B. In-situ Treatment without Backfilling

5.6.1.6 A 40-meter square test area with no backfilling within the KTAC would be selected for the trial. Injection of the selected oxidants will be applied through a fluid injection system to delivery the oxidants into the sediments from a barge-based operation. A number of injection points will be used to cover the test cell.

Field Trials for *Ex-situ* Treatment

5.6.1.7 Field trials of the *ex-situ* approach would involve suction dredging a small quantity of sediment and injecting the selected reagent into the dredge discharge line, with samples collected from the discharge line before and after reagent addition. Parameters of analysis will include organics, sulphides, and heavy metals. A truck-mounted sediment washing unit consisting of sediment processor, liquid/solids separation equipment, screens, water treatment equipment, equipment for biotreatment of the washed sediment and other accessories will be used in the site trials for *ex-situ* treatment. The suitability of reusing the treated material as fill material would be determined in the field trials.

5.7 Recommendations on the Reclamation Options

5.7.1 *Kai Tak Approach Channel (KTAC)*

5.7.1.1 The sediment contaminant levels in the KTAC were found to be exceptionally high and were enriched with heavy metals, organic pollutants and sulphide. The average depth of the contaminated sediments is about 2.9m below the seabed. A total volume of contaminated sediments is approximately $86x10^4$ m^3. The high methane potential in the KTAC sediments supports that sediment treatment would be required to minimize the methane hazards to the future developments at KTAC. The KTAC sediments could be treated by *in-situ* or *ex-situ* treatment. It is likely that either no dredged reclamation option with provision of *in-situ* treatment or dredge for *ex-situ* treatment reclamation option together with *ex-situ* treatment would be adopted for the KTAC reclamation. If temporary sea wall is to be constructed near the boundary between the KTAC and KTTS, it may involve dredging of sediments in the sea wall location. Minimum dredged reclamation would then be adopted. The undredged sediments would require *in-situ* treatment to reduce the methane potential and the dredged sediments would be treated. The treated material should be reused as fill material for reclamation as far as possible.

5.7.1.2 **Figure 5I** is a flowchart to show the approach to deal with the contaminated sediments in areas other than the locations where the major marine structures are to be constructed. Use of *in-situ* treatment avoids the need for sediment dredging and is preferable to remediate the KTAC sediments. However, the high contaminant levels and depth of the contaminant sediments in the channel may limit the treatment efficiency of *in-situ* treatment, if conducted from the water surface. For that reason, the preferred approach is to first carry out reclamation on the Kai Tak Approach Channel to above sea level, prior to the injection of oxidant on a grid basis through the reclamation fill into the sediment to achieve *in-situ* oxidation. Use of *ex-situ* treatment would not be restricted by these factors but removal or dredging of the contaminated sediments would be required. The preferred treatment method of *in-situ* oxidation and dredging for *ex-situ* treatment should be demonstrated through pilot tests.

5.7.1.3 It has been recommended that the pilot tests for *in-situ* treatment of the KTAC sediments should include Fenton's Reagent, ORC and Seditreat^{TM}. Each of these oxidants will be tested on a bench-scale basis for final oxidant selection; however, based on past experience it is anticipated that Fenton's Reagent would be used on a pilot-scale basis. Fenton's Reagent has successfully been applied in a number of projects to achieve high organic contaminant reduction rates (~ 99%). It is likely that Fenton's Reagent would be appropriate to treat the

KTAC sediments to acceptable levels, and to achieve geochemical fixation of metal ions in the sediments.

5.7.1.4 A reduction rate of about 92% of organic matter would reduce the TOC level in the KTAC sediments from 4.4 to 0.35% (dry weight). The estimated methane potential flux based on TOC with a half-life cycle of 2 years would be lower than the maximum safe rate of gas emission immediately after treatment. This gives a theoretical estimation on the reduced TOC level. The organic material with molecules containing more than 30 carbon atoms may not be easily degraded. Based on the 75% biodegradable carbon of the sediments from the SI results, the TOC level in the KTAC sediment would be reduced to 1.1% (dry weight). The estimated methane flux based on TOC with a half-life of 5 years would be lower than the maximum safe rate of gas emission immediately after treatment. However, the more conservative estimate based on a half-life of 2 years was above the maximum safe rate of gas emission for the first 3 years. It should be borne in mind that this assessment is based on conservative assumptions. The achievable reduction rate still has to be determined through the pilot tests.

