NEW WORLD PROPERTY MANAGEMENT

COMPANY LIMITED

PROJECT PROFILE

REUSE OF TREATED SEWAGE EFFLUENT FROM A TREATMENT PLANT AT MOUNT PAVILIA, SAI KUNG

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1 PROJECT INFORMATION

1.1 Project Title

Reuse of treated sewage effluent from a treatment plant at Mount Pavilia, Sai Kung.

1.2 Purpose and Nature of Project

1.2.1 Mount Pavilia is a low density residential and commercial complex consists of 680 apartments, club house, swimming pool, retail shops and a Chinese restaurant. The property management company has employed 100 staff in total serving over 1700 residents.

1.2.2 Since there is no public sewer connecting to the complex, a sewage treatment plant (hereinafter called "STP") is constructed to ensure water quality of treated effluent complies with the Water Pollution Control Ordinance (WPCO) discharge licence requirement. The existing STP makes use of the state-of-the-art membrane bioreactor process and has a design capacity of 690 m^3/day.

1.2.3 The project will involve installation of a treated sewage effluent (hereinafter called “TSE”) reuse system to divert part of the treated effluent from STP to undergo further treatment so reclaimed water can be produced for non-potable use. The maximum design flow of the TSE reuse system is 120 m^3/day. and the reclaimed water will be used for landscape irrigation. Potable water consumption can be reduced with the operation of the TSE reuse system and this will contribute to a green and sustainable environment.

1.3 Name of Project Proponent

New World Property Management Company Limited

1.4 Location and Scale of Project

1.4.1 Mount Pavilia is located at 663 Clear Water Bay Road, Sai Kung, Hong Kong (see **Figure 1**). The TSE reuse system will be situated inside the STP which is located at the basement level of the premises (see **Figure 2**). It will comprise a UV disinfection system, a sodium hypochloride (NaOCl) dosing system together with associated control instrumentation and

distribution pipe work (see **Figure 3**). According to the "Technical Specifications on Grey Water Reuse and Rainwater Harvesting" published by WSD, chlorine disinfection shall be supplemented to provide the necessary residual chlorine if the treated water by UV disinfection is to be stored for future use. As such, after UV disinfection system and before entering the rainwater storage tank, 10% NaOCl will be dosed into the treated effluent and the design concentration of total residual chlorine in treated effluent would be above 1 mg/L. The TSE system will occupy a footprint of around 5 m^2 within the STP and the piping network from the STP to the rainwater storage tank will be 50 mm in diameter and around 70 m long (see **Figure 4**). The rainwater storage tank will be connected to 75 irrigation water points on site covering the entire greening area within the complex.

1.4.2 The TSE reuse system is designed for unmanned operation on 24 hours a day basis. During normal operation, the effluent pumps will transfer part of the treated effluent from the STP to the TSE reuse system while the remaining will be discharged to Port Shelter. The rainwater storage tank has a volume of 53 m^3 and it will take priority to collect rainwater from the building rooftops before receiving any treated effluent from the TSE reuse system. The reclaimed water from the rainwater storage tank will then be distributed to designated water points for daily landscape irrigation use. The rainwater storage tank has level sensor that can control the inflow of reclaimed water from the TSE reuse system. Once the rainwater storage tank is at high water level, the automatic control valve will be closed and the treated effluent from STP will no longer enter the rainwater storage tank.

1.4.3 The TSE reuse system will only involve minor mechanical and electrical installation works within the boundary of Mount Pavilia. There should not be any additional site clearance, site formation or large scale excavation works involved during the construction and operation of the TSE reuse system. Adjacent sensitive receivers of Mount Pavilia are shown in **Figure 5**.

1.5 Number and Types of Designated Project Covered by this Project Profile

Reuse of treated effluent from STP for landscape irrigation is identified as a Designated Project in accordance to Item F.4, Part I, Schedule 2 – "An activity for the reuse of treated sewage effluent from a treatment plant" of the Environmental Impact Assessment Ordinance (EIAO).

1.6 Name and Telephone Number of Contact Person

Name:	Mr. Chris Lam
Capacity:	Project Manager of Dunwell Engineering Co., Ltd
Tel:	2443 8171
Address:	8 Wang Lee Street, Yuen Long Industrial Estate, Yuen Long, N.T.

2 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 Project Planning and Implementation

STP sub-contractor, Dunwell Engineering Co., Ltd., is responsible for the design and construction of STP and TSE reuse system, applying for the WPCO discharge licence and environmental permit and providing training to the operator. New World Construction Company Limited and Property Management Company Limited, on the other hand, are responsible for supervising the construction and operation of Mount Pavilia, respectively.

2.2 Program for TSE Reuse System Installation

The construction of the STP and the rainwater storage tank were completed in June 2017. It is anticipated that the installation of the TSE reuse system will commence in early 2020 and the whole system will be put into operation after testing and commissioning. Current WPCO discharge licence for the STP will be revised accordingly once the environmental permit for the proposed TSE reuse system is granted.

3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

3.1 Existing and Planned Sensitive Receivers

The representative sensitive receivers (SR) in the vicinity of the TSE reuse

system at Mount Pavilia are listed in **Table 1** and their locations are shown in **Figure 5**.

