2. PROJECT DESCRIPTION

2.1 Location and Description of the Project

2.1.1 The works for this Project in Sha Tau Kok mainly comprises of the following items and as shown in the Layout Plan of **Figure 2.1a**:

a) Increase the treatment capacity of Sha Tau Kok Sewage Treatment Works (STKSTW) to 5,000 m^3/day at ADWF by 2021, with suitable allowance to cater for a further increase of treatment capacity to 10,000 m^3/day at ADWF after 2030 in Phase 2;

b) Construct a temporary sewage treatment plant (TSTP);

c) Demolish the existing Sha Tau Kok Sewage Pumping Station (STKSPS) and decommission the rising main between STKSPS and STKSTW;

d) Construct a length of 520m new gravity sewer; and

e) Abandonment of the existing submarine outfall and construct a length of 1700m new submarine outfall.

f) Increase the Treatment Capacity of STKSTW and Construct a TSTP

2.1.2 The existing STKSTW is located at Sha Tau Kok Town. It currently provides secondary level treatment to sewage collected from Sha Tau Kok township (including Yim Liu Ha, Tsoi Yuen Kok and Sha Tau Kok Tsuen). STKSTW was commissioned in 1989 with a design capacity of 1,660 m^3/day at average dry weather flow (ADWF).

2.1.3 The proposed STKSTW expansion will increase the treatment capacity to 10,000 m^3/day with betterment to the current secondary treatment level. STKSTW will not receive sewage flow from existing catchment of other sewage treatment works. A Membrane-bioreactor (MBR) type sewage treatment plant will be adopted.

2.1.4 The MBR process can produce good quality effluent through a combination of microfiltration membranes and suspended growth biological reactor. The membranes replace the solids separation of secondary clarifiers and the polishing of granular filter media that are found in conventional activated sludge systems.

2.1.5 By eliminating the need for sludge settling, the MBR process can operate at higher mixed liquor suspended solids concentration than conventional activated sludge systems. This results in a plant that is more compact than a conventional plant, requiring a smaller footprint to produce effluent of similar quality. All the membrane modules will be placed in MBR tanks, which are covered and installed indoor.

2.1.6 The expansion works will include construction of new sewage treatment facilities. A temporary sewage treatment plant (TSTP) is proposed as the interim measure to cope with the sewage flow in order to isolate the existing STKSTW from the expansion works.

2.1.7 The proposed TSTP will have a treatment capacity of 2500 m^3/day. A Moving Bed Biofilm Reactor (MBBR) type sewage treatment plant will be adopted. A suitably designed additional Chemical Enhanced Primary Treatment (CEPT) process using ferric chloride or alum dosing to the influent will also be effected if necessary.

2.1.8 The MBBR process with secondary treatment and necessary enhancement can improve the effluent quality standard compared with the existing STKSTW such that the TSTP can comply with the discharge license of existing STKSTW.

2.1.9 All the expansion works will be constructed within the existing site boundary of STKSTW. The proposed general layout of the STKSTW and TSTP are shown in **Figure 2.4 – 2.14** respectively. The Schematic Process Flow Diagrams are shown in **Figure**

2.2 and Figure 2.3 for STKSTW and TSTP respectively. The dimension of the above-ground structure is 73m (L) x 25m (W). The respective height of the new structure for the expanded STKSTW and TSTP is approximately 10m – 19m and 10m above the proposed ground level. The site coverage of the sewage treatment works is 35%. The gross floor area for the expanded STKSTW and TSTP is approximately 5,700 m^2 and 1,550m^2 respectively. The breakdown of respective area for the expanded STKSTW and TSTP are as follow:

Area	Dimension	Height	Footprint
Site extent	-	-	4,950m^2
Above-ground structure for expanded STKSTW	73m x 25m	10m – 19m	1740m^2
Above-ground structure for TSTP	47m x 19m	10m	774m^2

Demolish the Existing STKSPS, Decommission the Rising Main between STKSPS and STKSTW, and Construct New Gravity Sewer

2.1.10 The existing STKSPS is located at Shun Lung Street. It is currently equipped with three submersible pumps (two duty and one standby) with the existing pumping capacity of 90L/s.

2.1.11 A sewerage scheme to demolish the STKSPS after expansion of STKSTW is proposed. The scheme includes construction of a section of sewer to divert the existing sewage flow from STKSPS to STKSTW which can isolate STKSPS for demolition.

2.1.12 The proposed scheme consists of the following:

- Sewage from STK town will be diverted to the proposed sewer and conveyed to the expanded STKSTW by gravity.
- The STKSPS and its rising mains will be decommissioned.
- The land will be utilized for other beneficial purposes.
- The rising mains will be grouted and abandoned.
- No excavation works will be required for the decommissioning of the rising mains.

Abandonment of the Existing Submarine Outfall and Construct a New One

2.1.13 The existing outfall is inadequate to cope with the increased sewage flow in the future. Construction of a new submarine outfall with larger capacity is necessary to discharge the treated effluent to Starling Inlet. The alignment of the new submarine outfall is shown in Figure 2.1b.

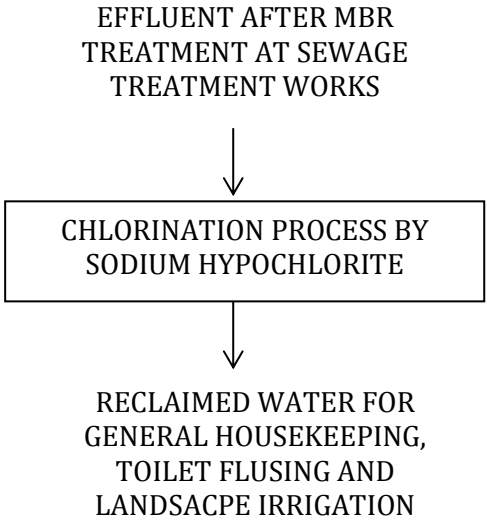
2.1.14 The discharge point of the proposed submarine outfall will be located in the water near Ah Kung Au. The submarine outfall will be constructed by trenchless method under the seabed of Starling Inlet. A diffuser (approximate 54m x 22m with 11 risers), which can help to improve the mixing and dilution efficiency of effluent, will be constructed on the seabed of Starling Inlet to discharge the treated effluent. It will be located far away from the water sensitive receivers as identified in Chapter 5, which are mainly in the inner water. It is not expected to have excavation/ dredging works for future routine maintenance works during operation. According to the Aerial Photographs, the proposed discharge location near Ah Kung Au is part of Starling Inlet from 1969.

Effluent Reuse

2.1.15 In view of recent developments in sewage treatment technology, which could produce high quality effluent, reuse of the treated effluent would also be considered for Phase 1 and Phase 2 STKSTW to minimize direct effluent discharge.

2.1.16 The expanded STKSTW will be able to advance treat the secondary effluent after secondary treatment at sewage treatment works for the production of reclaimed water for non-potable use within STKSTW. The use of reclaimed water is primarily for cleansing, toilet flushing and landscape irrigation within STKSTW. The maximum design flow of the abovementioned use is 50m^3/day which is 0.5% of the ultimate design capacity of STKSTW.