5.7.1.5 The pilot tests for *ex-situ* treatment including bench scale laboratory tests and field trials will evaluate the effectiveness of in-pipe oxidation of organics by reaction with Fenton's Reagent or other oxidants, sediment washing, biotreatment of washed sediments. It has been recommended to include BioGenesis^{TM} Sediment Washing and Daramend^{TM} Bioremediation in the pilot tests. The latter method provides a backup to deal with the soil pile generated from sediment washing process with high levels of contaminants. The properties of sludge and treated material would be examined in order to reuse these products as fill material in the KTAC reclamation. With reference to the TOC removal rate (96.9%) of the BioGenesis^{TM} Sediment Washing process shown in **Table 5.32**, the resulting TOC concentration in the KTAC sediments after treatment would be reduced to 0.14% (dry weight). Based on the resulting TOC concentration, the estimated methane potential for a half-life cycle of 2 years (3.68 $L/m^2/d$) is well below the maximum safe rate of gas emission (10 $L/m^2/d$). This indicates that application of *ex-situ* treatment could eliminate the methane hazards to the KTAC development. The geochemical fixation onto the ferric hydroxide and the sediment washing process could also minimise the pollution of the heavy metals and organic pollutants. An initial estimate is that the time required for the pilot tests for *in-situ* and *ex-situ* treatment would take approximately 2 months subject to the monitoring results.

5.7.1.6 The bench scale testing will evaluate various potential oxidants and biological approaches, including Fenton's Reagent, ORC, Seditreat^{TM}, Biogenesis Sediment Washing and Daramend for their ability to oxidize the organics and sulphides in the contaminated sediments. Field trials of *in-situ* remediation and *ex-situ* treatment have been detailed in the preceding section.

5.7.1.7 Through the bench scale laboratory tests and field trials, use of either *in-situ* and *ex-situ* treatment method can be evaluated. In the event that *in-situ* treatment is demonstrated to be feasible, the no dredged reclamation should be adopted for the KTAC reclamation. Adoption of the no dredged reclamation would not require sediment disposal. It is only if such *in-situ* techniques prove to be not successful, that the minimum dredged reclamation (ie only the contaminated layer to be dredged, by suction dredging) with the use of *ex-situ* treatment to remediate the KTAC sediments would be adopted as an alternative approach. The treated material after *ex-situ* treatment should be reused as fill material as far as possible unless they are environmental unacceptable or geotechnically not feasible to be reused for the reclamation. Mixing of the treated materials with suitable material (e.g. the imported public fill) should be considered, if necessary, in order to enhance their geotechnical acceptability to be reused as fill material for the reclamation. The suitability for reuse as fill material will require confirmation from the pilot test results.

5.7.1.8 Should the pilot tests indicates that both the *in-situ* treatment and *ex-situ* treatment fail to reduce the methane potential of the KTAC sediments to an acceptable level, use of protection measures to collect and vent off the methane gas in the locations with high methane potential would be adopted as a fall back option. Monitoring of methane gas emission rate in the KTAC would be carried out to identify the hotspots with high emission rate. In areas where exceedance of the maximum safe rate of gas emission is constantly detected, protection measures should be provided to safeguard the individual development in that particular area. **Figure 5I** includes also the fall back option as one of the possible solution to deal with the methane risks in the KTAC. Requirements for implementation of protection measures in the future developments could be included in the land lease document. Details of the mechanism to ensure the implementation of protection measures should be taken into account in the design stage of the development. The design of protection measures such as gas collection layer and vent pipes should be based on the final development plan so as to avoid any constraints that would pose to the development. Other protection measures include requirements such as adopting air tight sockets for electricity supply system, similar to that imposed for development near landfill site (*Reference: Development at Cha Kwo Ling Kaolin Mine Site*).

5.7.1.9 It should be reiterated that this protection approach serves only as a fall back option, only in case both the *in-situ* and *ex-situ* treatment methods fail in the pilot tests (which is highly unlikely), or should the post-treatment monitoring work reveal hotspots which still fail even after further *in-situ* treatment, a case likely to be at most only localised.

5.7.1.10 A conceptual outline of methodologies on both *in-situ* treatment and *ex-situ* treatment is given as follows:

<u>No Dredged Reclamation - *In-situ* Treatment</u>

5.7.1.11 Once the pilot tests confirm that *in-situ* treatment is able to reduce the methane potential in the KTAC sediments to an acceptable level. Injection of the selected reagent could be carried out from a barge-based operation in the KTAC, but probably can best be accomplished by first backfilling the channel and then conducting the *in-situ* treatment. The advantages of this innovative approach are that;

- Odour emission would be minimal if any at all for the land-based *in-situ* treatment;
- Release of oxidants into the water column during the injection process can be avoided and the operation is not likely not to cause any water quality impacts; and
- The land-based operation is more suitable for the application of *in-situ* treatment.

