at least temporarily on site, increasing the area of disturbance. Overall, the proposed development will lead to temporary and localised short-term disturbance for these terrestrial bird species in the Aol-1.

Several breeding territories of the Sardinian Warbler and the Zitting Cisticola will be disturbed or lost during the construction phase if works are carried out during the breeding season (March – August). Up to 2 breeding pairs of Blue Rock Thrush will be disturbed during the construction phase if works are carried out during the breeding season (March – July). The disturbance can potentially lead to the complete temporary displacement, and consecutive reduction in breeding success up to loss of nest sites leading to reproductive failure of the breeding pairs of all three species in the Aol-1 during the construction phase if it coincides with the breeding season.

Foraging areas and potential colonial nest sites of the Spanish Sparrow can be expected to be reduced temporarily during the construction phase and some broods may fail if works are carried out during the breeding season (March – August).

No significant impact is expected on the breeding population of Common Swifts in the area, since no breeding territories are expected to be destroyed, and as highly mobile aerial feeders, the birds can shift their foraging territories.

Temporary habitat loss and disturbance is expected to result in the destruction of foraging areas for other breeding, wintering, and/or staging species in the Aol-1 depending on the period of the year in which the construction works will take place.

²⁴ Dominoni, D. M. (2015). The effects of light pollution on biological rhythms of birds: an integrated, mechanistic perspective. *Journal of Ornithology*, 156, 409–418. <https://doi.org/10.1007/s10336-015-1196-3>

²⁵ Sultana et al. (2011): *The Breeding Birds of Malta*. BirdLife Malta, Malta.

²⁶ Epsilon Malta Ltd, Nature Conservation Consultants (2019). *Malta Breeding Bird Atlas 2018*. Malta: Wild Birds Regulation Unit, Ministry for the Environment, Sustainable Development and climate Change

Overall, the direct impacts during the construction phase of the TTF and ancillary facilities will act temporarily and mainly on a localised scale in the Aol-1 and, to some extent, along the access roads. The works are not expected to impact a significant proportion of the relevant bird populations on a national or wider scale. However, they are expected to impact few local breeders of common species significantly at least short-term.

3.1.2 Light pollution during night-time construction (Aol-1 and Aol-2)

Artificial light at night (ALAN) is well documented to negatively affect birds, including seabirds. Adults from all three procellariiform species nesting on the Maltese Islands actively avoid approaching breeding areas under high levels of illumination and may desert colonies as a result of exposure to ALAN. That seabirds are negatively affected even by temporary light pollution in front of their colonies has been recently proven for *P. yelkouan* in Malta²⁷. Furthermore, ALAN causes the stranding of seabird fledglings on their first flight out of the colony. These may be injured or killed by collisions with manmade structures such as street light poles, or they might get grounded. Unless grounded individuals are found and released, they are likely to die²⁸. In general, light pollution from ALAN is additive and light trespass that creates skyglow adds to light pollution in areas that are otherwise dark.

While the site of the proposed development is not situated within the immediate line of sight of any seabird nest sites, shearwater fledglings are known to strand at light polluted sites across the Maltese Islands²⁹. However, a *P. yelkouan* colony holding a significant number of breeding pairs is located on St Paul's Island (MT0000022) within the 5.0 km buffer zone Aol-2, in which additional sky glow from ALAN from the construction site can have significant impacts, including on adult attendance. This is relevant if night-time construction activities are carried out during the reproductive season (February to July). The negative impact will potentially act on 45-70 breeding pairs. Including their offspring and prospecting birds, this equates to 225-350 individuals.

Additionally, ALAN is known to have negative consequences on nocturnally migrating birds in general. Bright lights are known to attract, disorient, and ground birds in active migration during the night³⁰ if construction work or operations are carried out at night during spring or autumn migration with no mitigation measures in place. The lit-up construction site during night-time operation is highly likely to have above-mentioned impacts on nocturnally migrating birds passing within the Aol-2 (5.0 km buffer). However, it is extremely unlikely that the additional ALAN from the construction site will impact threshold numbers of significance of birds of any species during their nocturnal migration.

²⁷ Austad, M., Oppel, S., Crymble, J., Greetham, H., Sahin, D., Lago, P. & Metzger, B. (2023). The effects of temporally distinct light pollution from ships on nocturnal colony attendance in a threatened seabird. *J Ornithol* 164, 527–536. <https://doi.org/10.1007/s10336-023-02045-z>

²⁸ Rodríguez, A., Holmes, N. D., Ryan, P. G., Wilson, K. J., Faulquier, L., Murillo, Y., Raine, A. F., Penniman, J. F., Neves, V., Rodríguez, B., Negro, J. J., Chiaradia, A., Dann, P., Anderson, T., Metzger, B., Shirai, M., Deppe, L., Wheeler, J., Hodum, P., ... Corre, M. Le. (2017). Seabird mortality induced by land-based artificial lights. *Conservation Biology*, 31(5), 986–1001. <https://doi.org/10.1111/cobi.12900>

²⁹ Crymble et al. (2020): Identifying light-induced grounding hotspots for Maltese seabirds. *Il-Merill* 34, 23-43.

³⁰ Evans Ogden, L. J. (2002). Summary report on the bird friendly building program: Effect of light reduction on collision of migratory birds. In *Fatal Light Awareness Program (Vol. 1)*.

The most sensitive periods to migrating land birds are March to May and September to November. The most sensitive periods for fledging seabirds are during their respective fledging periods: June/July for Yelkouan Shearwaters and September/October for Scopoli's Shearwaters. Mediterranean Storm-petrels have an asynchronous breeding season, with fledglings expected between June and October.

3.2 Operational phase

3.2.1 Permanent loss of habitat, reduction of habitat quality

Situated mainly on ODZ land, the proposed TTF with ancillary facilities will result in the permanent reduction of breeding habitat on its footprint (and via disturbance, noise, and habitat alteration in the Aol-1 and along access roads) for up to five receptor species (see Table 1). Around 18,185 m² of land, predominantly consisting of non-intensive agricultural land, including rubble walls, afforested areas and disturbed zones, will be permanently lost. The direct vicinity of the planned development (Aol-1) will face permanent habitat modification from the physical structures (e.g. walls, roads) and operational activities (noise, vibration, dust and disturbance from truck traffic, thermal energy and residuals in the plume, etc.). Despite the development not being carried out in a Natura 2000 site, the current habitats in the footprint and Aol-1 provide nesting territories for protected birds^{31,32}. Depending on how the non-built landscape and flat roofs of the planned development will be landscaped, the development will result in the permanent loss of several breeding pairs of *C. melanocephala*, *C. juncidis* and *M. solitarius*. Furthermore, it will lead to a reduction in foraging and roosting habitat as well as potential nesting sites for a population of breeding pairs of *P. hispaniolensis*. In the Aol-1 remaining habitat for the same species of breeding birds are expected to be reduced in size and quality. The habitat loss and reduction in habitat quality is also expected to result in the reduction of foraging areas for other breeding, wintering, and/or staging species, listed in Annex A to this document.

Overall, the impact will be localised in scale and the numbers of birds impacted are expected to remain well below levels of significance when considering the local (national), EU or international populations of any bird species making use of the area, thus no significant impacts on avifauna are expected in the footprint including the buffer zone (Aol-1) during standard operations.

3.2.2 Light pollution during nighttime operation

The impacts of ALAN on seabirds are laid out in 3.1.1.2. The proposed development including the Aol-1 is not situated within the immediate line of sight of any seabird nest sites. However, a *P. yelkouan* colony holding a significant number of breeding pairs is located on Saint Paul's Island (MT0000022) within the 5.0 km buffer zone Aol-2, in which additional sky glow from ALAN emitted by the TTF during operation can have significant impacts. This is relevant when operations are carried out during night-time or if the TTF including the ancillary facilities remain illuminated during the night outside working hours. The negative impact will be permanent and potentially act on 45-70 breeding pairs. Including their offspring and

³¹ Sultana et al. (2011): *The Breeding Birds of Malta*. BirdLife Malta, Malta.

³² Epsilon Malta Ltd, Nature Conservation Consultants (2019). *Malta Breeding Bird Atlas 2018*. Malta: Wild Birds Regulation Unit, Ministry for the Environment, Sustainable Development and climate Change

prospecting birds, this equates to 225-350 individuals. Additional to the up to 70 young *P. yelkouan*, fledging from Saint Paul's Island annually, seabird fledglings from other colonies might also get attracted and grounded by ALAN originating from the planned development.

As mentioned above ALAN is known to have negative consequences on nocturnally migrating birds in general. Bright lights are known to attract, disorient, and ground birds in active migration during the night³³ if the TTF carries out night-time operations (or remains lit-up in general) during the spring or autumn migration period with no mitigation measures in place. The lit-up TTF is highly likely to have above-mentioned impacts on nocturnally migrating birds passing within the Aol-2 (5.0 km buffer). However, it is extremely unlikely that the additional ALAN from the TTF will impact threshold numbers of significance of birds of any bird species passing through the wider area (Aol-2) during their nocturnal migration.