2.1.17 There will be no off-site effluent reuse. The treated effluent will undergo a chlorination process by means of sodium hypochlorite with the dosage of 4kg/day before being conveyed to the point of usage to minimize bacterial growth and contamination during the transmission. The process for generation of chlorinated treated effluent will cease when its quantity reaches a pre-set level of 50m^3/day. The flow chart below shows the process train of the advanced treatment:



PROCESS TRAIN FOR ADVANCED TREATMENT FOR EFFLUENT REUSE

2.1.18 There are certain effluent reuse standards that are being practiced in Hong Kong. The effluent quality standards adopted for the reuse at Ngong Ping STW (for toilet flushing and controlled irrigation), North District (for toilet flushing, unrestricted irrigation & water features), Lo Wu Correction Institution (for toilet flushing) and WSD's water quality objectives for toilet flushing have been reviewed to derive the proposed standards for the STKSTW. The proposed standard is listed in **Table 2.1**.

Table 2.1 Proposed Reclaimed Water Quality for non-potable uses within STKSTW

Determinand	Unit	Proposed Reclaimed Water Quality Criteria for STKSTW *
pH	n/a	6-9 (d)
Turbidity	NTU	≤ 2 (b-d)
Total Suspended Solids	mg/L	≤ 10 (a)

Determinand	Unit	Proposed Reclaimed Water Quality Criteria for STKSTW *
Biochemical Oxygen Demand (BOD5)	mg/L	≤10 (a)
Colour	Hazen Unit	≤ 20 (a)
Ammonia Nitrogen	mg/L	≤ 1 (a)
Threshold Odour Number	T.O.N	≤ 100 (a)
Synthetic Detergents	mg/L	≤ 5 (a)
Escherichia coli	cfu/100ml	Not Detectable (b-d)
Dissolved Oxygen	mg/L	≥ 2 (a)
Residual Chlorine	mg/L	≥ 1 (b)(e) (For cleansing and toilet flushing)
	mg/L	≤ 1 (d) (For landscape irrigation)

*Note:
The effluent standards are adopted from:

(a) Agreement. No. CE 29/2001 – Outlying Islands Sewerage Stage 1 Phase 1 – Ngong Ping Sewage Treatment Works and Sewerage Investigation, Design and Construction.
(b) Agreement No. CE 16/2004 (DS) – Demonstration Scheme on Reclaimed Water Uses in the North District – Investigation
(c) Contract No. SS P320 – Design and Construction of the Redevelopment of Lo Wu Correctional Institution
(d) Guideline for Water Reuse, (2004), USEPA

2.1.19 In order to meet the above effluent reuse standard, sodium hypochlorite will be fed into reclaimed water storage tank for disinfecting and maintaining a suitable residual chlorine level on the portion of reclaimed water for reuse. Approximate 50L of sodium hypochlorite solution would be stored on-site for effluent reuse.

2.1.20 The effluent reuse is adhered to measures such as setting appropriate water quality requirements which is presented in Table 2.1 above, prevention of cross-connections with potable water supplies and avoidance of improper or inadvertent use of reclaimed water.

2.1.21 The reclaimed water pipeline 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 pipes for the reclaimed water will be specially arranged to differentiate them from that of the potable water pipe, e.g. clearly labelled with warning signs and notices, colour-coded, and/or using different pipe size, so that physical connection of the reclaimed water pipes with the potable water fittings would not be possible.

2.1.22 For ground and facility washing and landscape irrigation applications, operators will not be allowed to use high pressure jet to avoid any atomized water to minimize aerosol formation from the reclaimed water.

2.1.23 Usage of reclaimed water will reduce the quantity of potable water consumed in the existing DSD sewage treatment works. This is considered to be the benefits or positive impacts of the Project. The promotion of the use of reclaimed water in appropriate circumstances to enable conservation of potable water will contribute to a green and sustainable environment in Hong Kong.

2.2 Need of the Project

2.2.1 The need of the Project is to meet the sewage treatment demand of the future population for supporting the planned growth and development within the Sha Tau Kok area.

Existing Conditions

2.2.2 The existing STKSTW is inadequate to cope with the population growth and future development within the catchment.

2.2.3 The existing submarine outfall is inadequate to cope with the increased sewage flow in the future.

2.2.4 The existing submarine outfall is discharging treated effluent near-shore of Starling Inlet.

Purpose of the Project

2.2.5 The Project is to increase the capacity of STKSTW to cope with the forecast increase in sewage flow upon completion of sewerage under project "North District sewerage, stage 2 part 2 A – Pak Hok Lam trunk sewer and Sha Tau Kok village sewerage" in Sha Tau Kok areas, extensions of village sewerage in the areas planned by EPD, and the proposed housing developments in Sha Tau Kok Town.

2.2.6 A new submarine outfall is required for the Project to provide enough capacity for discharging the increased sewage flow to Starling Inlet.

Scope of the Project

2.2.7 The scope of the Project includes the following:

a) Increase the treatment capacity of Sha Tau Kok Sewage Treatment Works (STKSTW) to 5,000 m^3/day at ADWF by 2021, with suitable allowance to cater for a further increase of treatment capacity to 10,000 m^3/day at ADWF after 2030 in Phase 2

b) Construct a temporary sewage treatment plant (TSTP);

c) Demolish the existing Sha Tau Kok Sewage Pumping Station (STKSPS) and decommission the rising main between STKSPS and STKSTW;

d) Construct a length of 520m new gravity sewer; and

e) Abandonment of the existing submarine outfall and construct a length of 1700m new submarine outfall.

Environmental Benefits of the Project

2.2.8 The environmental benefits of the Project include the following:

a) Improve treatment to produce effluent with better quality

b) Provide more treatment capacity within the existing plant site

c) Enclose the treatment facilities and provide odour treatment to improve air quality

d) Incorporate environmental enhancements in the new treatment facilities, including renewable energy, energy-efficient electrical and mechanical equipment, greening, and water saving measures, etc.

e) Locate the discharge point of the new submarine outfall away from sensitive receivers, including the fish culture zones and the identified species of conservation importance

2.3 Scenarios With and Without the Project

Without Project

2.3.1 The existing capacity of STKSTW is expected to be fully committed in early 2019 based on the flow-build-up derived from the latest planning data and village sewerage programme.

2.3.2 The existing STKSTW will suffer from insufficient capacity to cope with the increase in sewage flow and loads in the future, and consequently deteriorate the coastal water quality. Sewage collected from the villages sewerage system will not receive treatment before discharge since STKSTW do not have sufficient capacity to cope with the sewage flow from the extended villages.

With Project

2.3.3 STKSTW will have sufficient capacity to cope with the increased sewage flow in the future for the existing catchment and sewage collected from the extensions of different villages sewerage projects. The proposed effluent quality is shown in the following table:

Table 2.2a Proposed Effluent Quality

Parameter	Proposed Effluent Quality	
	95% tile	**Upper Limit**
BOD_5 (mg/L)	20	40
Suspended Solids (mg/L)	30	60
Total Nitrogen (mg/L)	12	24
E. Coli (count/100mL)	1,500	100 (Note 1)
Note: *1. The upper limit is in monthly geometric mean*.		

2.4 Consideration of Alternative Treatment Level

2.4.1 The purpose of this section is to present the comparison of engineering and environmental benefits and drawbacks of possible sewage treatment options. The selection of the preferred option will consider avoiding the adverse environmental impacts to a maximum practicable extent.

2.4.2 The existing STKSTW provides a secondary level treatment. The existing discharge standard is shown below:

Table 2.1b STKSTW Existing Discharge Standard

Parameter	95% -tile	Upper limit
Suspended Solids (mg/L)	30	60
BOD_5 (mg/L)	20	40
E.Coli (count/100mL)	1,500	100 (Note 1)
Note: *1. The upper limit is in monthly geometric mean*.		

