MOTT MACDONALD

Project Trinity: Greater Changhua Northwest Offshore Wind Farm in Taiwan

Cumulative Impact Assessment

February 2024

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Mott MacDonald
5F, No.92 Sec 2
Dunhua S. Road
Da'an District
Taipei City 10668
Taiwan

T +886 (0)2 8978 8978
mottmac.com

Ørsted Wind Power TW
Holding A/S, Kraftværksvej
53, DK-7000 Fredericia
Denmark, (36 03 57 81)

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Executive summary

The Greater Changhua Offshore Windfarm Northwest Ltd. is a special purpose vehicle established by Ørsted Wind Power TW Holdings A/S (Ørsted) to develop the proposed Project Trinity: Greater Changhua Northwest (NW) Offshore Wind Farm in Taiwan (herein referred to as the "Project"). The Project is located approximately 50km offshore of the area of Xianxi Township, Changhua County, Taiwan.

The Project is located in Taiwan, off the coast of Changhua County. The offshore windfarm area selected was zone #12 of the list of proposed offshore windfarm sites in Taiwan, defined by the Bureau of Energy (BOE). The Project has proposed wind turbine generator (WTG) model with 8-11MW capacity which are planned for the installation of 54 to 74 WTG, amounting to a total capacity of 598MW. The site of the Project is approximately 117km^2 and the water depth is approximately between 30m and 45m, with an average depth of approximately 36.8m. The electric power will transmit to offshore with 33kV or 66kV inter-array cable strings and one onshore substation as well a 2 x 220kV onshore cable connecting to Taipower substation via Changkong grid connection point.

As part of the requirements for obtaining project financing, the Project may be required to demonstrate adherence to the Equator Principles (EP). Therefore, Mott MacDonald has been commissioned by Ørsted to undertake a Cumulative Impact Assessment (CIA), alongside other environmental and social documents.

This report presents a CIA which has been undertaken to identify Project related environmental and social impacts (as well as associated risks) in terms of their potential to contribute to cumulative impacts on valued environmental and social components (VECs) on which other existing or future developments may also have detrimental effects. In addition, the CIA aims to assess the significance of the Project's above mentioned (cumulative) impacts to propose measures to avoid, minimise and/or offset these impacts to the extent practically possible.

The following VECs were discussed within this report in terms of baseline status and impact assessment:

- Marine habitat, flora and fauna
- Community livelihood: fisheries resources and zones
- Migratory birds (including seabirds)

For the respective VECs discussed, a set of actions already in place or planned to be implemented for the VECs have been extracted from the published Environmental Impact Assessment (EIA) and relevant reports. Further recommendations are also made on strategies in terms of collaboration amongst developers for achieving effective mitigation and monitoring of cumulative impacts on the VECs in the broader context.

It was noted that comprehensive mitigation and monitoring plans have been identified in the EIA reports. Nevertheless, it is important for the Project and adjacent windfarm developments to coordinate management plans and share information with each other for a more robust and comprehensive management of the identified cumulative impacts.

1 Introduction

1.1 Overview

The Greater Changhua Offshore Windfarm Northwest Ltd. (herein referred to as “Project Company”) is a special purpose vehicle established by Ørsted Wind Power TW Holdings A/S (Ørsted) to develop the proposed Project Trinity: Greater Changhua Northwest (NW) Offshore Wind Farm in Taiwan (herein referred to as the “Project” or "Project Trinity"). The Project is located approximately 50km offshore from the coast of Changhua County, Taiwan.

The Project is planned in compliance with the “Offshore Wind Farm Site Application Regulation”, stipulated by the Bureau of Energy, Ministry of Economic Affair on 2 July 2015. The regulation gives endorsement to offshore wind energy development for developers to promote nuclear-free homeland by the year of 2025.

In 2022, the National Development Council (NDC) published Taiwan’s Pathway to Net-Zero Emissions by 2050. The plan is to decarbonise the electrical sector and targeted 60% renewable energy come 2050.[1] As of 2021[2], the electricity generation comprised of 81.5% fossil fuels, 9.6% nuclear, 6% renewable energy and 2.9% of other types of energy. By 2025, Taiwan has set an ambitious commitment for their electricity sector to be 20% renewable energy, 30% coal, and 50% gas. The most targeted renewable energy is solar photovoltaic (Solar PV) and wind power.

As part of the requirements for obtaining project financing, the Project may be required to demonstrate adherence to the Equator Principles (EP). Therefore, Mott MacDonald have been commissioned by Ørsted to undertake a Cumulative Impact Assessment (CIA), alongside other environmental and social services.

1.2 Aims and objectives

This CIA aims to:

- Identify Project related environmental and social impacts (as well as associated risks) in terms of their potential to contribute to cumulative impacts on valued environmental and social components (VECs)[3] on which other existing or future developments may also have detrimental effects
- Assess the significance of the Project’s abovementioned (cumulative) impacts in order to propose measures to avoid, minimise and/or offset these impacts to the extent practically possible

The aims of the CIA are achieved by implementing the framework approach, as further described in Section 2, based upon the good practice guidance[4] as published by IFC. The six steps outlined in the “Good Practice Handbook on Cumulative Impact Assessment and

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1 Lau, Hon Chung and Tsai, Steve C. 2022. A decarbonization Roadmap for Taiwan and Its Energy Policy Implications. MDPI

2 Retrieved from 110 年發電概況 - 能源統計 - 經濟部能源局(Bureau of Energy, Ministry of Economic Affairs, R.O.C.)全球資訊網 (moeaboegov.tw)

3 See Section 2.2 for definition.

4 https://www.ifc.org/wps/wcm/connect/58fb524c-3f82-462b-918f-0ca1af135334/IFC_GoodPracticeHandbook_CumulativeImpactAssessment.pdf?MOD=AJPERES&CVID=kbnYgI5

Management: Guidance for the Private Sector in Emerging Markets" (IFC CIA Handbook) have been followed.

1.2.1 Scope and limitations

This CIA considers potential offshore developments along the western coast of Taiwan and the spatial and temporal boundaries defined for this CIA is elaborated in Section 3.1.

This CIA is limited to available resources either provided by the Project Sponsors or are publicly available, such as local Environmental Impact Assessment (EIA) reports which have been published on the Environmental Protection Administration of Taiwan and other online resources. As the major impacts of windfarm developments mostly occur in the offshore area, this CIA focus' more on marine aspects such as marine macrofauna and sensitive habitats, as well as the social impacts on fisheries.

Notably, the offshore windfarm (OWF) component of the Project is situated approximately 50km away from the coast. At such distance from the coast, the main potential for the key/material cumulative impacts (eg underwater noise, bird collision risk) are largely from similar nearby offshore windfarms. The spatial proximity is one of the factors other coastal developments are not included in detail.

Furthermore, the subsequently identified VECs are primarily influenced by and pertinent to other offshore windfarm developments. Given the absence of significant interactions with other development types, the exclusion of these developments from this CIA is supported by their unlikely potential for cumulative impact.

Due to the above reasons, coastal/marine developments have been scoped out of this CIA.

In this CIA, no quantitative analysis such as modelling, and calculations were undertaken. This report was prepared based on professional judgment and available information eg qualitative assessment on the cumulative impacts with reference to the findings of the approved EIA reports.

1.3 Project background

The Project is being developed on the 12th Zone of Potential in Changhua County (彰化縣) according to the Offshore Wind Farm Site Application Regulations announced by the Bureau of Energy, Ministry of Economic Affairs (MOEA) on 2 July 2015[5]. The Project area will be approximately 117km^2 in size and located approximately 50km offshore from Xianxi Township (線西鄉), Changhua County, on the western coast of Taiwan (see Figure 1.1). The Project will comprise 54 to 74 wind turbine generators (WTGs) each of 8-11MW capacity and on- and offshore electrical substations, amounting to a total capacity of 598MW. The WTGs will be located in water depths approximately between 30m and 45m below mean sea water level (MSWL). Other project components include inter-array and export transmission cabling to connect to Taiwan's electrical grid, as well as various operational support vessels and ancillary facilities. The operation period is planned for 20 to 25 years and in line with permit requirements.

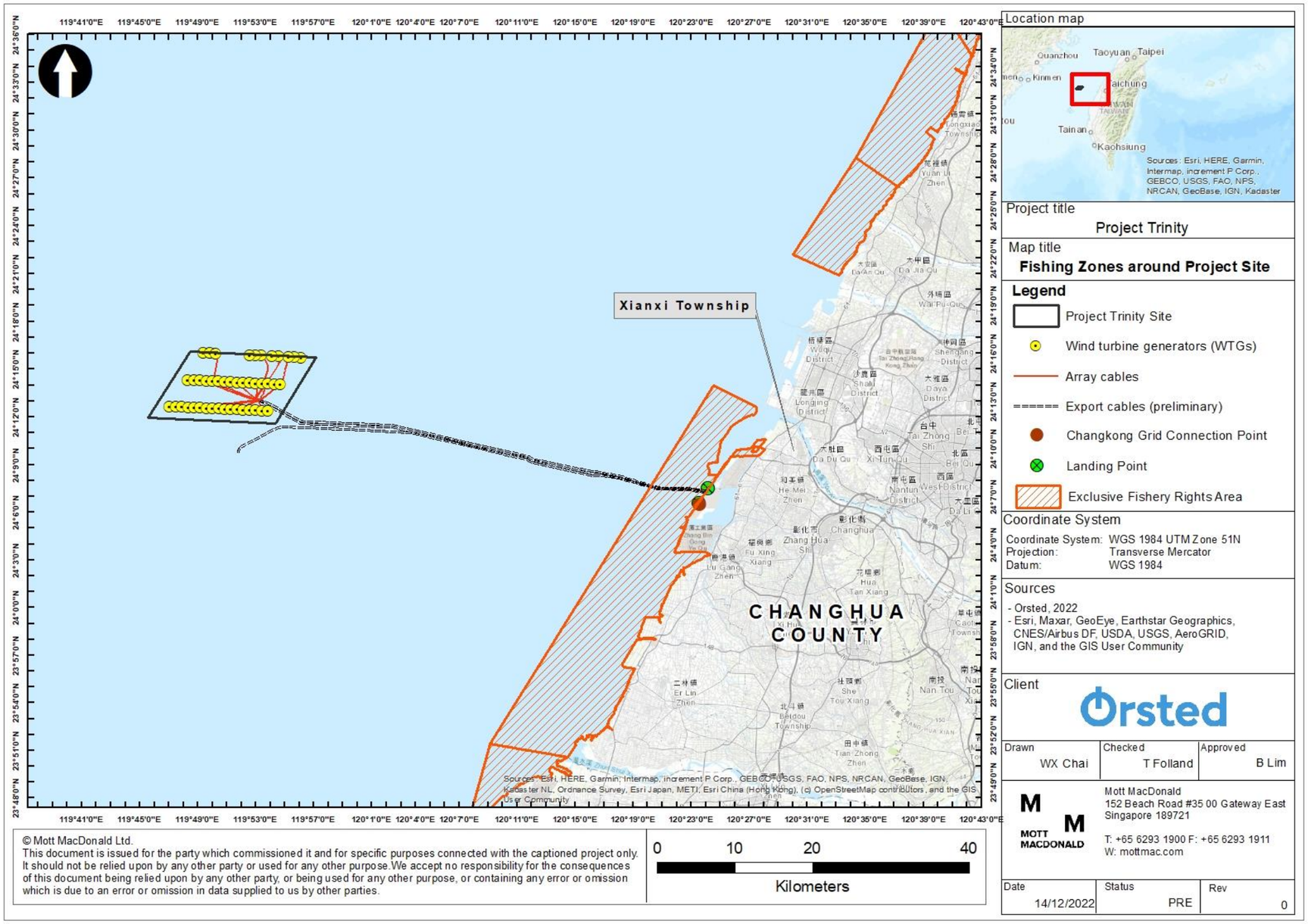
The WTGs will be connected to one offshore substation (OSS) via 33kV or 66kV inter-array cable strings and to the Changkong grid connection point owned by Taiwan Power Company (TPC) through 2 x 220kV export cables. The WTGs will also be connected to one onshore substation (OnSS) through 2 x 220kV onshore cables.

[5] https://www.moeaboe.gov.tw/ECW/populace/Law/Content.aspx?menu_id=2870

As noted above, the offshore WTG area of the Project (CHW04) is adjacent to the offshore WTG area of Greater Changhua Southeast windfarm (CHW01) which is also being developed by Ørsted. A HRIAF was developed for CHW01 in 2020 (Mott MacDonald, 2023). Figure 1.2 shows the locations of these two sites. CHW04 is serial number #12 on the map, and #15 on the map represents the CHW01 project.

The existing EIA stated that the Project is in the Fishing Rights Zone of Fisherman's Association under *Fisheries Act 2018*. The Project location and the Fishing Rights Zone of Fisherman's Association is shown in Figure 1.1.

Figure 1.1: Location of Project Trinity and Fishing Rights Zone of Fisherman's Association



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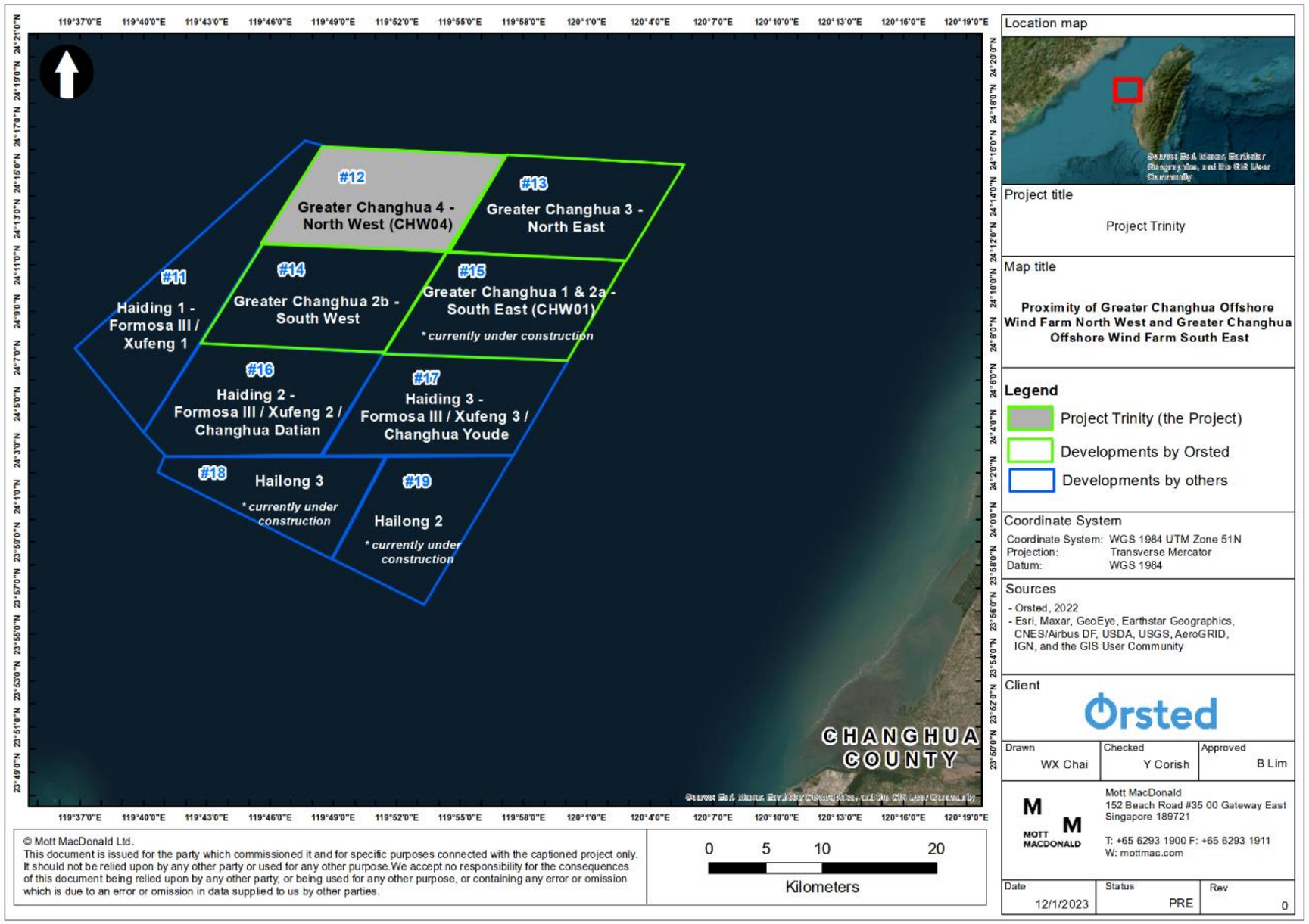
Source: Mott MacDonald, 2022

Figure 1.2: Proximity of Greater Changhua Offshore Wind Farm Northwest and Greater Changhua Offshore Wind Farm Southeast



Source: Mott MacDonald, 2023

The Project components consist of the following:

- Offshore components:
  - 54 to 74 units of offshore WTGs, each with a capacity of 8-11MW (depending on the confirmed model), covering an offshore area of approximately 117.4km^2.
  - 33kV or 66kV Inter-array submarine cables to offshore substation (OSS) (total length approximately 75km)
  - Interlink cables to ensure back-up power supply to the WTGs in case the grid connection is lost for an extended period
    - WTG to WTG interlink: voltage will be either 33kV or 66kV based on voltage transmitted between turbines
    - OSS to OSS interlink: voltage will be either 33kV, 66kV or 220kV
  - 220kV Offshore export submarine cables connecting the offshore substation to Changkong grid connection landing point
  - Offshore substation (OSS) to collect individual array cable strings and transform them to higher voltage before exporting them to shore
- Onshore components:
  - Project-dedicated onshore substation (OnSS) which steps down the voltage from 220kV to 161kV
  - Onshore cables (total length of up to 8.05km) connecting the following locations:
    - 3.7km from Transition joint bay (TJB) to the OnSS
    - 4.35km from OnSS to Changkong grid connection point owned by TPC
  - Transition joint bay (TJB) to connect offshore and onshore export cables

The Project has successfully obtained regulatory approval for its Environmental Impact Assessment (EIA) report on 10 August 2018.

1.4 Document structure

This CIA is structured as follows:

- **Section 1** (ie this section) outlines the aims and objectives of the CIA and Project.
- **Section 2** of this document describes the methodology for undertaking this CIA, including the definition of valued environmental and social components (VECs) as well as the methodology of six step approach prescribed by the IFC CIA Handbook to develop CIA.
- **Section 3** defines the spatial and temporal boundaries as well as identify this Project's VECs
- **Section 4** presents a summary of VECs' baseline data, including marine habitat, marine flora and fauna, community livelihood, and migratory birds.
- **Section 5** assesses future conditions of the selected VECs, as a result of cumulative impacts of the Project with other developments.
- **Section 6** presents the management strategies designed to address the Project's incremental contribution to cumulative impacts on the selected assessed VECs.
- **Section 7** displays the reference of this document

2 Approach and methodology

2.1 Overview

The approach used in this CIA was developed based on the recommendations found in the Guidance Note 1 (GN1) to the IFC Performance Standards (PS) 1, specifically in paragraphs GN37 through GN43, and in the CIA approach outlined in IFC's guidance document named "Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets" (thereafter known as "IFC CIA Handbook").

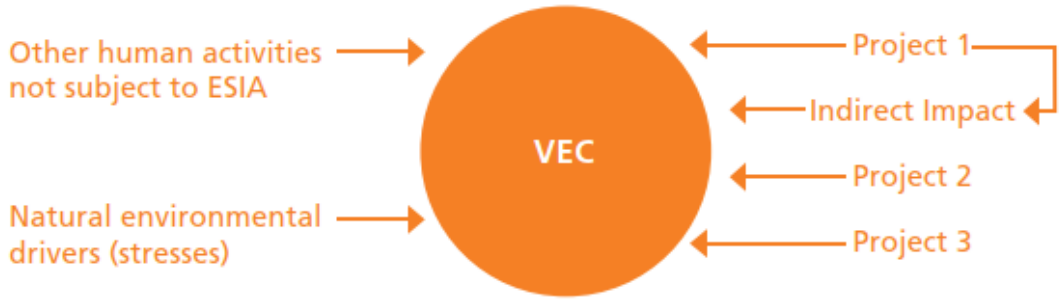
Of particular note, paragraph GN41 in IFC Guidance Note 1 recommends that clients assess cumulative impacts from: (a) further planned development of the project and other project-related developments; (b) any existing project or condition whose impacts may be exacerbated by the project; and (c) other development of the same type that are realistically defined at the time of the risks and impacts identification process. The IFC CIA Handbook further details the IFC GN 1 requirements and highlights the importance of a defined scope for CIA assessment by introducing the concept of VECs.