While light pollution during the operational phase has the same effects on the receptors as during the construction phase (outlined above), the impact during the operational phase is expected to act permanently (long-term).

3.2.3 Chemical pollution from the stack plume, fly ash residues, slag and bottom ash

A large variety of pollutants such as heavy metals, dioxins, furans and other pollutants are expected to end up in the TTF's stack plume when thermally treating some of the waste items listed in the PDS of the proposed project. Additionally, as the TTF is proposed to be fuelled by diesel, the plume can be expected to contain problematic diesel particulate matter (DPM), unburned partially polycyclic hydrocarbons (HC), benzene, formaldehyde, acetaldehyde, acrolein, 1,3-butadiene, carbon monoxide (CO) and nitrogen oxides (NOx). Impacts of pollutants from the stack plume are expected to extend to Aol-2, which includes Natura2000 sites designated for the breeding, foraging, and staging of protected bird species.

Apart from the implications for human health, there is substantial research into the negative effects such chemical pollutants pose on wildlife including birds, such as neurological and nervous deficiencies, impaired reproductive ability, physiological and behavioural abnormalities, mutagenic effects, and mortality³⁴. Even relatively low emission concentrations may result in higher contaminant burdens in receptors that are top-predators and long-lived species, such as seabirds, as a result of bioaccumulation³⁵ and biomagnification³⁶.

³³ Evans Ogden, L. J. (2002). *Summary report on the bird friendly building program: Effect of light reduction on collision of migratory birds*. In *Fatal Light Awareness Program* (Vol. 1).

³⁴ Fry, D. M. (1995). *Reproductive effects in birds exposed to pesticides and industrial chemicals*. *Environmental Health Perspectives*, 103(SUPPL. 7), 165–171. <https://doi.org/10.1289/ehp.95103s7165>

Péan, S., Daouk, T., Vignet, C., Lyphout, L., Leguay, D., Loizeau, V., Bégout, M. L., & Cousin, X. (2013). *Long-term dietary-exposure to non-coplanar PCBs induces behavioral disruptions in adult zebrafish and their offspring*. *Neurotoxicology and Teratology*, 39, 45–56. <https://doi.org/10.1016/j.ntt.2013.07.001>

³⁵ Bryan, G. W., Waldichuk, M., Pentreath, R. J., & Darracott, A. (1979). *Bioaccumulation of marine pollutants*. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 286(1015), 483–505. <https://doi.org/10.2307/2418066>

³⁶ Bearhop, S., Waldron, S., Thompson, D. R., & Furness, R. (2000). *Bioamplification of mercury in great skua *Catharacta skua* chicks: The influence of trophic status as determined by stable isotope signatures of blood and feathers*. *Marine Pollution Bulletin*, 40(2), 181–185. [https://doi.org/10.1016/S0025-326X\(99\)00205-2](https://doi.org/10.1016/S0025-326X(99)00205-2)

Therefore, appropriate flue gas treatment (FGT), using both dry and wet scrubber systems, must be implemented in combination with a CEMS, to make sure that chemical pollution values remain always well below legal limits.

A detailed Air Quality Study for the TTF (AIS Ref. No: PRJ-ENV598; Client Ref. No: PA/06096/23, 2nd version published on Jan 8, 2025) has modelled the impact of the stack plume on sensitive receptors in the wider area under three different simulation scenarios. With the FGT in place, the impact assessment for the three scenarios, corresponding to three different plant operations, all achieved a not significant adverse impact when evaluating the TTF in isolation. When considering cumulative effects in combination with the proposed WtE plant in the vicinity, the results obtained show that the cumulative impact of the project and the Waste to Energy facility is assessed as not significant, except for PM10 regarding sensitive receptor R27 (assessed as minor). Receptor R27 refers to agricultural land at Maghtab, 0.43km from the proposed development. With the mitigation measures in place (FGT), the overall adverse cumulative impact of reduced air quality on avian receptors can be assessed as not significant.

The fly ash residues expected from the thermal treatment operation are considered hazardous waste. Additionally, the slag and bottom ash can have hazardous components as well. Fly ash residues would be temporarily stored before being exported, since there are no facilities for the treatment of such waste in Malta. Leakage or spillage of fly ash residues into the environment during storage or transport is expected to result in severe environmental impacts, including contamination, bioaccumulation and biomagnification of toxic substances with expected severe consequences for wild bird populations (see above). Slag and bottom ash need to be tested for hazardous content vigorously, to make sure their contamination content falls below threshold levels, before disposing of them on the landfill or using them for road building etc.

Overall, the above mentioned FGT systems must be implemented and other necessary precautions and appropriate management must be taken, to avoid any hazardous residues ending up in the environment.

3.2.4 Biohazardous waste and infectious zoonoses

On the way into the boiler of the treatment facility, transport, storage and processing of dead animals including livestock that died of diseases as well as of biomedical waste from hospitals etc. pose a significant risk of leakage, accidental spills, bio-contamination (*Salmonella* sp., Botulism, etc.) and outbreaks of zoonoses (e.g. avian flu H5N1) and other diseases. Due to the close-by landfill, the wider area in which the development is proposed holds large populations (up to thousands) of gulls, mainly *L. michahellis* year-round and *C. ridibundus* during the non-breeding period. The gulls forage on the landfill, but also use the retention reservoirs and any other freshwater source in the area to drink, wash and preen. As scavengers, gulls can be expected to be highly attracted to the TTF if any organic waste, including dead livestock, is accessible to them. Gulls will be equally attracted to any open sources of freshwater, including run-off and puddles from biologically contaminated water (e.g. from cleaning the bring-in facilities, ramps, etc.), open retention reservoirs and sedimentation tanks. Even if the gulls might not be directly impacted by the zoonoses

Blanco, G., Frías, O., Jiménez, B., & Gómez, G. (2003). Factors influencing variability and potential uptake routes of heavy metals in black kites exposed to emissions from a solid-waste incinerator. *Environmental Toxicology and Chemistry*, 22(11), 2711–2718. <https://doi.org/10.1897/02-519>

themselves, and although they might not be of conservation concern, they can get infected and then act as reservoirs and carriers of zoonoses, infecting individuals of more susceptible protected species in the Natura 2000 sites. In recent years, there is evidence that outbreaks of zoonoses are further exacerbated by climate change³⁷.

3.2.5 *Incidental fires*

The transport, manipulation, and storage of flammable and potentially hazardous and toxic material in large quantities, as well as the operational activities of the TTF, impose a recognised high risk of a fire at the TTF. In such an event the plume of the blaze as well as the run-off from firefighting water will release toxins into the environment, with detrimental short- to long-term effects on living organisms including avifauna in the protected terrestrial and marine Natura 2000 sites in the Aol-2 and potentially beyond.

3.2.6 *Cumulative effects of overdevelopment and climate change*

The TTF is one of several waste management facilities proposed as part of the ECOHIVE complex, which to date include the groundwork for the Waste to Energy facility, a proposed Material Recovery Facility, an Organic Processing Plant and an Anaerobic Digestion Plant, as well as the potential for an extended road network to service these facilities³⁸. The TTF site will undergo a change in use from non-intensive agriculture to accommodate the facility. The proposed project within the entire ECOHIVE project presents another instance of open green space being sealed and developed in an already overdeveloped nation^{39, 40}. The associated effects of habitat loss, rainwater run-off, greenhouse gas emissions, and the urban heat island effect in the place of habitat restoration, water percolation, carbon sequestration, and climate change adaptation measures will have indirect, permanent, and adverse long-term negative effects on local avian biodiversity⁴¹.

3.3 *Decommissioning phase*

Similar disturbance to that during construction are expected as a result of disturbance, noise and light pollution.

³⁷ R. Rupasinghe, B. B. Chomel & B Martínez-López (2002): *Climate change and zoonoses: A review of the current status, knowledge gaps, and future trends*, *Acta Tropica*, V. 226,

³⁸ Ministry for the Environment, Climate Change and Planning (2021). *Long Term Waste Management Plan for Malta 2021-2030*. Environment and Resources Authority, Malta

³⁹ Portelli, M., Conrad, E., & Galdies, C. (2020). *Developing an Environmental Justice Index for Small Island States: The Case of Malta*. *Sustainability*, 12, 9519. <https://doi.org/doi:10.3390/su12229519>

⁴⁰ Environment and Resources Authority. *State of the Environment Report (SoER) 2018*; Environment and Resources Authority: Marsa, Malta, 2018; Available online: <https://era.org.mt/topic/soer/>

⁴¹ BirdLife International. (2018). *State of the world's birds: taking the pulse of the planet*. BirdLife International.

