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1. INTRODUCTION

1.1 Project Background

- 1.1.1 In 2002, the Environmental Protection Department (EPD) carried out the Outlying Islands Sewerage Master Plan Stage 2 Review, and completed the Preliminary Project Feasibility Study for Outlying Islands Sewerage Stage 2 (hereinafter referred to as “PPFS”).
- 1.1.2 In February 2008, Drainage Services Department (DSD) commenced the Investigation Stage of “Upgrading of Cheung Chau and Tai O Sewage Collection, Treatment and Disposal Facilities” under Agreement No. CE 31/2007 (DS) by commissioning a consultant to carry out review on the conclusions and recommendations of the PPFS report, surveys, investigations, impact assessments, preliminary environmental review and preliminary design of the recommended works (hereinafter referred to as “Investigation Consultancy”).
- 1.1.3 In December 2010, DSD commissioned Atkins China Limited (ACL) to undertake the consultancy for Design and Construction of “Upgrading of Cheung Chau and Tai O Sewage Collection, Treatment and Disposal Facilities” under Agreement No. CE 15/2010 (DS). This EIA study was also conducted under the consultancy assignment.
- 1.1.4 The purpose of this EIA study is to assess the environmental issues arising from the upgrading of Tai O sewage collection, treatment and disposal facilities (hereinafter referred to as “the Project”), and to recommend appropriate mitigation measures for all identified adverse environmental impacts.

2. PROJECT DESCRIPTION

2.1 Project Location and Brief Description

- 2.1.1 The Project is to improve the existing sewage collection, treatment and disposal facilities in Tai O. The Project mainly comprises the following main works elements as shown in **Figure 2.1 – 2.1A**:
- Expansion and upgrading of the existing Tai O Sewage Treatment Works (STW) which includes about 0.26 ha of site formation by reclamation associated with construction of a seawall and berthing area, construction of a new submarine outfall of about 130 m long, upgrading the existing level of sewage treatment of the STW to secondary treatment level, increasing the design capacity of the STW to 2,750 m³/day and construction of effluent reuse facilities within the STW;
 - Provision of new sewers to unsewered areas/villages in Tai O, where practicable, including Hang Mei, Wang Hang Tsuen, Leung Uk Tsuen, Nam Chung Tsuen, Fan Kwai Tong and scattered unsewered areas in Shek Tsai Po and Tai O Town in Tai O; and
 - Construction of two new Sewage Pumping Stations (SPSs) associated with twin sewer rising mains, one at Hang Mei and one at Fan Kwai Tong to convey sewage flows respectively generated at the east and south of the catchment area to the existing sewers near Lung Tin Estate.



- 2.1.2 The existing Tai O STW is located at the north coast of Tai O near Kau San Tei. It is currently a primary sewage treatment works with design capacity of 1,220 m³/day. To accommodate the expansion and upgrading of the existing Tai O STW, additional usable land of about 0.26 ha will be formed adjacent to the west of the existing Tai O STW site by reclamation comprising a seawall and stone fill reclamation. After completion of the works, Tai O STW will be expanded to a capacity of 2,750 m³/day with secondary treatment level. A Membrane-bioreactor (MBR) type of sewage treatment process will be adopted so as to upgrade the sewage treatment level to secondary level of treatment. Effluent reuse facilities will be provided for non-potable use within the Tai O STW including toilet flushing and process cleansing.
- 2.1.3 Two new SPSs, namely Fan Kwai Tong SPS and Hang Mei SPS, will be constructed under the Project to convey the sewage respectively generated from the south and east of the catchment area through the existing sewers near Lung Tin Estate to Tai O STW for proper treatment. The designed average dry weather flow (ADWF) for the Fan Kwai Tong SPS and Hang Mei SPS will be 540 m³/day and 350 m³/day respectively.
- 2.1.4 Sewers works in Tai O includes:
- Construction of approximately 5,000 m in length of new gravity sewers / twin sewer rising mains with size ranging from 100 mm to 300 mm diameter in the relevant village areas by open cut method; and
 - Construction of approximately 100 m in length of twin sewer rising mains with size of 100 mm diameter along Tai O Road underneath two sections of Tai O Creek by trenchless method.
- 2.1.5 Under Part I, Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO), the Project consists of the following Designated Projects (DP):
- (a) Construction of submarine outfall (Item F.6);
 - (b) Treated effluent reuse facilities within the Tai O STW (Item F.4); and
 - (c) Sewers works at Nam Chung Tsuen, which falls partly within the conservation area (Item Q.1).
- 2.1.6 The location of the Project is shown in Location Plan of **Figure 2.1 – 2.1A**.