2.2 Valued environmental and social components

Valued environmental and social components (VECs) are environmental and social attributes (ie such as physical features, habitats, biodiversity, ecosystem services, natural process, social conditions, cultural aspects) which may be directly or indirectly affected by a specific development, that are often affected by cumulative effects of several developments. The VECs are often the ultimate receptors of the combined impacts as they tend to be at the end of ecological pathways.

The identification of VECs begins from a project-centric perspective, where the environmental and social attributes potentially adversely affected by a specific project are identified. The focus then shifts to be centred around the VEC, whereby the study area considered is the area in which the VEC occurs where other stress (eg other developments, natural and social drivers) may affect them (see Figure 2.1).

Figure 2.1: CIA's VEC-centric approach



Source: "Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets", IFC, August 2013 (Downloaded from https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_cumulativeimpactassessment)

In summary, this CIA aims to assess the cumulative impacts which might occur when the effects of the Project components, other projects and/or other activities or stressors overlap with each other by affecting the same VECs.

2.3 Six step approach

In developing this CIA, the following six steps (as prescribed by the IFC CIA Handbook) were used to guide the framework approach for assessment:

1. Determine spatial and temporal boundaries (refer to Section 3.1)
2. (a) Identify VECs (using publicly available and approved local EIA reports which have undergone consultation with affected communities and stakeholders as well as appraisals from the concerned regulatory agency) (refer to Section 1.1); and (b) identify all developments and external natural stressors affecting VECs (refer to Section 3.3)
3. Determine present condition of each identified VECs (refer to Section 4)
4. Assess cumulative impacts (refer to Section 5)
5. Evaluate the significance of cumulative impacts over the predicted future conditions (refer to Section 5)
6. Recommend feasible management strategies (refer to Section 6) to include:
    a. Adequate procedures to manage cumulative impacts
    b. Identify appropriate monitoring indicators
    c. Effective supervision mechanisms

The commentary and assessment of the above-mentioned six steps are presented within the subsequent sections of this report.

3 Step 1 & 2: Scoping

The cumulative impact assessment of the VECs will encompass the geographic and temporal extent of the Project's impacts and the impacts from the other relevant current or foreseeable future developments. According to the IFC CIA Handbook, the first boundaries are often set by professional judgment but improved as new information indicates that a different boundary is required for the analysis. Thus, in this Section it is described how the boundaries were modified according to the effects of significant impacts, to scientific concerns or stakeholders' opinion derived from previous consultations during the EIA stage.

The boundaries for this CIA were determined following the process below (Step 1):

- Determination of the preliminary boundaries according to the Project's significant impacts on the relevant VECs
- Identification of the existing, planned or reasonably defined developments located within the boundaries of the Project and that could potentially affect the relevant VECs
- Final delineation of the geographic and temporal boundaries, if necessary, after assessment of the cumulative impacts (Section 5)

This process is further described in the subsections below. Although it is discussed in a stepwise fashion, the identification of the spatial and temporal boundaries of a CIA is an iterative process that took place simultaneously with the identification of relevant VECs and of the existing and foreseeable future developments that can impact relevant VECs.

3.1 Step 1: Spatial and temporal boundaries

Following the advice in the IFC handbook[6], the spatial boundary for this CIA had been determined based on the following:

- Area(s) that will be directly affected by the project or activity (ie direct area of influence or DAI)
- Wider area which the affected VECs occupy (that is beyond the DAI)
- Distance or range (beyond the DAI) an effect can travel, and other impacts the identified VEC may be exposed to within its range

Hence, the spatial boundary of this CIA include:

- **Project area:** the area that is directly affected by the Project and its components. Components include WTGs, offshore and onshore substations and cables (see section 1.3).
- **Other offshore windfarms and developments:** neighbouring offshore windfarms and developments located in the western coast of Taiwan that directly affect the VECs of the Project. Other windfarms include developments by the Project Company (see Figure 1.2) as well as other developers awarded licensed areas by the Taiwanese Bureau of Energy (BOE). The windfarms are delineated into three tiers based on the windfarm's developmental status (see section 3.3):
  - Tier 1 projects are fully operational, including Formosa 1 (Haiyang Zhunan), Formosa 2 (Haineng) and Taipower Phase 1 OWFs.
  - Tier 2 projects are currently under construction, including the Project, Hai Long No. 2 and No. 3 OWFs, Yunlin OWF and six others. Tier 2 projects' expected grid connection dates

[6] IFC Good Practice Handbook: Cumulative Impact Assessment and Management, 2019

range from end of 2023 to end of 2026, thus construction is expected to span to the end of 2026.

- Tier 3a projects have been rewarded development permission, including Formosa 4 (Haisheng), Fengmiao, Formosa 3 (Haiding 2) OWF and three others. Tier 3a projects aim to have grid connection between 2026 to 2027, thus construction is also expected to span from 2025 to 2027.

Details of each wind farm's tier and life cycle may be found in Table 3.4. These windfarms are confirmed to hold spatial capacity within the Project area and hence are considered within this cumulative impact assessment's spatial boundaries. Tier 3b projects are those that have only received EIA approvals but have yet to receive any development permissions or have received permission but decided not to continue with their development. As there is uncertainty whether the 3b projects will actually be developed, they are scoped out of the current CIA.

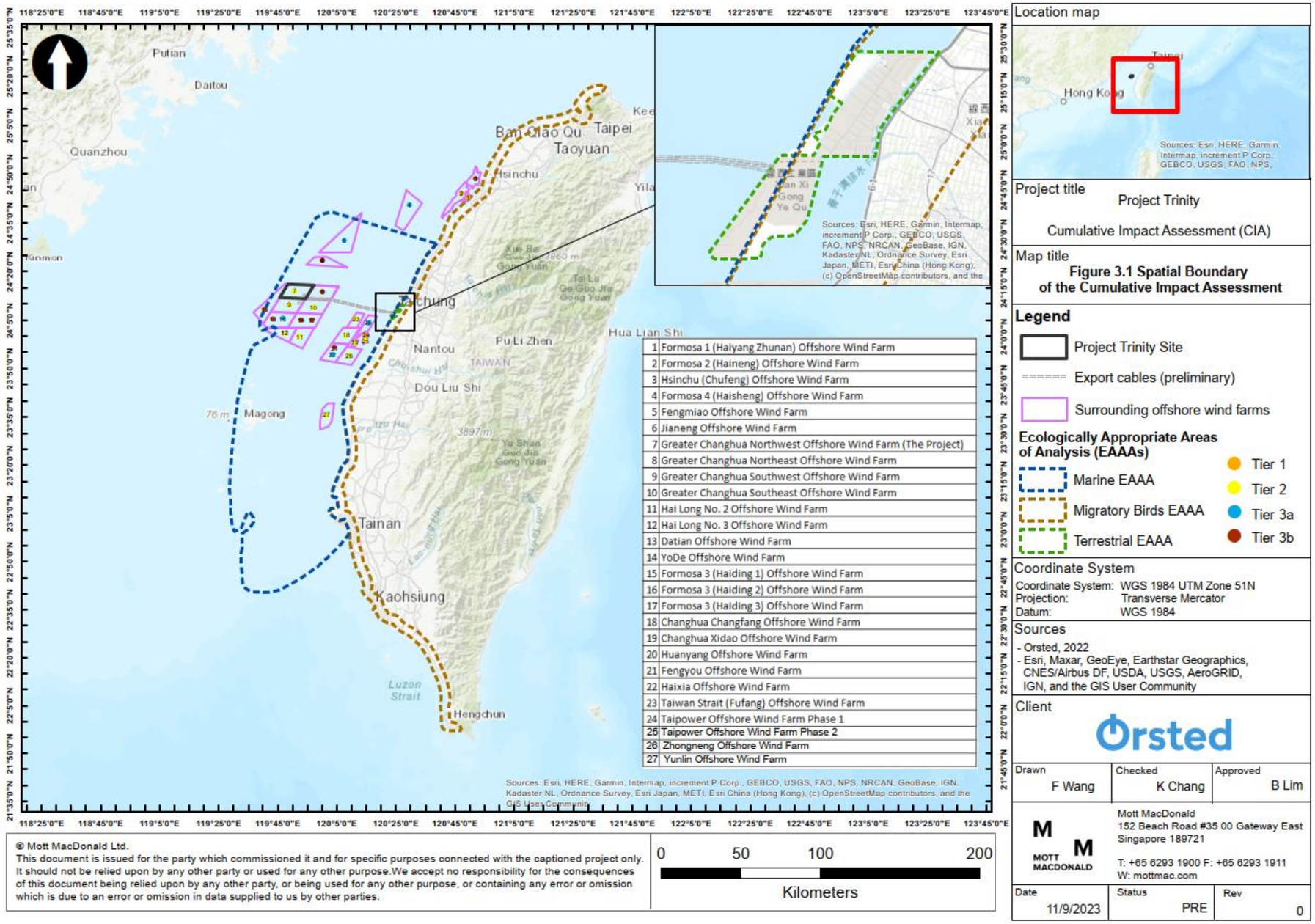
- **Boundaries of marine ecologically appropriate areas of analysis (EAAA**): referenced from the Project Trinity's Critical Habitat Assessment (CHA)[7], the EAAA boundaries for marine flora and fauna, migratory birds (including seabirds at sea) and terrestrial flora and fauna are considered. These EAAAs are geographic areas investigated and assessed for relevant biodiversity values regularly occurring in the Project's footprint. The EAAA is typically larger than the area affected by the Project directly or indirectly.

Figure 3.1 depicts the spatial boundary considered for this CIA.

The temporal boundary of this CIA factors the limits of the approach described above, the available information of the Project and public information of other surrounding windfarm developments, as well as the advice of the IFC handbook. The temporal scale of the CIA includes the full lifecycle of the Project up to the end of operation (ie 25 years). Given the uncertainty surrounding baseline conditions at the time of future decommissioning this is not included in the assessment at this time.

[7] Critical Habitat Assessment (Draft), Project Trinity, dated February 2023

Figure 3.1: Spatial boundary of the cumulative impact assessment



Source: Mott MacDonald, 2023

3.2 Step 2a: Identification of VECs

The concept of VECs is introduced by the IFC CIA Handbook (IFC, 2013). VECs are E&S attributes that are considered to be important in assessing project risks and can include physical characteristics, habitats, wild animal populations; ecosystem services; natural processes; social conditions; and cultural aspects. Consistent with the IFC CIA guidance, this CIA focused on VECs recognized as important on the basis of governmental regulation, scientific concerns and concerns from stakeholders.

The identification of relevant VECs (Step 2) for which cumulative impacts will be assessed and managed was done in two phases:

- Identification of potential VECs of relevance for this CIA (preliminary VECs)
- Identification of VECs of relevance for this CIA (applicable VECs)

The results of the activities undertaken during these two phases are presented in the subsections below.

3.2.1 Documents reviewed

Documents reviewed and used for this CIA were sourced from various websites / publicly available information and Ørsted. The documents include:

- Greater Changhua Northwest Offshore Wind Farm Project (大彰化西北離岸風力發電計畫):
  - EIA report (環境影響說明書)
  - EIA amendment report (環境影響說明書變更內容對照表)
- Changhua and Yunlin Offshore Wind Farms Project (彰化雲林地區離岸式風力發電計畫) (including this Project and the other windfarm developments):
  - Environmental Survey Report (2nd revised version) (環境影響調查報告書 第二次修訂本)
- Hai Long No. 2 and No. 3 Offshore Wind Farm:
  - EIA report
  - EIA bird monitoring report (鳥類調查報告)
- Offshore Wind Farm Developments in Taiwan (https://www.4coffshore.com/offshorewind/ and https://www.thewindpower.net/windfarms_list_en.php)
- Project Trinity's CHA (2023), which included the review of published data and literature:
  - Integrated Biodiversity Assessment Tool (IBAT) (https://www.ibat-alliance.org/)
  - International Union for Conservation of Nature (IUCN) Red List of Threatened Species (http://www.iucnredlist.org)
  - BirdLife International Data Zone (http://birdlife.org)
  - Biodiversity A-Z org (https://biodiversitya-z.org)
  - Catalogues of Life in Taiwan (https://taibnet.sinica.edu.tw/home_eng.php)
  - Convention on Biological Diversity (CBD) website (https://www.cbd.int/)
  - eBird (https://ebird.org)
  - Fishbase (https://fishbase.se)
  - The Amphibia Web
  - World Wildlife Foundation (WWF) Ecoregions (https://wordwildlife.org)
- Project Trinity's Stakeholder Engagement Plan (SEP, 2022)
- Map of Taiwan's Wetlands (https://wetland-tw.tcd.gov.tw/en/GuideMap.php)
- Habitat Protection in Taiwan (https ://conservation.forest.gov.tw/habitat)

- Marine Protected Areas in Taiwan (https://www.oca.gov.tw/ch/home.jsp?id=197&parentpath=0,5 and https://www.fa.gov.tw/upload/466/20190417103933104 00.pdf)
- Protected Reef Areas and Artificial Reef Areas in Taiwan (https://www.fa.gov.tw/en/Reef/index.aspx)
- Fisheries Zones of Taiwan (https://www.fa.gov.tw/cht/ResourceFishRight/index.aspx)

3.2.2 Stakeholder engagement activities and consultations

As mentioned above, the documents reviewed include approved local EIA reports which underwent series of reviews and appraisals in terms of the physical, ecological and socio-economic aspects. These reports include stakeholder engagement activities and public consultations as well as EIA appraisals and reviews, which are presented in in Table 3.1 below. In addition, the Project has continued engagements and consultations in compliance with international standards between 2018 to September 2023, which may be found in Table 5.3 of Project Trinity's SEP. The stakeholders engaged since the EIA stages up until September 2023 are outlined in Table 3.2. A brief summary of the environmental and social concerns raised during these stakeholder engagement activities are provided in Table 3.3. The EIA reports and SEP were both consulted to verify the VECs were previously considered by specialists to be affected by significant Project's impacts.

Table 3.1: Stakeholder engagement activities and public consultation meetings undertaken for the Project's EIA

Event	Date
Online publication of Project information on the Environmental Protection Administration (EPA) website for 15 days	9 January 2016
Four meetings/visits with the Changhua Fishermen Association	10 February 2016 – 6 April 2017
Online publication of project development information and EIA survey aspects on the EPA website for 20 days	21 September – 12 October 2016
Public seminar (open meeting) for EIA report at drafting stage	21 & 24 October 2016
Public opinion survey of the Project (750 local community members, 209 fishers and 50 opinion leaders interviewed)	19 November – 11 December 2016
Online publication of major EIA chapters on the EPA website for 20 days	24 January – 14 February 2017
Opinion Presentation Meeting	20 June 2017
The 1st EIA Review Meeting	30 June 2017
The 2nd EIA Review Meeting	11 September 2017
The 3rd EIA Review Meeting	27 November 2017
EPA EIA Vetting Committee Meeting on the Project (the 327th meeting)	9 February 2018
Eight meetings with the Changhua Fishermen Association	17 July 2018 – 16 October 2018
Public Hearing for Coastal Utilization and Management of CHW01 & CHW02	8 August 2018
Review meeting on EIA report deviation comparison	20 November 2018
Public hearing for Coastal Utilization and Management of CHW04	22 May 2019
EPA on-site audit meeting	29 October 2019
The 1st EPA Review Meeting	21 October 2021
The 2nd EPA Review Meeting	22 December 2021
EPA Vetting Committee (the 414th meeting)	2 March 2022
Pre-construction EIA public hearing of CHW04	26 September 2022

Event	Date
Pre-CP application public hearing of CHW04	16 December 2022
1st EIA Supervisory Committee Meeting	23 December 2022

Source: Unitech, 2018 and EIA Project Forum (https://eiadoc.epa.gov.tw/EIAFORUM/)

Table 3.2: Stakeholders consulted during the Project's EIA stages to September 2023

Government authorities	Stakeholders in Changhua County	Non-governmental organizations
Executive Yuan ● Environmental Protection Administration ● Office of Energy and Carbon Reduction ● Forestry Bureau ● Fisheries Agency ● Coast Guard Administration Ministry of Economic Affairs ● Bureau of Energy ● Industrial Development Bureau ● Changhua Coastal Park Service Centre Ministry of Transportation and Communications ● Maritime and Port Bureau ● Civil Aeronautics Administration	● Legislator of Changhua County ● Changhua County Council ● Changhua Fishermen's Association ● Xianxi, Lukang and Fangyuan Township Offices ● Xianxi, Lukang and Fangyuan Township Township Representative Councils ● Village heads and residents in Xianxi, Lukang and Fangyuan Township ● Community Development Associations ● Community representatives of Changhua County ● Show Chwan Memorial Hospital ● Changhua Christian Hospital	● Changhua Environmental Protection Alliance ● Wild Bird Society of Changhua ● Wetlands Taiwan ● Matsu Fish Conservation Union, Taiwan ● Taiwan Cetacean Society ● Taiwan Environmental Information Association ● Taiwan Energy & Climate Law Association ● Wild at Heart Legal Defense Association, Taiwan ● New Power Party ● Taiwan Renewable Energy Alliance ● Coastal Ocean Monitoring Centre, National Cheng Kung University ● Industrial Development & Investment Promotion Committee of Changhua County (IDIPC) ● Chunghua Fund for Children and Families ● Taiwan Ocean and Environmental Sustainability Law Centre (TOESLC) ● Metal Industries Research and Development Centre (MIRDC) ● Penghu marine biology research centre
Ministry of the Interior ● Construction and Planning Agency Ministry of Culture ● Bureau of Cultural Heritage Changhua County Government ● Environmental Protection Bureau Changhua County	Local academia ● National Changhua University of Education (NCUE) ● Da-Yeh University ● Mingdao University ● Chienkuo Technology University ● Chungchou University of Science and Technology ● Xianxi Elementary School and Junior High School ● Academia Sinica, Biodiversity Research Centre ● National Taiwan Ocean University (NTOU) ● National Taiwan University ● National Pingtung University of Science and Technology	

Source: Greater Changhua Northwest Offshore Wind Farm Project EIA Report, 2018 and SEP, 2023

Table 3.3: Brief summary of environmental and social concerns raised during stakeholder engagement activities from the Project's EIA stage

Environmental / Social Concern	Stakeholder
Impact on marine ecology, marine mammals and water quality	● Local community members, fisher folk and opinion leaders interviewed in the public opinion survey ● Changhua Environmental Protection Union ● Matsu Fish Conservation Union ● Wild at Heart Legal Defense Association
Safety and maintenance	Local community members, fishermen and opinion leaders interviewed in the public opinion survey

Environmental / Social Concern	Stakeholder
Impact on fisheries and fishing production	● Local community members, fishermen and opinion leaders interviewed in the public opinion survey ● Xianxi Township office
Noise and vibration	Local community members, fishermen and opinion leaders interviewed in the public opinion survey
Impact on fishing boat operation, fisheries activities/area, fishing ground and compensation for fishermen	Fishermen interviewed in the public opinion survey
Benefits of green energy from wind power generation	Local community members interviewed in the public opinion survey
Communication with fishermen	● Changhua District Fishermen's Association ● Xianxi Township Office
Impact of offshore wind turbine on local livelihood, social economic, landscape and recreation, and impact of onshore facilities on traffic, noise, environmental hygiene and handling of dredged materials	Xianxi Township Office
Impact of transportation, environmental hygiene, noise and interference of electromagnetic waves	Xianxi Township Office
Bird collision and flight corridor for migratory birds	● Environmental Protection Bureau, Changhua County ● Changhua Environmental Protection Alliance ● Matsu Fish Conservation Union ● Taiwan Environmental Information Association ● Wild Bird Society of Changhua
Underwater cultural heritage	Bureau of Cultural Heritage, Ministry of Culture
Decommissioning activities of windfarm	Changhua Environmental Protection Alliance
Impact of Project components and activities with surrounding developments	● South Natural Gas Division of CPC Corporation, Taiwan ● CPC Corporation – Exploration and production division

Source: Section 6.5.5-3, Table 6.5.5-1 and Appendix 17 of the Project EIA Report, 2018 and Table 5.4 of the Project SEP, 2023

As of the current Project's plans, ongoing and future stakeholder engagements and consultations include:

- December 2023 to January 2024: Primary surveys (ie key informant interviews and focus group discussions) relating to livelihood and human rights (whereby cumulative impact would be one of the topics) will be conducted with stakeholder groups, including, but not limited to:
  - Fisher folks registered under the Changhua Fishermen's Association (CFA)
  - Women's groups in the townships impacted by the Project
  - Taiwan human rights non-governmental organisation (NGO)

  More details can be found in the Project's livelihood restoration plan (LRP) and human rights impact assessment (HRIA).
- 2024 onwards:
  - Project's LRP programmes and activities
  - Corporate social responsibility (CSR) programmes (eg scholar programmes or green energy education with local universities)
  - Biodiversity and environmental monitoring related engagements, including:
    - Periodic review/meetings of Project's EIA conditions/commitments with government supervisory committee
    - Biodiversity forums co-organised with NCUE

    - Green Energy Scholarship Program 2.0: Sustainable Innovation Accelerator with MIRDC
- Other stakeholder activities:
    - Engagement with CFA and Taichung Fishermen's Association (TFA)
    - Regular meetings with county governments, local township offices and environmental monitoring committee

Stakeholder engagement activities are planned and updated on an on-going basis. Hence, appropriately, the details of executed and planned stakeholder engagements will be presented and updated within the Project Company's SEP. As applicable, specific/further details on biodiversity related stakeholder engagement/consultation would also be updated within the Project Company's biodiversity action plan (BAP).