2.4.3 Secondary treatment level has been considered for STKSTW, which is capable of removing biodegradable organic matter, suspended solids and total nitrogen for compliance with the Water Quality Objectives of Mirs Bay Water Control Zone. The treatment method can fulfil the Project requirements without causing adverse water quality and ecological impact.

2.4.4 Different options of secondary treatment have been considered and presented in Section 2.5.13. All these options are capable of meeting the Water Quality Objectives of Mirs Bay Water Control Zone.

2.5 Consideration of Alternative Design, Layout and Outfall Alignment

2.5.1 The consideration of alternatives of the Project in conjunction with the existing STKSTW include the following:

- Options of Expansion Scheme
- Options of Treatment Process
- Disinfection Options
- Sludge Treatment and Disposal
- Consideration of Demolition of the STKSPS
- Consideration of New Sewer Alignment
- Consideration of new submarine Outfall Alignment
- Consideration of Abandonment of the Existing Outfall

2.5.2 The alternatives were developed to consider alternative treatment level, processes, design and internal layouts, alternative locations for the new treatment facilities and submarine outfall alignment, alternative phased installation for different flow projections, alternative designs to avoid or minimize emergency discharges and alternative scale/size of the above-ground structures, with a view to avoiding or reducing air quality, noise, water quality, ecological, fisheries, landscape and visual and cultural heritage impacts during construction and operation of the Project. The considerations covered by the alternatives are summarized in the following table.

Table 2.2 Summary of the Considerations Covered by the Alternatives

Considerations	Options of Expansion Scheme	Consideration of Decommission of TSTP	Options of Treatment Process	Disinfection Options	Sludge Treatment and Disposal	Consideration of Alternative Internal layouts	Consideration of Demolition of the STKSPS	Consideration of New Sewer Alignment	Consideration of Outfall Alignment	Consideration of Abandonment of the Existing Outfall	Consideration of Phased installation	Consideration of minimizing emergency discharges	Consideration of Alternative Construction Methods and Sequence of Works
Alternative Treatment Level			✓	✓					✓				
Alternative Treatment Processes				✓	✓								
Alternative Design and Internal Layouts			✓		✓	✓							
Alternative Locations for the New Treatment Facilities	✓												

Alternative Submarine Outfall Alignment									✓	✓			
Alternative Phased Installation for Different Flow Projections											✓		
Alternative Designs to Avoid or Minimize Emergency Discharges												✓	
Alternative Scale/Size of the Above-Ground Structures			✓		✓								
Other Considerations		✓					✓	✓		✓			✓

2.5.3 Comparisons of the environmental benefits and dis-benefits of alternative development options are summarized and presented for the alternative evaluation. The recommended preferred options are selected to avoid adverse environmental impacts.

Options of Expansion Scheme

2.5.4 Based on the programme and cost of construction, land requirement and environmental issues, three options are considered suitable for the expansion of STKSTW. These options for expansion scheme are shown in **Figure 2.18 – 2.20**.

a) Option 1 – Offsite Temporary Sewage Treatment Plant (TSTP)

An offsite TSTP with a capacity of 2500m^3/day ADWF will be constructed to maintain the sewage treatment operation during upgrading works of existing STKSTW.

Existing STKSTW will be expanded in the existing site after the TSTP is commissioned.

The TSTP will be decommissioned upon commissioning of the Phase 1 expansion.

b) Option2 – Onsite Temporary Sewage Treatment Plant (TSTP)

An onsite TSTP with a capacity of 2500m^3/day will be deployed at the south-eastern corner of the existing site to maintain sewage treatment operation before decommissioning STKSTW for construction.

The TSTP will be decommissioned upon commissioning of the Phase 1 expansion.

c) Option 3 – Utilize the area of existing Police Operation Base (POB)

The existing POB will be relocated to a new site.

A new STW with a capacity of 5000m^3/day ADWF will be built at POB site such that the existing STKSTW can be maintained until commissioning of the Phase 1 expansion in the POB site.

The commission time of Phase 1 expansion will be delayed as time is needed to relocate the POB.

An onsite TSTP will still be deployed as the existing STKSTW could not meet the project sewage flow after 2019.

2.5.5 The options have been assessed based on the evaluation criteria of cost, programme, land requirement, public acceptance and environmental considerations. For the environmental considerations, the environmental benefits and dis-benefits were compared. The findings of the assessment are summarized in **Table 2.3** and **Table 2.4**.

2.5.6 Option 2 is found to be the preferred option. The major environmental benefits of this option are that the expansion works will be carried out in the existing STKSTW and relocation of the police operation base is not necessary. The cost, programme, and public acceptance of this option are also considered comparatively favourable.

Table 2.3 Evaluation of Alternative Expansion Schemes

	Options		
	1	**2**	**3**
Item	**Offsite TSTP**	**Onsite TSTP**	**Offsite Expansion**
Environmental Considerations	2	3	1
**Note: "3" indicates the most preferable option and "1" indicates the least preferable option.*			

Table 2.4 Environmental Benefits and Dis-benefits for Alternative Expansion Schemes

Options	Environmental Benefits	Environmental Dis-Benefits	Other Considerations
1	• Confine permanent STKSTW to the existing plant area. • Relatively shorter overall construction period which can reduce the duration of environmental impact and public concerns.	• Larger footprint up to 7,700m^2 (such as longer sewer, additional pumping station, using additional land temporarily) which will create additional environmental impacts and public nuisance. • Offsite TSTP may cause additional adverse impacts to offsite ecological and landscape resources, and visual impacts to more VSRs. For example, LR2.16 would be occupied where approximate 40 trees would be affected. It would also be close to the Night Roosting Site for Great Egrets which is on the north of the site.	-
2	• Limit the footprint up to 5,000m^2 for the construction works to the existing STKSTW site. This is far from residential area and comparatively less environmental (air quality, noise, ecology, landscape, visual) impacts will be created. • The TSTP area can be used for tree planting for landscape and visual enhancement. • Relatively less excavation is involved and fewer trees are affected as the footprint for construction works is limited into the existing STKSTW site and less C&DM materials will be produced.	-	• Construction difficulties will be encountered for the construction works at existing STKSTW footprint due to limited space.

Options	Environmental Benefits	Environmental Dis-Benefits	Other Considerations
3	-	• Largest footprint, due to extended STKSTW site area and re-provisioning of POB. This will create additional environmental (air quality, noise, ecology, landscape, visual) impacts and public nuisance. • The long construction programme (construction of new POB, demolition of existing POB, construction of STKSTW Phase 1 and Phase 2) will create additional environmental impacts and public nuisance. • The separation distance between the extended STKSTW site and sensitive receivers becomes closer. • The relocation of POB site would cause additional adverse impacts to offsite ecological and landscape resources, and visual impacts to more VSRs. • More trees will be affected under this option.	• Very tight programme as the new POB must be ready for occupation before commencement of STKSTW Phase 1 construction.

Consideration of Decommission of TSTP

2.5.7 The TSTP is necessary to maintain sewage treatment service during the construction of STKSTW which is anticipated to be completed by 2021. Upon completion of the expansion works of STKSTW, the TSTP is recommended to be decommissioned.

2.5.8 To save construction time and cost, TSTP would adopt MBBR process as mentioned in Section 2.1.7 as MBBR is relatively operation and maintenance friendly with less energy consumption. It would also be constructed aboveground and would adopt packaged units such as packaged pre-treatment unit with supporting facilities which enable it to be completed by 2019.