2.2 Purpose of the Project

- 2.2.1 The existing Tai O STW is a primary sewage treatment facility which only provides a basic form of treatment for sewage collected. The existing STW was built in the 1980's and the conditions are deteriorating, particularly for the submarine outfall where leakages at the joints were identified. Although the effluent qualities (without nutrient removal) are able to meet the effluent discharge standard for primary sewage treatment level, the STW is currently operated near its design capacity and would be inadequate to cope with the future demand within the catchment arising from population growth and future developments in Tai O.
- 2.2.2 The Project is to improve the hygiene conditions in Tai O and to improve the coastal water quality to the northwest of Tai O, by providing new sewers where practicable to unsewered areas in Tai O, upgrading the sewage treatment level of the existing Tai O STW from primary to secondary, expanding the STW by increasing its design capacity to cope with the population growth and future developments at Tai O, and replacing the existing deteriorated submarine outfall by



constructing a new submarine outfall with improved conditions and capacity.

2.3 Project Implementation Programme

2.3.1 The tentative schedule for the Project is presented in **Table 2.1** below.

Table 2.1 : Tentative Schedule for the Project

	Expansion and Upgrading of Tai O STW associated with Site Formation, a New Submarine Outfall and Effluent Reuse Facilities	Construction of Hang Mei and Fan Kwai Tong SPSs associated with Rising Mains and Sewerage System to unsewered areas
Scheme Gazette under Foreshore and Seabed (Reclamation) Ordinance	March 2017	--
Scheme Gazette under Water Pollution Control (Sewerage) Regulation	--	March 2017
Contract Commencement	April 2018	June 2018
Contract Completion	March 2022	December 2022

3. KEY ENVIRONMENTAL OUTCOMES OF THE PROJECT

3.1 Environmental Benefits of the Project

3.1.1 The sewage treatment level of the Tai O STW will be upgraded from primary to secondary and the capacity will be expanded to cope with the anticipated sewage flows in Tai O. Discharge of low quality effluent to the receiving water body will be reduced and hence this will improve the coastal water quality of Tai O. Furthermore, hygiene problems within the catchment area arising from the use of septic tanks will be largely relieved with provision of public sewers to currently unsewered areas/villages, where practicable.

3.2 Population and Environmentally Sensitive Area Protected

3.2.1 The marine waters near Tai O will be protected by the improved treatment standard and increased treatment capacity of the Tai O STW. The residential areas and village houses which are currently unsewered will be provided with new sewers under this Project.

3.3 Environmental Protection Measures and Environmentally Friendly Designs Recommended

3.3.1 For Tai O STW, Fan Kwai Tong SPS and Hang Mei SPS, the provision of standby parts and standby power sources will enhance the reliability of the sewage treatment and disposal system, while the provision of deodorizing units would reduce the possible odour impact to adjacent sensitive receivers. In the design of Tai O STW, non-potable reuse of treated effluent within the STW site will reduce the consumption of potable water.



3.3.2 In addition to the standard pollution control measures during construction, the Project will further minimise the potential construction noise impacts during the sewer works at locations close to village houses through the adoption of the drill with chemical agent for breaking purpose.

3.4 Key Environmental Problems Avoided

3.4.1 The Project is a sewage treatment and sewerage improvement project. Through the implementation of the Project, potential deterioration of effluent quality of the existing Tai O STW due to ageing problem of the facilities and incapability to cope with the population growth and future developments will be avoided by the proposed upgrading of the sewage treatment level and increasing the existing capacity of the STW. The hygiene and water pollution problems arising from the use of septic tanks will also be largely relieved by provision of public sewers to the currently unsewered areas/villages where practicable, so that sewage generated from these unsewered areas/villages will be conveyed through the public sewers to the upgraded and expanded Tai O STW for proper treatment and disposal. Moreover, the potential risk of structural failure due to the deterioration and ageing effect of the existing submarine outfall which could cause leakage of effluent to the inshore water can be avoided by the provision of a new submarine outfall.