Table 1: Representative Sensitive Receivers in the Vicinity of TSE Reuse System at Mount Pavilia

SR No. *	Description	Type of Use	No. of Storey	Distance between SR and Plant Boundary (m)
ANSR1	Tai Po Tsai Village	Residential	3	30
ANSR2	The Hong Kong University of Science and Technology	Institution & Residential	10	200
WSR3	Natural Stream	Stream	N.A.	300
WSR4	Nature's Harvest	Farm Land	N.A.	600
WSR5	Port Shelter	Sea	N.A.	700

* Remarks: ANSR denotes "Air & noise sensitive receiver"
WSR denotes "Water sensitive receiver"

3.1.1 Air Quality and Noise

Tai Po Tsai Village (ANSR1) located to the west (about 30 m from relevant facilities) and the Hong Kong University of Science and Technology (ANSR2) located to the east (about 200 m from relevant facilities) are identified as air and noise sensitive receivers during the construction and operation stage.

3.1.2 Water Quality

Natural Stream (WSR3) located to the northeast (about 300 m from relevant facilities), Natures' Harvest (WSR4) located to the northeast (about 600 m from relevant facilities) and Port Shelter (WSR5) located to the east (about 700 m from relevant facilities) are identified as water sensitive receivers during the construction and operation stage.

3.1.3 Health and Hygiene

Users of Mount Pavilia including residents, staff and visitors are identified as sensitive receivers during the operation stage.

4 POSSIBLE IMPACTS ON THE ENVIRONMENT

4.1 Possible Environmental Impacts during Construction Stage

4.1.1 Air Quality

Given the small scale of electrical and mechanical works involved and with the implementation of suitable dust suppression measures stipulated in the Air Pollution Control (Construction Dust) Regulation, the potential dust impacts are expected to be minimal.

4.1.2 Noise

Construction noise would be generated mainly from equipment installation within the STP and associated pipeline connection within the boundary of Mount Pavilia. In view of the small scale of the project, adverse construction noise impact to nearby sensitive receivers would not be anticipated.

4.1.3 Water Quality

No site runoff and wastewater would be generated from the construction of the TSE reuse system hence adverse water quality impact to nearby sensitive receivers during the construction stage is not anticipated.

4.1.4 Waste

There will be negligible amount of solid waste produced during the construction of the TSE reuse system. Waste to be generated includes some packaging for the equipment and other general refuse. All waste will be taken away by garbage trucks; therefore, adverse waste management impact is not anticipated during the construction stage.

4.1.5 Ecology

Relevant equipment installation and associated distribution pipe work would be located within the boundary of Mount Pavilia. Adverse ecological impact is not anticipated during the construction stage.

4.1.6 Landscape and Visual

Relevant equipment installation and associated distribution pipe work would be located within the boundary of Mount Pavilia. No trees will be

cut down owing to construction of TSE reuse system. The landscape and visual impact during the construction stage is negligible due to the small scale of the project.

4.1.7 Health and Hygiene

Adverse impact on health and hygiene is not anticipated during the construction stage.

4.2 Possible Environmental Impacts during Operation Stage

4.2.1 Natural Resources

Currently, greening area within Mount Pavilia mainly utilizes rainwater supplemented with potable water for landscape irrigation. The use of reclaimed water under the proposed TSE reuse system will reduce the potable water demand for landscape irrigation, especially during dry season. It is anticipated that a maximum of 120 m^3/day of potable water can be saved due to the proposed TSE reuse system.

4.2.2 Air Quality

The TSE reuse system will be operated in enclosed STP consuming only electricity with no fuel combustion exhaust gases. There will be no gaseous air pollutants, odour emissions and fugitive dust emissions during the operation of TSE reuse system. In addition, a deodourizing unit is installed inside the STP to treat any odour generated from the wastewater treatment process. Adverse impact to nearby air sensitive receivers is not anticipated during the operation stage.

4.2.3 Noise

All equipment for the TSE reuse system will be installed inside the STP which is located at basement level of the premises. As the whole system consists of only a UV disinfection system, a NaOCl dosing system and some control instrumentation, there will be minimal noise generated during the operation of the TSE reuse system.

4.2.4 Water Quality

Apart from membrane bio-reactor, all reclaimed water to be used for landscape irrigation will undergo UV disinfection and NaOCl dosing. The

reclaimed water quality of the TSE reuse system is shown in **Table 2**.

Table 2: Reclaimed Water Quality of TSE Reuse System

Water Quality Parameter	Unit	USEPA Criteria Urban Reuse (Unrestricted) *	Treated Water Quality of the TSE Reuse System	Reclaimed Water Monitoring Frequency
pH	-	6-9	6-9	Weekly (Rapid Test Kit)
Biochemical Oxygen Demand (BOD_5)	mg/L	≤ 10	≤ 10	Monthly (HOKLAS Accredited Laboratory)
Turbidity	NTU	≤ 2	≤ 2	Online Monitoring (Continuous)
Fecal Coliform	No./100mL	Not Detectable	Not Detectable	Daily (Rapid Test Kit) Monthly (HOKLAS Accredited Laboratory)
Total Residual Chlorine	mg/L	≥ 1	≥ 1 **	Daily (Rapid Test Kit)

Remarks:

* From Table 4-4 of USEPA (2012) Guidelines for Water Reuse.