2.5.9 An alternative has been considered that the TSTP is constructed based on permanent plant standards such that its service life can last longer. As the site is congested, only the southern side of site is free to construct TSTP. As it is close to the existing sea wall, deep excavation is considered at high risk and difficult. Hence, in sake of safety, it is not recommended to construct a permanent plant at southern side of site.

2.5.10 As mentioned in Section 2.1.8, the effluent standard of TSTP would be better than the existing STKSTW and can comply with the discharge license of existing STKSTW.

2.5.11 TSTP is recommended to be decommissioned after the expanding works of STKSTW completed as the expanded STKSTW would have better effluent quality than TSTP which could generally improve the water quality of Starling Inlet. In addition, as TSTP is considered as a temporary structure, it could not blend in with the surrounding and would obstruct the original landscape proposal at the area which is part of the mitigation measures in operation phase to mitigate the visual impact of the expanded STKSTW.

2.5.12 As the E&M equipment design life is usually 15 years, the decommissioned E&M equipment is recommended to be reused either by the Contractor or DSD for other similar project as far as practicable.

Options of Treatment Process

2.5.13 Based on the treatment capacity, effluent standard and land availability, we have identified three compact processes that are considered suitable for the expanded STKSTW and TSTP. These process options are:

- Membrane Bioreactor (MBR) - a mechanically intensive process with excellent solids, BOD and coliform removal;
- Moving Bed Bioreactor in combination with Dissolved Air Floatation (MBBR+DAF) - a high-rate variation of the conventional aeration plant process; and
- Sequencing Batch Reactor with filtration (SBR + Filtration) - a flexible and less mechanically-intensive process.

2.5.14 During operation and maintenance, all 3 process options will require regular cleansing and use of chemicals. A number of chemicals such as calcium carbonate, lime, citric acid, sodium hypochloride and sugar will be required. The sewage after cleansing will be diverted back to the treatment process tanks for treatment before discharging through the outfall. All used chemicals will also be neutralized and treated appropriately to stabilize the pH before discharging through the outfall. Therefore, no environmental dis-benefit is anticipated.

2.5.15 The advantages and disadvantages of the 3 process options are compared in Table 2.5.

Table 2.5 Comparison for Three Processes

Options	Environmental Benefits	Environmental Dis-benefits
MBR	• Smallest footprint required and hence limits the extent for creating environmental impacts. • Provide the best effluent quality within a small footprint. • Produce the least amount of sludge amongst the options	• Highest power consumption among the 3 processes.
MBBR	-	• Require larger footprint for meeting the discharge standard which will create additional environmental impacts and public nuisance.
SBR	-	• Require larger footprint for meeting the discharge standard which will create additional environmental impacts and public nuisance.

2.5.16 MBR process is preferred for the expansion of STKSTW taking into consideration the lower life cycle cost, effluent quality, process reliability, compact footprint, and process full-scale application experiences in Hong Kong.

2.5.17 Higher level of treatment process is not considered as effluent provided by MBR process can already meet the WQO standard. Adopting higher level treatment is considered not cost effective and will delay the construction programme. In addition, taking into the consideration of land requirement, compact process is considered more suitable for this project.

Disinfection Options

2.5.18 The water quality impact assessment results as presented in Section 5 showed that the discharge of effluent from the expanded STKSTW after biological treatment by MBR will not cause any adverse water quality impact and will comply with the Water Quality Objectives of Mirs Bay Water Control Zone. Under normal operation, the membranes are able to remove E. Coli and other bacteria from the treated effluent before discharge to the outfall.

Sludge Treatment and Disposal

2.5.19 Sludge digestion is used for energy recovery and to reduce the mass of sludge solids in sewage treatment. The major part of the energy recovery and solids destruction comes from primary sludge. The waste activated sludge (WAS) solids from the secondary biological treatment (in MBR, MBBR and SBR) remain largely constant throughout the digestion unless extensive pre-treatment, such as thermal hydrolysis, is applied.

2.5.20 It is considered inefficient to provide sludge digestion since the required pre-treatment cannot be efficiently provided for this plant size.

2.5.21 Based on above evaluation, it is recommended not to include sludge digestion at the expanded STKSTW. This will allow the new treatment facilities to fit within the limited footprint available; reduce capital and operational cost of the expanded STKSTW; and retain the heating/energy value in the sludge. When the sludge is dewatered and transported to the Sludge Treatment Facility (STF), the heating/energy value in the sludge will help the incineration process achieve

autogenous combustion i.e. continuous incineration without the additional use of external fuel.

2.5.22 There is an existing administrative requirement imposed by EPD to have a minimum of 30% dry solids content of dewatered sludge cake for disposal at the strategic landfills or further treatment at the STF. Filter presses will be provided at the expanded STKSTW to dewater the sludge to achieve a minimum of 30% dry solid content in the dewatered sludge.

2.5.23 Based on the preliminary estimation, 1.7m^3/day, 3.5m^3/day and 7m^3/day of dewatered sludge will be produced for TSTP, phase 1 expanded STKSTW and phase 2 expanded STKSTW respectively. The dewatered sludge is recommended to transport to STF at Tuen Mun for disposal or further treatment.

2.5.24 A preliminary layout plan for the expanded STKSTW and TSTP with the recommended treatment options are shown in **Figure 2.4a – 2.12** and **2.13 – 2.14** respectively. The layout minimizes the impact on landscape and visual aspects by providing greening and tree planting area as shown in **Figure 2.4a** and **Figure 2.4b** for construction stage and operation stage respectively. Structures for the expanded STKSTW and TSTP will adopt a low-rise design to minimize their height as far as practicable and minimize the obstructive effect. The respective height of the new structure for the expanded STKSTW and TSTP is approximately 10m – 19m and 10m above the proposed ground level. In addition, the process flow diagrams are shown in **Figure 2.2** and **2.3** for the expanded STKSTW and TSTP respectively.

Consideration of Alternative Internal Layouts

2.5.25 An alternative internal layout has been considered and is shown in **Figure 2.24** and **Figure 2.25**. The underground tanks are proposed to place above ground at the southern side of the site which can facilitate the operation and maintenance works during operation phase. However, in view of the above ground tanks, the alternative layout will have greater visual impact compared to the proposed scheme as shown in **Figure 2.4a- 2.12**. In addition, as the above ground tanks will occupy the southern side of site which will be in conflict with the TSTP. The TSTP has to be constructed offsite and the environmental dis-benefits of the offsite TSTP expansion scheme has been illustrated in Section 2.5.4. Hence, this alternative internal layout is not recommended.

Consideration of Demolition of the Sha Tau Kok Sewage Pumping Station

2.5.26 The existing STKSPS is currently delivering all the sewage from the existing STKSTW catchment to the inlet of STKSTW. A sewerage scheme which will demolish the STKSPS after expansion of STKSTW is proposed. The scheme includes provision of a new sewer along Shun Hing Street and the access road leading to STKSTW.

2.5.27 The proposed sewer will connect to a section of sewer to be completed in 2016 for discharging to the expanded STKSTW by gravity.

2.5.28 Under the proposed scheme, sewage from STK town will be diverted to the new sewer and conveyed to the expanded STKSTW by gravity. The STKSPS will be demolished and its rising mains will be decommissioned and the land will be released to Lands Department.