4. ASSESSMENT FINDINGS OF ENVIRONMENTAL ASPECTS

4.1 Air Quality

4.1.1 Construction dust generating activities were identified and assessed. Mitigation measures including proper watering of on-site construction area and good practices on dust control measures are recommended. Model simulation results show that the fugitive dust emissions are minimized and the dust levels are limited to acceptable levels by implementing the recommended mitigation measures.

4.1.2 The operation of Tai O STW, Hang Mei SPS and Fan Kwai Tong SPS are the main potential odour emission sources. With this project, all potential odour generating components of the facilities will be enclosed, and odourous gas will be ventilated to the deodorization units for further treatment before discharge. During sludge transportation, the sludge will be contained by enclosed container. The same odour control measures will also be provided for the temporary STW during construction stage. The inclusion of all these control measures in the Project will avoid or minimize potential odour nuisance.

4.1.3 With the above measures, odour impact should be insignificant. An Environmental Monitoring and Audit (EM&A) programme will be implemented to ensure the continuing effectiveness of the odour control installations.

4.2 Noise

4.2.1 Construction noise impacts from the Project have been assessed. Construction noise control measures such as adopting quiet plant, use of temporary noise barriers, good scheduling of works and alternative construction method have been recommended. With the implementation of the measures, the construction noise levels will comply with the relevant noise criteria.

4.2.2 Potential noise impact due to the operation of the upgraded Tai O STW and the proposed Hang Mei SPS and Fan Kwai Tong SPS is not anticipated as proper



acoustic treatment including silencer and acoustic louver will be provided. Basic building design such as avoiding opening or louvers facing the nearest Noise Sensitive Receiver (NSR) will also be adopted. Noise commissioning test for all major fixed noise sources is recommended and the requirements will be included in the works contracts' tender documents.

4.3 Water Quality

4.3.1 With the proposed sewers works and upgrading of Tai O STW, discharge of low quality effluent to the receiving water body will be reduced and hence the coastal water quality of Tai O will be improved. Commissioning of this Project will be beneficial to the coastal water quality of Tai O.

4.3.2 During operational phase, improvement in water quality of surrounding water body due to the operation of the Project is anticipated. This is mainly attributable to the improved treatment efficiency of upgraded facilities and better quality of the expanded and upgraded Tai O STW, resulting in a reduction in pollution loads into the marine waters.

4.3.3 The potential water quality impacts during construction phase will be mainly associated with dredging activities for construction of the submarine outfall. It was predicted that there would be only a localized increase in suspended solid concentration in the vicinity of the dredging area. Nevertheless, according to the recent dive surveys, the dredging area is of low habitat quality. The observed species are common and known to be tolerant of turbid and harsh environment. With adoption of closed grab dredgers and silt curtains, it is anticipated that the possible impact from dredging activities is temporary and insignificant.

4.3.4 As confirmed with DSD's operational staff, functions of both the Hang Mei and Fan Kwai Tong SPSs can be restored within 4 hours in case of an emergency situation. A retention of sewage flows for at least 4 hours will be provided at both SPSs before any emergency discharge could take place. Therefore, an emergency discharge of sewage overflows from the SPSs is unlikely to occur. A contingency plan will be developed to deal with emergency situation during the operation of pumping stations.

4.3.5 For the Tai O STW, measures such as standby pumps and storm tanks will be incorporated to avoid emergency discharge. Also, quantitative assessment's result shows that even in the event of emergency discharge, its impact would be localized in the vicinity of the project site and the high concentration of water quality parameters of concern such as *E.coli* would disappear rapidly and return to their normal background levels after the emergency discharge is ceased. The potential impact to more distant WSRs would be extremely small and insignificant.

4.4 Waste Management

4.4.1 Waste types generated by the construction activities include C&D materials, site clearance wastes, general refuse from the workforce, chemical wastes and dredged marine sediment. Wastes generated during the operation activities include screenings, silts and debris, dewatered sludge and chemical wastes from the Tai O STW and the SPSs, general refuse from the office of the Tai O STW. These wastes will be handled, transported and disposed of using approved handling procedures and disposal methods, and good site practices will be implemented. Adverse environmental impacts are not anticipated during the construction and operation phases.