** The proposed dosing of NaOCl should be determined subject to actual effluent quality prior to commissioning in order to maintain the specific residual chlorine level. The required dosing of NaOCl should also be reviewed through the monitoring mechanism as stated in Clause 5.2.3.

Reclaimed water from the TSE reuse system shall follow the USEPA criteria for Urban Reuse (Unrestricted). With the implementation of suitable control of the NaOCl dosing process and close monitoring of the reclaimed water quality, no adverse water quality impact is expected during the operation of the TSE reuse system.

4.2.5 Waste

During operation phase, sludge generated from the wastewater treatment process will be recycled back to the anoxic tanks for biological degradation. Excess sludge will be stored inside the sludge holding tank and dewatered by the filter press before disposal at landfill if required. No adverse waste management impact is expected during the operation.

4.2.6 Ecology

Part of the treated effluent from the STP will be further processed at the TSE reuse system while the remaining will be discharged to Port Shelter (WSR5). Since treated effluent from the STP should comply with the WPCO discharge licence requirement, no adverse ecology impact is anticipated during the operation of the TSE reuse system.

4.2.7 Health and Hygiene

Since reclaimed water from the TSE reuse system is for non-potable use, the impact on human health and hygiene is minimal. Reclaimed water will be treated by the UV disinfection system and NaOCl dosing system prior to use. Potential health and hygiene concerns may exist if there is incorrect connection of the potable and reclaimed water pipes. Operators will be required to wear personal protective gears to minimize contact with the reclaimed water whilst carrying out daily landscape irrigation. Also, non-spray irrigation will be adopted and restricted access to the irrigation area will be enforced to minimize any health and hygiene impact to the general public.

4.2.8 Hazard to Life

50% sodium hydroxide solution (50L) will be used at the STP to provide pH adjustment to the wastewater treatment process and 10% sodium hypochlorite solution (200L) will be used at the TSE reuse system to provide residual chlorine to meet the reclaimed water quality standard. Sodium hydroxide is classified as Category 3 corrosive substance under the Dangerous Goods Ordinance (Cap 295). It is hazardous in case of skin contact or eye contact. Sodium hypochlorite is classified as Category 4 poisonous substance under the Dangerous Goods Ordinance (Cap 295). It will liberate toxic gas if it is accidentally mixed with incompatible chemicals. In fact, if sodium hydroxide mixes with sodium hypochlorite,

only heat, but not toxic gas, would be evolved. The small amount of sodium hydroxide and sodium hypochlorite solutions stored on site is within Fire Services Department dangerous goods exemption quantity. Also, they would not constitute potentially hazardous installations in accordance with HKPSG Chapter 12.4. As such, no hazard impact is anticipated during the operation of the TSE reuse system.

4.2.9 Landscape and Visual

Since relevant equipment installation and associated distribution pipe work would be located within the boundary of Mount Pavilia, the landscape and visual impact is anticipated to be insignificant during the operation stage.

5 ENVIRONMENTAL PROTECTION MEASURES TO BE INCORPORATED

5.1 Environmental Protection Measures during Construction Stage

5.1.1 Air Quality

As discussed in Section 4, dust suppression measures stipulated in the Air Pollution Control (Construction Dust) Regulation would be implemented to reduce the dust impact. Hence, no adverse air quality impact due to construction of TSE system will be anticipated.

5.1.2 Noise

Implementation of good site practices e.g. regular maintenance of powered mechanical equipment and use of silent equipment as the proper noise control measures are recommended to minimize the potential noise impact during the construction stage.

5.1.3 Water Quality

There will be no site runoff and wastewater generated from the construction of TSE reuse system.

5.1.4 Waste

There will be negligible amount of solid waste produced from the construction of the TSE reuse system. The waste will be taken away by garbage trucks and disposed of at nearby refuse collection point or refuse

transfer station.

5.2 Environmental Protection Measures during Operation Stage

5.2.1 Air Quality

The TSE reuse system will be operated in enclosed STP consuming only electricity with no fuel combustion exhaust gases. There will be no gaseous air pollutants, odour emissions and fugitive dust emissions during the operation of TSE reuse system. In addition, a deodourizing unit is installed inside the STP to treat any odour generated from the wastewater treatment process. No adverse air quality impact to the nearby sensitive receivers is anticipated during the operation stage.

5.2.2 Noise

Equipment will be enclosed to contain any noise emissions generated from the STP. Acoustic door and air duct silencer will also be adopted. It is believed above measures are sufficient in reducing noise transmission out of the plant room.

5.2.3 Water Quality

A program should be set up for monitoring the water quality from the TSE reuse system to ensure compliance with the quality standards specified in **Table 2**. Turbidity will be monitored continuously by a sensor installed on site. Water sample will be withdrawn from the rainwater storage tank daily for fecal coliform and total residual chlorine testing and weekly for pH testing by rapid test kits. In addition, water sample will be withdrawn from the rainwater storage tank monthly for BOD_5 and fecal coliform testing by HOKLAS accredited laboratory (or other international accredited laboratory that is HOKLAS-equivalent). Should exceedance of water quality standard be found, the TSE reuse system will be suspended immediately. The TSE reuse system will be resumed only when the quality of water sample is tested and complies with the requirement stated in **Table 2**. In addition, in order to promote the reclaimed water quality from TSE reuse system, the rainwater storage tank will be cleaned at least once every six months.