2.5.29 Alternatively, the STKSPS will be upgraded to accommodate the increased sewage flow. In addition to increase the pumping capacity, the upgrade of STKSPS will include the following considerations:

a) The aesthetic design of the existing STKSPS will need to be enhanced according to Guidelines on Aesthetic Design of Pumping Station Buildings;

b) Upgrading the existing STKSPS will be classified as a designated project which require an environmental permit under item F.3(b)(i), Part I of Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO), as the proposed sewage pumping station has an installed capacity (average dry weather flow) of more than 2,000 m^3 per day and its boundary is less than 150 m from an existing residential area.

c) Stringent requirement for odour, water, noise impacts, etc. resulting from the upgrading works will need to be met according to Technical Memorandum of EIAO; and

d) Construction works at the current site of STKSPS will likely arouse public objection since the site is located near Sha Tau Kok Chuen.

2.5.30 The environmental benefits and dis-benefits of the two options are summarized in the following table.

Table 2.6 Environmental Benefits and Dis-benefits for the STKSPS Options

Options	Environmental Benefits	Environmental Dis-benefits
Demolish the existing STKSPS	• Limit the footprint for the construction works to the existing STKSTW site. This is far from residential area and comparatively less environmental impacts will be created. • Odour, noise and visual impacts to surrounding sensitive receivers can be removed.	• Minor dust and noise issues are anticipated during the short demolishing period.
Upgrade the existing STKSPS	-	• Construction works at the current site of STKSPS will arouse public objection since the site is located near Sha Tau Kok Chuen due to higher significance of impacts on air quality, noise, landscape and visual condition.

2.5.31 In addition to the environmental dis-benefits, the STKSPS upgrading works will increase the cost of construction and delay the programme for the Project.

2.5.32 It is considered that demolishing of the existing STKSPS and replacing it by gravity sewer is the preferred option.

Consideration of New Sewer Alignment

2.5.33 There are 2 options for the construction of the new sewer.

a) The first option is to lay the new sewer along the existing rising main on the Sha Tau Kok Road – Shek Chung Au section.

b) The second option is to lay the new sewer along Shun Hing Street and passing the outside of the southern boundary of the Sha Tau Kok Recreation Ground to the STKSTW.

2.5.34 Two options for the alignment of the gravity system are shown in **Figure 2.16**.

2.5.35 The environmental benefits and dis-benefits of the sewer alignment options are summarized in the following table.

Table 2.7 Environmental Benefits and Dis-benefits for the Alternative Sewer Alignments

Options	Environmental Benefits	Environmental Dis-benefits
Sha Tau Kok Road	• Excavation occurs once during construction of the proposed sewer system and decommission of the existing rising main.	• Numbers of sensitive receivers immediately affected (Sha Tau Kok Chuen, Sha Tau Kok Recreation Ground and residential buildings along Sha Tau Kok Road) during construction and maintenance.
Shun Hing Street	• Fewer sensitive receivers are immediately affected (Sha Tau Kok Chuen and Sha Tau Kok Recreation Ground) during construction and maintenance in comparison to the other option.	-

2.5.36 Shun Hing Street Option is the preferred option since it will affect fewer environmental sensitive receivers.

2.5.37 Significant traffic impact and interface issue is anticipated if the sewer is to be constructed along Sha Tau Kok Road – Shek Chung Au as it is the only access for Sha Tau Kok Chuen and most of the utilities are laid under Sha Tau Kok Road – Shek Chung Au.

Consideration of Outfall Alignment

Maintain the Existing Discharge Location

2.5.38 The preliminary outfall design was to discharge the effluent near the discharge location of the existing outfall. A preliminary near-field water quality modelling by CORMIX was conducted.

2.5.39 The preliminary result revealed that compliance of the Water Quality Objectives of Mirs Bay Water Control Zone (WQO) at the sensitive receiver (e.g. Sha Tau Kok Fish Culture Zone) may be difficult in view of the weak hydrodynamic and shallow water condition of Starling Inlet at the proposed diffuser location.

2.5.40 The following design reviews were subsequently carried in order to meet the WQO at sensitive receivers. However, there wasn't a design that could completely meet the WQO.

- Revise the diffuser design such as discharge orientation, increase the number of discharge ports, adjust the discharge velocity, etc.
- Review the effluent discharge qualities

2.5.41 The mariculturists' strong objection to the proposed outfall alignment could be a major risk to the project since public consultation is of paramount importance to the successful implementation of the Project.

2.5.42 In addition to the mariculturists ' strong objection, there is a lack of strong evidence that the WQO could be met with certainty. Maintaining the existing discharge location is considered not feasible. An alternative outfall alignment and design is proposed.

Proposed Outfall Alignment

2.5.43 The proposed outfall alignment from Starling Inlet to the water near Ah Kung Au is shown in **Figure 2.15**.

2.5.44 The considerations taken for the proposed new outfall alignment include the following:

a) Minimize environmental impacts

b) Gain public acceptance

c) Optimize the length of the outfall

2.5.45 With reference to the latest Nautical Chart of 2012 at Starling Inlet, the water depth near Ah Kung Au is about 5m (during low tide) which is more favourable for effluent mixing and enhance the near-field modelling result. Apart from the water depth, the current velocity is generally stronger than that of the original proposed outfall location which will also favour mixing and dilution of effluent. The Ah Kung Au discharge location will minimize environmental impact and meet the WQO.

2.5.46 A near-field modelling with CORMIX was carried out. The overall trend is that the initial dilution is better performed offshore than inshore, which allows the possibility of meeting the WQO. In order to obtain more accurate modelling results, the proposed effluent quality has been fine-tuned (as illustrated in **Table 2.**) for further modelling. The proposed effluent quality will not affect the footprint of STKSTW and have minimal impact to the process design.

2.5.47 The Horizontal Direction Drilling (HDD) method will be implemented to construct the submarine outfall beneath the Starling Inlet (Approximate 90m below the seabed level). A cofferdam at the receiving pit of the outfall will be constructed and the receiving pit will be dried. Then, the marine deposit will be removed from the cofferdam and pre-reaming will be carried out in order to install the pipeline and diffuser. The receiving pit will then be backfilled to the original seabed level and the cofferdam will be removed. In accordance with the construction sequence described, the HDD method will not disturb the surrounding sediments. A simple cross section illustrates the HDD method is shown in **Figure 2.17**.

2.5.48 Since the mariculturists prefer the proposed discharge point to be away from the Fish Culture Zone (FCZ), the proposed outfall alignment discharging at Ah Kung Au has addressed the local's concern.

2.5.49 The proposed outfall alignment was estimated to be about 2.0km long. Based on the near-field model results, the proposed outfall alignment was optimized to about 1.7km long. Further reduction is not recommended due to the decreasing water depth and the decreasing distances to the nearby sensitive receivers.

Table 2.8 Environmental Benefits and Dis-benefits for Alternative Outfall Alignment

Options	Environmental Benefits	Environmental Dis-benefits
Maintain Existing Discharge Location	• Outfall alignment is short • Less mud will be dredged from the sea-bed.	• Located near the Sha Tau Kok Fish Culture Zone which could create fisheries impact and concern to mariculturists • May not be able to achieve the Water Quality Objectives of Mirs Bay Water Control Zone
Discharge at Ah Kung Au	• Improve water quality at Starling Inlet. • Can achieve the Water Quality Objectives of Mirs Bay Water Control Zone • Located further away from Sha Tau Kok Fish Culture Zone	• Outfall Alignment is long • More soil will be dredged or excavated from the sea-bed. • Reaming of rock underneath the sea-bed will be required.

Temporary Sewage Treatment Plant

2.5.50 Effluent from the TSTP will be discharged through the existing outfall. According to the preliminary construction programme, the new outfall and the TSTP will be completed by Year 2020 and Year 2018 respectively. Calculations show that the existing outfall will be able to cope with the maximum projected flow from the TSTP, during construction of the permanent STKSTW.