4.0 *Mitigation measures*

The recommended mitigation measures to reduce this project's impact on avifauna are largely related to foreseen light pollution impacts on breeding birds, seabirds in particular, and nocturnally migratory land birds:

- » Construction work at night requiring bright lights should be avoided or kept at a minimum.
- » All lighting during all phases of the proposal (construction, operation, and decommissioning) should follow the Guidelines for the Reduction of Light Pollution in the Maltese Islands (2020) published by ERA/PA, specifically:
 - Lighting should not be directed towards the sea, upwards towards the sky, or onto adjacent peripheral habitat.
 - The use of bright "cold" white lights during the night is discouraged and warm light (<3000K) should be used instead.
 - The building should not be fully lit at night during the operational phase, with the stack being lit using intermittent red light.
 - In the event that bright lights at night must be used, it is recommended to avoid the most sensitive period for seabirds, which would experience the most significant impact from such disturbance.
 - Specifically, night time security lighting should follow the above mentioned guidelines, particularly in that the site should not be permanently illuminated but triggered by motion sensors.
- » Appropriate filter technology (FGT) keeping the emission levels well below threshold levels, as proposed, should be ensured.
- » Appropriate protection measures against fires and waste spillage, as well as rapid response plans, must be in place to limit and reduce the potential effects of environmentally hazardous incidents.
- » Reducing the overall footprint of the proposed development by reducing the number of parking spaces for private vehicles would reduce the direct impact of habitat loss on local avifauna. By further implementing alternative modes of transport for the staff to the site (e.g. a shuttle service) would bring additional benefits by reducing the carbon footprint.

In addition to these points, it is recommended that the development does not take up a footprint larger than necessary, particularly when considering the access roads, to decrease the disturbance and destruction of terrestrial habitat used by birds. These adverse effects can be further reduced through compensatory measures such as appropriate landscaping (see section below).

Regarding the risk of pollutants from the stack plume and from leakages and accidental spillages, both during standard operations and in case of accidents such as fires, it is of utmost important that highest standards regarding infrastructure such as the implementation of BAT within the Flue Gas Treatment (FGT). Additionally, the stack should be monitored through a Continuous Emissions Monitoring System. Protocols should be implemented and adhered to, in order to keep the risk that relevant avifaunal receptors get exposed to any harmful substances, including bio-hazardous material, at a minimum.

5.0 Residual impacts

5.1 Partially compensating for cumulative effects of overdevelopment and climate change

It is highly recommended that an area of an equivalent size to that of the planned development is unsealed, where natural habitat can be restored and protected to compensate for the sealing and habitat loss caused by the planned development. This is especially important due to the cumulative effect of ongoing development in the Maltese islands with an increasing loss of natural or semi-natural open and unbuilt habitats and unsealed areas which contribute to a healthy avian assemblage.

It can also be considered to financially contribute to restoration and habitat protection projects by other entities (such as eNGOs) both at land and at sea.

5.2 Nest boxes for breeding birds

Since the TTF plant and facilities would likely displace breeding bird territories, we would suggest the provision of nest boxes for *A. apus*, *M. solitarius*, and *P. hispaniolensis* but also for *Falco tinnunculus*. Appropriate nest boxes and nesting structures for *A. apus*, *F. tinnunculus*, *M. solitarius*, and *P. hispaniolensis* could be made available at suitable locations at the site.

5.3 Appropriate landscaping

In order to sustain a healthy invertebrate community for birds foraging in the area, landscaping with endemic trees, shrubs, and plants that increase arthropod abundance and diversity and provide fruits for migratory, wintering and breeding birds, shelter and nesting habitats is suggested. Species of Mediterranean garrigue and grasslands for *Sylvia melanocephala* and *C. juncidis* could be incorporated to compensate for breeding territories lost for the species. Additionally, removing alien invasive plants from the wider area and replacing them with indigenous flora that provide food, shelter, and nesting habitat would also be advised.

6.0 Summary of Impacts

Table 3: Summary of impacts table

Impact type and source			Impact receptor		Effect & Scale							Impacts				
Impact type	Specific intervention leading to impact	Project phase	Receptor type	Sensitivity & resilience toward impact	Direct/ Indirect/ Cumulative	Beneficial/ Adverse	Severity	Physical/ geographic extent of impact	Short-/ Medium-/ Long-term	Temporary/ Permanent	Reversible/ Irreversible	Probability of impact occurring	Overall impact significance	Proposed mitigation measures	Residual impact significance	Other requirements
Loss of habitat for terrestrial avian species	Destruction of agricultural land in ODZ	Construction	Terrestrial avian species	High & Low	Direct	Adverse	Low	Local in footprint and Aol-1	Short-term	Temporary	Reversible	Inevitable	Moderate	Keep time short, keep footprint low, avoid (if possible) reproductive season, habitat restoration	Minor	N/A
Noise, vibration, and light pollution negatively affecting terrestrial avian assemblages in Aol-1	Construction activities, operation	Construction, decommissioning	Terrestrial avian species	Moderate & Moderate	Direct	Adverse	Low	Local, in footprint and Aol-1	Short-term	Temporary	Reversible	High	Moderate	Limit night-time activities, reduce light pollution, avoid (if possible) sensitive periods	Minor	N/A
Light pollution negatively impacting nocturnally migrating birds	Lighting during construction	Construction, decommissioning	Nocturnally migrating birds	Moderate & Moderate	Direct	Adverse	Low	Broad (Aol-1 and Aol-2)	Short-term	Temporary	Reversible	High	Moderate	Limit night-time activities, reduce light pollution, avoid (if possible) sensitive periods	Minor	N/A
Colony disturbance grounding of seabird fledglings, associated induced mortality caused by ALAN	Lighting during construction and operation	Construction, operation, decommissioning	Procellariiform seabirds, specifically <i>P. yelkouan</i>	High & Low	Direct	Adverse	High	Broad (Aol-2)	Short-term, potentially long-term	Temporary, potentially permanent	Reversible	High	Major	Limit night-time activities, reduce light pollution, avoid (if possible) sensitive periods.	Minor	Strictly follow guidelines for the reduction of light pollution
Exposure of (marine) avifauna to harmful substances, including biohazardous material (pathogens etc.), reducing life expectancy, physiological health state, reproductive success, disease outbreaks	Pollutants from stack plume, spills of fly ash and bottom ash, spills, of contaminated water during standard operation, transport or during accidents, bioaccumulation	Operation, potentially decommissioning	Marine avian species and others	High & Low	Direct	Adverse	High	Broad (Aol-2 and beyond)	Long-term	Permanent	Reversible	Inevitable	Major	Infrastructure (FGT) and monitoring (CEMS) of the stack. Protocols in place to minimise release and spills of any harmful substances, including biohazardous material into the environment	Not significant	N/A
Contribution to climate change, impacting biodiversity	Increase in CO2 due to use of diesel, heat-island effect from built-up footprint	Operation	Biotic and abiotic environment	Moderate & Moderate	Indirect/ Cumulative	Adverse	Moderate	Very broad	Long-term	Permanent	Reversible, with difficulty	Low to Inevitable	Not significant	Reduce footprint, Reuse of generated steam for internal purposes where possible	Not significant	N/A

7.0 Annex A: List of bird species in the Aol-1 and 2

The following species are expected to make use of the Aol-2 including Natura 2000 sites, identified as a 5km buffer area around the planned TTF development:

Seabirds *sensu lato*

Ferruginous Duck *Aythya nyroca* – Near Threatened, Annex I, population trend decreasing. A significant proportion of the European Ferruginous Duck population and more than 1% of the global population funnels through Gozo Channel situated in the mSPA (MT0000112) annually, mainly during spring migration. The birds often pass in larger flocks, also alighting on the water to rest. Occasionally observed in Is-Salini (MT0000007). However, no significant numbers of the species have been recorded in the Aol-2.

Greater Flamingo *Phoenicopterus roseus* – Least Concern, Annex I, overall population trend increasing. Flamingos migrate through the Maltese Islands, including the mSPA MT0000112 annually often gathering in larger flocks. In recent years they have been recorded in increasing numbers, mainly in autumn. Expected to pass through the Aol-2 regularly on migration, but it is unlikely that this happens in significant numbers. Reported stopping over in Is-Salini (MT0000007).

Slender-billed Gull *Chroicocephalus genei* – Least Concern, Annex I, European population size decreasing. In Malta Slender-billed Gulls are recorded annually on migration mainly from (July) August to March (April) in single to low double figures of daily observations. Slender-billed Gulls are considered a coastal species. The species can be expected to occur regularly in the Aol-2, including foraging at Magħtab landfill and foraging, roosting and passing over the marine part of the Aol-2 that is situated in the SPA MT0000112. Furthermore, it has been reported making use of the reserves, Is-Salini (MT0000007) and L-Għadira s-Safra (MT0000008) for foraging and roosting. However, it is very unlikely that numbers in the areas reach significant levels from a global or European population perspective at any point.