5.2.4 Waste

There will be negligible amount of sludge produced from the wastewater treatment process. Excess sludge will be stored inside the sludge holding tank and dewatered by the filter press before disposal at landfill if required.

5.2.5 Health and Hygiene

The reclaimed water pipeline system will be a separate system and will not be connected with the potable water pipeline system. To avoid cross-connection of the reclaimed water supply to the potable water supply, the reclaimed water pipes will be colour-coded and clearly labeled with warning signs so that physical connection of the reclaimed water pipes with potable water fittings would not be possible. To minimize any health and hygiene impact to the general public, there are two measures to be implemented.

a) Non-spray irrigation – drip irrigation is adopted so as to minimize the exposure to the general public.
b) Restricted access to the irrigation area – Mount Pavilia adopts a comprehensive security system so general public cannot enter the complex and its greening area without approval.

5.2.6 Hazard to Life

The chemical will be stored in enclosed tank and protected by drip tray. The sodium hydroxide solution will be kept below 50L in storage and the sodium hypochlorite solution will be kept below 250L in storage not exceeding the exempted quantity under the Dangerous Goods Ordinance (Cap. 295) and its subsidiary Regulations. During normal operation, staff will be required to wear personal protective gears, including hand gloves, face mask and apron to prevent direct contact with the chemical while working inside the STP. An emergency plan will also be developed for the operation of the TSE reuse system.

5.3 Comments on Environmental Effects

The use of treated water for landscape irrigation will reduce the quantity of potable water consumed. This is considered to be benefits or positive impacts of the project. The promotion of the use of treated water in appropriate circumstances to enable conservation of potable water will

contribute to a green and sustainable environment in Hong Kong.

6 USE OF PREVIOUSLY APPOVED REPORTS

6.1.1 Reference is made to similar projects making direct application of an Environmental Permit under Item F.4, Part I, Schedule 2 of the EIAO in **Table 3**.

Table 3: Previous Applications for Permission to Apply Directly for Environmental Permit

Application No.	Project Title	Approval Date
DIR-177/2009	Water Reclamation Facilities in Shatin Sewage Treatment Works	26-Jun-2009
DIR-182/2009	Water Reclamation Facilities for Yuen Long, Sai Kung and Stanley Sewage Treatment Works	12-Aug-2009
DIR-183/2009	Water Reclamation Facilities for Stonecutters Island, Siu Ho Wan and Sham Tseng Sewage Treatment Works	7-Aug-2009
DIR-214/2011	Water Reclamation Facility in Tai Po Sewage Treatment Works	28-Sep-2011

6.1.2 For the projects of (i) Water Reclamation Facilities in Shatin Sewage Treatment Works operated by DSD, (ii) Water Reclamation Facilities for Yuen Long, Sai Kung and Stanley Sewage Treatment Works operated by DSD, (iii) Water Reclamation Facilities for Stonecutters Island, Siu Ho Wan and Sham Tseng Sewage Treatment Works operated by DSD and (iv) Water Reclamation Facility in Tai Po Sewage Treatment Works operated by DSD previously, the performance of the facilities was satisfactory.

7 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS AND MIGITATION MEASURES

7.1.1 The potential environmental impacts and environmental mitigation measures of the TSE reuse system are summarized in the **Table 4**.

Table 4: Summary of Potential Environmental Impacts & Mitigation Measures

Project Stage	Potential Environmental Impact	Mitigation Measures	Relevant Section in the Project Profile
Construction	Minor air quality impact	Dust suppression measures would be implemented.	4.1.1 & 5.1.1
	Minor noise impact	Implementation of good site practices e.g. regular maintenance of powered mechanical equipment and use of silent equipment as proper noise control measures.	4.1.2 & 5.1.2
	Water quality	No adverse impact is identified; no mitigation measure is required.	4.1.3 & 5.1.3
	Minor waste management impact	The waste will be taken away by garbage trucks and disposed of at nearby refuse collection point or refuse transfer station.	4.1.4 & 5.1.4
	Ecological impact	No adverse impact is identified; no mitigation measure is required.	4.1.5
	Landscape and visual	No adverse impact is identified; no mitigation measure is required.	4.1.6
	Health and hygiene	No adverse impact is identified; no mitigation measure is required.	4.1.7
Operation	Impact on natural resources	Beneficial impact; no mitigation measure is required.	4.2.1
	Air quality	There will be no gaseous air pollutants, odour emission and fugitive dust emissions during the operation of TSE	4.2.2 & 5.2.1

Project Stage	Potential Environmental Impact	Mitigation Measures	Relevant Section in the Project Profile
		reuse system. In addition, a deodourizing unit is installed inside the STP to treat any odour generated from the wastewater treatment process.	
	Minor noise impact	Equipment will be enclosed to contain any noise emissions generated from the STP. Acoustic door and air duct silencer will also be adopted.	4.2.3 & 5.2.2
	Water quality	Water samples will be taken regularly. Should exceedance of water quality standard be found, the TSE reuse system will be suspended immediately. The rainwater storage tank will be cleaned at least once every six months.	4.2.4 & 5.2.3
	Minor waste management impact	Excess sludge will be stored inside the sludge holding tank and dewatered by the filter press before disposal at landfill if required.	4.2.5 & 5.2.4
	Ecological impact	No adverse impact is indentified; no mitigation measure is required.	4.2.6
	Health and hygiene	To avoid cross-connection of the treated water supply to the potable water supply, the treated water pipes will be colour-coded and clearly labeled with warning signs.	4.2.7 & 5.2.5

