# Hong Kong Offshore LNG Terminal Project
# Marine Conservation Enhancement Fund

## COMPLETION REPORT

**PART A: The Project and Investigator**

### 1. Funded Project Details

| | | | | |
|---|---|---|---|---|
| Project Number: | MCEF20017 | | | |
| Project Title: | Removal of micro/nano plastic from marine environments using Nanobubble | | | |
| Name of Organisation: | City University of Hong Kong | | | |
| Reporting Period: | From: | 1st May 2021 | To: | 30 April 2023 |
| Date of Report Submission: | 31 May 2023 | | | |

### 2. Information of the Principal Investigator *For reasons of confidentiality, the information remains undisclosed

| | |
|---|---|
| Name: | Alicia An |
| Position Held: | Associate Professor |
| Tel. No. | |
| Email Address | |
| Signature: | |

### 3. Funded Project Schedule

| Commencement Date | | Completion Date | |
|---|---|---|---|
| Original | Actual | Original | Actual |
| 01/05/2021 | 01/05/2021 | 30/04/2023 | 30/04/2023 |

**PART B: Completion Report**

**1. Eexecutive summary of 1-2 pages of the Funded Project including a way forward following completion of the Funded Project;**

The project aimed to address the pressing issue of plastic pollution in HK marine ecosystems, and the potential of applying nanobubbles (NBs) to enhance their removal. Particularly, the potential microplastic (MPs) pollution associated with the Hong Kong Offshore LNG Terminal Project. Over the course of the project, significant progress has been made in developing, testing, and implementing NBs for the removal of micro and nano plastics. This executive summary briefs the key accomplishments, challenges faced, and provides recommendations for the way forward following the completion of the project.

During the project, several key accomplishments have been achieved, demonstrating the effectiveness of the NB technology in removing micro and nano plastics from marine environments. These accomplishments include:

- A thorough study on MPs pollution levels in Pui O village including site visits, samples collection and analysis, and comprehensive characterization of detected MPs.
- Successful testing and deployment of the NBs system, enabling efficient and targeted removal of micro and nano plastics in marine waters. The system has demonstrated a MPs removal efficiency of 86.34 ± 2.01% and 88.19 ± 2.90% for MPs size of 40-50um and 10um, respectively, leading to a significant improvement in the health of marine ecosystems.
- Conducted comprehensive lab testing and field trials, showcasing the scalability and adaptability of the NB technology across different marine environments. These trials have provided valuable data and insights into the efficacy and limitations of the system.
- Established partnerships with other research institutions in HK, fostering knowledge exchange and collaboration. These partnerships have facilitated some of the characterizations needed and helped the continuous improvement of the NB technology and its integration into broader plastic pollution mitigation efforts.

These accomplishments not only validate the effectiveness of the project's approach but also contribute to the global understanding of micro and nano plastic removal technologies.

Throughout the project period, several challenges were encountered, requiring continuous adaptation and refinement of the sampling preparation and application of NB system. However, through rigorous research and iterative testing, the project team successfully addressed these challenges, leading to

valuable lessons learned that can guide future endeavours in MPs pollution mitigation. Further elaboration on the encountered challenges is discussed within the body of this report.

The project has also yielded significant impact and results in the removal of MPs from marine environments. Key outcomes include:

- Considerable reduction in plastic concentrations within the targeted areas of Pui O village, leading to improved water quality and the protection of marine organisms.
- Enhanced understanding of the distribution patterns and sources of micro and nano plastics in the marine ecosystem, particularly at the area under study, aiding in the development of targeted mitigation strategies.
- Increased awareness among the general public about the severity of plastic pollution and the potential of innovative technologies like NBs for its remediation.

Building on the accomplishments and lessons learned, the completion of the project paves the way for the next steps and future directions. The following recommendations outline the key actions for moving forward:

Recommendation 1: Further optimize the NB system by investing in research and development to enhance its efficiency, durability, and cost-effectiveness. This can involve collaborating with engineering firms and experts to refine the technology and streamline its implementation.

Recommendation 2: Establish strategic partnerships with the HK government, environmental NGOs, and industry stakeholders to integrate the NB technology into broader plastic pollution mitigation initiatives and into existing frameworks. This can involve conducting pilot projects in high-priority areas to showcase the effectiveness of the technology on a larger scale. Additionally, such partnerships can ensure the long-term sustainability and impact of the project's outcomes.

Recommendation 3: Promote knowledge sharing and collaboration by organizing workshops, conferences, and training programs to disseminate the findings, best practices, and lessons learned from the project. This will facilitate the adoption of the NB technology by other researchers, policymakers, and practitioners working on plastic pollution mitigation.

Recommendation 4: Secure additional funding and resources to support continued research and development efforts, as well as the scaling up of the NB technology for wider application.

These recommendations provide a clear path for the future, enabling the optimization, integration, and expansion of the technology, thereby advancing the global efforts to combat plastic pollution and safeguard our oceans.