Mediterranean Gull *Larus melanocephalus* – Least Concern, Annex I, European population trend decreasing. In the Maltese islands the species is mainly recorded from October to April with numbers in the lower hundreds reported in the period from November to March. Regularly makes use of the SPA MT0000112, including the marine part of the Aol-2. Birds will also make use of the adjacent land areas for roosting as well as foraging at the landfill. SPA MT0000112. Also recorded regularly in the reserves Is-Salini (MT0000007), L-Għadira s-Safra (MT0000008) and Selmunett (MT0000022). It is not expected that Mediterranean Gulls reach relevant numbers in the Aol-2 as compared with the European population which is equivalent to the global population.

Audouin's Gull *Ichthyaetus audouinii* – Least Concern, Annex I, the European breeding population has increased and is currently stable. Audouin's Gulls are mainly found in marine habitats year-round, very frequently following trawlers to feed discarded fish. The species is migratory and dispersive. Before 2000 the Audouin's Gull was considered a very rare bird species to the Maltese islands. The species' status has changed significantly since. From 2000 to 2009 there were 311 records of 535 individuals, with a maximum of 184 sightings in 2007.

During stopover on migration the species can be expected regularly in the Aol-2, foraging at Magħtab landfill and roosting, foraging and passing through SPA MT0000112, including the Aol and the area of the water inlet and discharge. It has also been recorded regularly from Is-Salini (MT0000007), L-Għadira s-Safra (MT0000008) and Selmunett (MT0000022). However, it is very unlikely that numbers in any of the aforementioned areas reach significant levels from a global or European population perspective at any point.

Little Tern *Sternula albifrons* – Least Concern, Annex I, overall population trend is decreasing, the European population size trend is unknown. In Malta Little Terns are recorded annually in small numbers, mainly in spring (April-May). The species is at least partially migratory and dispersal in the region. Little Terns regularly frequent coastal areas, including lagoons and salt pans when foraging, including the marine part of the Aol-2 inside SPA MT0000112. They also have been reported from Is-Salini (MT0000007). However, it is highly unlikely that significant numbers regarding the global, European or EU population are reached inside the Aol-2 at any time.

Common Gull-billed Tern *Gelochelidon nilotica* – Least Concern, Annex I, the global population is suspected to be in decline, while the European population is estimated to be increasing. The species is recorded in Malta annually in single to double digit numbers on migration, both in spring and autumn. It is likely that Gull-billed terns occur in the SPA MT0000112 and in the marine part of the Aol-2 annually during passage on migration and make use of the area for foraging. However, it is highly unlikely that significant numbers regarding the European population are reached at any time.

Caspian Tern *Hydroprogne caspia* – Least Concern, Annex I, the global as well as the European population trends of this species are increasing. It is recorded in Malta annually in double digit numbers on migration, both in spring and autumn. It is likely that Caspian Terns occur in the SPA MT0000112, including the Aol-2 and in the relevant reserves annually during passage on migration and that they make use of it as foraging areas, plunge-diving for fish while feeding on the wing. However, it is highly unlikely that significant numbers regarding the European population are reached at any time. Ringed Caspian Terns that have been recorded in Malta were ringed in Finland (e.g. 9 until 1996), confirming that birds of the European population are passing through Malta regularly.

Black Tern *Chlidonias niger* – Least Concern, Annex I, the global population trend of the species is declining, while the European population trend is unknown. Black terns occur in Maltese waters annually and in large numbers mainly during autumn migration, peaking in the second half of August to the beginning of September with few scattered records from spring migration. The species passes through the Maltese islands mainly in offshore areas, frequently foraging on the wing for small prey items at or close to the sea surface. The birds are often attracted to the net cages of the Maltese Tuna aquaculture industry where they feed from next to the cages but also rest on the rails of the cages. Black Terns can also be frequently observed offshore resting on the floats of FAGs of the Dolphin-fish (*Lampuka, Coryphaena hippurus*) fisheries, but also on sun-bathing turtles (*Caretta caretta*), buoys and floating debris (all own observations). During vessel-based surveys and trips to tuna-cages in the Maltese FMZ at the end of August, numbers of up to 2000 individuals were counted during a single trip. On migration, Black Terns are very likely to pass through the SPA MT0000112 including the Aol-2 and use it to forage and rest during migration and stop-over. They also have been

recorded from the relevant reserves. Nevertheless, it is not likely that significant threshold values are reached in the AoI-2 as compared to the global, European and EU populations.

Sandwich Tern *Thalasseus sandvicensis* - Least Concern, Annex I, the overall and European population trends are fluctuating. In Malta Sandwich Terns occur on passage and - to a lower extent - wintering from (August) September to March (April). They are reported annually in double figures. As other tern species, Sandwich Terns forage in coastal waters. Sandwich Terns occur in the SPA MT0000112, including the marine part of the AoI, annually during passage on migration and make use of it as foraging area. Furthermore, they are recorded or can be expected regularly in the reserves Is-Salini (MT0000007), L-Għadira s-Safra (MT0000008) and Selmunett (MT0000022). However, it is very unlikely that significant numbers regarding the global European or EU population are reached inside the AoI-2 at any time.

Red-breasted Merganser *Mergus serrator* – Least Concern, expected to pass through the marine part of the AoI-2 (within MT0000112) in small numbers on migration; also observed in singles on stopover in the shallow coastal waters of L-Għadira s-Safra (MT0000008).

Common Shelduck *Tadorna tadorna* – Least Concern, recorded regularly in small numbers from Is-Salini (MT0000007) and L-Għadira s-Safra (MT0000008), as well as on passage in the SPA MT0000112.

Garganey *Spatula querquedula* – Least Concern, recorded in small numbers on stop-over from Is-Salini (MT0000007)

Northern Shoveler *Spatula clypeata* – Least Concern, recorded in small numbers on stop-over from Is-Salini (MT0000007).

Mallard *Anas platyrhynchos* – Least Concern, feral individuals recorded in high numbers from Is-Salini (MT0000007).

Pintail *Anas acuta* – Least Concern, recorded in small numbers from Is-Salini (MT0000007).

Common Teal *Anas crecca* – Least Concern, regularly recorded in small numbers on stop-over from Is-Salini (MT0000007).

Little Grebe *Tachybaptus ruficollis* – Least Concern, regular winter visitor to the reserve Is-Salini (MT0000007).

Great-crested Grebe *Podiceps cristatus* – Least Concern, scarce winter visitor and passage migrants, recorded from Is-Salini (MT0000007) and mSPA MT0000112.

Black-necked Grebe *Podiceps nigricollis* – Least Concern, regular winter visitor and passage migrant in small numbers in Is-Salini (MT0000007).

Common Moorhen *Gallinula chloropus* – Least Concern, year-round, recent breeding attempt from Is-Salini (MT0000007).

Northern Gannet *Morus bassanus* – Least Concern, expected to pass through and potentially forage in the marine part of the AoI-2, including mSPA MT0000112, mainly during the winter months

Great Cormorant *Phalacrocorax carbo* – Least Concern, recorded regularly in increasing numbers wintering in the Maltese islands, including the marine part of the Aol-2 and the relevant reserves (MT0000007, MT0000008 and MT0000022).

Little Gull *Hydrocoloeus minutus* – Least Concern, regularly passing through marine SPA MT0000112 during migration, has been occasionally recorded roosting and/or foraging in singles at Is-Salini (MT0000007).

Black-headed Gull *Chroicocephalus ridibundus* - Least Concern, large numbers migrate through the Maltese islands and winter there. Larger flocks forage and roost in the Aol-2, including the Landfill at Maghtab and the relevant Natura2000 sites (MT0000007, MT0000008, MT0000022, MT0000112).

Lesser Black-backed Gull *Larus fuscus* – Least Concern, regular on migration and to some extent wintering in smaller numbers, making use of the Aol-2 for foraging and roosting, recorded regularly in all relevant Natura2000 sites (MT0000007, MT0000008, MT0000022, MT0000112)

Long-tailed Skua *Stercorarius longicaudus* - Least Concern, expected to pass through the marine part of the Aol-2 (including mSPA MT0000112) on migration in small numbers.

Arctic Skua *Stercorarius parasiticus* – Least Concern expected to pass through the marine part of the Aol-2 (including mSPA MT0000112) in small numbers on migration.

Pomarine Skua *Stercorarius pomarinus* – Least Concern expected to pass through the marine part of the Aol-2 (including mSPA MT0000112) in small numbers on migration.

Great Skua *Catharacta skua* - Least Concern expected to make use of marine parts of the Aol-2 (including mSPA MT0000112) in small numbers on migration and when wintering.