4.5 Land Contamination

4.5.1 A land contamination assessment was undertaken by reviewing historical and



current land uses and site reconnaissance. Based on the findings of the site appraisal, no potential contaminated sites were identified within the proposed construction areas at Hang Mei SPS and Fan Kwai Tong SPS. The existing Tai O STW was a primary treatment facility comprised an Imhoff Tank for solid separation and sedimentation since no chemical was applied during the treatment process, hence, it is not considered to have potential for land contamination with reference to the Practice Guide. Also, the operation of the Project will not cause potential land contamination. The impacts of land contamination are not expected during the construction and operational phases of the Project.

4.6 Ecology

- 4.6.1 The Project will only cause a loss of small area of habitat with limited ecological value. No important habitat or species of conservation importance will be lost due to the Project. A total of six trees of common species at the construction areas of the Tai O STW and the two proposed SPSs will be affected. Tree loss will be minimized and compensatory planting will be carried out as appropriate.
- 4.6.2 Apart from good site practices, mitigation measures for dolphins such as dolphin exclusion zone during the silt curtain deployment and the subsequent dolphin watching plan during construction will be implemented. The effect due to the construction works is limited and localized, and with the regular site inspection performed by the Environmental Team, no adverse ecological impact is anticipated.

4.7 Fisheries

- 4.7.1 The potential impacts during the construction phase include loss of sea fishing grounds, distribution of fishing operation, water quality impacts from the reclamations and the submarine outfall. The Project will result in only a small net loss of 0.26 ha of seabed and water column due to the expansion of the Tai O STW, and thus the loss of fishing ground, and is expected to be insignificant. Also, as the majority of fishing vessels operating in the vicinity are small-sized vessels, these small vessels would have higher flexibility in their operations and less sensitive to disturbance due to marine traffic of working vessels of the Project.
- 4.7.2 With the implementation of the mitigation measures for water quality, no significant residual impacts are predicted during the construction and operation phases on capture fisheries or mariculture.

4.8 Cultural Heritage

- 4.8.1 The construction and operation of the expanded and upgraded Tai O STW and the sewerage works will not cause any insurmountable impacts to any built and archaeological heritage. Monitoring and preventative measures including condition survey, vibration monitoring, provision of buffer zone, protective covering, safe public access and archaeological watching brief programme have been recommended. With the implementation of the recommended measures, adverse impact is not anticipated.

4.9 Landscape and Visual

- 4.9.1 Landscape Resources, Landscape Character Areas and Visually Sensitive Receivers are identified within the study area to assess the landscape and visual impacts arising from the proposed expansion and upgrading of the Tai O STW, proposed Hang Mei SPS and Fan Kwai Tong SPS. With reference to the criteria defined in EIAO-TM, landscape and visual impacts in the construction and operation phases arising from the proposed works is considered to be acceptable.



with mitigation measures.

- 4.9.2 The proposed sewers works will be laid underground along the existing carriageway, footpaths and paved tracks. During the construction stage, local areas may experience a slight adverse visual impact. However the impact will be temporary and insignificant as the construction works will be carried out section by section in a local area with a short period of time. The works area will be reinstated to its original conditions after the completion of the works. Landscape and visual impact during construction and operation stage of the sewers is considered to be insignificant.

4.10 Environmental Monitoring and Audit

- 4.10.1 An Environmental Monitoring and Audit (EM&A) Manual and an Environmental Mitigation Implementation Schedule (EMIS) have been prepared to monitor and audit the relevant air quality, noise, water quality, waste management, cultural heritage impacts, and landscape and visual impacts. Event and action plan for the potential environmental impacts has been formulated and stated in the EM&A Manual.

5. CONCLUSION

- 5.1.1 Upon completion of the proposed sewerage works, there will be improvement in water quality of the water body around Tai O. The EIA study concludes that with incorporation of the recommended mitigation measures and proper implementation of the EM&A programme, the Project will not impose adverse impacts on the neighbouring environment during construction and operation phases. An EM&A programme has also been recommended before and during the construction and operation phases of the Project to check the implementation and effectiveness of the recommended mitigation measures.