3.2.3 Identified VECs

3.2.3.1 Preliminary identified VECs

Considering the concept of VECs introduced by the IFC CIA Handbook, in accordance with the IFC CIA Handbook, this CIA initially gathered the potential VECs of concern from prior sectoral assessments disclosed in the public domain (ie ChangFang and Xidao windfarms EIAs, CHA, CIA and Fisheries Livelihood and Restoration plan). VECs known or suspected to be affected by Taiwanese OWF projects include:

- Marine fauna (marine mammals and elasmobranchii)
- Offshore ornithology (migratory birds and seabirds at sea)
- Fisheries access and movement
- Local communities residing near project area

Regarding concerns from affected communities, it should be noted that there was no site visit or interviews / stakeholder engagements undertaken as part of this CIA to determine the stakeholder's opinion on the present condition of VECs. In turn, Mott MacDonald has relied on publicly available database (mostly approved EIA and deviation reports) containing typical issues common in the area. It was determined that this available database provides ample information and has already undergone consultations, EIA appraisals and reviews. In view of this, this database was considered an appropriate source of information to identify the main concerns expressed by affected local community (including fisher folk and local residents).

The Project EIA was also reviewed to verify which VECs were previously considered by specialists to be affected by project impacts. Hence, the preliminary VECs as presented below are shortlisted after a review of the Project EIA and selected review of neighbouring windfarms' EIAs.

Preliminary VECs evaluated in respect of the Project include:

- Marine habitat
- Marine flora and fauna
    - Mammals, fish, reptiles, invertebrates and plants
    - Community livelihood: fisheries resources and zones
- Migratory birds (including seabirds)
- Terrestrial habitat
- Terrestrial flora and fauna
    - Mammals, reptiles, amphibians and plants
    - Terrestrial birds

- Legally protected and internationally recognized areas
- Marine water quality
- Air quality
- Ecosystem services related with community health and safety
- Community health and safety (related to project infrastructure and equipment design)
- Community health and safety (related to hazardous materials)
- Community health and safety (related to communicable diseases)
- Land use and local property owners
- Community daily routine and quality of life
- Public and private services and facilities

3.2.3.2 Applicable VECs

Starting with the preliminary VECs, an analysis of readily available information on baseline conditions of the VECs and on the Project's aspects and impacts was undertaken to conclude which VECs are relevant for this CIA. The applicable VECs address the following criteria:

- Potential to be affected by the Project in some or all phases (construction and operation)
- Identified as already under pressure by other developments and the Project will promote additional stress
- Identified as sensitive and relevant according to professional judgment, legal requirements (laws and directives) and stakeholder's opinion
- Existing natural or social stressors if any

Preliminary VECs within section 3.2.3.1 that are not listed below are scoped out (ie not selected as applicable VECs). This is because they do not meet the above criteria or are already deemed to have minor to negligible impact within selected publicly sourced EIAs of the Project and its nearby OWFs. 'Applicable VECs' are intended to be considered as priority for focus, this is whereby the principle of the CIA is to prioritise the assessment on key VECs where there are material accumulation of cumulative impacts, resulting in a concern for the Project.

As a high-level summary of the scoping out of various VECs, some considerations are:

- Terrestrial based environmental VECs are scoped out because:
  - The Project's main components (ie the WTG area) are too far from the coast (ie approximately 50km) to have direct impacts (ie not to mention cumulative impacts).
  - Onshore activities of the Project (eg cabling laying, substation construction) is not likely to cause significant impacts
- VECs such as 'community health and safety' as well as 'public and private services and facilities' are scoped out because for the construction phase, the onshore works (eg substation and cable laying construction) is expected to mainly be allocated to contractors with a local workforce, while offshore accommodations will be on-board working vessels.
  - It is possible that another OWF by Ørsted, Greater Changhua Southwest OWF, could be developed simultaneously with the Project. The estimated peak onshore and offshore workforce for the Project, together with Greater Changhua Southwest, is estimated to be approximately 1,060 workers for the construction phase (ie Q1 to Q4 2025). However, it should be noted that, offshore workers would comprise the majority of the workforce throughout the construction phase. For the peak labour, the composition of the offshore worker would be approximately more than 90% of the peak workforce, and the offshore workers will be staying in on-board vessel accommodations. The maximum number of onshore construction workers at any point would not exceed 220 persons. The maximum

number of onshore (ie booster station) workers during the operation phase is 100 workers[8] (ie 2026 onwards). These workers are expected to be skilled labour and/or white-collar workers. These employees are expected to be accommodated within permanent facilities or rented properties within the nearby County. Based on current project information, there are no worker's accommodations/camps expected to be built[9]. Hence, at the Project level, this does not indicate a likely significant influx into the Project's (onshore) area.

- In the Project's proximity (ie based on offshore working areas and onshore works), only a few of the Tier 2 and Tier 3a OWFs (four Tier 2 and two Tier 3a projects) could have potential to spatially overlap (ie likely to share similar worker influx areas). These are then considered in the context of potential temporal overlap of the possible offshore/onshore construction timeline. The project with possible spatial and temporal overlaps are likely to be:
  - Tier 2 – Greater Changhua Southwest, Hai Long No. 2 and Hai Long No. 3 and Taipower OWF Phase 2 – targeting commercial operation in 2025 and 2026
  - Tier 3a – Formosa 3, Huanyang and Haixia – targeting commercial operation in 2026 and 2027
  - Due to timeline/progress and target grid connection dates (eg 2024 or earlier), other Tier 2 projects (eg Changfang, Xidao and CHW01) are not likely to overlap temporally in terms of construction phase
- The Project's construction phase is aimed to be Q1 to Q4 2025. From above, it should be noted that there would be limited potential for temporal overlap, particularly for Tier 3a projects, as overlap is only possible if the construction for these projects are substantially early (ie in 2025). The only other projects with a target 2025 commercial operation date (ie the Project's target date) is Phase 2A for Hai Long No. 2 and Greater Changhua Southwest.
- As understood, in terms of workers/contractor deployment, OWFs in Taiwan to date employ similar arrangements. This is whereby for offshore works, specialised offshore working vessels would have workers' accommodations on-board. Onshore works (eg substation and cable laying construction) is expected to mainly be allocated to contractors with a local workforce, and no worker's camps are expected to be built.
- It should also be noted that Lukang Township, where most onshore work will occur for these offshore windfarm projects, has a population of 84,678 people, as of December 2023. The maximum influx by the Project, assuming the Project and Greater Changhua Southwest are to be developed together, is 220 persons for the construction phase and 100 persons for the operational phase.
  From Hailong's publicly disclosed social impact assessment (SIA)[10], the estimated total peak construction workforce for Hailong in 2025 is 216 persons. Conservatively considering Hailong's figure to be entirely as onshore workers, the total cumulative influx of onshore workers working within the Project's AoI is 0.5% of the total population for the construction phase. It should be noted that similar to the Project, Hailong's SIA also states that there are no dedicated onshore workers' accommodations expected.
- Therefore, at this stage, it is not expected that there will be significant workers' influx due to construction mobilisation (ie whether by the Project or the possible neighbouring

[8] Estimated value from the Project's EIA, 2018 (p.7-181).

[9] Further details of subcontractor/supplier worker numbers and their worker's accommodation arrangements (and associated management) are updated on an on-going basis within Ørsted's future Labour Management Plan.

[10] 0599176 Hailong SIA Rev5 (hailongoffshorewind.com)

windfarms) given the limited temporal overlap as well as the fact that no worker's camps/accommodations are expected for OWF projects.
  - Further up-to-date details with regard to managing workers' accommodation can be found within the Project Company's Labour Management Plan[11].
  - Further assessment as relevant to workers' influx could also be found within the Project's Focused Social Impact Assessment (FSIA)[12].
- Other social VECs, as mentioned above, the CIA is to meaningfully focus on aspects which are of material concern. Of the social VECs, it was determined that only 'Community livelihood: fisheries resources and zones' fulfilled the criteria as described above to be considered as a high priority to be covered within this CIA.

The applicable VECs for which cumulative impacts will be assessed and managed are listed below:

- Marine habitat
- Marine flora and fauna
- Community livelihood: fisheries resources and zones
- Migratory birds (including seabirds)

The present conditions of the relevant VECs within the temporal and spatial boundaries are described in Section 3.1.

3.3 Step 2b: Developments affecting the VECs

The preliminary spatial and temporal boundary of this CIA is defined by employing a modified[13] tiered approach for cumulative impact assessment suggested by Joint Nature Conservation Committee (JNCC) and Natural England[14]. Three main tiers following this approach have been identified:

- **Tier 1:** Developments that are built and operational
- **Tier 2:** Developments under construction
- **Tier 3:** Developments where construction has yet to commence. This tier is further split into:
  - **Tier 3a:** Developments officially awarded development permission in the Round 3.1 auction
  - **Tier 3b:** Developments that have received EIA/development approval only or known as possible future developments.

This tiered approach considers the current offshore developments, including wind energy developments, along the western coast of Taiwan (ie spatial boundary). The result of the first auction of Round 3 Zonal Development (ie Round 3.1 auction) announced on 14 December 2022[15] has also been included, where BOE selected six developers and ten OWFs. For the

[11] Labour Management Plan Framework (Final Draft), Project Trinity, October 2023

[12] Focus Social Impact Assessment (Final), Project Trinity, January 2024

[13] The tier approach for cumulative impact assessment suggested by Joint Nature Conservation Committee (JNCC) and Natural England consist of further tier levels that considers eg application submitted to the appropriate regulatory body that have not yet been determined; regulatory body are expecting an application to be submitted; projects that have been identified in relevant strategic plans or programmes. Due to limited publicly available information, these tiers were omitted from the above consideration.

[14] Scottish Power renewables (2013) JNCC and Natural England Suggested Tiers for Cumulative Impact Assessment

[15] This is further updated as based on the known results/outcomes as of the report writing. Which would take into account of developments which are confirmed to surrender their rights to develop their project, where they are awarded.

purposes of this CIA only those projects within Tier 1, 2 and 3 that have made information publicly available are included in this assessment.

The existing, planned or reasonably defined developments located within the spatial boundaries of the CIA that could potentially affect the relevant VECs were identified (Step 2). These developments, together with their respective assigned tier category (ie based on the methodology of tier approach for cumulative impact assessment) are summarised in Table 3.4, Figure 3.1 illustrates the location of these developments.

Table 3.4: Existing, planned or reasonably defined developments scoped in this CIA and their respective assigned tier category

Development	Developer	Project life cycle phase	Tier category
Offshore Wind Farm Developments at Hsinchu County, Miaoli County and Taichung City			
Formosa 1 (Haiyang Zhunan) Offshore Wind Farm	Formosa 1 Wind Power Co., Ltd.	Operational. Phase 2 construction completed since December 2019.	Tier 1
Formosa 2 (Haineng) Offshore Wind Farm	Formosa 2 Wind Power Co., Ltd.	Operational. Fully commissioned in March 2023.	Tier 1
Fengmiao Offshore Wind Farm	Copenhagen Infrastructure Partners (CIP)	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2027.	Tier 3a
Jianeng Offshore Wind Farm[16]	Northland Power Inc.	Awarded the Round 3.1 auction but did not sign development agreement. Might be reconsidered for Round 3.2, (ie dependent on the auction rules).	Tier 3b
Hsinchu (Chufeng) Offshore Wind Farm	Chufeng Power Co., Ltd.	Received EIA approval only.	Tier 3b
Formosa 4 (Haisheng) Offshore Wind Farm	Synera Renewable Energy	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2027.	Tier 3a
Changhua Offshore Wind Farm Developments			
Greater Changhua Southeast Offshore Wind Farm (CHW01)	Greater Changhua Offshore Wind Farm SE Ltd.	Construction, expected commercial operation to begin in end of 2023.	Tier 2
Greater Changhua Southwest Offshore Wind Farm (CHW02)	Greater Changhua Offshore Wind Farm SW Ltd.	Construction, Phase 2a expected commercial operation to begin in end of 2023. Phase 2b has been consented / approved. Has not started development.	Tier 2
Greater Changhua Northwest Offshore Wind Farm (The Project)	Greater Changhua Offshore Wind Farm NW Ltd.	Targeting to commence offshore construction in Q1 2025 and reach grid connection by end of 2025.	Tier 2
Greater Changhua Northeast Offshore Wind Farm	Greater Changhua Offshore Wind Farm NE Ltd.	Received EIA approval only.	Tier 3b
Hai Long No. 2 Offshore Wind Farm	Hai Long 2 Wind Power Co., Ltd. Preparatory Office	Commenced onshore construction, targeting commercial operation to begin for December 2025 for 2A and December 2026 for 2B.	Tier 2

[16] The Jianeng Offshore Wind Farm Site is overlapped with the EIA approved Fengmiao Offshore Wind Farm (from CIP).

Development	Developer	Project life cycle phase	Tier category
Hai Long No. 3 Offshore Wind Farm	Hai Long 3 Wind Power Co., Ltd. Preparatory Office	Commenced onshore construction, targeting commercial operation to begin for December 2026.	Tier 2
Datian Offshore Wind Farm	Skyborn Renewable Energy	Awarded the Round 3.1 auction but did not sign development agreement. Might be reconsidered for Round 3.2, (ie dependant on the auction rules).	Tier 3b
YoDe Offshore Wind Farm	Wpd Energy	Received EIA approval only.	Tier 3b
Formosa 3 (Haiding No.1) Offshore Wind Farm Site	Formosa 3 (Haiding No.1) Wind Power Co., Ltd. Preparatory Office	Received EIA approval only.	Tier 3b
Formosa 3 (Haiding No.2) Offshore Wind Farm Site[17]	Formosa 3 (Haiding No.2) Wind Power Co., Ltd. Preparatory Office	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2026.	Tier 3a
Formosa 3 (Haiding No.3) Offshore Wind Farm Site[18]	Formosa 3 (Haiding No.3) Wind Power Co., Ltd. Preparatory Office	Received EIA approval only.	Tier 3b
Fengyou Offshore Wind Farm	CIP	Received EIA approval only.	Tier 3b
Huanyang Offshore Wind Farm[19]	Taiya Renewable Energy/ Électricité de France	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2027.	Tier 3a
Changhua Nearshore Wind Farm Developments			
Changhua Demonstration	Taiwan Power Company (or 'Taipower')	Fully commissioning as of 31 August 2021.	Tier 1
Offshore Wind Farm Project Phase 1	Taiwan Power Company	Operation as of 2021	Tier 1
Changhua Changfang Offshore Wind Farm	Changfang Wind Power Co., Ltd.	Changfang Phase 1 is at partial generation, with full commissioning expected by 31 December 2024. Changfang Phase 2 is under construction, with commissioning expected by 31 December 2023.	Tier 2
Changhua Xidao Offshore Wind Farm	Xidao Wind Power Co., Ltd.	Xidao Phase 1 is at partial generation, with full commissioning expected 31 December 2024. Xidao Phase 2 is under construction.	Tier 2
Offshore Wind Farm Phase 2	Taiwan Power Company	Construction. Onshore construction commenced in June 2020. Full commissioning and grid connection expected in 2025.	Tier 2
Zhongneng Offshore Wind Farm	Zhongneng Power Co., Ltd.	Construction. Onshore construction commenced in January 2019. The	Tier 2

[17] The Haiding No.2 Wind Farm Site is overlapped with the EIA approved 16Datian Wind Farm Site (from Skyborn Renewable Energy).

[18] The Haiding No.3 Wind Farm Site is overlapped with the EIA approved YoDe Offshore Wind Farm (from wpd Energy).

[19] The Huanyang Wind Farm Site is overlapped with the EIA approved Wind Farm Site of Fengyou Wind Farm Site (from Copenhagen Infrastructure Partners).

Development	Developer	Project life cycle phase	Tier category
		grid connection year is expected in 2024.	
Haixia Offshore Wind Farm	Skyborn Renewable Energy and Lealea Group	Awarded the Round 3.1 auction. Has not started development. The grid connection year is expected in 2026.	Tier 3a
Offshore Wind Farm Project at Yunlin County			
Yunlin Offshore Wind Farm	Yunneng Wind Power Co. Ltd	Construction. Offshore construction commenced in 2021. The grid connection year is expected in 2024.	Tier 2
Other Coastal developments			
Changhua Coastal Park Service Center (彰化濱海工業區開發計畫)	MOEA	Operational as of 2010.	Tier 1
Construction of offshore wind power booster station and expansion of substation in Changhua Coastal Industrial Park (離岸風力彰工升壓站新設及彰濱變電所增設工程計畫)	Taiwan Power Company	Approved. Construction is anticipated to start in September 2020 and complete in end of 2025.	Tier 1/2
Development of Changhua Fishing Port (彰化漁港開發計畫)	Changhua County Government	Under construction, anticipated to be completed in 2024	Tier 2

Source: Greater Changhua Northwest Offshore Wind Farm Project EIA Report, 2018; Global offshore map on 4C Offshore, accessed on 25 January 2023; , updated on 4 November 2022; Taipower official website, assessed on 6 February 2023

4 Step 3: Baseline conditions of identified VECs

This Section presents Step 3 which discusses information on the baseline status of the selected VECs, and aims to describe their current conditions, spatial boundaries and potential response to project-related stresses/impacts and assess trends. Historical information about the VECs was gathered from various sources and used to assess the baseline conditions.

In this CIA, the presented baseline is limited to information that can be used to assess changes in VEC conditions due to cumulative impacts with other anthropogenic sources of impacts in the spatial and temporal boundaries; which subsequently contributed to the assessment of cumulative impacts (section 5) and the development of management measures (section 6).