Land-birds (Non-passeriformes)

Common quail *Coturnix coturnix* – Least Concern, declining, irregular breeder, common passage migrant (nocturnal), winters in small numbers, expected to occur regularly in the Aol-2, mainly on stopover during migration.

European Turtledove *Streptopelia turtur* – Vulnerable, strong decline, would breed regularly if spring hunting was abolished, regular passage migrant in declining numbers, more commonly seen in spring; can be expected stopping over in the terrestrial part of the Aol-2 regularly in small numbers.

Collared Dove *Streptopelia decaocto* – Least Concern, trend increasing. Likely to occur in the Aol-2 in the near future, as the species is expanding its range across the islands.

European Nightjar *Caprimulgus europaeus* – Least Concern, common on passage in spring and autumn, can be expected to pass regularly through the Aol-2 on migration and make use of its terrestrial parts, including the Natura 2000 sites for foraging and roosting.

Alpine Swift *Tachymarptis melba* – Least Concern, recorded in small numbers during spring and autumn migration, aerial feeder, likely to pass occasionally through the Aol-2.

Pallid Swift *Apus pallidus* – Least Concern, in Malta regularly to commonly seen from March to October, small breeding populations in Malta, can be expected to make regular use of the airspace of the Aol-2 and all relevant Natura 2000 sites (MT0000007, MT0000008, MT0000022, MT0000112).

Common Swift *Apus apus* – Least Concern, common on migration in spring and autumn, small but increasing breeding population, including the Aol. Can be expected/ has been recorded to make regular use of the airspace of the Aol and all relevant Natura 2000 sites (MT0000007, MT0000008, MT0000022, MT0000112).

Common Cuckoo *Cuculus canorus* – Least Concern, fairly common on spring migration, less common during autumn, single breeding records in Malta. Expected to occur in the terrestrial part of Aol-2 during migration and stopping over, reported from Is-Salini (MT0000007).

Western Water Rail *Rallus aquaticus* – Least Concern, population numbers decreasing. Frequent autumn migrant and common winter visitor in the wetlands of the Maltese islands. Some breeding attempts. Regularly reported from Is-Salini (MT0000007) in small numbers.

Spotted Crake *Porzana porzana* – Least Concern, Annex I, small numbers in spring and autumn on migration.

Common Crane *Grus grus* – Least Concern, Annex I, population trend increasing, recorded annually on migration in small flocks, potentially passing through the Aol-2

Black Stork *Ciconia nigra* – Least Concern, Annex I, European population increasing, in Malta annually in small numbers during migration, mainly in autumn.

White Stork *Ciconia ciconia* – Least Concern, Annex I, population increasing, in Malta annually in small numbers on migration mainly autumn, to less extend in spring. White Storks are frequently foraging on landfills. Therefore, the species can be expected to occur in the Aol-2.

Eurasian Spoonbill *Platalea leucorodia* – Least Concern, Annex I, trend increasing, in Malta mainly on passage in spring and autumn. Regularly migrating through mSPA MT0000112 and has been recorded on stopover in Is-Salini (MT0000007). Potentially migrating through the Aol-2.

Glossy Ibis *Plegadis falcinellus* – Least Concern, Annex I, European population increasing, in Malta recorded annually on migration. Has been recorded passing through mSPA MT0000112. Potentially migrating through the Aol-2.

Common Little Bittern *Ixobrychus minutus* - Least Concern, Annex I, European population stable, irregularly breeding in Malta, recorded annually in small numbers on migration. Expected to migrate through the Aol-2 (at night). Recorded on stopover during migration for the Natura 2000 site Is-Salini (MT0000007).

Black-crowned Night Heron *Nycticorax nycticorax* - Least Concern, Annex I, decreasing in Europe, frequently migrating over Malta, regularly observed during stop-over at Is-Salini (MT0000007), can be expected to migrate regularly through the Aol-2.

Squacco Heron *Ardeola ralloides* - Least Concern, Annex I, European population considered stable, passing through Malta in small numbers on migration annually. Has been recorded at Is-Salini (MT0000007), can be expected to migrate through the Aol-2 occasionally.

Grey Heron *Ardea cinerea* - Least Concern, regular visitor to the Maltese islands year-round but higher numbers during migration. Can be expected to migrate regularly through the Aol-2. Has been recorded regularly to frequently in all relevant Natura 2000 sites (MT0000007, MT0000008, MT0000022, MT0000112).

Purple Heron *Ardea purpurea* - Least Concern, Annex I, European population decreasing, passing through the Maltese Islands annually during migration in good numbers. Has been recorded regularly at Is-Salini (MT0000007). Can be expected to pass through the Aol-2 on migration occasionally.

Great White Egret *Casmerodius alba* – Least Concern, Annex I, recorded annually on passage in small numbers, including Is-Salini (MT0000007). Can be expected to pass through the Aol-2 occasionally on migration.

Little Egret *Egretta garzetta* – Least Concern, Annex I, fairly common passage migrant in spring and autumn, few individuals year-round, recently established small breeding population close to Is-Salini, at least partially founded by escapes. Recorded regularly from Is-Salini (MT0000007) and L-Għadira s-Safra (MT0000008). Therefore, it is recorded to occur in the Aol-2 including the relevant Natura2000 sites regularly.

Cattle Egret *Bubulcus ibis* – Least Concern, Annex I, fairly common passage migrant in spring and autumn, some individuals year-round, established a small breeding population close to Is-Salini, at least partially founded by escapes. Recorded regularly from Is-Salini (MT0000007 and L-Għadira s-Safra MT0000008), as well as foraging at Maghtab landfill, thus recorded regularly in the Aol-2 and in the relevant Natura2000 sites.

Stone Curlew / Eurasian Thick-knee *Burhinus oedicanus* – Least Concern, Annex I, recorded in Malta regularly in small numbers on migration in spring and autumn. Potentially passing through the Aol-2 in low numbers

Oystercatcher *Haematopus ostralegus* – Near threatened, population declines across Europe, recorded in Malta annually in small numbers. Potentially passing through and resting/ foraging in the Aol in small numbers, including MT0000008 and MT0000022.

Pied Avocet *Recurvirostra avosetta* – Least Concern, Annex I, recorded in Malta annually in small numbers mainly during autumn migration, potentially wintering. Recorded from Is-Salini (MT0000007).

Black-winged Stilt *Himantopus himantopus* – Least Concern, Annex I, frequent spring migrant in the Maltese islands, scarce breeder of up to 3 pairs in the Maltese Islands Is-Simar

(MT0000006) and visitor of Is-Salina Ghadira (MT0000007). Can be expected to occur occasionally along the rocky shores of the Aol-2 and MT0000022.

Grey Plover *Pluvialis squatarola* – Least Concern, in Malta recorded annually in small numbers during spring and autumn migration. Potentially migrating through the Aol.

Eurasian Golden Plover *Pluvialis apricaria* - Least Concern, Annex I, population trend increasing. Common in Malta during winter months, both on migration and wintering. Has been reported from Is-Simar (MT0000006). Potentially migrating through and/or stopping over in the Aol.

Eurasian Dotterel *Charadrius morinellus* - Least Concern, Annex I, in Malta annually in small numbers, stopping over mainly during autumn migration. Potentially migrating through and stopping over in the Aol.

Common Ringed Plover *Charadrius hiaticula* – Least Concern, decreasing on EU and global level, fairly common passage migrant in spring and autumn. Recorded from Is-Salini (MT0000007). Expected to be also foraging and stopping over at MT0000022 on migration and to pass through the Aol-2.

Little Ringed Plover *Charadrius dubius* – Least Concern, population decreasing, common passage migrant in spring and autumn, breeding annually in few pairs. Recorded regularly from Is-Salini (MT0000007), inside the Aol-2. Expected to also occur in the reserve MT0000022.

Kentish Plover *Charadrius alexandrinus* – Least Concern, Annex I, regular passage migrant in small numbers in spring and autumn. Potentially occurring in the Aol-2.

Northern Lapwing *Vanellus vanellus* – Near Threatened, overall declining population trend, recorded regularly in Malta during the winter months in small flocks; regular passage migrant in small numbers in spring and autumn. Potentially occurring in the Aol-2.

Whimbrel *Numenius phaeopus* – Least Concern, recorded annually in small numbers in spring and autumn during migration. Expected to occur in the Aol-2 in small numbers and irregularly, foraging/ roosting on the rocky shore and migrating through the area at night.

Eurasian Curlew *Numenius arquata* – Near Threatened, global population trend decreasing, passing regularly through Malta during spring and autumn. Expected to occur in the Aol-2 in small numbers and irregularly, foraging/ roosting on the rocky shore and migrating through the area at night.

Black-tailed Godwit *Limosa limosa* – Near Threatened, population trend decreasing, in Malta recorded annually, mainly on spring migration. Potentially migrating through the Aol-2 in small numbers.