Consideration of Abandonment of the Existing Outfall

2.5.51 Following the operation of the expanded STKSTW, the existing outfall will cease operation. The existing outfall will be abandoned by grouting or foam concreting. Prior to the grouting / foam concreting of the existing outfall, the outlet of the outfall would be isolated from the sea level (such as temporarily extent the outfall above sea level) and pump out the sea water inside the pipe. The grouting / foam concreting would be performed by tremie pipe in order to avoid leakage of concrete to the sea. The temporary works on the outlet of the outfall would not be demolished until the concrete inside the outfall settled.

2.5.52 The arrangement will avoid the needs of dredging and backfilling such that the seabed and aquatic ecosystem will not be disturbed. The increase in turbidity of the surrounding water body is minimised for the abandonment operation.

2.5.53 The environmental impact of this arrangement is insignificant in comparison with the demolition and removal option.

Consideration of Phased Installation for Expanded STKSTW

2.5.54 Based on the Sha Tau Kok Sewage Treatment Works Expansion – Feasibility Study, the forecasted sewage treatment capacity of STKSTW shall be increased to cope with the increased sewage flow due to population growth and expansion of sewage catchment of STKSTW by different sewerage projects.

2.5.55 As mentioned in paragraph 2.5.6, the civil and structural works will be built to Phase 2 capacity (10,000 m^3/day at ADWF) by 2021.

2.5.56 The following options on phased installation have been considered:

Installation of sewage treatment facilities in one single phase

2.5.57 The sewage treatment facilities will be installed in one single stage with a treatment capacity of 10,000 m^3/day at ADWF by 2021. Some of the sewage treatment facilities will be left idle since there is not enough sewage flow at early stage. The operation & maintenance cost will increase since extra maintenance will need to be taken for the units installed.

Phased installation of sewage treatment facilities

2.5.58 The sewage treatment facilities will be installed in phases. According to the latest flow-buildup, sewage flow would not reach 10,000m^3/day until 2030. As such, it is proposed to install the sewage treatment facilities in phases. When phase 1 expansion completes, sewage treatment facilities with a treatment capacity of 5,000m^3/day will be installed first to cope with the increased sewage flow. Continuous monitoring of the sewage flow will be carried out in order to plan for the increase in treatment capacity for phase 2 expansion.

Table 2.9 Environmental Benefits and Dis-benefits for Phased Installation

Options	Environmental Benefits	Environmental Dis-benefits
Installation of Sewage Treatment Facilities in One Single Phase	• Completing all works in one single phase would minimize nuisance to the public.	• Idle equipment will still require energy to maintain which increase energy consumption
Phased Installation of Sewage Treatment Facilities	• Reduce the amount of idle equipment which increase energy efficiency • Reduce use of chemicals required for the maintenance of the idle equipment	• May have nuisance to the public during installation of facilities in Phase 2.

Consideration of Minimizing Emergency Discharge

2.5.59 In the event of emergency, such as power outage, it is essential to provide measures to prevent flooding of the sewage treatment works and direct discharge of sewage into nearby watercourse.

2.5.60 One option to avoid emergency discharge is to export the sewage to the nearest STW. However, as the sewerage system to STKSTW is by gravity, a pumping station would be required to divert the sewerage to nearest STW which is Shek Wu Hui STW. As Shek Wu Hui STW is about 11km away from STKSTW, it required a long sewer pipe and numbers of pumping station which may induce other environmental impact during construction. Hence, this option is not preferable,

2.5.61 In order to minimize the risk of emergency discharge of untreated or partially-treated sewage into the marine water of Starling Inlet, a number of precautionary measures have been taken into account in the design of the expanded STKSTW. These measures include:

- Provision of dual power supply;
- Provision of standby equipment for all treatment units; and
- Provision of onsite storage of raw sewage up to 6 hours.

Dual power supply to eliminate the risk of power failure

2.5.62 The electrical system of the STKSTW is proposed to receive two incoming supplies. Such dual supply configuration is to achieve a reliable power supply for continuous operation of the pumps and auxiliary equipment. Also, the arrangement for the two power sources to be fed by two different ring circuits is desirable.

Provision of standby equipment for all treatment units

2.5.63 Standby sewage treatment units will be provided in case of individual equipment breakdown. Extra on-line sewage treatment units will be provided as standby or on-shelf standby.

Provision of onsite storage of raw sewage

2.5.64 A total storage capacity of 6-hour ADWF (2500 m^3) will be provided in case of failure of the sewage treatment works or power failure as it is expected that the plant operation could normally be resumed within 6 hours based on detailed assessment on the emergency response procedure of STKSTW and TSTP. The proposed emergency response plan is shown in **Annex 2A**. The emergency storage in STW will hold the untreated sewage. In case overflow of the emergency storage occurs at the

STW, a safety outlet will function to divert excess incoming flows directly into Starling Inlet to protect the STW from flooding. The location of safety outlet of STKSTW is shown in **Figure 2.4b**. For TSTP, the safety outlet will be the existing outfall of STKSTW. The detailed design will investigate and incorporate all practicable precautionary measures to minimize the likelihood of such an event.

Table 2.10 Environmental Benefits and Dis-benefits for Emergency Measures to Prevent Emergency Discharge

Options	Environmental Benefits	Environmental Dis-benefits
Dual Power Supply	• Minimize the risk of power outage hence a more reliable STW	-
Provision of Standby Equipment	• Minimize the risk of individual equipment failure affecting the sewage treatment process	• Standby equipment will require extra energy for maintenance. • Extra material, such as lubricant, will be needed for maintenance of the standby equipment
Provision of onsite storage of raw sewage	• Reduce risk of sewage overflow and flooding of the sewage treatment works	• Largest footprint, due to construction of additional tanks for onsite storage. This will create additional environmental impacts and public nuisance. • Surplus C&D material.

2.5.65 As a result, precautionary measures such as routine/ regular checking of equipment, provision of dual power supply and backup generator, provision of standby equipment for sewage treatment, 24-hour monitoring on the operation of STKSTW, installing remote control and monitoring system (SCADA) to allow off-site monitoring and provision of 6-hour emergency storage will be provided. According to the emergency response plan in **Annex 2A**, the plant operation could normally be resumed within 6 hours. Hence, with the implementation of above preventive measures, the possibility of sewage overflow from STKSTW will be extremely low. Although emergency discharge has never been happened in STKSTW since it is commissioned in 1989, safety outlet will still be provided to the storage tanks to prevent flooding of the STKSTW in case emergency discharge is required.

2.6 Consideration of Alternative Construction Methods and Sequence of Works

2.6.1 Alternative construction methods and sequence of works have been considered for the construction of the expanded STKSTW and the new outfall.

Construction of the Expanded STKSTW

2.6.2 The new structures for expanded STKSTW will be constructed mostly with reinforced concrete for the benefits of durability and ease of maintenance.

2.6.3 Reinforced concrete construction is required for the water-retaining treatment tanks within the expanded STKSTW.

2.6.4 Steel construction typically takes less time. This alternative construction method cannot be widely adopted because of the water retaining requirement within the new structure within the expanded STKSTW. To facilitate the construction programme and minimize the environmental impacts during construction, steel construction will be adopted locally in the above-ground portion of the new structures where considered feasible and practical. Constructing the expanded STKSTW completely above-ground is feasible. As this will reduce the excavation volume, the construction duration will be shortened. However, the elevated structure will not only require more pumping which consumes more energy from lifting the water to higher

elevation but also cause adverse visual impact. Therefore, a completely above-ground design is not adopted.