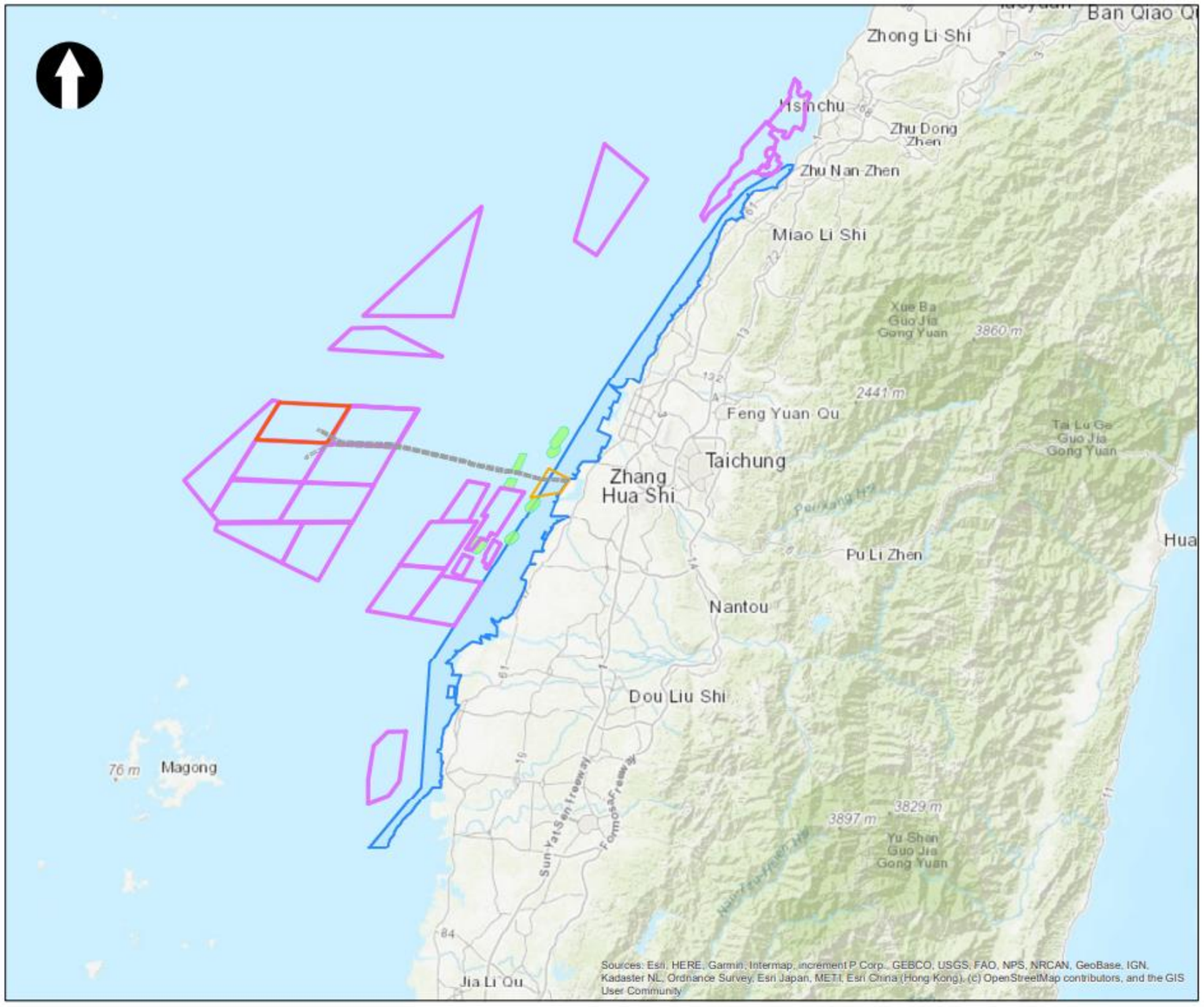
4.1 Marine habitat

Along the western strait of Taiwan, there are marine habitats including Taiwanese Humpback Dolphin Major Wildlife Habitat (MWH) (中華白海豚野生動物重要棲息環境), Protected Reef Areas (保護礁區), Artificial Reef Areas (人工魚礁區) and Marine Protected Area (海洋保護區) including the Fisheries Resources Conservation Areas (業資源保護區).

The following two categories of marine habitats have been identified, (i) Taiwanese Humpback Dolphin MWH; (ii) marine category along western coast (ie Protected Reef Areas and Fisheries Resources Conservation Area).

The submarine cables of most of the OWF developments located off the western coast of Taiwan would overlap with the Taiwanese Humpback Dolphin MWH. Figure 4.1 illustrates how submarine cable of OWF projects pass through the MWH. The Taiwanese Humpback Dolphin MWH was first proposed on 21 April 2014 and was formally gazetted by the Ocean Affairs Council with effect from 1 September 2020. It was identified that Taiwanese Humpback Dolphin (*Sousa chinensis ssp. taiwanensis*), an Endangered species (ie under category I) in Taiwan and considered Critically Endangered under the IUCN Red List of Threatened Species, exists in the Eastern Taiwan Strait (ETS) (Reeves, 2008).The Taiwanese Humpback Dolphin inhabits a narrow strip of waters off the western coast of Taiwan, between Miaoli County and Jiangjun fishing port of southern Taiwan. The species distribution comprises shallow coastal waters at depths up to 30m, between 2 and 2.5km from the coast (Wang *et al.*, 2017). The range of the Taiwanese Humpback Dolphin is situated outside of the Project's windfarm array but overlaps the export cable route as well as potential construction and operational vessel routes.

Figure 4.1: Project footprint, surrounding OWF areas and boundary of the Taiwanese Humpback Dolphin MWH



Project title
Project Trinity
Cumulative Impact Assessment (CIA)

Map title
Figure 4.1 Project Footprint and Boundary of the Proposed Taiwanese Humpback Dolphin major wildlife habitat (MWH)

Legend

- Project Trinity Site
- Export cables (preliminary)
- Surrounding offshore wind farms
- Taiwanese Humpback Dolphin MWH
- Protected Reef Area
- Changhua Northern Common Corridor

Coordinate System

Coordinate System:	WGS 1984 UTM Zone 51N
Projection:	Transverse Mercator
Datum:	WGS 1984

Sources
- Orsted, 2022
- https://map.4coffshore.com/offshorewind/
- Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DF, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Client: Ørsted

Drawn	Checked	Approved
F Wang	K Chang	B Lim

Mott MacDonald
152 Beach Road #35 00 Gateway East
Singapore 189721
T: +65 6293 1900 F: +65 6293 1911
W: mottmac.com

Date	Status	Rev
1/12/2023	PRE	0

0 20 40 80
Kilometers

Source: Mott MacDonald, 2023

There are a total of 89 Artificial Reef Areas[20] and 62 Protected Reef Areas[21] established in Taiwan. At Changhua County, there are eight Protected Reef Areas, in which five are located near Xianxi Township and Lukang Township. The Protected Reef Areas and Artificial Reef Areas have been implemented to address the overuse of fisheries resources, as artificial reef has been recognised for the rebuilding of the fishing grounds and enhancement of marine environment. The establishment of Protected Reef Areas and Artificial Reef Areas aims to (1) restock fisheries resources and (2) develop complex ecological environments. In Artificial Reef Areas, artificial reef structures (mainly concrete structures) have been deployed along the coast to deter illegal trawling activities.

As of February 2023, there are 46 Marine Protected Areas in Taiwan, with a total approximate area of 5,264 km^2, accounting for 8.17% of Taiwan's offshore borders and domestic water area[22]. The definition of marine protected area in Taiwan refers to "an area extending seaward from mean hightide mark to a certain range, with special natural features, important cultural heritage and sustainable use of ecological resources, protected by law or other effective means". The marine protected areas are subject to different levels of control, from multifunctional use of the most lenient to most stringent use of no entry. Marine Protected Area (MPA) are classified into three levels in accordance with its protection status: (i) "No entry of impact"; (ii) "No take"; and (iii) "Multifunction".

Fisheries Resources Conservation Area is designated as a type of MPA in Taiwan. The conservation area aims to restrict the length or seasonality on the capture of marine commercial goods. There are currently 27 Fisheries Resources Conservation Area in Taiwan, three of which are located in Changhua County[23]. They are Shengang Mud Shrimp Breeding Conservation Area, Shengang (2) Mud Shrimp Breeding Conservation Area and Wanggong Mud Shrimp Breeding Conservation Area (see Table 4.1).

Table 4.1: Summary of Fisheries Resources Conservation Area in Changhua County

Description	Shengang Mud Shrimp Breeding Conservation Area	Shengang (2) Mud Shrimp Breeding Conservation Area	Wanggong Mud Shrimp Breeding Conservation Area
Year of establishment	2006	2006	2013
Area (m^2)	36	2	41
Habitat of core area	Mudflats within the intertidal zone		
Levels of protection	No take		

Source: Taiwan Marine Protected Area (https://mpa.oca.gov.tw/Default.aspx)
https://www.oca.gov.tw/en/home.jsp?id=99&parentpath=0,5/

4.2 Marine fauna and flora

The baseline conditions of marine fauna and flora within the study area of the cumulative impact assessment considers the project footprint and its relevant marine EAAA defined within the project's CHA[24].

Regarding the relatively broad seascape and the wide-ranging behaviour of many marine species, it is considered that 3026 species of marine fauna and flora are likely to be present

[20] https://www.fa.gov.tw/view.php?theme=Info_on_AF_and_PF&subtheme=&id=1

[21] https://www.fa.gov.tw/view.php?theme=Info_on_AF_and_PF&subtheme=&id=2

[22] https://mpa.oca.gov.tw/Default.aspx https://www.oca.gov.tw/en/home.jsp?id=99&parentpath=0,5/

[23] The establishment and management of Fisheries Resources Conservation Areas(Fisheries Agency, Council of Agriculture, Executive Yuan) (coa.gov.tw)

[24] Critical Habitat Assessment (Draft), Project Trinity, dated February 2023

within the marine EAAA, and as such the study area of Project's CIA. Marine flora and fauna within the marine EAAA are assigned to the following IUCN conservation status categories:

- Critically Endangered – 18
- Endangered – 59
- Vulnerable: 174
- Near Threatened: 177
- Least Concern – 2382
- Data Deficient – 216

A total of 129 marine species were recorded during the baseline surveys of the EIA report. During the Project's marine mammal surveys conducted between April 2016 and March 2017, five groups of the globally Near Threatened Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*), consisting of three to six individuals in each group were recorded within the Project site boundary.

According to the EIA report of Greater Changhua Northwest Offshore Wind Farm Project, the Taiwan Cetacean Stranding Network together with Taiwan Cetacean Society have started to record stranding events in Taiwan since the beginning of 1995. In the coastal areas of Changhua and Penghu, 56 stranding events were encountered during the EIA baseline survey with a cumulation of 59 individuals of 10 cetacean species.

Transect surveys covering the OWF site were conducted to inform the Project's EIA. Where any marine mammals are observed, geospatial coordinates, estimated group size, behaviours and environmental data were collected alongside photographic records for individual identification.

Indo-Pacific Bottlenose Dolphin is listed as Category II – Rare and vulnerable species under the Wildlife Conservation Act in Taiwan and globally listed as Near Threatened in IUCN Red List. The Indo-Pacific Bottlenose Dolphin would usually inhabit shallow coastal water near continental shelf and oceanic islands. The entire Taiwan Strait (including the project site) is located well within the range of extent of the Indo-Pacific Bottlenose Dolphin. The Taiwan Strait is well suited as a foraging ground for the Indo-Pacific Bottlenose Dolphin. During the 20 sea surveys between April 2016 to January 2017, five groups of Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*), in groups of three to six were recorded in travelling.

Taiwanese Humpback Dolphin, was first described in 2002 and is considered a subspecies of the Indo-Pacific Humpback Dolphin, occurring only in the eastern Taiwan Strait. However, it did not receive a formal description until 2015, and formal recognition from the Society of Marine Mammals Taxonomy Committee in 2016. The species is listed as Critically Endangered in the IUCN Red List. During the 20 sea surveys between April 2016 to January 2017, no sighting of Taiwanese Humpback Dolphin was recorded during the EIA surveys.

Taiwanese humpback dolphin Taiwanese humpback dolphin (*Sousa chinensis ssp. Taiwanensis*) and Taiwan picnic seabream (*Acanthopagrus taiwanensis*) are identified as critical habitat triggering marine species[25] within the Project's CHA.

4.3 Community livelihood: fisheries resources and zones

Changhua County is located in the western coastal area of Taiwan with a 60km long coastline. Its geographical location provides potentials and resources to develop fisheries industry, together with the support in fisheries facilities by the government.

The number of fisher folk households in Changhua County is 4,414 with 14,527 full-time or part-time fisheries worker, according to the 2021 statistics published (Changhua County

[25] Critical habitat triggering species are those that fall under Criterion 1 to 5 as described by the International Finance Council (IFC) Performance Standards 6

Government, September 2022)[26]. For Xianxi Township there are 884 fisher folk households with 2,733 fisheries workers, while in Lukang Township, there are 645 fisher folk households with 1,231 fisheries workers. Generally, Xianxi Township and Lukang Township contribute a total of 35% fisher folk households and 27% fisheries workers in Changhua County. As of 2022, there is a total of 25,391 members registered in Changhua Fishermen Association, 12,429 of them are male and 12,962 of them are female.

According to annual fishery census report for 2020[27] (Accounting and Statistics, Executive Yuan, dated 20 June 2022), there were 34,991 fisher folk households of sole proprietorship with the average annual income of 2,292K TWD, while there were 34,129 fisher folk households of non-sole proprietorship with the average annual income of 30,004K TWD.

In Changhua County, different type of fisheries have been practised including offshore fisheries, coastal fisheries, marine aquaculture, inland water fisheries and inland water aquaculture. Offshore fisheries are fishery operations occurring between 12 to 200 natural miles from the shoreline, while coastal fisheries are operations within 12 nautical miles from the shoreline[28]. Most of the fisher folk households practise inland water aquaculture and coastal fisheries, while fewer households practise inland water fisheries and offshore fisheries. However, more fisher folk households adopt coastal fisheries instead of inland water aquaculture in Lukang Township. The total fishery production of Changhua County in 2021 was 12,179.2 tonnes, of which Inland Water Aquaculture and Marine Aquaculture accounted for more than 98% of the production, with the contribution of 1,453.2 tonnes (11.93%) and 10,423.1 tonnes (85.58%) respectively.

Vulnerable groups may be present within the project area's fishing communities. Fishermen households may be considered vulnerable due to their gender, age, physical or mental disability, or disadvantaged by their economic or social status. The presence of vulnerable groups will be verified during consultations and assessment as part of the Project's human rights impact assessment (HRIA) and livelihood restoration plan (LRP). The assessment as relating to vulnerable groups is not considered priority issues for detailed discussion within this report as based on the CIA approach (ie as described in Section 2). These will, however, be appropriated are focused at the project level, through the HRIA and LRP, as mentioned above.

[26] Agricultural Statistics Announcement (農業類預告統計資料發布區)

[27] Annual fishery census report for 2020 (109 年農林漁牧業普查初步統計結果), Accounting and Statistics, Executive Yuan, dated 20 June 2022

[28] 國立海洋生物博物館-海洋生態系 (nmmba.gov.tw)

Table 4.2: Statistics of fisher folk household and population, fisheries workers and fishery production in Changhua County, Xianxi Township and Lukang Township

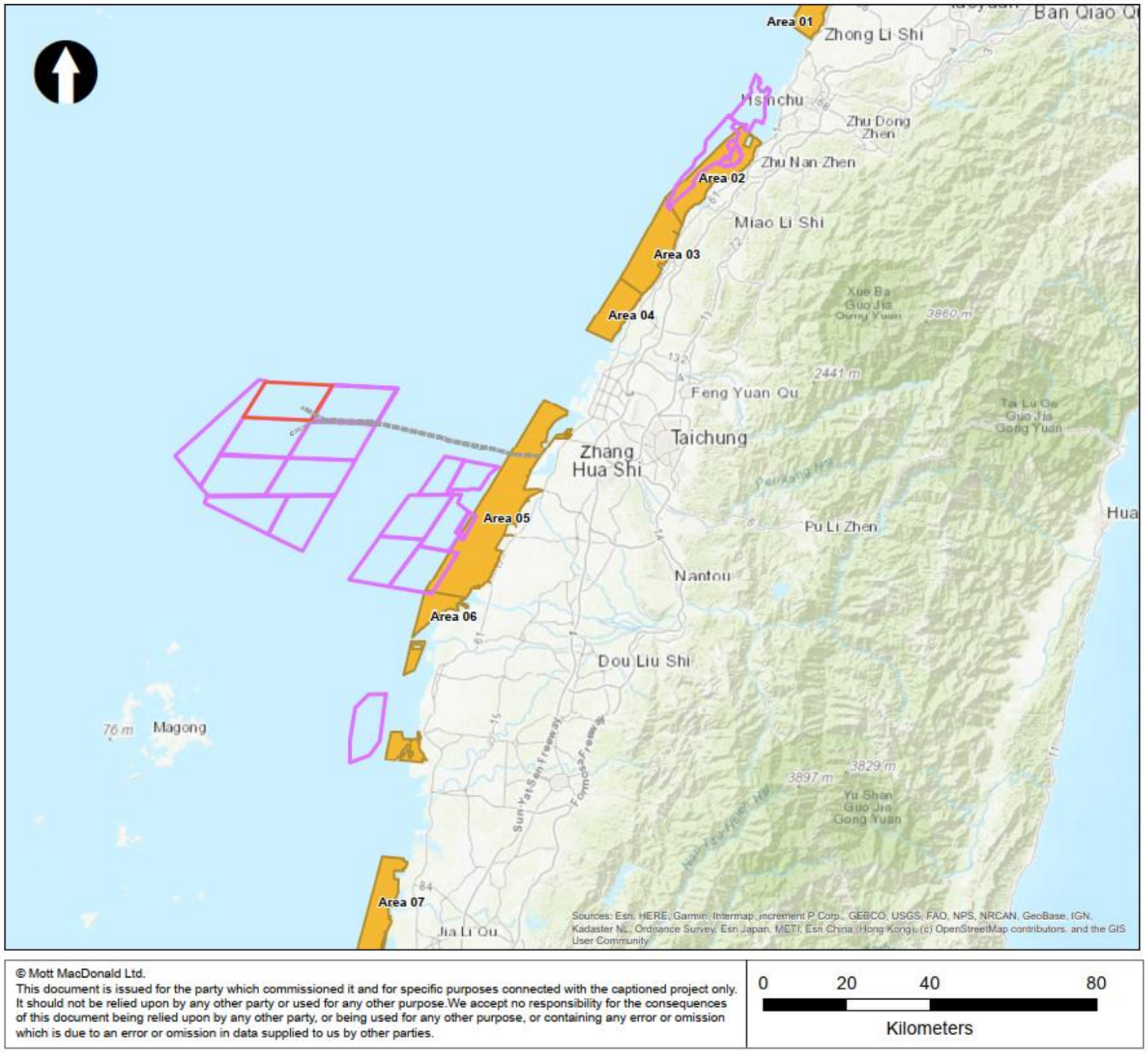
Parameter	Changhua County	Xianxi Township	Lukang Township
Number of fisher folk households	4,414	884	645
Offshore fisheries	17	7	-
Coastal fisheries	1,767	862	341
Marine aquaculture	472	6	-
Inland water fisheries	343	-	33
Inland water aquaculture	1,815	9	271
Population of fisher folk (persons)	15,357	2,733	2,021
Offshore fisheries	40	20	-
Coastal fisheries	5,991	2,670	1,063
Marine aquaculture	1,773	9	-
Inland water fisheries	1,210	-	115
Inland water aquaculture	6,343	34	843
Fisheries workers (persons)	14,527	2,733	1,231
Offshore fisheries	20	20	-
Coastal fisheries	5,259	2,670	331
Marine aquaculture	2,856	9	-
Inland water fisheries	120	-	108
Inland water aquaculture	6,272	34	792
Fishery production (tonnes)	12,179.7	-	-
Offshore fisheries	71.4	-	-
Coastal fisheries	232.1	-	-
Marine aquaculture	1,53.2	-	-
Inland water fisheries	-	-	-
Inland water aquaculture	10,423.1	-	-

Source: Changhua County Government, 2022

Currently, there are two fishing ports within Changhua County, Wang-Gong and Lun-Wei-Wan, with a total of 10 berths. Both parts are Type II fishing ports[29] and are located in the tidal harbour. Due to the large tidal range in Changhua County, entry and exit of fishing boats are limited by the tides and it is estimated that there are only four to six hours available for entry and exit in a day. Navigation channels have been designated to segregate fishing boats, working vessels and other ships, as indicated in Figure 4.3. Shipping lanes between the major ports in the waters off western Taiwan have also been revised to facilitate the development of OWFs.