Ruddy Turnstone *Arenaria interpres* – Least Concern, recorded in Malta annually in small numbers in spring and autumn. Expected to occur in the Aol-2 in small numbers and irregularly, foraging/ roosting on the rocky shore and migrating through the area at night.

Red Knot *Calidris canutus* – Near Threatened, global population trend decreasing, recorded in Malta almost annually in small numbers on passage. Potentially passing through the Aol-2 on migration.

Ruff *Calidris pugnax* – Least Concern, Annex I, population trend decreasing, recorded in the Maltese islands regularly and in good numbers, mainly during spring migration, including in Is-Salini (MT0000007). Expected to be passing through the Aol-2 on migration.

Curlew Sandpiper *Calidris ferruginea* – Near Threatened, suspected to be declining, in Malta regularly in small flocks on passage migration in spring and autumn. Recorded in Is-Salini (MT0000007) and expected to be passing through the Aol-2 on migration.

Temminck's Stint *Calidris temminckii* – Least Concern, population trend stable, recorded in Malta in small numbers during spring and autumn migration, including in Is-Salini (MT0000007). Expected to be passing through the Aol-2 on migration occasionally.

Sanderling *Calidris alba* – Least Concern, passing through Malta annually in small numbers during spring and autumn. Potentially passing through the Aol-2.

Dunlin *Calidris alpina* – Least Concern, recorded in Malta annually in small numbers mainly on passage in spring and autumn including at Is-Salini (MT0000007). Expected to be passing through the Aol-2 on migration.

Little Stint *Calidris minuta* – Least Concern, singles recorded in Malta year-round, common during spring and autumn migration. Observations also at Is-Salini (MT0000007) and expected to be passing through the Aol-2 on migration.

Eurasian Woodcock *Scolopax rusticola* – Least Concern, trend estimated stable, observed in Malta during the winter months, expected to occur in the Aol-2 during passage and foraging/wintering.

Great Snipe *Gallinago media* – Near Threatened, Annex I, overall trend decreasing, in Malta encountered annually in singles on spring migration. It can't be excluded that the species occasionally passes through the Aol-2 on migration.

Common Snipe *Gallinago gallinago* – Least Concern, common passage migrant, mainly in spring, regularly observed at Is-Salini (MT0000007). Can also be expected to occur at SAC L-Għadira s-Safra u l-Iskoll tal-Għallis (MT0000008) and to pass through the Aol-2 on migration.

Jack Snipe *Lymnocyptes minimus* – Least Concern, population trend stable, passing through the Maltese islands annually in small numbers during the winter months, occasionally passing through and stopping over in the Aol-2, including at Is-Salini (MT0000007).

Common Sandpiper *Actitis hypoleucos* – Least Concern, overall population trend decreasing, common passage migrant in Malta in spring and autumn, recorded in small numbers year-round. Recorded or expected regularly in all relevant Natura2000 sites (MT0000007, MT0000008, MT0000022, MT0000112). Expected to occur frequently in the Aol-2.

Green Sandpiper *Tringa ochropus* – Least Concern, population trend increasing, regular passage migrant through the Maltese islands in spring and autumn, expected to pass through the Aol-2 on migration regularly in small numbers.

Spotted Redshank *Tringa erythropus* – Least Concern, population trend stable, recorded annually in Malta in small numbers on migration and in winter. Expected to occasionally pass through the Aol-2 in small numbers.

Common Greenshank *Tringa nebularia* – Least Concern, population stable, common visitor to the Maltese islands in relatively low numbers on spring and autumn migration. Expected to occasionally pass through the Aol-2I in low numbers.

Common Redshank *Tringa totanus* – Least Concern, European population has undergone a moderate decline, a regular passage migrant in Malta in small numbers, both in spring and autumn. Reported for Is-Salini (MT0000007). Expected to occasionally pass through the Aol-2 in low numbers.

Wood Sandpiper *Tringa glareola* – Least Concern, Annex I, population trend stable, common passage migrant in the Maltese islands in spring and autumn. Reported for Is-Salini (MT0000007). Expected to occasionally pass through the Aol-2 in low numbers.

Marsh Sandpiper *Tringa stagnatilis* – Least Concern, overall population trend decreasing, recorded in Malta regularly in small numbers on migration, including at Is-Salini (MT0000007). Potentially passing through the Aol-2.

Collared Pratincole *Glareola pratincola* – Least Concern, Annex I, overall population trend decreasing, recorded almost annually in singles, mainly on short stop-overs during spring migration, including at Is-Salini (MT0000007). Potentially passing through the Aol-2.

Eurasian Scops-owl *Otus scops* – Least Concern, global population trend declining, regularly recorded in the Maltese islands, mainly during migration. Can be expected to pass through the Aol-2 regularly and in low numbers and also make use of the terrestrial part of the area during stopover on migration.

Short-eared Owl *Asio flammeus* – Least Concern, Annex I, population trend in Europe fluctuating, recorded annually in small numbers, mainly on migration, has been reported nesting in the Maltese islands, at least two times in recent years. Can be expected to pass through the Aol-2 occasionally and in low numbers and also use the area during stopover on migration.

Osprey *Pandion haliaetus* – Least Concern, Annex I, European population trend increasing, regularly recorded in the Maltese islands on spring and autumn migration. Has been observed foraging and roosting at Is-Salini (MT0000007) Can be expected to pass through the Aol-2 regularly in small numbers.

European Honey-buzzard *Pernis apivorus* – Least Concern, Annex I, overall population trend decreasing, common passage migrant over the Maltese islands, mainly in autumn. Can be expected to migrate through the Aol-2 regularly.

Egyptian Vulture *Neophron percnopterus* – Endangered, Annex I, population trend declining in entire range, recorded in Malta almost annually in singles on migration, mainly in autumn. Birds might be attracted to the landfill and therefore the species might occur in the Aol-2 occasionally on migration.

Short-toed Snake-eagle *Circaetus gallicus* – Least Concern, Annex I, population trend stable, appears on passage in the Maltese islands annually in small numbers, mainly in autumn. Potentially passes through the Aol-2 on migration.

Lesser spotted Eagle *Aquila pomarina* – Least Concern, Annex I, European population estimated stable, in Malta almost recorded annually in singles to small flocks mainly on autumn migration. Potentially passes through the Aol-2 on migration.

Booted Eagle *Aquila pennata* – Least Concern, Annex I, population size increasing in Europe, recorded in Malta almost annually in singles mainly during autumn migration. Potentially passes through the Aol-2 on migration.

Western Marsh Harriers *Circus aeruginosus* – Least Concern, Annex I, population trend in Europe increasing, common passage migrant to the Maltese islands both in spring and autumn. Has been reported at Is-Salini (MT0000007). Can be expected to appear in the Aol-2 on passage migration regularly in small numbers.

Montagu's Harrier *Circus pygargus* – Least Concern, Annex I, population decreasing in the EU, recorded in the Maltese islands annually in double figure numbers during spring and autumn migration. Can be expected to migrate through the Aol-2 occasionally.

Eurasian Sparrowhawk *Accipiter nisus* – Least Concern, overall population trend stable, recorded annually in Malta in small numbers on migration, mainly in autumn. Can be expected to pass through the Aol-2 occasionally.

Black Kite *Milvus migrans* – Least Concern, Annex I, population trend unknown, recorded in Malta annually in double figure numbers on migration. The species is attracted to landfills. Can be expected to occur in the Aol-2 occasionally.

Common Hoopoe *Upupa epops* – Least Concern, overall population trend decreasing, common passage migrant in Malta, both in spring and autumn, at least one breeding record in recent years. Has been observed at Is-Salini (MT0000007). Can be expected to pass through the Aol and foraging and roosting there during stop-over on migration.

European Bee-eater *Merops apiaster*, Least Concern, overall population trend declining, common spring migrant in Malta, less common in autumn, has made single breeding attempts on the islands in recent years. Regularly observed in all relevant Natura 2000 sites and can be expected regularly in the Aol-2 during migration.

European Roller *Coracias garrulus* – Least Concern, Annex I, European population trend decreasing, recorded in Malta annually in small numbers, mainly during spring migration. Can be expected to pass through the Aol or to stay in the area during stopover occasionally.

Common Kingfisher *Alcedo atthis* – Least Concern, Annex I, European population trend decreasing, common winter visitor and passage migrant in Malta. Observed regularly making use of all relevant Natura2000 sites, including the coastal marine part of the Aol (MT0000112). Expected to be present in the Aol-2 regularly on migration and when wintering in small numbers.

Eurasian Wryneck *Jynx torquilla* – Least Concern, population trends: long-term decline, short-term increase, fairly common passage migrant and winter visitor to the Maltese islands. Can be expected to be present in the Aol-2 during migration, stopping over and potentially also wintering.