2.6.5 The expanded STKSTW will be designed to a multi-level structure to minimise the footprint and fit within the existing site. The water retaining treatment tanks will be constructed below ground to minimize pumping and energy consumption. As a whole, a low-rise design will be adopted to minimize the visual impact.

2.6.6 The environmental benefits and dis-benefits of the alternative STKSTW construction methods are summarized in the table below.

Table 2.11 Environmental Benefits and Dis-benefits for Alternative STKSTW Construction Methods

Options	Environmental Benefits	Environmental Dis-benefits
Reinforced Concrete Construction	• Considered most favorable for durability and ease of maintenance	• Longer construction period
Steel Construction	• Shorter construction period	• Not feasible or practical for the water retaining treatment tanks
Above-ground Construction	• Shorter construction period	• Require more pumping and higher energy consumption • More obtrusive visually and aesthetically
Combination of Above –ground and below-ground Construction	• Minimize pumping and energy consumption • Less visible • Public acceptance	• Longer construction period

2.6.7 The alternative sequence of works are previously considered and discussed under the alternative expansion schemes.

Construction of the New Outfall

2.6.8 Trenchless construction techniques are proposed for the construction of the submarine outfall beneath the Starling Inlet. It is identified that trenchless technique by Tunnel Boring Machine (TBM), by Horizontal Direction Drilling (HDD) and dredging are feasible in the construction of the submarine outfall. But as discussed below, the trenchless technique by HDD is more suitable for the construction of submarine outfall.

2.6.9 TBM method for the construction of the submarine outfall is considered technically feasible in Sha Tau Kok. The major concern for TBM method is that the heavy TBM equipment which will generate transport logistics problem within the existing STKSTW footprint. Furthermore, TBM method requires large working area in order to house the slurry tank and electricity generator which is infeasible due to limited site area.

2.6.10 Dredging method requires the excavation of the soil at the sea-bed of the Starling Inlet. After dredging, the submarine outfall will be laid on the rock and backfilled by soil. This method will create disturbance to aquatic ecosystem since the bottom sediments will be disturbed and release toxic chemicals which will contaminate the aquatic organism. The increase in turbidity during dredging will also create ecological impact to the marine life

2.6.11 Horizontal Directional Drilling (HDD) involves drilling a pilot hole, typically 100 to 150mm in diameter, and then progressively enlarging the hole, using reaming tools in increments of 200 to 300 mm, until the required diameter is achieved (1.3 to 1.5 times the outer diameter of the pipe). Drilling fluid (bentonite and/or polymer) is used to remove the cuttings from the bore and in soft ground to stabilize the hole

during construction. Reaming is either done in the reverse direction to the pilot boring or in the same direction (forward reaming). Once the reamed hole has been fully formed, the pipeline is pulled and/or pushed into the reamed hole. The suitability of HDD for this project is largely dependent on the geotechnical conditions and the identification of suitable sites for launching and reception of the drill and the pipe.

2.6.12 Table 2.12 provides the environmental benefits and dis-benefits of the three options of construction methods for the submarine outfall.

Table 2.12 Environmental Benefits and Dis-benefits for Alternative Outfall Construction Methods

Options	Environmental Benefits	Environmental Dis-benefits
Trenchless Technique by TBM	• No significant impact to marine ecology, landscape and visual quality in comparison to the dredging method. Approximately 7,500m^3 sediment will be removed	• There is no sufficient space for slurry tank and power generator within the STKSTW. A temporary worksite is required which creates a larger footprint is needed and hence more environmental impact is anticipated.
Trenchless Technique by HDD	• No significant impact to marine ecology, landscape and visual quality in comparison to the dredging method. Approximately 3,040m^3 sediment will be removed.	• Require treatment prior to discharge of the drilling fluid.
Dredging	• Construction period and impact duration may be shorter than the trenchless methods.	• Causes water quality issues with a larger extent of impact area. The sediments of the seabed will be disturbed, toxic substances from the sediments will be released, and turbidity will increase. Approximately 40,000m^3 sediment will be removed by dredging method. • Disturbance of the marine ecology, landscape and visual quality. • Potential impact to Sha Tau Kok Fish Culture Zone.

Sequence of Works

2.6.13 As the proposed gravity sewer overlap with Shun Hing Road, it shall be constructed in segments (approximately 20m – 30m per workfront) with limited number of concurrent workfronts to minimize disturbance to the local public and road users. In view of the potential noise impact, a total of not more than two workfronts working simultaneously would remarkably reduce the construction noise to the surrounding but at the same time be able to deliver the Project as per programme.

2.6.14 A comparison on sequence of works is presented in **Table 2.13.**

Table 2.13 Environmental Benefits and Dis-benefits for Alternative Works Sequence

Options	Environmental Benefits	Environmental Dis-benefits
Single Workfront	• Surface works limited to the single workfront, and hence minimize the disturbance to the local public and road users. • Less PMEs is required	• Nearby Sensitive receivers will be subjected to longer period of environmental disturbance. • Longer overall project construction period with longer duration of environmental impacts.
Multiple workfronts	• Reduce the overall duration of construction works and thus reduce the duration of potential environmental impacts to nearby sensitive receivers.	• More PME will be involved and this would cause relatively heavier noise and dust impacts.

2.6.15 Temporary Sewage Treatment Plant will be constructed by erection of temporary steel structure. The foundation of the expanded STKSTW will first be constructed and followed by erection of falsework and formwork for superstructure and concreting. No viable alternative is considered.

2.7 Selection of Preferred Scenario

2.7.1 After assessing the expansion schemes in respect of their cost, programme, land requirement, public acceptance and environmental consideration, Option 2A is recommended for the expansion scheme of STKSTW. An expanded STKSTW will be built within the existing site of STKSTW and a TSTP will be built to cope with the sewage flow during the construction of the expanded STKSTW.

2.7.2 It is unavoidable to construct TSTP to temporary treat the sewage flow during the construction of the expanded STKSTW. It would be decommissioned after the expanded STKSTW operated. The materials of the TSTP could be reused if there are projects necessary.

2.7.3 The treatment process selected for the expanded STKSTW will be the MBR Process as it can provide the best effluent quality within a small footprint. Smaller footprint can also limit the extent for creating environmental impacts.

2.7.4 The STKSPS will be demolished instead of upgrading it. The sewage in the Sha Tau Kok Town will be collected and conveyed to STKSTW by gravity. Extra upgrading works for the STKSPS will further increase the cost of construction and delay the programme for the Project. Therefore it is considered that demolishing of the existing STKSPS and replacing it by gravity sewer will be a more favourable option in terms of cost and programme. The gravity sewer will be constructed along Shun Hing Street to connect the existing sewerage network and convey to the expanded STKSTW.

2.7.5 The new outfall will extend from Starling Inlet to Ah Kung Au to move the discharge point away from the sensitive receivers as far as practicable and to ensure the effluent can comply with the WQO.

2.7.6 The existing outfall will be abandoned in place by grouting or foam concreting to minimize impacts to the surrounding waters.

2.7.7 The expanded STKSTW will be a multi-level building which consists of a partially below-grade reinforced concrete structure to facilitate maintenance, minimize energy consumption and visual impacts.

2.7.8 For the submarine outfall, the trenchless technique of HDD is recommended because it creates the least environmental impact to the marine ecosystem. In consideration to the length of the submarine outfall and the placement of the whole section of the pipe under the sea, Horizontal Directional Drilling (HDD) is the most suitable trenchless method. The other trenchless methods are greatly constrained by the length and site condition.