Project Stage	Potential Environmental Impact	Mitigation Measures	Relevant Section in the Project Profile
		To minimize any health and hygiene impact to the general public, non-spray irrigation will be adopted and restricted access to the irrigation area will be enforced.	
	Hazard to life	The chemical tanks will be protected by drip tray. Staff will be required to wear personal protective gears while working inside the STP.	4.2.8 & 5.2.6
	Landscape and visual	No adverse impact is identified; no mitigation measure is required.	4.2.9

7.1.2 With proper implementation of the above environmental mitigation measures that will be incorporated into the TSE reuse system, insurmountable environmental impact during the construction and operation stages of the proposed TSE reuse system is not expected.

7.1.3 To conclude, the use of the treated effluent for landscape irrigation has the advantages of (i) reducing the demand on potable water since it is a scarce resource deserved for preservation and (ii) reducing wastewater discharges from the STP and the pollution loading to the environment.

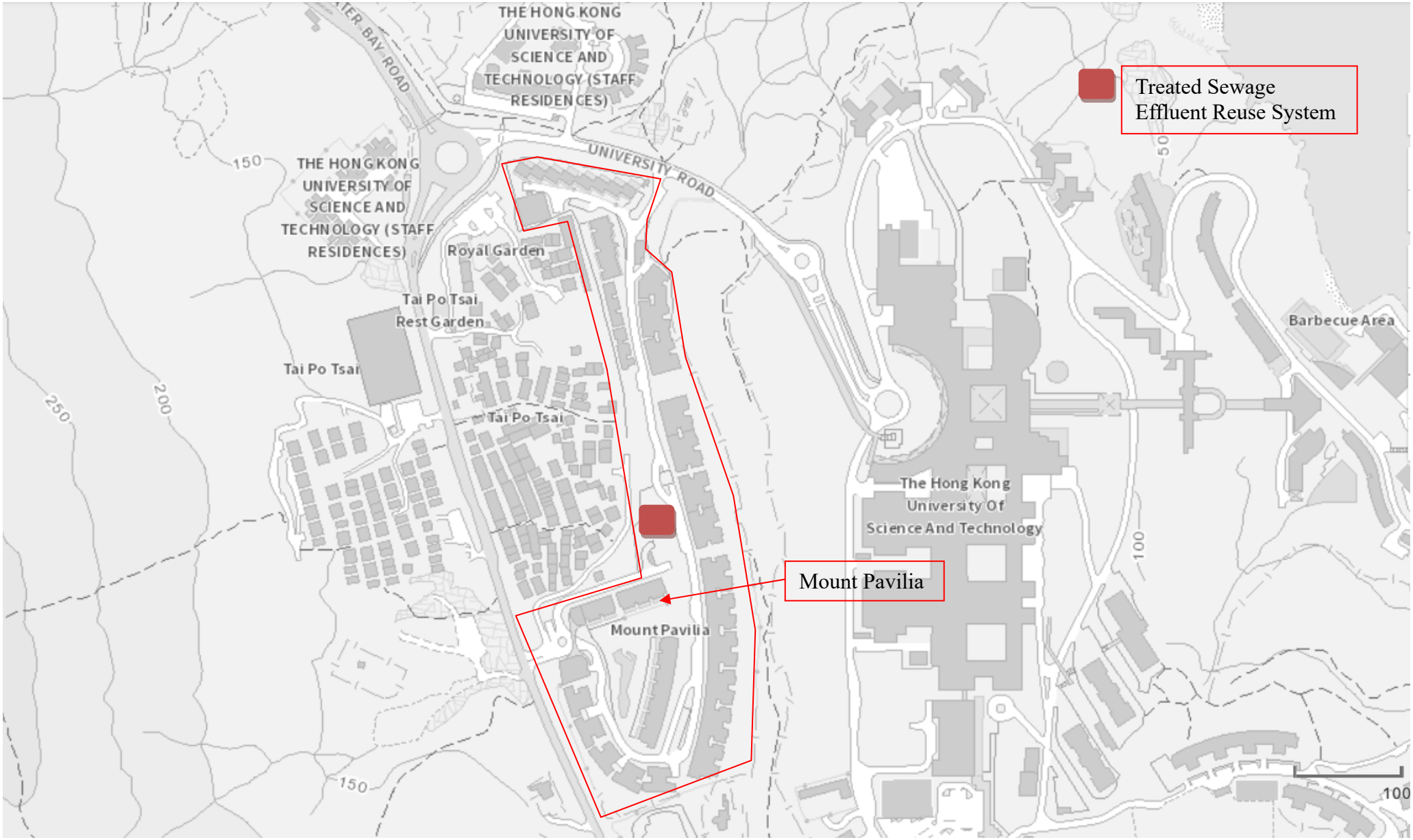


Figure 1: Site Location Plan of Mount Pavilia

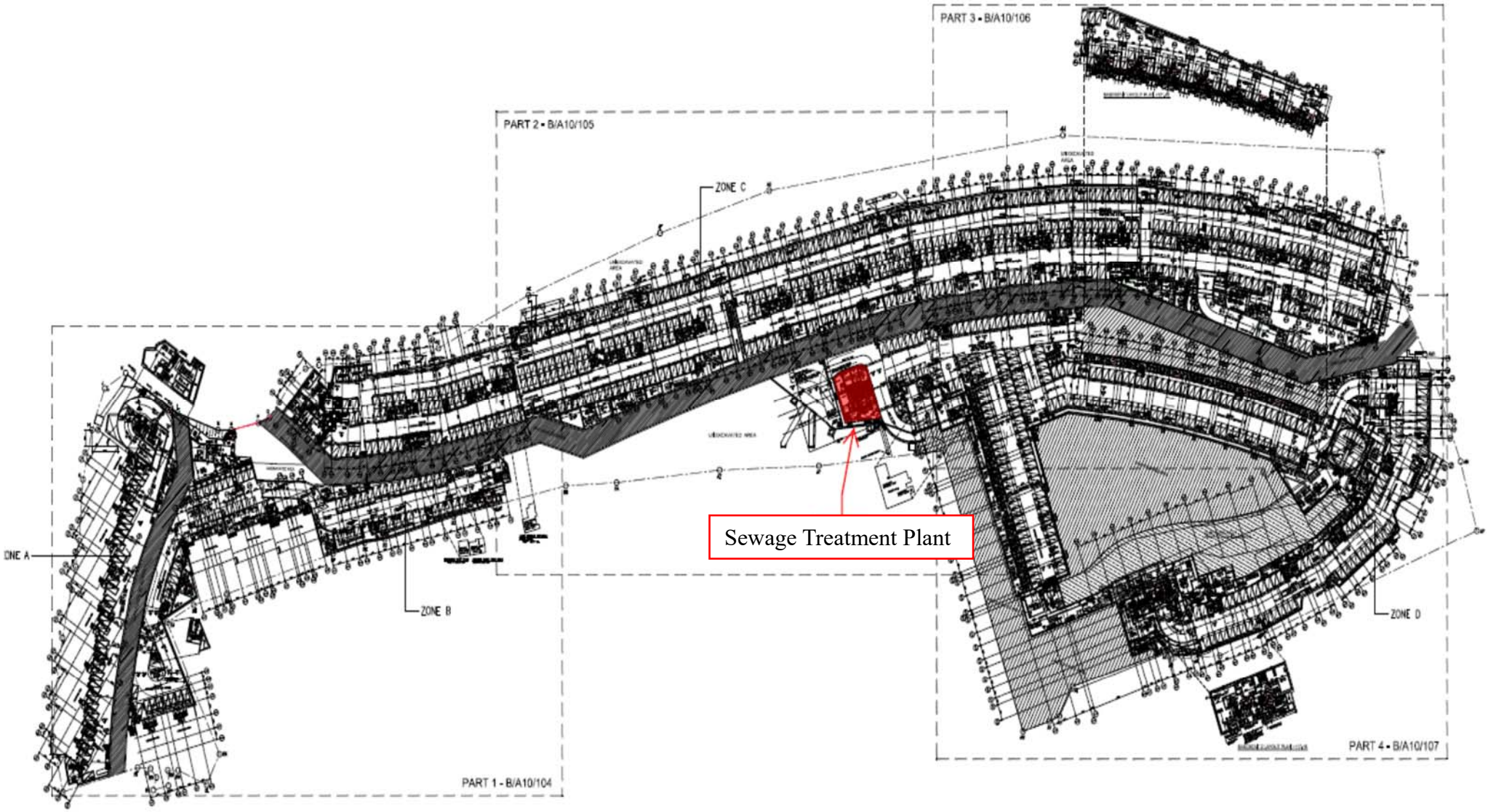


Figure 2: Site Layout Plan of Mount Pavilia

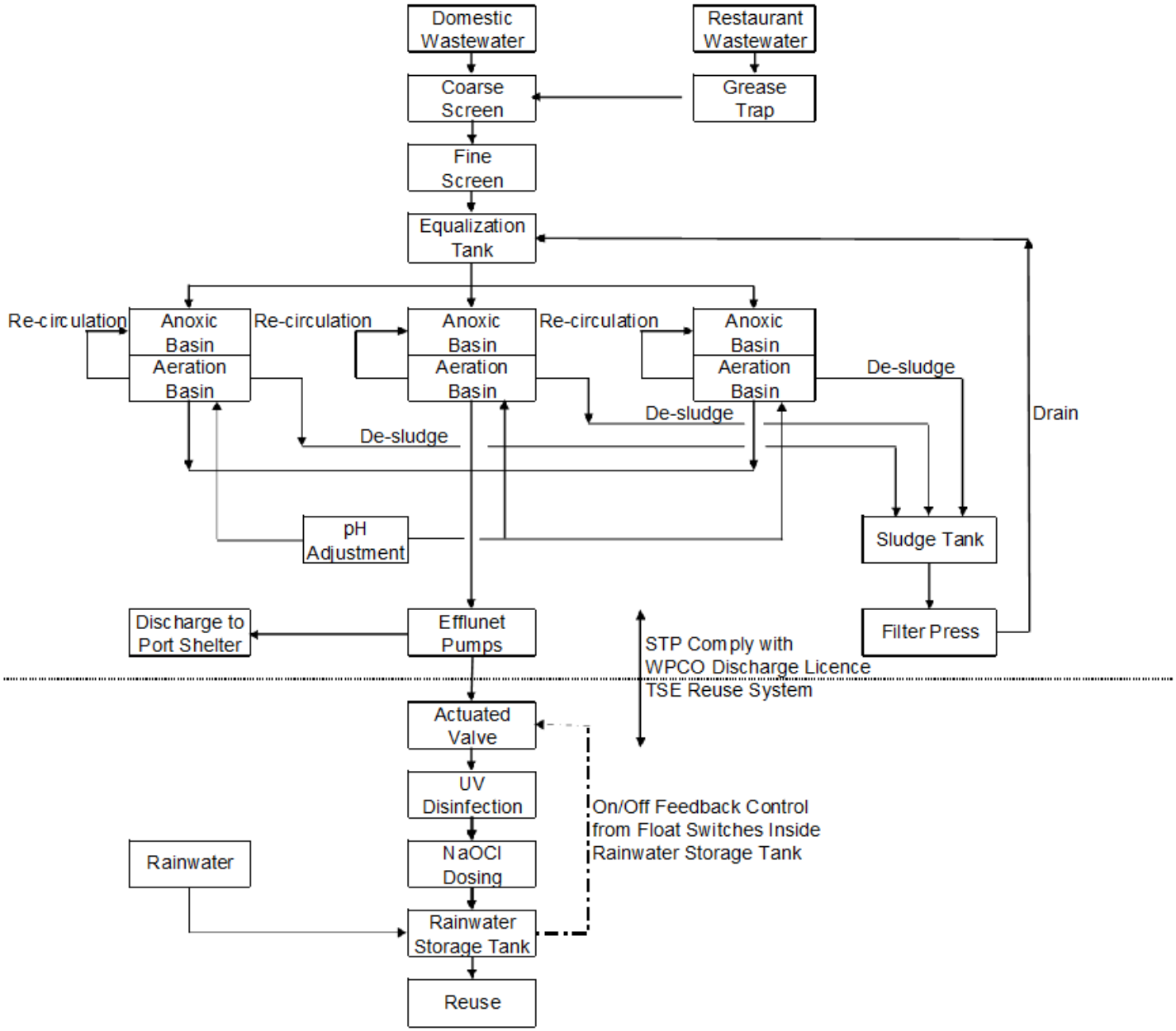