Figures

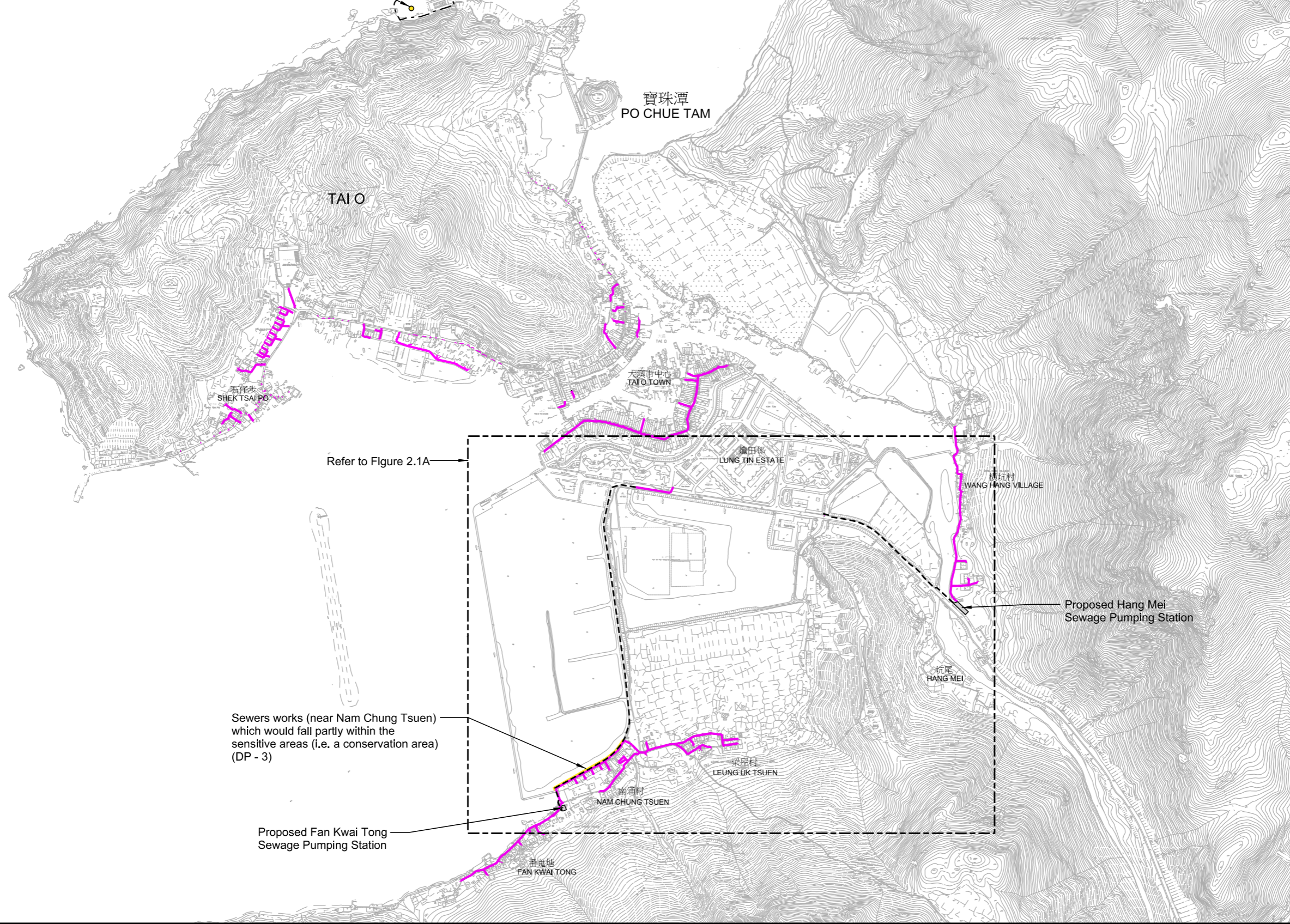


Proposed Submarine Outfall (DP - 1)