[29] Type II fishing ports include all the fishing ports that do not belong to Type I. The characteristic of Type I is national and to meet the special needs of fishery development. The definition of Type I can be found at: Enforcement Rules of Fishing Port Act

Figure 4.2: Project footprint and fishing areas



0 20 40 80
Kilometers

Project title
Project Trinity
Cumulative Impact Assessment (CIA)

Map title
Figure 4.3 Project footprint and Fishing Areas

Legend
- Project Trinity Site
- Export cables (preliminary)
- Surrounding offshore wind farms
- Fishing areas

Fishing Ground Area
Area 01: Taoyuan City - Chongli
Area 02: Miaoli County - Nanlung
Area 03: Miaoli County - Tongyuan
Area 04: Taichung City
Area 05: Changhua County
Area 06: Yunlin County
Area 07: Tainan City

Coordinate System
Coordinate System: WGS 1984 UTM Zone 51N
Projection: Transverse Mercator
Datum: WGS 1984

Sources
- Orsted, 2022
- https://map.4coffshore.com/offshorewind/
- Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DF, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Client: Ørsted

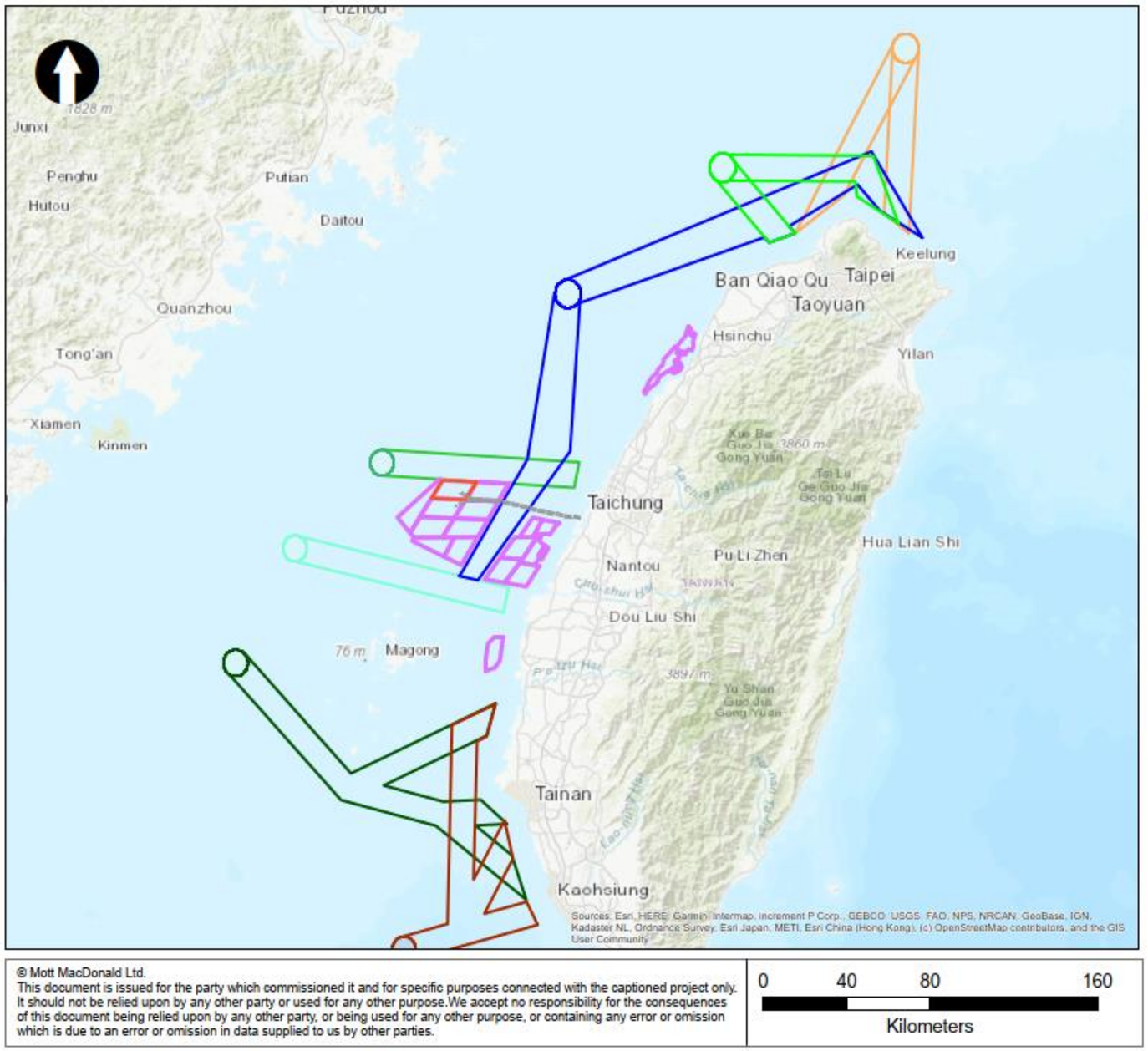
Drawn	Checked	Approved
F Wang	K Chang	B Lim

Mott MacDonald
152 Beach Road #35 00 Gateway East
Singapore 189721
T: +65 6293 1900 F: +65 6293 1911
W: mottmac.com

Date	Status	Rev
17/1/2023	PRE	0

Source: Mott MacDonald, 2023

Figure 4.3: Project footprint and navigation channels



Project title
Project Trinity
Cumulative Impact Assessment (CIA)

Map title
Figure 4.3 Project footprint and Navigation Channels

Legend

- Project Trinity Site
- Export cables (preliminary)
- Surrounding offshore wind farms

Navigation Channel Lanes

- Keelung
- Taichung- Taipei - Keelung
- Mailiao
- Budai - Anping
- Kaohsiung
- Tai Chung
- Taipei

Coordinate System
Coordinate System: WGS 1984 UTM Zone 51N
Projection: Transverse Mercator
Datum: WGS 1984

Sources
- Orsted, 2022
- https://map.4coffshore.com/offshorewind/
- Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DF, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Mott MacDonald
152 Beach Road #35 00 Gateway East
Singapore 189721
T: +65 6293 1900 F: +65 6293 1911
W: mottmac.com

Date	Status	Rev
17/1/2023	PRE	0

0 40 80 160
Kilometers

Source: Mott MacDonald, 2023

4.4 Migratory birds (including seabirds)

The baseline conditions of migratory birds and seabirds at sea within the study area of the cumulative impact assessment considers the Project footprint and its relevant ecological appropriate area of analysis (EAAA).

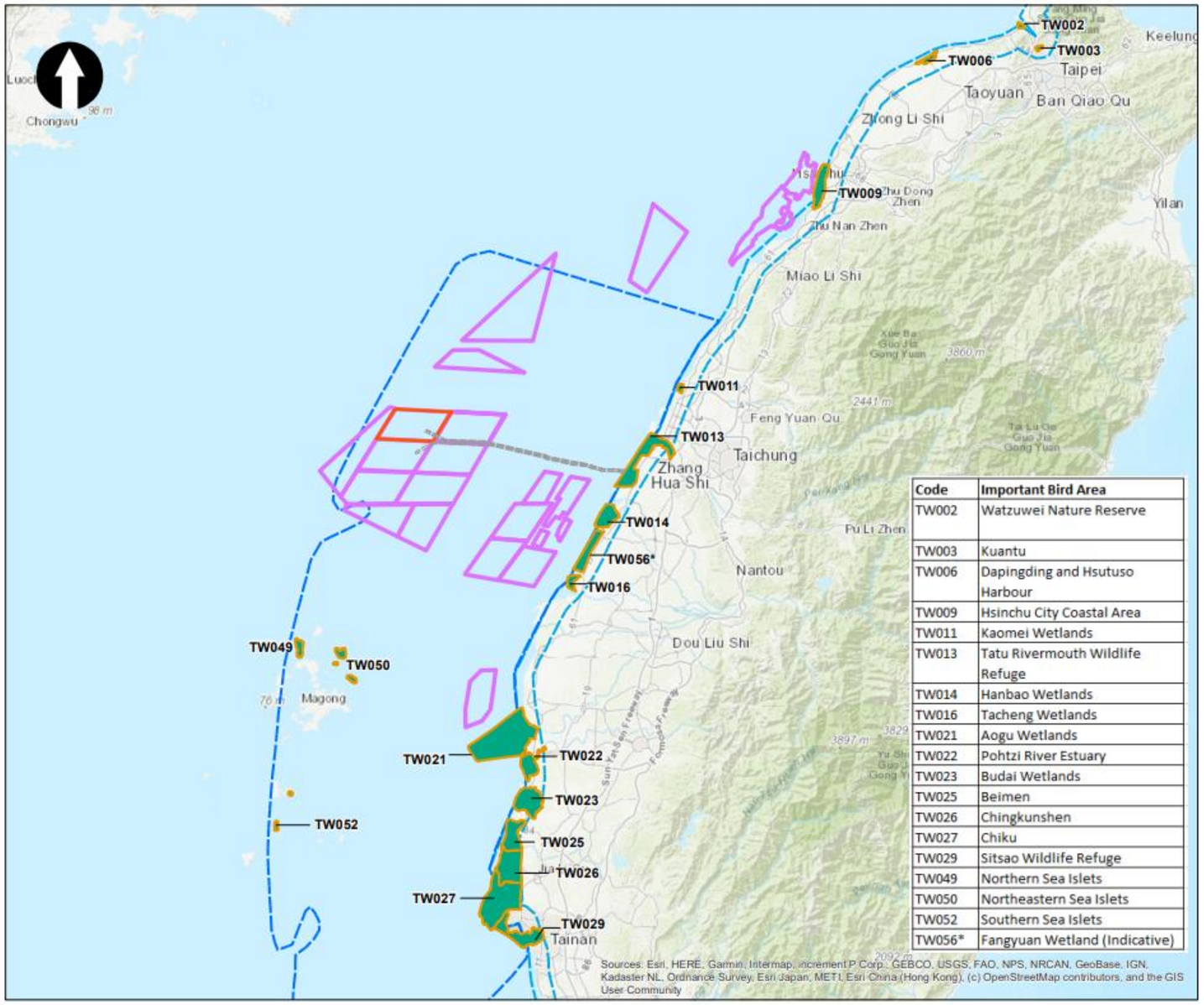
Given the wide-ranging behaviour of migratory birds and seabirds at sea, it is considered that nine globally threatened species (ie listed as Endangered and Vulnerable on the IUCN Red list) and a total of 102 species are likely to be present within the migratory bird EAAA. The IUCN conservation status can be categorised as follows:

- Critically Endangered – 0
- Endangered – 3
- Vulnerable – 6
- Near Threatened – 10
- Least Concern – 83

Of note, the black-faced spoonbill (BFS, endangered species), Saunders' gulls (vulnerable species) and Kentish Plovers (migratory species) are identified within the Project's Critical Habitat Assessment (CHA) as critical habitat triggering species.

The mudflat located at the south of Dadu Estuary, where the Dadu Estuary Important Wetland is recognised as an Important Bird Area (IBA) due to high abundance of congregating migratory birds. Other IBAs on the west coast of Taiwan that fall within the migratory or marine EAAA are depicted in Figure 4.4, with diverse and large flocks of migratory birds and seabirds utilising these areas as foraging, resting and breeding grounds. Besides, migratory birds are also scattered around the coastal area of Changhua Coastal Industrial Park, where the intertidal zone is found. During low tides, migratory birds are usually scattered at the mudflat of intertidal zone for foraging, while during high tides, they fly towards south to fishponds or other habitats for resting.

Figure 4.4: Project footprint and Important Bird Areas on the west coast of Taiwan



Code	Important Bird Area
TW002	Watzuwei Nature Reserve
TW003	Kuantu
TW006	Dapingding and Hsutuso Harbour
TW009	Hsinchu City Coastal Area
TW011	Kaomei Wetlands
TW013	Tatu Rivermouth Wildlife Refuge
TW014	Hanbao Wetlands
TW016	Tacheng Wetlands
TW021	Aogu Wetlands
TW022	Pohtzi River Estuary
TW023	Budai Wetlands
TW025	Beimen
TW026	Chingkunshen
TW027	Chiku
TW029	Sitsao Wildlife Refuge
TW049	Northern Sea Islets
TW050	Northeastern Sea Islets
TW052	Southern Sea Islets
TW056*	Fangyuan Wetland (Indicative)

Project title
Project Trinity
Cumulative Impact Assessment (CIA)

Map title
Figure 4.4 Project footprint and Important Bird Areas on the west coast of Taiwan

Legend
- Project Trinity Site
- Export cables (preliminary)
- Surrounding offshore wind farms
- Important Bird Areas
- Marine EAAA
- Migratory bird EAAA

Coordinate System
Coordinate System: WGS 1984 UTM Zone 51N
Projection: Transverse Mercator
Datum: WGS 1984

Sources
- Orsted, 2022
- https://map.4coffshore.com/offshorewind/
- Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DF, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Client
Ørsted

Drawn	Checked	Approved
F Wang	K Chang	B Lim

Mott MacDonald
152 Beach Road #35 00 Gateway East
Singapore 189721
T: +65 6293 1900 F: +65 6293 1911
W: mottmac.com

Date	Status	Rev
22/11/2023	PRE	0

0 25 50 100
Kilometers

Source: Mott MacDonald, 2023

5 Step 4 & 5: Cumulative impacts and significance

This section presents steps 4 and 5 which assesses future conditions of the selected VECs, as a result of cumulative impacts of the Project with other developments within spatial and temporal boundaries as defined in Section 3.1. The Section describes the key potential impacts that could affect the long-term sustainability of the VECs, if these impacts interact with each other, and also determines the significance of impacts based on qualitative analysis to verify if cumulative changes are a concern.

In a CIA, the impacts are measured in terms of the VEC response and, ultimately, any significant changes to its condition (VEC-centred perspective); not in terms of the intensity of the stress added by a given development (Project-centred perspective). Hence, this CIA focuses on estimating the future condition of VECs due to cumulative impacts and in determining the significance of the forecasted change in the VECs condition based on the likelihood that a threshold will be reached and exceeded. This likelihood for change is due to the incremental (cumulative) impact and in terms of the vulnerability and/or risk to the sustainability of the VECs assessed. In the absence of defined thresholds or in the face of an inability to determine limits of acceptable change, and based on available scientific evidence, professional judgment was employed to suggest appropriate[30] thresholds or limits.

Where possible, incremental change is represented by endpoints or indicators as recommended in the IFC CIA Handbook, using as reference the Appendix 1 in said document[31]. Relevant indicators of cumulative impact for respective VECs are as follows:

Table 5.1: Cumulative impact indicators for respective VECs and the associated impacts

VEC	Phase of Project	Indicator of cumulative impact	Potential impacts identified
Marine habitat	Construction	Habitat fragmentation or disturbance	Disturbance effect from construction activities
	Operation	Area of habitat loss	Project footprint falls permanently into sensitive marine habitat
Marine flora and fauna	Construction	Change in / fragmentation / displacement of marine flora/fauna population	Project footprint causes permanent loss/change in the habitat of marine fauna Underwater noise Increased marine traffic and the associated risk of collision with construction vessels Water quality degradation due to sediment suspension
	Operation	Population or range fragmentation of marine flora/fauna	Effect of electromagnetic field (EMF)
		Creation of artificial habitats through WTG foundations	Project footprint produces new habitats of marine fauna
	Construction	Shifts in livelihoods	Spatial conflict between fishing ground and construction area Increased marine traffic

[30] A precautionary approach considering uncertainty was assumed when thresholds were being suggested.

[31] Appendix 1 of the IFC CIA handbook provides examples of endpoints or indicators typically used on standard ESIAs vis-á-vis those that would be recommended or used in a CIA.

VEC	Phase of Project	Indicator of cumulative impact	Potential impacts identified
Community livelihood: fisheries resources and zones			Displacement of fisheries resources
	Operation	Sustainability of livelihoods	Reduction of fisheries resources
Migratory birds (including seabirds)	Operation	Change in migratory/sea bird population	Collision with wind turbine blades and barrier effect

Source: Mott MacDonald, 2023

In broad terms, significance can be characterised as the product of the degree of change predicted (the magnitude of impact) and the value of the receptor/resource that is subjected to that change (sensitivity of receptor). For each impact the likely magnitude and the sensitivity of the receptor are defined. Generic criteria for the definition of magnitude and sensitivity are summarised below.

Impacts will be categorised as major, moderate, minor or negligible (Table 5.2) based on consideration of the parameters such as:

- Duration of the impact (Table 5.3)
- Spatial extent of the impact
- Likelihood
- Compliance with legal standards and Good International Industry Practice (GIIP)

Sensitivity is specific to each VEC as is defined in Table 5.4.

Table 5.2: Criteria for magnitude of impact

Magnitude	Definition
Major	Fundamental change to the specific conditions assessed resulting in long term or permanent change, typically widespread in nature and requiring significant intervention to return to baseline Would violate national standards or Good International Industry Practice (GIIP) without mitigation Impacts has a net loss or is a detriment to biophysical or socio-economic conditions
Moderate	Detectable change to the specific conditions assessed resulting in non-fundamental temporary or permanent change
Minor	Detectable but small change to the specific conditions assessed
Negligible	No perceptible change to the specific conditions assessed Impacts has no net benefit or loss to biophysical or socio-economic conditions.

Source: Mott MacDonald, 2023

Table 5.3: Criteria for temporal scale

Assessment criteria		Definition
Duration (period of the event causing the effect)	Short term	● Impacts occurs during the extent of preconstruction and construction through to project commissioning
	Medium term	● Impacts occurs during the first 10 years of operations
	Long term	● Impacts extending greater than 10 years, over the life of the Project and beyond

Source: Mott MacDonald, 2023

Table 5.4: Sensitivity criteria

Sensitivity	Criteria
Significant	Receptor (human, physical or biological) with little or no capacity to absorb proposed changes and/or minimal opportunities for mitigation. For example, critically endangered species and their supporting habitats within protected areas.

Sensitivity	Criteria
Not significant	Receptor with capacity to absorb proposed changes and/or good opportunities for mitigation. For example, widespread Vulnerable species and natural habitats that can be restored in the short term.

Source: Mott MacDonald, 2023

5.1 Marine habitat

The cumulative impacts of the Project with other existing/foreseeable OWF and coastal developments in the study area for this VEC are mainly related to habitat disturbance and fragmentation due to construction activities.

5.1.1 Construction phase

Submarine cables of almost all of the OWF developments within the study area would overlap with the Taiwanese Humpback Dolphin MWH at the coastal strip of northwest to west Taiwan (Figure 4.1). Hence, construction activities of all these submarine cables scattering along the MWH could cause a moderate disturbance impact on the MWH.

Nevertheless, measures have been undertaken in design phase to minimise the impact of submarine cables construction. The alignment of submarine cables of this Project as well as the other windfarm developments (ie Greater Changhua OWFs, Hai Long OWFs, Changfang Xidao, Taipower's OWF Phase 2, and Zhongneng) are designed to array within a common area, namely the Changhua Northern Common Corridor, to the landing point at seawall of Changhua Coastal Industrial Park's Lunwei Area. The export cable from the landing point extending out to the Project's offshore substation (OSS) would have approximately 4km in length within the Taiwanese Humpback Dolphin MWH (see Figure 4.1).

Given that the Taiwanese Humpback Dolphin MWH is defined to have a size of 673km^2, and with an assumption of a cable (trenching) width of 2m[32], the area in which the Project's two submarine export cables overlap with the Taiwanese Humpback Dolphin MWH is approximately 0.015km^2. This is estimated to be 0.002% of the total Taiwanese Humpback Dolphin MWH area, which are only temporarily affected during cable laying works for a few weeks at maximum of 200m length at one time.