2.7.9 The civil works for the construction will be carried in single phase and phased installation will be carried out for E&M works and sewage treatment facilities.

2.7.10 To minimize the emergency discharge of raw sewage, precautionary measures such as routine/ regular checking of equipment, provision of dual power supply, provision of standby equipment for sewage treatment, 24-hour monitoring on the operation of STKSTW, installing remote control and monitoring system (SCADA) to allow off-site monitoring and provision of an on-site 6 hours ADWF storage. With the implementation of above preventive measures, the possibility of sewage overflow from STKSTW will be extreme low. However, safety outlets will be provided to prevent flooding of the STKSTW.

2.7.11 The gravity sewer along Shun Hing Road will be constructed in segments (approximately 20m to 30m per workfront) with limited number of concurrent workfront to minimize disturbance to the local public and road users. The expansion of the Sha Tau Kok Sewage Treatment Works will be limited in the extent of the existing STKSTW.

2.8 Programme

2.8.1 The proposed site for the modification/upgrading of sewage treatment works (STW) and expansion of STW falls within an area zoned "Government, Institution or Community" ("G/IC") on the approved Sha Tau Kok Outline Zoning Plan (OZP) No. S/NE-STK/2. According to the Notes of the OZP, 'sewage treatment plant' is a Column 2 use and requires planning permission from the Town Planning Board (TPB). As regards the existing STW, according to the covering Notes, no action is required to make use of any land or building which was in existence immediately before the first publication in the draft development permission area plan. However, any material change of such use or any other development (except minor alteration and/or modification to the development of the land or building in respect of such use which is always permitted) must always be permitted in terms of the Plan or in accordance with a permission granted by the TPB. As the expansion works will include construction of new temporary sewage treatment plant to handle the interim flow as well as the demolition of the existing sewage treatment plant and construction of a new one to increase the treatment capacity from 1,660m^3/day to 10,000m^3/day. In this connection, the proposed sewage treatment works require planning permission from the TPB.

2.8.2 The tentative implementation schedule for the Project is presented below:

Table 2.14 Key Dates of Implementation Programme

Item	Date
Approval of Application for Permission under Section 16 of the Town Planning Ordinance	Nov 2016
Tender Gazette	Jan 2017
Commencement of Construction	May 2017
Completion of Construction	Dec 2022

2.9 Public Consultations

2.9.1 Public consultation started as early as in 2012 and consists of various meeting, discussion and site visit. Consultations had been conducted with Sha Tau Kok Rural Committee and mariculturists regarding the proposed works under this Project. Three consultation meetings had been arranged in 2014. Referring to Section 2.5.48 above, the outfall location leading to potential deterioration of water quality affecting the nearby fish culture zone is the major concern. 5 consultation meetings were carried out in 2015 to gather the views from STKRC and mariculturists on the proposed alignment of the submarine outfall. The public also concerns about the visual impact of the STKSTW and TSTP, particular on their height with "fung shui" issue to their villages. In the design of STKSTW, two basements were proposed in order to minimize the height of plant aboveground such that the visual impact is mitigated. STKRC and North District Council finally endorsed the design. The summary of the consultation meeting is summarized in **Table 2.16**.

Table 2.16 Summary of the consultant/meeting events

Date	Consultations / Meeting Events
28 Nov 2012	Consultation with Sha Tau Kok District Rural Committee (STKRC)
28 Nov 2012	Consultation with Sha Tau Kok District councilors
20 Dec 2012	Meeting with STKRC
2 Feb 2013	Visiting Sai Kung Sewage Treatment Works with STKRC
24 Apr 2014	Meeting with STKRC
7 Aug 2014	Consultation with STKRC and fishers Representative
23 Jun 2015	Consultation with Sha Tau Kok District councilors
15 Jul 2015	Consultation with STKRC and fishers Representative
20 Jul 2015	North District Council – The 22nd Meeting of the District Minor Works & Environmental Improvement Committee
19 Aug 2015	Meeting with STKRC & Sha Tau Kok District councilors
24 Aug 2015	Consultation with Sha Tau Kok Tam Shui Hang villagers
24 Aug 2015	Consultation with Sha Tau Kok Town residents and fishers
14 Sep 2015	North District Council – The 23rd Meeting of the District Minor Works & Environmental Improvement Committee

2.10 Project Interfaces and Concurrent Projects

2.10.1 Prompt resolution of project interfaces will be critical to the successful implementation of this Project. Immediate liaison meeting with the interface parties will proactively commence at early stage. Possible solutions will be investigated to resolve the potential conflicts. The relevant drawings are shown in **Figure 2.21 – 2.23**. The potential project interfaces identified so far are summarized in **Table 2.17.**

Table 2.17 Summary of Project Interfaces of STKSTW

Item	Details	
1	**Project Title**	**Sediment Removal at Sha Tau Kok Fish Culture Zone, Boat Shelter and Approach Channel**
	Works Department	Civil Engineering Office, CEDD
	Description of Works	To remove the sediments at the Sha Tau Kok Fish Culture Zone, as well as to carry out maintenance dredging at Sha Tau Kok Boat Shelter and Approach Channel.
	Programme	Commencement Date: 2017 tentatively Completion Date: 2018
2	**Project Title**	**Drainage Improvement Works at North District, including various drainage improvement measures in Sha Tau Kok.**
	Works Department	Drainage Projects Division, DSD
	Description of Works	To carry out drainage improvement works in Sha Tau Kok Town area, including various drainage improvement measures.
	Programme	Commencement Date: 2018 Completion Date: 2022
3	**Project Title**	**Public Rental Housing Estate at Sha Tau Kok**
	Works Department	Hong Kong Housing Society
	Description of Works	To construct public housing blocks which can accommodate a maximum population of 800 people.
	Programme	Commencement Date: December 2014 Completion Date: End 2016

Drainage Improvement Works at North District, including various drainage improvement measures in Sha Tau Kok

2.10.2 According to the drawings provided by Drainage Projects Division of DSD, an approximate 1m diameter covered drainage pipe is proposed to be constructed along the access road to STKSTW. A twin 1350 mm diameter drainage pipes is proposed to be constructed along Sha Tau Kok Road – Shek Chung Au. There will be minor interface between the drainage pipes by Drainage Projects Division and the proposed gravity sewer. Liaison will be done with Drainage Projects Division to determine the alignment of the proposed gravity sewer

Public Rental Housing Estate at Sha Tau Kok

2.10.3 According to Hong Kong Housing Society, the construction of the project will be completed by end of 2016 with immediate population. It is assumed that during the commencement of the construction for the expansion of STKSTW, the main construction works for the public rental housing estate development, such as piling and excavation works will be completed and there will be no potential project interface.

Sediment Removal at Sha Tau Kok Fish Culture Zone, Boat Shelter and Approach Channel

2.10.4 The proponent (CEDD) of "Sediment Removal at Shat Tau Kok Fish Culture Zone" has been consulted to obtain the latest programme. The CEDD's sediment removal project would be conducted from the first half of 2017 to the first half of 2018 to remove sediment from the STKFCZ, STK boat shelter and approach channel, as well as the dredging area between the island and the shore. The programme overlaps with the marine construction of cofferdam at the location of outfall diffuser for this Project which would be conducted in 2017 for 3 months. There will be a minor

interface issue between construction of cofferdam and dredging for sediment removal along the approach channel. No adverse cumulative environmental impact was anticipated and details were presented in the following chapters. DSD will liaise with CEDD to avoid concurrent works being undertaken in the vicinity of the proposed diffuser.