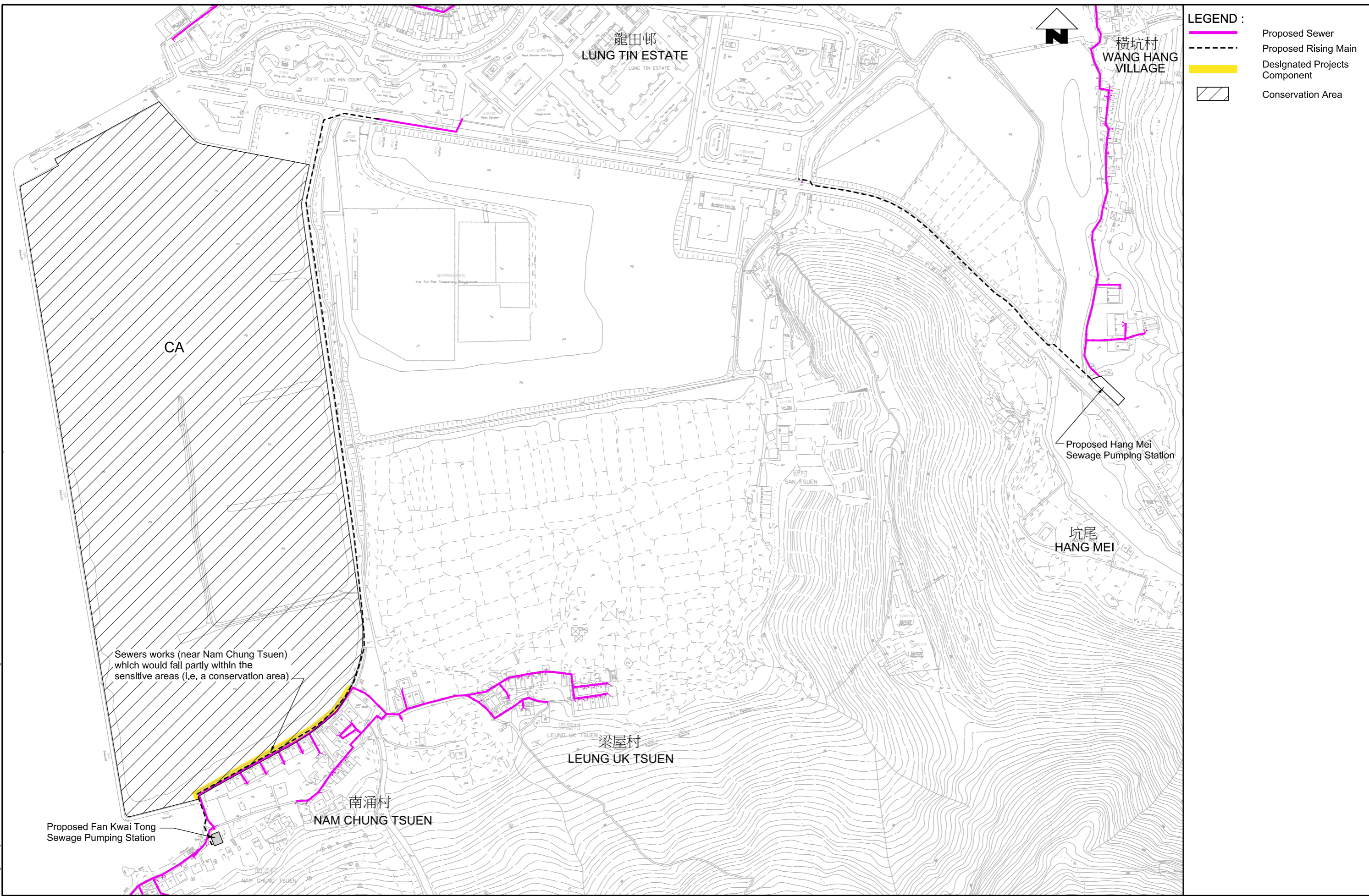
Proposed Expansion and Upgrading of the Tai O Sewage Treatment Works

Proposed Treated Effluent Reuse in Tai O STW (DP - 2)

- LEGEND :**
- Proposed Sewer
 - - - - Proposed Rising Main
 - Designated Projects Components
 - DP - 1 : Proposed submarine outfall;
 - DP - 2 : Proposed treated effluent reuse in Tai O STW;
 - DP - 3 : Proposed sewers works near Nam Chung Tsuen



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