The spatial and temporal (ie temporary disturbance for short sections of the cable route) impact of the cable laying works are expected to be similar. Given that the cable laying area impacts are only during construction phase, the aggregated extent of possible overlap (ie even on a conservative basis) indicates the spatial and temporal impact of cable construction on Taiwanese Humpback Dolphin MWH is very minor to negligible on a percentage basis (eg six projects - would still be <0.2% of temporary impacts). Furthermore, the common corridor design will minimise the extent of submarine cable construction for individual windfarm projects and associated impact of habitat disturbance and fragmentation on the Taiwanese Humpback Dolphin MWH. This measure will also minimise impact of marine benthic and intertidal habitat loss.

It should be noted that the impacts of the submarine cables are largely only during the cable's construction phase (ie laying works in nearshore areas). It should also be noted that the nearby windfarm developments all utilised the same export cable alignment and landing point via the Changhua Northern Common Corridor (see Figure 1.1).

Submarine cable installation within/near the MWH may cause temporary displacement of Taiwanese Humpback Dolphin as the effect of underwater noise and increased marine traffic generated from cable laying activities. The activities may result in behavioural disturbance to the

[32] Based on the Project EIA's dredging width for the submarine cables.

dolphins which may be displaced from their preferred habitat. Cable laying is expected to be temporary and localised (ie a short period of disturbance within small portion of the overall habitat area). Cable laying activities will be conducted in sequential sections to minimise any impact on the MWH and the affected area will be reinstated before commencing on the construction of the next section.

It is also noted that the nearby windfarm developments are also required to adhere to their respective EIA requirements, whereby construction vessels that are within approximately 1500m radius of known Taiwanese Humpback Dolphin habitat are to maintain a speed below six knots. Furthermore, vessels will avoid entering known Taiwanese Humpback Dolphin 'hotspots' during their peak activity periods.

Overall, impact on the MWH, as well as the impact to corals and fish populations, are anticipated to be minor and short-term.

For the development of Changhua fishing port, the planned breakwaters are overlapped with the MWH. However, with the construction design and mitigation measures (ie low-noise construction method) committed in the project of Changhua fishing port's third EIA deviation report of Changhua fishing port[33], the Project does not seem to cause significant adverse impact to the Taiwanese White Dolphins.

5.1.2 Operation Phase

The submarine cables of Project Trinity and other windfarms will be buried, and the seabed will be reinstated, thus no permanent loss of the MWH is expected. The footprints of the Project and other Changhua windfarm developments have avoided the artificial reef areas assigned for habitat enhancement are located around the nearshore area at the northern part of Changhua County. The foundation of the installed WTGs would also function similar to artificial reef and provide positive impact to the marine environment. The eight Protected Reef Areas at nearshore of Changhua as well as the Marine Protected Areas including Fisheries Resources Conservation Areas along the coast were also avoided by the planned windfarm and coastal developments, thus potential impact of the Project and the other developments on marine habitat during operation phase is expected to be negligible. Impact significance to this VEC is considered to be not significant.

The cumulative impact on marine habitat during construction phase and operation phase are summarized in Table 5.5.

[33] 彰化漁港開發計畫環境影響說明書第 3 次環境影像差異分析報告暨變更, dated April 2020

Table 5.5: Summary of cumulative impact on marine habitat

Phase of Project	Indicator of cumulative impact	Potential impact identified	Mitigation measures	Residual impact magnitude – Project Trinity	Residual impact magnitude – from other developments	Impact duration	Significance of cumulative impact after mitigation measures implemented
Construction	Habitat fragmentation or disturbance	• Disturbance effect from submarine cable installation	• The submarine cables of Changhua windfarm to array within a common corridor • The cable laying activities to be conducted in sequential sections	• Minor as conducted by sequential laying in sections	• Reduced to minor cable arrayed in common area	• Short term	• Not significant
Operation	Area of habitat loss	• Project footprint falls permanently into sensitive marine habitat	• The seabed will be reinstated after submarine cable construction • WTG foundations can function similar to artificial reef	• Negligible as no habitat loss	• Negligible as no habitat loss	• Nil	• Not significant

Source: Greater Changhua Northwest Offshore Wind Farm Project EIA Report, 2018; Mott MacDonald, 2023

5.2 Marine flora and fauna

The cumulative impacts that affect this VEC in the study area are relevant to changes or displacement in wildlife population mainly due to increased underwater noise, degrade water quality and risk of vessel collisions during construction phase, as well as habitat loss/disturbance mainly due to areas occupied by developments (eg WTGs, offshore substation, submarine cable, cable tower, breakwaters) and electromagnetic field (EMF) generated during operation phase.

5.2.1 Construction phase

5.2.1.1 Underwater noise

Underwater noise would be generated mainly by offshore piling of WTG and offshore substation foundations as well as the operation of construction vessels during the construction phase. Underwater noise can impact marine mammals by causing temporary/permanent hearing loss, behavioural change/reaction and interference with echolocation/communication. According to the Project's EIA report, piling sound pressure may reach up to 200 dB re 1 µPa (RMS[34]) at 100m from the piling location. Based on actual record, a single piling SELss[35] 145 dB re 1 μPa^2s was released to Harbor Porpoise, hearing loss can be detected in as short as 30 minutes, the SELcum[36] at this time is 176 dB re 1 μPa^2s, hearing can return to normal after hearing about 50 to 60 minutes of noise (Ronald A. Kastelein, 2016). Piling activities and construction vessels cause noise disturbance to marine fish, resulting in displacement of prey species of marine mammals. Underwater noise generated from offshore piling can also interfere echolocation and communication of marine mammals due to masking effect[37], disrupting their feeding and movement habits. In view of the abovementioned potential underwater noise impacts on marine mammals, the Project has committed to implement mitigation measures as detailed in Section 6.2. Jacket-type foundation piling, and noise reduction mitigation techniques are expected to reduce piling sound pressure level to SEL 160 dB at 750m from the piling location. In addition to the mitigation measures, in compliance to the Taiwan Cetacean Observer (TCO) Regulation and Management Manual by the Ocean Conservation Administration as well as EIA requirements, the Project and neighbouring offshore wind farms will deploy qualified TCOs to carry out marine mammal monitoring during construction phase. As detailed in Table 6.1, this is an EIA prescribed mitigation measure for minimising impact of underwater noise to marine mammals that are near the project's piling works. With all the abovementioned mitigation measures in place, residual impact of underwater noise by the Project is deemed to be minor.

Regarding other developments, concurrent offshore piling of WTG foundations across windfarm developments could generate significant impact of cumulative underwater noise on marine mammals. Nevertheless, as detailed in Section 6.2, concurrent piling activities will be minimised to pile driving of only one WTG at a time at each site amongst the OWF developments in Changhua, Miaoli and Yunlin County. On the other hand, low-noise piling activities for the fishing port development will generate only a small extent of underwater noise. As described within their respective EIAs, other projects such as Formosa 3 and Hai Long 2 and 3 are also required to set up underwater mitigations (eg bubble curtains) to meet underwater noise limits (ie sound exposure levels not to exceed 160 dB at 750m away from piling). Under this context, given that the closest possible distance between a piling location of the Project with Formosa 3 or Hai Long 2 and 3, the potential for significant adverse cumulative impact for underwater noise is limited. This is also subjected to the coincidental concurrent occurrence of piling at the WTG

[34] Root mean square

[35] Sound Exposure Level single strike

[36] Sound Exposure Level cumulative

[37] The effect occurs when the artificial noise is produced higher than the ambient noise in a particular frequency range, and there is an overlap in the frequency range of species sound signals.

locations at each development's boundary edge. This scheduling conflict could be largely avoided via communications and collaboration between developers.

In terms of underwater noise piling impacts (and its potential for cumulative impacts) specifically to the critical habitat triggering marine mammal species, Taiwanese humpback dolphin, these are considered to be highly unlikely. This is due to the distance from coast (ie approximately 50km) and the depth of water (ie 30m to 45m) where the Project's OWF is located. Taiwanese humpback dolphin are only known to be generally presented at shallow coastal waters at depths of up to 30m, between 2 to 2.5km from the coast.

Overall residual magnitude of cumulative impact of underwater noise on this VEC would be deemed minor and short-term with implementation of management measures to minimise cumulative noise from piling.

5.2.1.2 Risk of collision with construction vessels

Risk of collisions between construction vessels and marine fauna would potentially affect this VEC. Significant numbers of construction vessels and associated supporting and emergency rescue vessels are anticipated to be travelling across the windfarm sites and the shore for this Project and other windfarm developments. Navigation of these vessels may result in potential collisions with marine mammals, fish and sea turtle species which have a wide range of use and movements in the Taiwan Strait, leading to injury or death and thus potential change in population of these vulnerable marine animals.

In view of the abovementioned potential impact of vessel strike on marine fauna, the Project has committed to limit vessel speed near the Taiwanese Humpback Dolphin MWH and setup a navigation safety plan, as detailed in Section 6.2. These measures are expected to minimise the impact of vessel strikes during the construction phase of the Project to insignificant levels. However, the cumulative number of construction vessels from all concurrently constructing OWF projects and cumulative effect of vessel strike are uncertain. Although construction vessel channels have been designated along the offshore windfarm sites (Figure 4.3), cumulative impact of vessel collision risk on this VEC could be moderate if there is no further management on capping of construction vessels to feasible numbers across the projects.

5.2.1.3 Water quality degradation due to sediment suspension

Water quality is expected to be degraded due to suspended solids during the construction phase, mainly due to foundation and cable laying works. Polluted water quality may cause migration or loss of fish resources, degrade marine habitat for critical habitat triggering species like the Taiwanese picnic seabream, and impact foraging capabilities and food sources for marine mammals.

Suspended solids within the seawater during offshore foundation works were simulated within the Project's EIA report. Results showed that with simultaneous WTG foundation construction of the Project, Haiding and Hai Long windfarms, the seawater quality impact is concluded by the EIA to be minor to insignificant. Impact significances were also stated to be minor to insignificant within the EIA for simultaneous cable laying for the abovementioned developments. Mitigation measures (ie such as anti-turbidity/silt curtains, and limiting maximum trenching length at one go) for water quality are also implemented for the Project as well as prescribed within the EIAs of the abovementioned windfarm developments. Overall, degraded water quality due to sediment suspension during construction is expected to be minor and short-term, hence the cumulative impact is not significant to this VEC.

5.2.1.4 Effect of project footprint on marine habitat of marine fauna

Seabed areas that will be occupied by WTGs, offshore substation and submarine cables may result in habitat loss for marine benthos during the construction phase. Using the Project's indicative foundation design (ie 4 legged jacket), the seabed area affected by the foundation required for one WTG is conservatively[38] taken to be 1600m^2. The Project had planned for 54 to 74 WTGs and one offshore substation (OSS) (ie designed to use same foundation as one WTG). Therefore, the Project's offshore WTG and OSS are expected to take up a total of 0.0672 km^2 of seabed area. The Project is also designed to have two export submarine cables of maximum length of 75km (ie from OSS to landing points). Hence, conservatively assuming the cable (trench) width of 2m, the total area taken up by the Project's export cables will be 0.3 km^2. In total, the Project's seabed footprint is 0.37km^2, which is 0.003%[39] out of the whole marine EAAA (which has an area of 13,377km^2).

Based on publicly available information, Hai Long No. 3's EIA Bird Monitoring Report[40] notes the greater Changhua outer seas (ie where the Project is located), greater Changhua coastal seas and Yunlin OWF (total of 14 projects) aggregate up to 1178 WTGs. Fengmiao OWF is also estimated to have 128 WTGs[41]. Hence, conservatively assuming similar foundations to the Project design[42], substation area and submarine cable length and width for all projects, the total area taken up by the projects (ie excluding the Project itself) within the marine EAAA will be around 5.94 km^2, or 0.04% of the entire marine EAAA. It should also be noted that the marine benthos survey results of the Project's EIA found that marine benthos at the seabed areas of both the windfarm site and along submarine cable alignment were of low biodiversity importance.

Benthic habitat loss caused by WTGs and offshore substations will be permanent, whereby cable laying will be reinstated after cable burial to allow the marine environment to return to its original stage. However, the overall extent of habitat loss (ie even if both permanent and temporary losses are aggregated) is small (ie 0.003%) given the limited area size occupied by the windfarm components relative to the wider ecological area bearing similar attributes (ie the surrounding marine EAAA area). Given the size/scale of the marine habitat region, the cumulative habitat loss due to the Project and its surrounding windfarm development are still levels of magnitude below what might be considered significant. It is also worth noting that the foundations of the WTGs are considered to have a potentially positive impact in benthos habitat creation during the operational phase.

5.2.2 Operation phase

5.2.2.1 Effect of electromagnetic field

During the operation phase, electric currents in the inter-array submarine cables and submarine cables connecting the WTGs to the cable landing point may induce an electromagnetic field EMF), influencing the behaviour of marine ecology. With the Project's construction design approach, the potential significant adverse impact from EMF can be minimized, where:

- The submarine cable route from WTG to landfall shall take the shortest distance feasible.

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38 It is conservatively taken that the affected seabed area is the entire area under the 4 legged jacket.

39 This is a conservative figure, as the cable laying route is not subjected to permanent habitat loss. The seabed area disturbed for cable laying is only temporary, and will be reinstated after the cable laying (ie a few weeks for each section) is completed.

40 https://eiadoc.epa.gov.tw/EIAWEB/DownloadFiles.ashx?shcode=1080247A&sfilename=000.PDF

41 CIP 第三階段區塊開發計畫 EN (ciptwr3.com)

42 This is a conversative estimate as some projects would use a monopile or three-legged jacket design, which would take up less space on the seabed as a four-legged jacket.

- The submarine cable will be buried 1m to 2m (2m within the nearshore area) to reduce electromagnetic field (EMF) effects.

It is noted that the EIA reviewing committee usually request the windfarms[43] using the Changhua Northern/Southern Common Corridor (ie 彰化離岸風電海纜上岸共同廊道) to commit burying the submarine cables at least 1.5m. As such, the EMF cumulative impact on marine flora and fauna during operation phase is minor and not significant.

The cumulative impact on marine flora and fauna during construction phase and operation phase are summarized in Table 5.6.

5.2.2.2 Effect of project footprint on marine habitat of marine fauna

As identified within the construction phase, seabed areas occupied by WTGs, offshore substation and submarine cables may result in habitat loss for marine benthos during the construction phase.

On the contrary, the foundations of WTGs and offshore substations could potentially have positive effect for marine benthos as the structures provide hard substratum for colonisation of benthic communities. For the Project, protective seabed rock berms for scour protection will be adopted to protect the foundation of WTG. The rock berms are designed to protect the wind turbine foundation. Meanwhile, it can serve as artificial reef, providing marine habitat. On the other hand, habitat loss caused by submarine cables construction will be temporary as the seabed substrate will be reinstated above the buried cables and benthic organisms can be re-colonised within the area. Likewise, the positive impact of WTG foundations and offshore substation, as well as the temporarily negative impact of submarine cable construction will be applicable to the neighbouring windfarms. As such, cumulative impact on marine benthos during operation phase is minor and short term.

[43] #11 to #19 in Figure 1.2

Table 5.6: Summary of cumulative impact on marine flora and fauna

Phase of Project	Indicator of cumulative impact	Potential impact identified	Mitigation measures	Residual impact magnitude – Project Trinity	Residual impact magnitude – from other developments	Impact duration	Significance of cumulative impact after mitigation measures implemented
Construction	Change in / displacement of population	Underwater noise	• Refer to Table 6.1	• Minor	• Minor	• Short term	• Not significant for underwater noise, water quality and project footprint; • Significant for risk of collision
		Risk of collision with construction vessels	• Vessel speed control • Navigation safety plan	• Minor	• Moderate	• Short term	
		Water quality degradation due to sediment suspension	• Anti-turbidity/silt curtains • Limiting maximum trenching length at one go	• Minor	• Minor	• Short term	
		Effect of project footprint on marine habitat of marine fauna	• Cable alignment will be reinstated after cable burial	• Minor	• Minor	• Short term	
Operation	Population or range fragmentation	Project footprint causes permanent loss/change in the habitat of marine fauna	• The foundations of WTGs and offshore substations could provide hard substratum for colonisation of benthic communities.	• Minor	• Minor	• Short term	• Not significant
		Effect of electromagnetic field (EMF)	• The submarine cable route from WTG to landfall shall take the shortest distance feasible. • The submarine cable will be buried 1m to 2m (2m within the nearshore area) to reduce EMF effects.	• Minor	• Minor	• Long term	

Source: Greater Changhua Northwest Offshore Wind Farm Project EIA Report, 2018; Mott MacDonald, 2023

5.3 Community livelihood: fisheries resources and zones

Cumulative impacts that affected this VEC are related to shifts in livelihoods and sustainability of livelihoods, mainly caused by spatial conflicts between fishing and construction activities, underwater noise from pile driving, and habitat loss/ disturbance.

In the spatial aspect, the fishing ground under the Changhua County Exclusive Fishing Right does not overlap with the windfarm site (ie approximately 50km from the coastline) of this Project or other offshore wind developments in Changhua.

The area of the Changhua Northern Common Corridor (ie utilised by the Project, other Greater Changhua projects, Hai Long and Formosa 3) for submarine cable installation does overlap with the fishing ground, but the spatial and temporal overlap will be limited to the construction phase. Potential impact of shifts in livelihood of fishery are anticipated during construction of cable trenches and laying of submarine cables. Nevertheless, the impact will be short-term and localized as the construction activities (ie cable laying) will be conducted in sections with the completed area being reinstated.

In terms of fishery activities, none of the fishing vessels registered with the CFA are known to operate at the windfarm area. It is because relative to the windfarm location (ie 50km from coastline), there are no fishing vessels registered as “far seas” category (ie operating range of >12 nautical mile or >22km). Thus, impact to community livelihood is considered as minor.

In 2018, the Project’s WTG site as well as its adjacent windfarms had low marine vessel density of one (1) to 25 vessels, while the nearshore area had high marine vessel density (from 25 to above 75 vessels, see Figure 5.1). The Project’s EIA notes 31 vessels will be used during the construction phase. Due to the increasing OWF developments, the fisher folk might be affected by the significant increase in marine traffic that navigates between the windfarm sites and the shore. There will be a risk of collision between fisheries operating boats and construction vessels operated for this Project and other windfarm developments, which would potentially affect the VEC. However, it should be noted that the working vessels (with exception of cable laying works) of the Project (and other windfarm developments) are mainly only transiting through the coastal area en-route to their OWF area. The existing coastal fishing areas where fisher folk will most likely conduct activities already have high levels of marine traffic, and it is expected that the fisher folk will likely avoid the heavy traffic areas to minimise collision risk and aggregate at certain parts of the fishing ground. As mentioned in section 3.2.3.2, most of the Project’s neighbouring windfarms are also likely to have staggered offshore construction periods with the Project’s offshore construction phase. Hence, marine traffic is likely to increase temporarily for certain overlapped construction periods and at potentially at nearshore area (ie since the offshore WTG areas of the windfarm are relatively far apart). The mitigation measures of the Project and neighbouring OWF developments will include:

- Limiting vessel speed nearshore
- Controlling vessel movements along a predefined marine transportation route are expected to minimise the impact of potential collision with fishing vessels.
- Vessel captains to adjust their routes based on traffic and weather conditions.

However, if there is no management of a cumulative number of constructions associated vessels to avoid collision risk with fishing operations, increase in marine traffic will thus lead to potential moderate impact on displacement in fisheries livelihoods in the short term (during the construction phase).

Increased maritime traffic and underwater noise from pile driving may cause disturbance to fish habitats and subsequent displacement of fish and interference with spawning activities. These activities may result in shifting of productive fishing grounds and affect the livelihood of fisher folk in the short term. However, it has been observed from a windfarm in operation in Western

Taiwan that the area with wind turbines located had relatively better fish aggregation effect than nearby neighbouring artificial reef (Huang, et al., 2021). In accordance with Taiwanese regulations, windfarm developers are mandated to provide compensation to fisher folk to mitigate potential economic impact on fisheries. It is understood that this is applicable to all OWFs within the spatial boundary. Direct (monetary) compensation is provided for vessel owners registered under the local fishermen's association (ie CFA), as parties whose 'exclusive fishing rights' had been affected. The potential economic impact on other project-affected persons (PAPs) (ie which include vulnerable groups and women) will be assessed and mitigated further in the livelihood restoration plan (LRP) and human rights impact assessment (HRIA), whilst applicable biodiversity offsets (if required) will be discussed in the Biodiversity Action Plan (BAP).