Figure 3: Process Flow Diagram of STP with TSE Reuse System

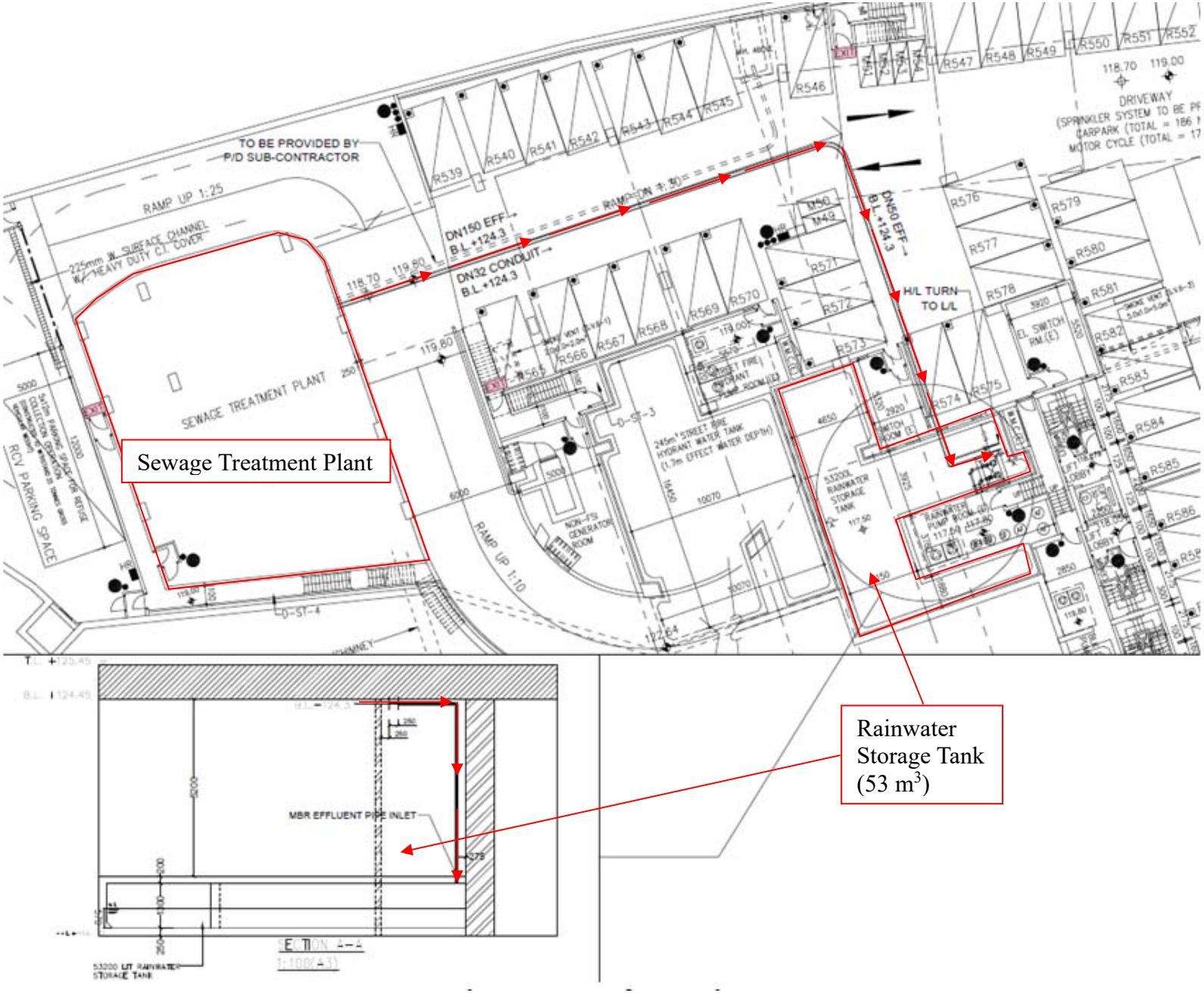
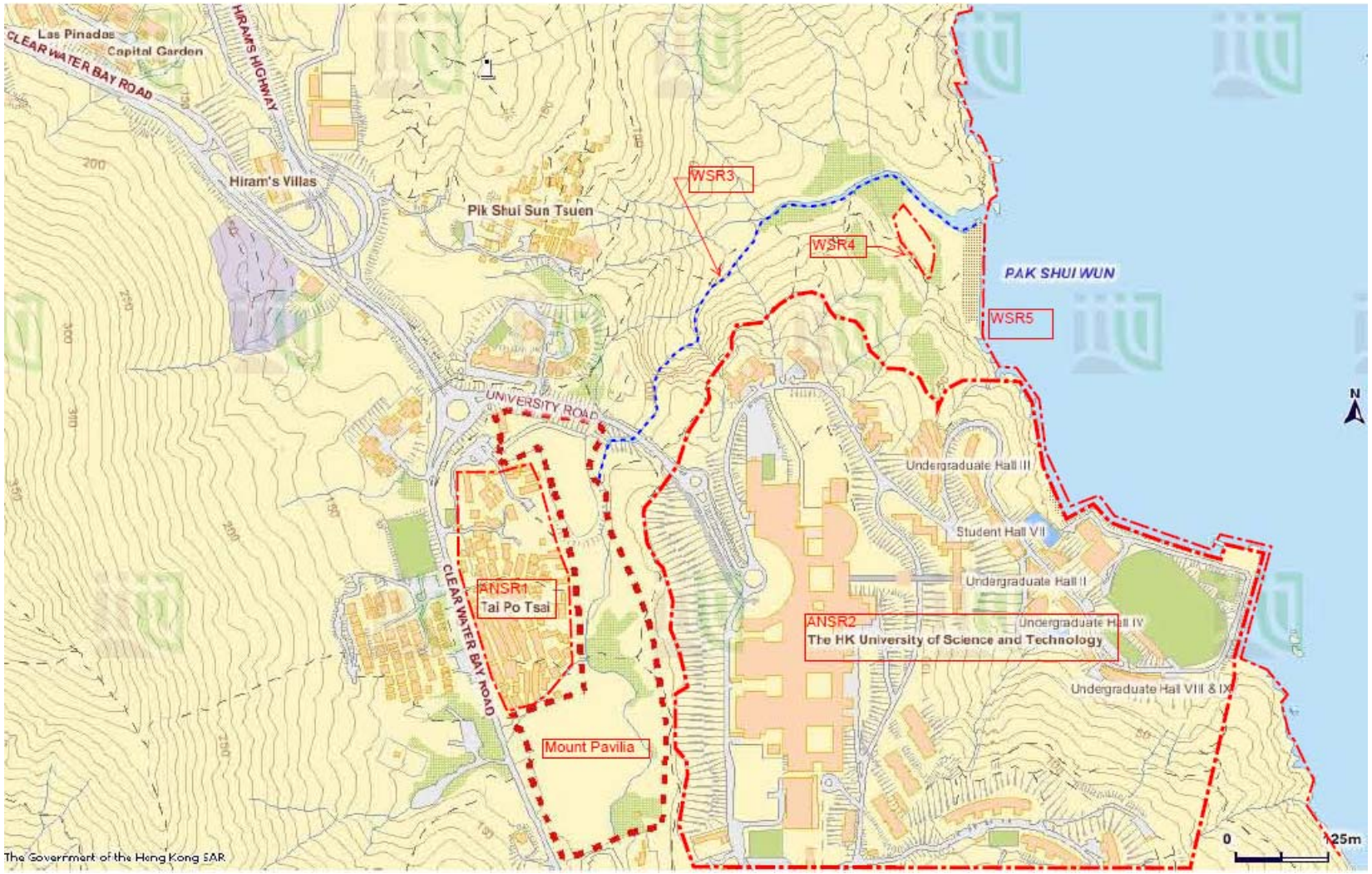


Figure 4: Pipe Connection from TSE Reuse System to Rainwater Storage Tank



Legend

- ANSR1: Tsai Po Tsai Village
- ANSR2: The Hong Kong University of Science and Technology
- WSR3: Natural Stream
- WSR4: Nature's Harvest
- WSR5: Port Shelter

Figure 5: Adjacent Sensitive Receivers of Mount Pavilia