Lesser Kestrel *Falco naumanni* – Least Concern, Annex I, population trend previous severe declines, recently stable, fairly common passage migrant to the Maltese islands in spring and autumn.. Expected to pass through the Aol-2 on migration and also foraging in the terrestrial parts of the area when stopping over.

Common Kestrel *Falco tinnunculus* – Least Concern, population trend decreasing, present in Malta year-round, common during passage in spring and autumn, breeding almost annually in very low numbers (1-3 pairs). Can be expected foraging in the Aol-2 year-round (local birds). Passage migrants can be expected to pass through the area and also forage there on migration.

Red-footed Falcon *Falco vespertinus* – Near Threatened, Annex I, European population trend declining, in Malta fairly regularly encountered on migration, numbers higher in spring. Can be expected to pass through the Aol-2 and forage there during passage.

Eleonora's Falcon *Falco eleonora* – Least Concern, Annex I, European population size increasing, recorded in Malta annually in fairly good numbers on migration in spring and autumn. Can be expected to pass through the Aol-2, including the relevant Natura 2000 sites on migration occasionally.

Merlin *Falco columbarius* – Least Concern, Annex I, population trend fluctuating, recorded in Malta annually in low numbers mainly on autumn migration. Might occasionally migrate through the Aol-2.

Eurasian Hobby *Falco subbuteo* – Least Concern, overall population trend declining, fairly common in Malta on migration in spring and autumn. Can be expected to migrate through the Aol-2 regularly in small numbers.

Peregrine Falcon *Falco peregrinus* – Least Concern, Annex I, population trend increasing, potential breeder in the Maltese islands in very low numbers, would be more common if left undisturbed/ not persecuted; also appears on passage and as winter visitor. Can be expected to make use of the Aol-2 including the relevant Natura2000 sites regularly and year-round, especially hunting for Black-headed Gulls etc. in the landfill area.

Passeriformes

Here we provide a list of all passerine species that are recorded in the Maltese islands regularly to frequently on migration and as winter visitors. We also include those species that are

residents i.e. breeding on the islands. Information regarding their conservation status, whether they are listed in Annex I of the EU-Birds directive, and their local occurrence (wintering, breeding, migrant) and frequency of occurrence (scarce, regular, common) is noted. Furthermore, information on their expected or reported status in the Aol-2, including in the relevant Natura2000 site is given.

The vast majority of species is listed as Least Concern, two are listed as Near Threatened, both not in Annex I. Seven species are listed in Annex I of the EU-Birds-Directive all listed as Least Concern. Two passerine species listed in Annex I have been recorded breeding in the Maltese islands, one a common breeder – the Greater Short-toed Lark *Calandrella brachydactyla*, while the other one has been reported breeding irregularly - the Tawny Pipit *Anthus campestris*.

In general, small passerines have relatively higher reproductive rates and shorter life-spans (generation cycles) compared to most larger non-passerine species. This, together with a large distribution range and often distribution density in most species listed below, reduces their overall population vulnerability. The majority of migratory species listed here mainly migrate during the night and cross the area in broad front. It is not likely that any of the species listed below will reach threshold values in the Aol-2. However, as previously outlined, even broad-front passerine migrants funnel spatially over peninsulas and islands to avoid open sea crossings, and migration over the Mediterranean concentrates temporally as large numbers of birds take advantage of favourable meteorological conditions. In most such “pulse” nights with high numbers and densities of birds actively migrating, the vast majority of birds is likely to pass high over the Maltese islands in a single night without stopover, with mainly some young, inexperienced and weak birds coming down to land and rest. If however, the meteorological conditions change during such nights of high migratory activities, e.g. with a rain-front, deep clouds or fog moving in or the birds suddenly encountering stronger headwinds, the flow of migration slows down, shifts to lower altitudes and birds start being attracted to land where so called bird falls might occur on small islands. Under these circumstances, birds will also be highly attracted by anthropogenic lights of man-made lit up structures such as the proposed development.

Species list of Passeriformes regularly encountered on the Maltese islands

Eurasian Golden Oriole *Oriolus oriolus* - *Least Concern*, common passage migrant, expected frequently in the Aol-2.

Red-backed Shrike *Lanius collurio* - *Least Concern, Annex I*, passage in low numbers, not expected to occur in the Aol-2 in relevant numbers.

Woodchat Shrike *Lanius senator* - *Least Concern*, regular passage migrant, expected to occur in the Aol-2 occasionally.

Penduline Tit *Remiz pendulinus* - *Least Concern*, passage in small numbers, might migrate through the Aol-2 occasionally and in small numbers.

Greater Short-toed Lark *Calandrella brachydactyla* - *Least Concern, Annex I*, common breeder and passage migrant, not reported breeding in the Aol-2, not expected to occur in

the Aol in relevant numbers, but expected to pass through on migration and potentially stopping over.

Woodlark Lullula arborea - *Least Concern, Annex I*, passage migrant low numbers, expected to also pass through the Aol-2.

Eurasian Skylark Alauda arvensis - *Least Concern*, common on passage and wintering, expected to make use of the Aol-2 regularly.

Zitting Cisticola Cisticola juncidis - *Least Concern*, common breeder in the Aol-2, including at Is-Salini (MT0000007).

Olivaceous Warbler Iduna pallida - *Least Concern*, passage in low numbers, potentially occurring in the Aol-2.

Isabelline Warbler Iduna opaca - *Least Concern*, passage in low numbers, potentially occurring in the Aol-2.

Icterine Warbler Hippolais icterina - *Least Concern*, regular passage migrant, expected to pass through the Aol regularly on migration.

Moustached Warbler Acrocephalus melanopogon - *Least Concern*, passage and wintering in low numbers, expected to pass through the Aol-2 occasionally in very low numbers.

Sedge Warbler Acrocephalus schoenobaenus – *Least Concern*, regular passage migrant, expected to pass through the Aol-2 regularly on migration.

Common Reed Warbler Acrocephalus scirpaceus - *Least Concern*, breeder in small numbers, regular passage migrant, single winter records. Expected to pass through the Aol-2 regularly on migration.

Great Reed Warbler Acrocephalus arundinaceus - *Least Concern*, regular passage migrant, expected to pass through the Aol-2 regularly on migration.

Savi's Warbler Locustella luscinioides - *Least Concern*, passage migrant in low numbers, expected to pass through the Aol-2 occasionally on migration.

Northern House Martin Delichon urbicum - *Least Concern*, rare breeder, common passage migrant, expected to make use of the airspace of the Aol-2 regularly, foraging in the area during migration, potentially roosting in the area, too.

Red-rumped Swallow Cecropis daurica - *Least Concern*, regular passage migrant, expected to make use of the airspace of the Aol-2 regularly, foraging in the area during migration, potentially roosting in the area, too.

Barn Swallow Hirundo rustica - *Least Concern*, breeder in low numbers, common passage migrant, expected to make use of the airspace of the Aol-2 regularly, foraging in the area during migration and potentially during breeding. Potentially roosting in the area, too.

Common Sand Martin *Riparia riparia* - *Least Concern*, regular passage migrant, expected to make use of the airspace of the Aol-2 regularly, foraging in the area during migration and potentially roosting.

Eastern Bonelli's Warbler *Phylloscopus orientalis* - *Least Concern*, regular passage migrant, expected to pass through the Aol-2 occasionally during migration.

Western Bonelli's Warbler *Phylloscopus bonelli* - *Least Concern*, regular passage migrant expected to pass through the Aol-2 occasionally during migration.

Wood Warbler *Phylloscopus sibilatrix* - *Least Concern*, common passage migrant, expected to regularly occur in the Aol-2 on passage.

Yellow-browed Warbler *Phylloscopus inornatus* - *Least Concern*, passage migrant, expected to occur occasionally in the Aol-2 on migration.

Willow Warbler *Phylloscopus trochilus* - *Least Concern*, common passage migrant, expected to regularly pass through the Aol-2 on migration.

Common Chiffchaff *Phylloscopus collybita* - *Least Concern*, common passage migrant and winter visitor, expected to pass through the Aol-2 regularly on migration and winter there regularly.

Cetti's Warbler *Cettia cetti* - *Least Concern*, common breeder, possibly breeding also at Is-Salini (MT0000007). Expected to occur in the Aol-2 regularly during dispersal.

Eurasian Blackcap *Sylvia atricapilla* - *Least Concern*, common passage migrant and winter visitor. Single breeding records in Malta in some years. Expected to pass through the Aol-2 regularly during migration and make use of it during stop-over and wintering.

Garden Warbler *Sylvia borin* - *Least Concern*, common passage migrant. Expected to pass through the Aol-2 regularly during migration and make use of it during stop-over.

Lesser Whitethroat *Sylvia curruca* - *Least Concern*, passage migrant in small numbers. Expected to occur in the Aol-2 occasionally on migration.