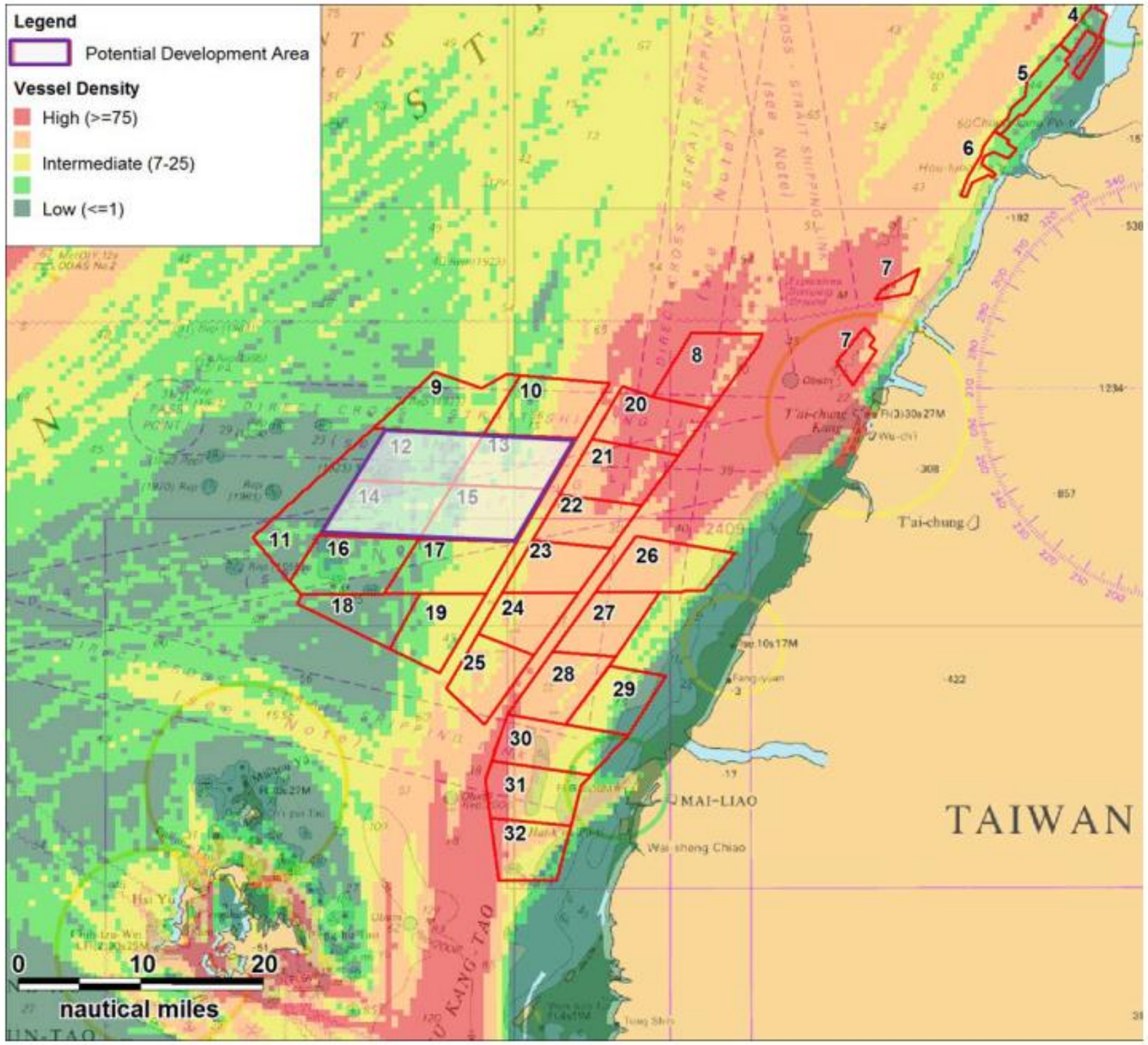
It should be noted that as part of the Project's LRP, there is an eligibility and entitlement matrix (ie Table 5.1) which describes the community investment/support and livelihood restoration measures for vulnerable groups and women. In addition, primary data gathering in the form of key informant interviews (KIIs) and focus group discussions (FGDs) with the community would be conducted in November/December 2023. The identification of vulnerable groups, the Project's associated concerns/impacts on these groups, as well as the perceived potential economic impact (ie both at project-level and cumulative basis) will be updated in the Project's LRP and HRIA, whereby further commentary and assessment with regard to these groups can be found.

For the operation phase of this Project and other windfarm developments, loss in fisheries resources or fishing ground is not expected as the WTG sites of this Project and other windfarm developments have avoided the area of Exclusive Fishing Rights (EFR), Protected Reef Areas and Artificial Reef Areas. Exclusion zones (ie area where non-Project vessels, including fishing vessels, are not allowed to access) will be established around the WTGs (ie 50m radius from the WTG foundation) during non-maintenance and non-emergency periods for the operational phase. The zone extends to 500m in all directions from the exterior boundaries of the turbine, foundation, and/or offshore substation when under maintenance. However, there are no registered "far seas" fishing folks within the CFA, which are fisher folks (or associated vessels) that are expected to regularly operate within the Project's offshore area (ie approximately 50km away from the coast). Where there are such fishing vessels were present, their primary fishing methods are gillnets and trawls, which require continuous movement to cover a large area rather than staying stationery to fish near the WTGs. Vessels that can reach this range are also likely to be able to access a much wider area of sea (ie for fishing operations), and thus will not experience significant impact from the additional operational windfarms.

It is worth mentioning that the foundations of the WTGs can serve the function of artificial reefs, providing substratum for colonization of marine fauna and thus positive impact on fisheries resources. Other measures nearby offshore windfarms aim to adopt include assisting fisher folk to adopt new fishing techniques around WTG foundations and aiding the access to windfarm areas for fishing for the fisher folk. For this VEC, the overall cumulative impact is considered as minor and not significant when management of working vessels and fishing grounds are implemented.

The cumulative impact on community livelihood during construction phase and operation phase are summarized in Table 5.7.

Figure 5.1: Statistical map of marine vessel density in Changhua offshore area



Source: Greater Changhua Northwest Offshore Wind Farm Project EIA Report, 2018

Table 5.7: Summary of cumulative impact on community livelihood – fisheries resources and zones

Phase of Project	Indicator of cumulative impact	Potential impact identified	Mitigation measures	Residual impact magnitude – Project Trinity	Residual impact magnitude – from other developments	Impact duration	Significance of cumulative impact after mitigation measures implemented
Construction	Shifts in livelihoods	Spatial conflict between fishing ground and construction area	• Limiting vessel speed nearshore • Controlling vessel movements along a predefined route are expected to minimise the impact of potential collision with fishing vessels. • The WTG site of this Project avoids the area of Exclusive Fishing Right	• Minor	• Minor	• Short term	• Not significant if management of working vessels is implemented
		Increased marine traffic		• Minor	• Moderate	• Short term	
		Displacement of fisheries resources		• Minor	• Minor	• Short term	
Operation	Sustainability of livelihoods	Reduction of fisheries resources		• Minor	• Minor	• Nil	• Not significant

Source: Greater Changhua Northwest Offshore Wind Farm Project EIA Report, 2018; Mott MacDonald, 2023

5.4 Migratory birds (including seabirds)

The key threat of the cumulative development of offshore windfarms to migratory birds and seabirds would be bird collision with WTG. Due to risk of collision with WTG and barrier effect from this Project and other windfarm developments in the area, the cumulative effects of the changes in migratory bird population are of importance for this VEC within the study area. It is noted that of the species identified in section 4.4, the black-faced spoonbill (BFS, migratory birds), Saunders' gulls (migratory seabirds) and Kentish Plovers (migratory birds) are considered within the Project's CHA as critical habitat triggering species.

From visual observation in the daytime, seabirds, which include Saunders' gulls, mostly flew close to the surface of the ocean, where the observed flight altitudes within the windfarm are all below 10m Above Sea Level (ASL)[44]. A collision risk modelling (CRM) was conducted for the Project, and the collision vulnerability of different birds with WTG was qualitatively evaluated in the EIA report, as summarised in Table 5.8.

By considering the overlap of average bird flight altitude with the rotation range of wind turbine blade, flexibility of habitat use, survival rate of adult and national conservation status. Results showed that migratory waterbirds (Charadriidae and Scolopacidae) and breeding seabird (Sternidae) are considered vulnerable groups. Breeding seabird group is considered as of high vulnerability because of three Sternidae species of conservation concern (Greater Crested Tern, Bridled Tern and Roseate Tern) being recorded among Orsted's windfarms in Changhua[45], and the group's high survival rate of adult implies that loss from collision could be a significant impact on the breeding colony.

From radar survey for nocturnal birds, a total of 20 bird flight activities were recorded in four vertical radar surveys from No.12 to No.15 windfarms (Figure 1.2). Based on the 20 records of flying altitude, the flight height was mainly distributed between 25-100 meters (45%), followed by 0~25 meters (30%), and between 100~300 meters (15%), with approximately 60% under 300 meters which is within the range of possible impact hazards. Only 10% is above 300 meters, which shows that the flying height of night birds is 60% with substantial potential impact risk in collision with the WTG in the range of 25m~300m.

It is recognized that migratory birds may be at risk of collision with wind turbine blades during the Project's operation phase. The CRM conducted within the Project's EIA Report predicted the annual collision number to be less than 1% threshold value of population. Drawing from publicly available reports, HL NO.3 EIA Bird Monitoring Report[46] has further conducted CRM for various bird species across potential windfarms in western Taiwan. This overarching CRM analysis encompassed a total of 1178 WTGs situated in greater Changhua seas of western Taiwan. The WTGs covered within the CRM are:

- 670 WTGs are situated within the greater Changhua outer seas, which include the Project, CHW01, Hai Long 2 and 3, Haiding and others shown in Figure 1.2.
- 402 WTGs are situated in greater Changhua coastal seas, which include windfarm developments like Haixia, Huanyang, Changhua Changfang and others.
- 106 WTGs belong to Yunlin OWF, which is the southernmost windfarm within this CIA's spatial boundary.

Results of the CRM conducted for BFS (ie as based on potential windfarms in western Taiwan) was presented in Appendix 3 of the HL NO.3 Bird Monitoring Report, and summarised in Table

[44] Greater Changhua Northwest Offshore Wind Farm Project EIA Report, 2018

[45] #12 to #15 in Figure 1.2

[46] 海龍二號離岸風力發電計畫環境影響說明書環境影響調查報告書（鳥類調查報告）, 2020

5.9 below. It is noted that the collision counts presented below are the same and applicable to 6MW, 8MW or 10MW size WTGs.

Table 5.8: BFS collision risk modelling of western Taiwan windfarms

Wind farms	Number of WTGs	Collision count based on avoidance rate			
		95%	98%	99%	99.5%
Greater Changhua outer seas	670	2	1	0	0
Greater Changhua inner seas	402	4	2	1	0
Yunlin OWF	106	0	0	0	0

Source: HL NO.3 EIA Bird Monitoring Report

For the Yunlin OWF, which is also the southernmost windfarm within the spatial boundary, no collisions occur at any of the avoidance rates[47]. On the northernmost end of the spatial boundary, the two operational windfarms (ie Haineng and Haiyang Zhunan) account for 69 WTGs. Haineng (Formosa 2) OWF's EIA environmental impact survey report (dated 16 May 2018) found no BFS passing through its Project area via satellite tracking between 2012 to 2015 and 2016 to 2018. Hence the collision rate was calculated to be zero (0) as well.

The various assessment (ie in particular, the cumulative impact assessed at the western Taiwan level) had indicated that the collision risk on the BFS species would not be significant and is unlikely to affect the growth trend of natural population.

CRM were also conducted for Saunders' gulls within the Project's EIA amendment report[48]. The CRM had indicated that collision risk was simulated to be less than one collision annually. The Saunders's gull is considered to be a non-breeding seabird that winters in Taiwan. Non-breeding seabird groups are considered of low vulnerability and the group's high adult survival rate implies that loss from collision could be non-significant on the breeding population. Similarly, within the same set of CRM conducted, the collision risk for Kentish Plovers was also predicted to be less than one collision annually.

In terms of broader literature review, it is noted that:

- In the United Kingdom, study on bird avoidance behaviour and collisions around offshore windfarms has been done to support consenting applications for offshore wind development (Skov *et al*. 2018). The results showed that the study empirical avoidance rates of five target seabird species were over 99%. Though the study was not conducted in Taiwan, it can be inferred that bird species do exhibit avoidance behaviour to avoid colliding with wind turbines.
- Another radar survey conducted by Denmark researcher, Horns Rev in 2003~2005 revealed similar findings on the change of flight direction to avoid collision with the WTG at Nysted windfarm. The distance between the turbine layouts at Nysted is less than 500m, and the row spacing of the Nysted's turbines is only 850m. While, for this Project, the spacing between wind turbines along the east-west wind direction is estimated to be between 500m to 710m, and the spacing between wind turbines along the north-south wind direction is estimated to be between 3700m to 4200m. Considering that Nysted could achieve 99% of

[47] 雲林離岸風力發電廠興建計畫環境影響說明書 (定稿本), 2018

[48] 大彰化西北離岸風力發電計畫環境影響差異分析報告 (定稿本), April 2022

bird avoidance rate, the larger distance between the WTGs (ie at least 500m) and row spacing (ie 1775-2600m) in this Project should create a much bigger space and be able to achieve a higher bird avoidance rate.

It should be noted that monitoring (ie during construction and operations) of offshore/sea birds will be conducted as based on the EIA requirement, This monitoring is key in providing further updated Project survey results to potentially determine if there is sufficient need (eg such as observation of BFS or Saunder's Gull) to undertake an updated CRM run.

As based on the "Checklist for Round Third of Offshore Wind Power EIA Review (第三階段離岸風電環評審查建議事項檢核表)[49] drafted by the EPA, it has been proposed that the distance between wind turbines in Taiwan is to be greater than 700m, and the distance between blades of adjacent turbines are to be greater than 400m. However, it should be noted that the distances proposed by EPA have not been promulgated to date. For the nine (9) offshore windfarm developments in Changhua (Figure 5.2), a distance of 2km between WTG arrays will be retained by the offshore windfarm developers to minimise the risk of migratory bird collisions with WTGs.

Based on the Project's EIA, Changhua's offshore wind developers[50] will jointly set up a bird monitoring system in each windfarm to observe bird activity, including thermal imaging, sonic microphones, and high-performance radars. Changhua's offshore wind developers[51] will also share the monitoring results with each other, to analyse the bird activities in different directions[52].

As per the discussions above, the overall cumulative impact to this VEC, including on the critical habitat trigger species (ie BFS and Saunders's gulls), during operation phase is considered as not significant.

The cumulative impact on migratory birds during construction phase and operation phase are summarized in Table 5.9.

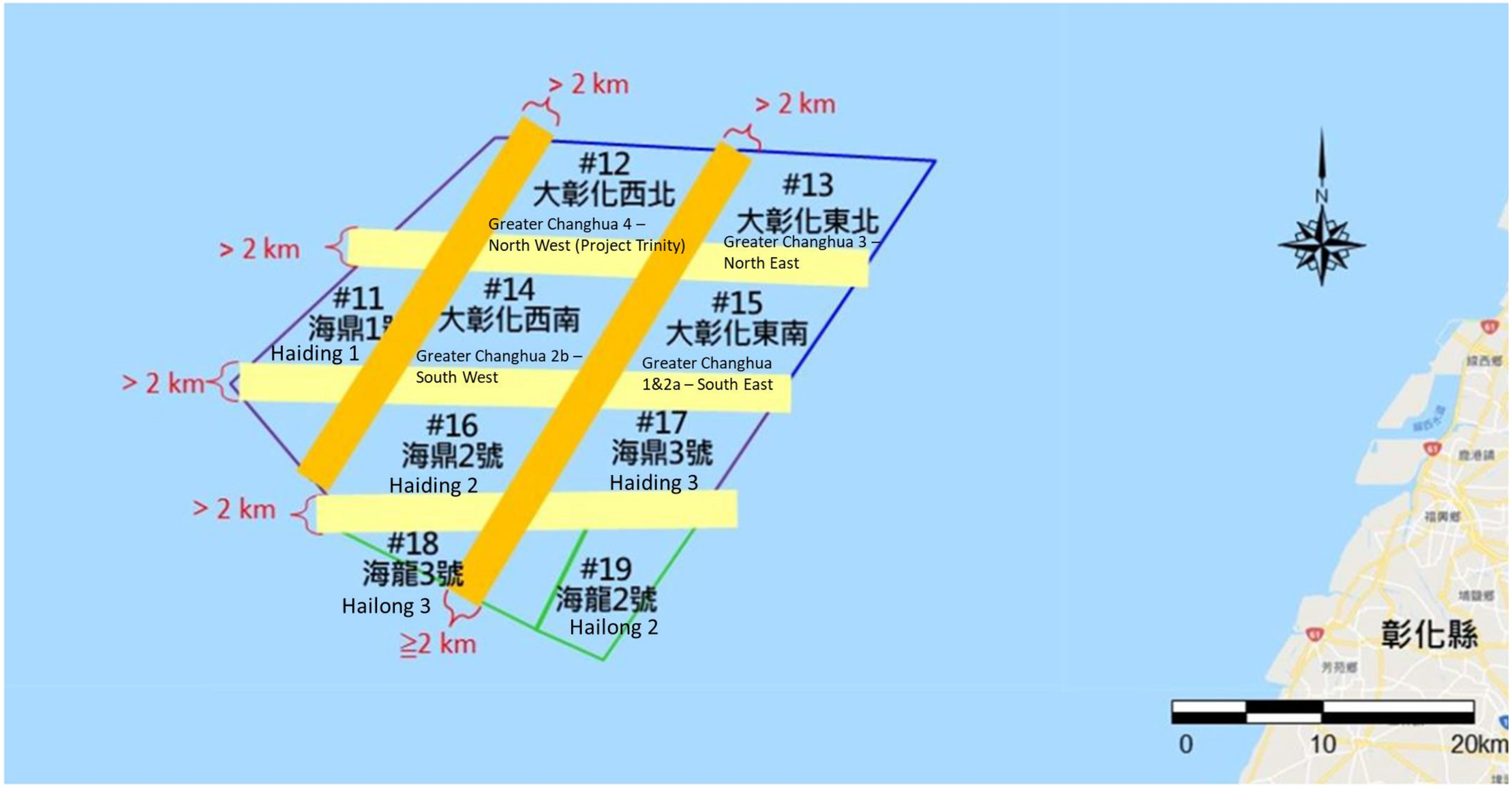
[49] The Environmental Impact Assessment Review Committee meeting on 2 March 2022 decided that the recent EIA review would suggest follow the checklist.

[50] #11 to #19 in Figure 1.2

[51] #11 to #19 in Figure 1.2

[52] Hai Long No.3 Environmental Impact Comparative Analysis Report, 2021

Figure 5.2: Bird flying corridor setup at Changhua offshore area



Source: Hailong No.3 Environmental Impact Comparative Analysis Report, 2021

Table 5.9: Summary of cumulative impact on migratory birds (including seabirds)

Phase of Project	Indicator of cumulative impact	Potential impact identified	Mitigation measures	Residual impact magnitude – Project Trinity	Residual impact magnitude – from other developments	Impact duration	Significance of cumulative impact after mitigation measures implemented
Operation Phase	Change in population	Collision with wind turbine blades and barrier effect	• For this Project, the spacing between wind turbines along the east-west wind direction is estimated to be between 500m to 710m, and the spacing between wind turbines along the north-south wind direction is estimated to be between 3700m to 4200m. • As proposed by the EPA (ie have not been promulgated), the distance between wind turbines in Taiwan that it is to be greater than 700m, and the distance between blades of adjacent turbines are to be greater than 400m.	• Minor	• Minor	• Long term	• Not significant

Source: Greater Changhua Northwest Offshore Wind Farm Project EIA Report, 2018; Mott MacDonald, 2023

6 Step 6: Management strategies

This section presents the management strategies designed to address the Project's incremental contribution to cumulative impacts on the selected assessed VECs (Step 6). For each selected VEC, an appropriate management action was identified following the mitigation hierarchy concept – avoid, minimise, and compensate. Effective indicators and threshold triggers are also proposed. The set of strategies are based on the Project's level of impact on a referred VEC and the overall cumulative impact to the VEC. Required measures and tangible and reasonable best efforts to mitigate impacts were also taken into consideration.