Sardinian Warbler *Sylvia melanocephala* - *Least Concern*, common breeder, including at Is-Salini (MT0000007). Probably breeding in the Aol-2 in good numbers and present year-round.

Subalpine Warbler *Sylvia cantillans* - *Least Concern*, common passage migrant, expected to regularly pass through the Aol-2 during migration.

Common Whitethroat *Sylvia communis* - *Least Concern*, common passage migrant, expected to regularly pass through the Aol-2 during migration.

Spectacled Warbler *Sylvia conspicillata* - *Least Concern*, regular breeder in Malta, possible breeder in the wider Is-Salini area (MT0000007), expected to occur in the Aol-2 regularly.

Common Starling *Sturnus vulgaris* - *Least Concern*, breeding in small numbers, common passage migrant and winter visitor, regularly recorded from the reserves, expected to occur

in the Aol-2 regularly in good number on passage and while wintering, including making use of the area for foraging and potentially roosting.

Mistle Thrush *Turdus viscivorus* - *Least Concern*, regular passage migrant, can be expected to pass through the Aol-2 occasionally on migration.

Song Thrush *Turdus philomelos* - *Least Concern*, common passage migrant and winter visitor, can be expected to occur regularly in the Aol-2.

Redwing *Turdus iliacus* - *Near Threatened*, regular passage migrant in small numbers, potentially wintering, can be expected to occasionally occur in the Aol-2 on migration.

Eurasian Blackbird *Turdus merula* - *Least Concern*, regular passage migrant and winter visitor, can be expected in the Aol-2 on passage and during wintering.

Fieldfare *Turdus pilaris* - *Least Concern*, regular passage migrant, potentially wintering, can be expected to occasionally occur in the Aol-2 on migration.

Rufous-tailed Scrub-robin *Cercotrichas galactotes* - *Least Concern*, rare visitor, potentially occurring irregularly in the Aol-2 in very low numbers.

Spotted Flycatcher *Muscicapa striata* - *Least Concern*, breeder in increasing numbers, common passage migrant, expected to be present regularly in the Aol-2 on passage and stopping over.

European Robin *Erithacus rubecula* - *Least Concern*, common passage migrant and winter visitor. Expected to be present in the Aol-2 outside the breeding season in good numbers.

Bluethroat *Luscinia svecica* - *Least Concern, Annex I*, regular passage migrant, potentially wintering in small numbers including at Is-Salini (MT0000007), can be expected to pass through the Aol-2 occasionally on migration.

Common Nightingale *Luscinia megarhynchos* - *Least Concern*, common passage migrant, one breeding record from 1995, expected to regularly pass through the Aol-2 on migration.

Semicollared Flycatcher *Ficedula semitorquata* - *Least Concern, Annex I*, regular passage migrant in small numbers, expected to pass through the Aol-2 occasionally on migration.

European Pied Flycatcher *Ficedula hypoleuca* - *Least Concern*, common passage migrant, expected to be present regularly in the Aol-2 during the migration periods.

Collared Flycatcher *Ficedula albicollis* - *Least Concern, Annex I*, regular passage migrant in low numbers, expected to pass through the Aol-2 during the migration periods.

Black Redstart *Phoenicurus ochruros* - *Least Concern*, common passage migrant, common winter visitor, expected to be regularly present in the Aol-2 during the non-breeding period.

Common Redstart *Phoenicurus phoenicurus* - *Least Concern*, common passage migrant, expected to regularly occur in the Aol-2 during the migration periods.

Rufous-tailed Rock-thrush *Monticola saxatilis* - *Least Concern*, regular passage migrant in low numbers, can be expected to occur in the Aol-2 on passage and stop-over in the migration periods.

Blue Roch-thrush *Monticola solitarius* - *Least Concern*, common breeder, possibly breeding in the Aol, expected to make use of the Aol-2 year-round.

Whinchat *Saxicola rubetra* - *Least Concern*, common passage migrant, expected to pass through the Aol-2 on migration and also stopping over in the area.

Common Stonechat *Saxicola rubicola* - *Least Concern*, common passage migrant and winter visitor, expected to be commonly wintering in the Aol-2.

Northern Wheatear *Oenanthe oenanthe* - *Least Concern*, common passage migrant, can be expected to pass through the Aol-2 on migration regularly.

Isabelline Wheatear *Oenanthe isabellina* - *Least Concern*, regular passage migrant in low numbers, might occasionally pass through the Aol-2 on migration.

Black-eared Wheatear *Oenanthe hispanica* - *Least Concern*, regular passage migrant, expected to occur in the Aol-2 regularly in low numbers during migration.

Goldcrest *Regulus regulus* - *Least Concern*, regular passage migrant and winter visitor, can be expected to regularly occur in the Aol-2 on passage and potentially as winter visitor.

Common Firecrest *Regulus ignicapilla* - *Least Concern*, regular passage migrant and winter visitor, can be expected to regularly occur in the Aol-2 on passage and potentially as winter visitor.

Dunnock *Prunella modularis* - *Least Concern*, regular passage migrant and winter visitor, expected to be present in the Aol-2 outside the breeding season in small numbers.

Spanish Sparrow *Passer hispaniolensis* - *Least Concern*, very common breeder in the Maltese Islands and regular passage migrant, common breeding resident in the Aol-2.

Eurasian Tree Sparrow *Passer montanus* - *Least Concern*, regular breeder in Malta, expected to occur in the Aol-2 during dispersal and in the non-breeding period in low numbers.

Tree Pipit *Anthus trivialis* - *Least Concern*, common passage migrant, expected to occur regularly in the Aol-2 on passage, including stopping over.

Red-throated Pipit *Anthus cervinus* - *Least Concern*, regular passage migrant, wintering in low numbers, expected to occasionally pass through the Aol-2 during migration and also stopping over.

Meadow Pipit *Anthus pratensis* - *Near Threatened*, common passage migrant and winter visitor, expected to make regular use of the Aol-2 on stop-over during migration and as foraging grounds in winter.

Water Pipit *Anthus spinoletta* - *Least Concern*, rare passage migrant or winter visitor, expected to make use of the Aol-2, especially the coastal areas including MT0000022 during migration occasionally.

Tawny Pipit *Anthus campestris* - *Least Concern, Annex I*, rare and irregular breeder in Malta, regular passage migrant, expected to pass through the Aol-2 occasionally on migration.

Western Yellow Wagtail *Motacilla flava* - *Least Concern*, common passage migrant, expected to pass through the Aol-2 regularly during migration, including foraging and potentially roosting during stop-over.

Grey Wagtail *Motacilla cinerea* - *Least Concern*, rare breeder, regular passage migrant and winter visitor, expected to occur in the Aol-2 occasionally to regularly in small numbers.

White Wagtail *Motacilla alba* - *Least Concern*, common passage migrant and winter visitor, regularly reported at Is-Salini (MT0000007), expected to be common in the Aol-2 during the wintering period.

Common Chaffinch *Fringilla coelebs* - *Least Concern*, regular passage migrant and winter visitor, potential breeder, but no breeding confirmed in recent years, expected to occur in the Aol-2 regularly during migration and as winter visitor.

Hawfinch *Coccothraustes coccothraustes* - *Least Concern*, regular passage migrant and winter visitor, expected to occur in the Aol-2 occasionally on migration and as winter visitor.

European Greenfinch *Chloris chloris* - *Least Concern*, common passage migrant and winter visitor, has bred occasionally on the Maltese islands but no confirmed breeding record in recent years. Can be expected to occur in the Aol-2 regularly during migration and as winter visitor.

Common Linnet *Linaria cannabina* - *Least Concern*, common passage migrant and winter visitor, irregular breeder in very low numbers, expected to occur in the Aol-2 regularly during migration and as winter visitor, potentially year-round.

European Goldfinch *Carduelis carduelis* - *Least Concern*, common passage migrant and winter visitor, irregular breeder in very low numbers, expected to occur in the Aol-2 regularly during migration and as winter visitor, potentially year-round.

European Serin *Serinus serinus* - *Least Concern*, common passage migrant and winter visitor, irregular breeder in very low numbers, expected to occur in the Aol-2 regularly during migration and as winter visitor.

Eurasian Siskin *Spinus spinus* - *Least Concern*, regular passage migrant and winter visitor, expected to occur in the Aol-2 on migration and as winter visitor occasionally.

Corn Bunting *Emberiza calandra* - *Least Concern*, formerly regular breeder in small numbers, scarce in recent years, might occasionally occur in the Aol-2 during dispersal.

Ortolan Bunting *Emberiza hortulana* - *Least Concern, Annex I*, regular passage migrant, expected to occasionally pass through the Aol-2 during migration.

Reed Bunting *Emberiza schoeniclus* - *Least Concern*, regular passage migrant and winter visitor, expected to pass through the Aol-2 occasionally during migration and in the winter months.