In order to identify adequate strategies, plans and procedures to manage the Project's contribution to cumulative impacts, the mitigation and monitoring plan identified in the EIA, EIS and Coastal Management reports were reviewed.

6.1 Marine habitat

For the Taiwanese Humpback Dolphin MWH, alignments of submarine cables of various windfarm developments are designed to array within the Changhua Northern Common Corridor and take the shortest feasible route to the cable landing point to minimise extent of impact associated with construction works on fragmentating the MWH. Sequential laying of submarine cables will be conducted in sections to avoid blocking the passage of dolphins between north and south of the MWH. A Project Vessel Master Guide will be issued to provide pertinent information regarding the construction of the Project offshore windfarm and surrounding area. The guide is based on agreements with the governmental agencies and should always be followed unless instructed and approved otherwise. The following management actions specify the mitigation measures to be implemented for cumulative impact on the Taiwanese Humpback Dolphin MWH throughout construction phase:

- Vessels within 1,500m radius of the Taiwanese Humpback Dolphin MWH and its borders, are to maintain a speed of 6 knots or lower
- Construction vessels are to avoid travelling across areas known with high density of dolphin activities during peak season and other sensitive areas
- Navigation route of vessels will be designed to avoid sensitive areas

Furthermore, although the guide does not define specific sailing routes, but each vessel is expected to formulate its own sailing plan or navigational safety plan to avoid nearby fishing vessels and ensure safety of ships when entering and leaving the construction port. With reduced traffic collisions or safety issues also means reduced disturbance to the marine habitat and waters.

Protected Reef Areas, Artificial Reef Areas and Fisheries Resources Conservation Areas have been avoided during the design of windfarm sites and alignments of submarine transmission cables. Nevertheless, as a precautionary strategy, developer will notify and seek advice from responsible administrative authorities to minimise any potential impact if the Project footprint overlaps any of these sensitive areas. Furthermore, protective seabed work stones will be put in place to protect wind turbine foundations, and this will serve as artificial reefs and providing marine habitat.

As per the EIA report, progressive construction methods will also be adopted during the construction process, to reduce the impact on local wildlife and provide sufficient time and space for biological habitat in the area to migrate.

6.2 Marine flora and fauna

To minimise impact of underwater noise on marine flora and fauna, offshore construction activities can be managed to ensure pile driving of only one WTG at a time within each of the Changhua OWF developments. Pile driving work will also be coordinated amongst the windfarm developers for achieving piling of only one WTG between the adjacent rows of the windfarm at any one time. Nevertheless, the concerned marine fauna species, constituted in this VEC, have wide range of use and movement in the Taiwan strait. To minimise cumulative impact of collision risk between working vessels and marine fauna (discussed in section 5.2.1), a Project Vessel Master Guide will be issued to require each vessel to formulate their own sailing plan or navigational safety plan. The plans should cover avoidance of vessel collisions, port entry and exit safety, and reference or align to the vessel navigation-related mitigation measures for the Taiwanese Humpback Dolphin MWH as discussed in Section 6.1, as well as the Marine and Helicopter Coordination Centre (MHCC) and/or Vessel Traffic Management System (VTMS) that were suggested in the EIA report.

Moreover, it is also recommended to setup a coordination platform by the management level of all the windfarm projects for the following management strategies:

- Communication on coordinated implementation of various measures (as summarised in Table 6.1) at Project level, particularly when marine mammal is observed within the warning zones and monitoring zones
- Sharing and consolidation of monitoring data to achieve effective mitigation and monitoring of cumulative impacts on marine fauna in the broader context

Table 6.1: Mitigation and monitoring for marine fauna to be implemented at project level

Phase	Mitigation measure / monitoring at project level
Pre-construction	Conduct underwater acoustic survey at two stations located at the boundary of windfarm site for one whole month (consecutive 30 days) during each of the four seasons of a year to fully grasp the long-term underwater noise (including cetacean acoustics)
	Review the pre-construction monitoring results for any unpredicted findings or differences with the findings of the EIA stage, and review the adequacy of management actions for minimising negative impact on this VEC.
	An interval of 500m to be kept between turbines to allow for sufficient space for birds to fly through
	Piling activities are to only commence and/or recommence 30 minutes after confirmation that there are no mammal activities within the warning zone.
	Adopt jacket type foundation for WTGs which generates low-noise level during pile driving, as far as practicable
	The submarine cable route from WTG to landfall shall take the shortest distance feasible.
	The submarine cable will be buried 1 to 2m (2m within the nearshore area) to reduce electromagnetic field (EMF) effects.
Construction	Conduct cetacean monitoring 20 times per year
	Offshore piling of WTG foundation: ● Remind workers not to use any Acoustic Deterrent Device or other sound-emitting device at any time ● Adopt the best applicable underwater noise reduction method, such as bubble curtains or balloon curtain ● Set up four underwater acoustic monitoring stations that are evenly distributed at 750 m from each piling location. Sound exposure level should not exceed 160 dB as monitored by the four underwater acoustic monitoring stations. ● Deploy at least three qualified TCOs on construction vessel to watch the warning zone (750 m from piling location) and monitoring zone (1500 m from piling location). TCO will inform piling workers if marine mammal is observed or detected within the warning zone, and the piling workers should suspend piling under safe condition until marine mammal has left and not been observed/detected within the warning zone for 30 minutes. For any marine mammal entering

Phase	Mitigation measure / monitoring at project level
	the monitoring zone, TCO will watch its movement to confirm if it approaches the warning zone. ● Progressive construction method (ie gradual increase of pile driving from low strength to full strength) to be implemented for at least 30 minutes to allow any nearby cetaceans to leave the area affected by piling noise ● Offshore construction activities will be coordinated between the windfarms of the Project Company to mitigate cumulative impacts of underwater noise from pile driving. Piling activities are to be coordinated to ensure piling activity of only one WTG at a time.
	Vessel speed and navigation: ● Vessels within 1,500m radius of the Taiwanese Humpback Dolphin Major Wildlife Habitat (MWH) and its borders, are to maintain a speed of 6 knots or lower. ● Construction vessels are to avoid entering the hot spots during the dolphin's peak activity periods as far as practicable. ● Navigation route of vessels will be designed to avoid sensitive areas. ● Construction vessels will be sourced and based from the nearest port and to minimise transit routes
	Construction vessels are to avoid entering areas known to have high density of dolphin activities.
	Navigation route of vessels will be designed to avoid sensitive areas.
	Construction of the submarine cable will be conducted in sections. Each section will be reinstated following completion of cable installation. This will be completed before commencing on the construction activities of the next section.
	Conduct intertidal ecological survey at 50m range from both sides of the submarine cable landing point, at a frequency of once per season
Operation	Continuous cetacean acoustic monitoring and dolphin monitoring programme to continue monitoring the effect of operation to cetacean, with the frequency of 20 times per year
	Warning lights are to be installed on the blades of the WTG, in accordance with the Aviation obstacle sign and obstacle light setting standard (航空障礙物標誌與障礙燈設置標準) to reduce the likelihood of bird collision at night. Its implementing methods should follow horizontal direction intervals not exceeding 900m and be implemented on the corners or most outer row.

Note: Procedures for the suspension of monitoring works are to comply with Clause 37 of Enforcement Regulations for Environmental assessment.

6.3 Community livelihood: fisheries resources and zones

The marine navigation route management plan recommended in Section 6.1 should also consider fishing boats and adopt similar measures in particular for mitigating cumulative impact on areas known with high density of fisheries activities. Speed limit and setting of predefined marine navigation routes for construction vessels mentioned in Section 6.1 would also serve as measures for minimising risk of collision with fishing boats and impact on shifts in fisheries livelihoods. Navigation channels were segregated for fishing boats, construction vessels and other ships to facilitate the development of OWF[53]. Nevertheless, it is recommended that relevant developers of adjacent windfarm developments and coastal developments that would affect the same fishing ground in the Country could coordinate/liaise with the Fishermen's Association on the management actions (designed at project level and summarised in Table 6.2) to achieve effective mitigation of cumulative impact on fisheries livelihoods over the construction phase of windfarm developments.

Table 6.2: Mitigation and monitoring for fisheries to be implemented at project level

Phase	Mitigation measure / monitoring at project level
Construction	● From fisheries resources (number of fishing boats, fisheries type, species, catch, etc.) published by the Fisheries Agency, identify reference species for monitoring to compare the impact before and after operation.

[53] 離岸風電推動現況與展望, presentation by Ministry of Economic Affairs for Executive Yuan meeting: https://www.ey.gov.tw/File/11A5C30CA17A5735?A=C (Accessed: 14 April 2020)

Phase	Mitigation measure / monitoring at project level
	● Point count survey of plankton, fish fry, fish egg and benthos as well as line survey of fish species and abundance once every season ● Observation by underwater photography at two WTG foundations for the colonization effect of fish ● Adopt the best applicable underwater noise reduction method ● Communicate with Changhua District fishermen's association to get mutual agreement on compensation as listed under the Fishery Compensation Benchmark for Offshore Wind Power (離岸式風力發電廠漁業補償基準)[54] ● Proposal on cooperation with fishermen's association to develop a Fishery Resources Conservation Zone, through reinstatement of affected marine habitats with the foundation of WTGs and connection with artificial reefs ● A navigation safety plan will be formulated.
Operation	● Point count survey of plankton, fish fry, fish egg and benthos as well as line survey of fish species and abundance once every season ● Observation by underwater photography at two WTG foundations for the colonization effect of fish ● Annual analysis of the Taiwan Fisheries Yearbook from Fisheries Agency to organise related fishery livelihood and economics information (fishery environment, fishery facilities, number of fisher folk, amount of catch) ● Design and implement a program to ensure continuous stakeholder engagement

Note: Procedures for the suspension of monitoring works are to comply with Clause 37 of Enforcement Regulations for Environmental assessment.

6.4 Migratory birds (including seabirds)

To minimise the significance of negative impact on migration birds due to risk of collision with WTGs, the Project has made adjustments to the WTG placements, creating bird flight corridors to favour avoidance behaviour of birds (see Section 5.3). The Project's EIA also notes that Hai Long windfarms and Formosa 3 windfarms will also adopt this measure, while Hai Ding has also adjusted their designs to leave a 2km bird corridor between its projects and the Project. Other management actions designed for implementation are consolidated in Table 6.3. The Project also has a biodiversity action plan (BAP) in place which outlines action plans to ensure conservation and enhancement of biodiversity, in particular for critical habitat species identified within the CHA. Refer to the Project's BAP for the specific actions in place.

Similar to the recommendation mentioned in Section 6.3, as the migratory waterbirds and breeding seabirds have a broad range in the Taiwan Strait, this Project will participate coordination platform by the management level of nearby windfarm projects (ie consisting of nine (9) projects[55]). The platform will facilitate better communication on implementing relevant measures and sharing resources. This Project will, as prescribed by the EIA commitments, execute an environment monitoring plan, whereby general project information will be shared to the general public through quarterly reports.

Table 6.3: Mitigation and monitoring for migratory birds (including seabirds) to be implemented at project level

Phase	Mitigation measure / monitoring at project level
Pre-construction surveys	Conduct direct observation at vessel transect survey and radar survey for seabirds for two years before commencement of marine works
	Conduct satellite tracking of shorebirds for once in each season before commencement of marine works
Construction	Avoid construction work on intertidal habitat during the bird migration period (November to March)

[54] Fishery Compensation Benchmark for Offshore Wind Power (離岸式風力發電廠漁業補償基準): https://www.fa.gov.tw/cht/LawsRuleFisheries/content.aspx?id=540&chk=5207eda4-0453-4482-a789-08406f114339&param (Accessed: 7 February 2020)

[55] The offshore windfarm projects CHW01, 02, 03, 04, Hai Long 02, 03 and Hai Ding 01, 02 and 03.

Phase	Mitigation measure / monitoring at project level
	Follow the design of WTG placement allowing bird flight corridors between WTGs and each windfarm site to minimise bird collision with windfarms
	If there are any changes in windfarm placement narrowing the bird flight corridors, developer will seek advice from responsible administrative authorities and further liaison with personnel of other windfarm sites for alternative offsets.
Operation	Measures for Seabirds ● The project shall follow Article 17 of the Aviation obstacle sign and obstacle light setting standard, the electric generator structure should use Type A obstructing light. Its implementing method should follow horizontal direction intervals not exceeding 900m and be implemented on the corners or most outer row. Hence the number of warning lights installed on the turbines will be based on the windfarm layout configuration. ● At time of environment monitoring, if large flocks of protected species or large-sized birds are passing through windfarm, the operator shall be committed to conduct a feasible speed reduction mechanism (風機降轉機制). ● Maintain the distance of at least 500m separation between each WTG ● Maintain the north-south and east-west flight corridor with at least 2km between each of the windfarm sites ● Maintain at least 8km distance from the coastline for the north-south flight corridor
	Bird monitoring programme ● Surveillance devices (ie thermal imaging, acoustic microphone, radar) on turbines shall be installed within the windfarm to allow continuous monitoring of bird activities. ● Supplemental and seasonal birds/ ecological surveys should be undertaken around the WTGs during the operation period. ● Adaptive measures including seeking feasible mitigation measures in the future should be considered.

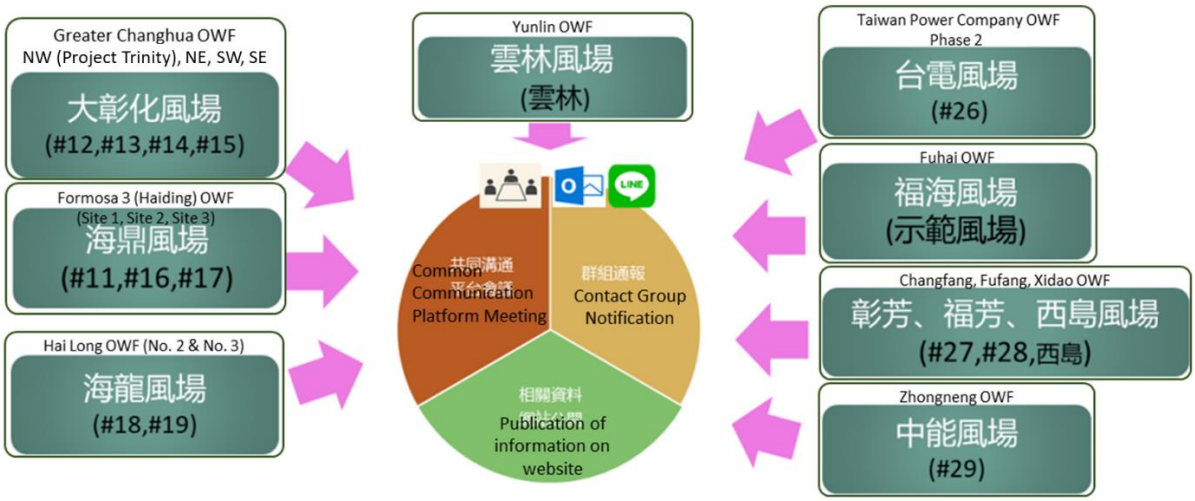
Note: Procedures for the suspension of monitoring works are to comply with Clause 37 of Enforcement Regulations for Environmental assessment.

6.5 Collaboration with adjacent developments

Besides the mitigation and monitoring plan identified in the EIA reports, it is important for the Project and adjacent windfarm developments to coordinate their management plans and share information with each other for a more robust and comprehensive management of the identified impacts. The environmental management plans should ideally be standardised, and monitoring programmes should be integrated between the WTG developments in the area. This would allow for a wide-reaching dataset, providing the developers an opportunity to identify additional mitigation measures. This would also allow the developers to build its own cetacean monitoring system and rescue/ rehabilitation program, probably even supporting local fishing communities in terms of sustainable fishing activities. Proposed actions, including sharing of information with other windfarm developers in the area and potential offsets and additional conservation actions with various stakeholders, will be developed and implemented as part of the BAP.

The Project and the adjacent 14 windfarm developments in Changhua and Yunlin have initially suggested common communication platform to conduct regular meetings for discussion and coordination on matters regarding migratory birds and ecology, and suggested setup of contact groups for facilitating mutual notification (refer to the EIS Report). The communication platform suggested is indicated in Figure 6.1 below.

Figure 6.1: Suggested communication platform amongst Changhua and Yunlin windfarm developments



Source: Environmental Impact Investigation Report of Offshore Wind Power Project in Yunlin and Changhua (Third revision) (Unitech, 2020), 2020

7 References

Accounting and Statistics, E. Y. (2022). *Annual fishery census report for 2022.*

Changhua and Yunlin Offshore Wind Farms Project. (2022). *Environmental Survey Report (2nd revised version) (環境影響調查報告書 第二次修訂本).*

Changhua County Government. (2022). *Fishery Employees Statistics in Changhua County of 2021.*

Changhua County Government. (2022). *The Statistical Yearbook of Changhua County 2021 No. 71 (彰化縣統計年報 2021).*

Council of Agriulture, Executive Yuan. (2018, December 26). *Fisheries Act*. Retrieved from Laws & Regulations Database of The Republic of China (Taiwan): https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=M0050001

Fisheries Agency. (2015, December 18). *Changhua County Exclusive Fishing Right*. Retrieved from Fisheries Agency, Council of Agriculture: https://en.fa.gov.tw/view.php?theme=Fisheries_Right&subtheme=&id=7

Greater Changhua Offshore Wind Farm Northwest Company Preparatory Office . (2018). *Greater Changhua Northwst Offshore Wind Farm Project (大彰化西北離岸風力發電計畫). EIA report (環境影響說明書).*

Greater Changhua Offshore Wind Farm Northwest Company Preparatory Office . (2022). *Greater Changhua Northwst Offshore Wind Farm Project (大彰化西北離岸風力發電計畫). EIA amendment report (環境影響說明書變更內容對照表).*

Hailong No.3 Environmental Impact Comparative Analysis Report. (2021).

Huang, T.-C., Lu, H.-J., Lin, J.-R., Sun, S.-H., Yen, K.-W., & Chen, J.-Y. (2021). *Evaluating the Fish Aggregation Effect of Wind Turbine Facilities by using Scientific Echo Sounder in Nanlong Wind Farm Area, Western Taiwan.* Taipei: Journal of Marine Science and Technology.

IFC. (2012). *Guidance Note 1: Assessment and Management of Social and Environmental Risks and Impacts.*

IFC. (2012). *Performance Standard 1: Assessment and Management of Social and Environmental Risks and Impacts.*

IFC. (2013). *IFC Good Practice Handbook: Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Market.*

IUCN . (2023). *The IUCN Red List of Threatened Species*. Retrieved from http://www.iucnredlist.org

Mott MacDonald. (2023). *Project Trinity Biodiversity Action Plan.*

Mott MacDonald. (2023). *Project Trinity Critical Habitat Assessment .*

Reeves, R. R.-G. (2008). *Sousa chinensis (eastern Taiwan Strait subpopulation). IUCN 2009 Red List of Threatened Species.*

Ronald A. Kastelein, L. H.-H. (2016). *Pile driving playback sounds and temporary threshold shift in harbor porpoises (Phocoena phocoena): Effect of exposure duration* (Vol. 139). The Journal of the Acoustical Society of America. doi:https://doi.org/10.1121/1.4948571

Taiwan Marine Protected Area. (n.d.). *Fishery Resrouces Conservation Area*. Retrieved from Taiwan Marine Protected Area: https://mpa.oca.gov.tw/ProtectedShow.aspx

Unitech. (2020). *Environmental Impact Investigation Report of Offshore Wind Power Project in Yunlin and Changhua.*