5.7.1.12 As a number of conservative assumptions were adopted in the biogas risk assessment, the assessment results provided indicative information on the likely risk to the future developments. The actual methane emission rate could only be determined through *in-situ* methane gas monitoring after reclamation. *In-situ* treatment should be applied only to the areas with high methane emission rate. In areas with low methane emission rate, *in-situ* treatment would not be required. In order to balance the safety of the future developments and the scale of sediment treatment, it is recommended to apply *in-situ* treatment to the potential hotspots with high methane potential immediately after the KTAC reclamation. Concurrently, methane gas monitoring should be carried out to cover the treated hotspots and the remaining reclaimed areas without treatment. One of the objectives of the monitoring is to ensure that the methane potential at the potential hotspots is reduced to acceptable levels after *in-situ* treatment. Besides, the monitoring is to identify whether high methane emission rate would occur in the remaining reclaimed areas with no treatment applied. If areas with high methane emission rate exist, *in-situ* treatment would then be applied to cover these areas.

5.7.1.13 Based on the SI results, sediment sampling points AC1, AC2, AC3, AC4 and AC5, which showed the highest methane potential, are considered as the potential hotspots. The sampling points covered the areas extending from the upstream location of the KTAC to the location near the Taxiway Bridge.

5.7.1.14 Taking the preferred approach to first carry out the reclamation, a direct-push fluid injection system would be used to delivery the reagent into the sediments on a grid of injection points in the hotspot areas. The matrix of injection points and dosage will be determined in the pilot tests for *in-situ* treatment. To provide a full coverage of the contaminated sediments, the injection should be delivered to a depth of 3m from the existing sediment surface. An increase in injection points or the injection pressure to achieve hydrofracturing in the KTAC can deal with the low permeability areas, which are composed of clays and silts. *In-situ* oxidation would be conducted on a moving basis after the channel sections are reclaimed.

5.7.1.15 The pressure injection system used for delivery of the reagent should be suitably controlled to avoid high pressure leading to uncontrolled reaction. Loss of the reagent during the injection process should be minimised. This minimises the release of reagent into the water column or ground surface during *in-situ* treatment.

5.7.1.16 During the full-scale treatment, the KTAC would be divided into a number of cells. The first and the last cells would be allocated in the upper and lower sections of the KTAC respectively. It is anticipated that the injection process of the *in-situ* treatment at the hotspots in the first cell would be completed within 3 months after the commencement of the full-scale treatment, after initial reclamation to a level above high tide, say +3mPD. It is not necessary to wait until the completion of treatment in the whole KTAC. This in turn shortens the whole reclamation period. An initial estimate is that *in-situ* oxidation in the KTAC would be accomplished in less than a year.

5.7.1.17 The methane potential of the KTAC sediments would be determined after *in-situ* treatment to ascertain the suitability of the KTAC development. As the sediments would remain in place and the methods to estimate methane potential are based on a range of assumptions, methane gas monitoring is required after reclamation and *in-situ* treatment to ensure that the actual methane emission rate is lower than the maximum safe rate of gas emission. It is very unlikely that protection measures would be required following the application of *in-situ* treatment. The recommended criteria for methane gas monitoring should be adopted. It is proposed to install a total of approximately 10 monitoring boreholes in the KTAC to monitor the emission of methane gas. The monitoring boreholes can be evenly distributed across the KTAC. **Drawing No. 22936/EN/145** shows the locations of the proposed monitoring boreholes in the KTAC. In case that the measured methane emission rate is higher than the maximum safe rate of gas emission, additional monitoring boreholes in between the adjacent boreholes may be required to give a better indication of the methane emission in the area of concern. Provision of protection measures would only be required if residual methane emission rate remains high after treatment.

<u>Dredge for *Ex-situ* Treatment Reclamation</u>

5.7.1.18 *Ex-situ* treatment would be an alternative option to remediate the KTAC sediments, should the pilot tests indicate that *in-situ* treatment is not suitable. The sediments in the KTAC would be suction dredged onto a barge. During the suction dredge operation, a strong oxidant, e.g. Fenton’s Reagent, would be fed into the dredge pipeline to oxidize the organic contaminants and much of the AVS. The odour problem that may generate during dredging would be minimized through the almost instantaneous in-pipe oxidation of AVS. When the slurry reaches the land-based treatment facility, an oxidized sediment slurry with ferric hydroxide material coating the larger sediment grains would be formed. Some of the heavy metals will be sorbed on the sediments.

5.7.1.19 A vibrating screen system is used to remove the oversized debris in the slurry and a land-based sediment washing unit would be installed to remove the inorganic and organic contaminants in the sediment slurry. Adding of reagents in the system accelerates the treatment process. The sediment in solid form would then be produced through the physical separation process. The clean fraction of sediments could be used as fill material after dewatering. It is likely that the methane potential in the dredged sediments would be lower to acceptable levels after the application of the sediment washing process. If not, the contaminated solids would go to the soil pile for biotreatment. The plant to accommodate the facilities for biotreatment of soil pile would be suitably enclosed to minimise any potential air, noise and odour emission. The reduction in sediment volume through the sediment washing process is estimated to be about 80% or higher. In other words, the total volume of the KTAC sediments would be reduced to approximately 17×10^4 m^3.

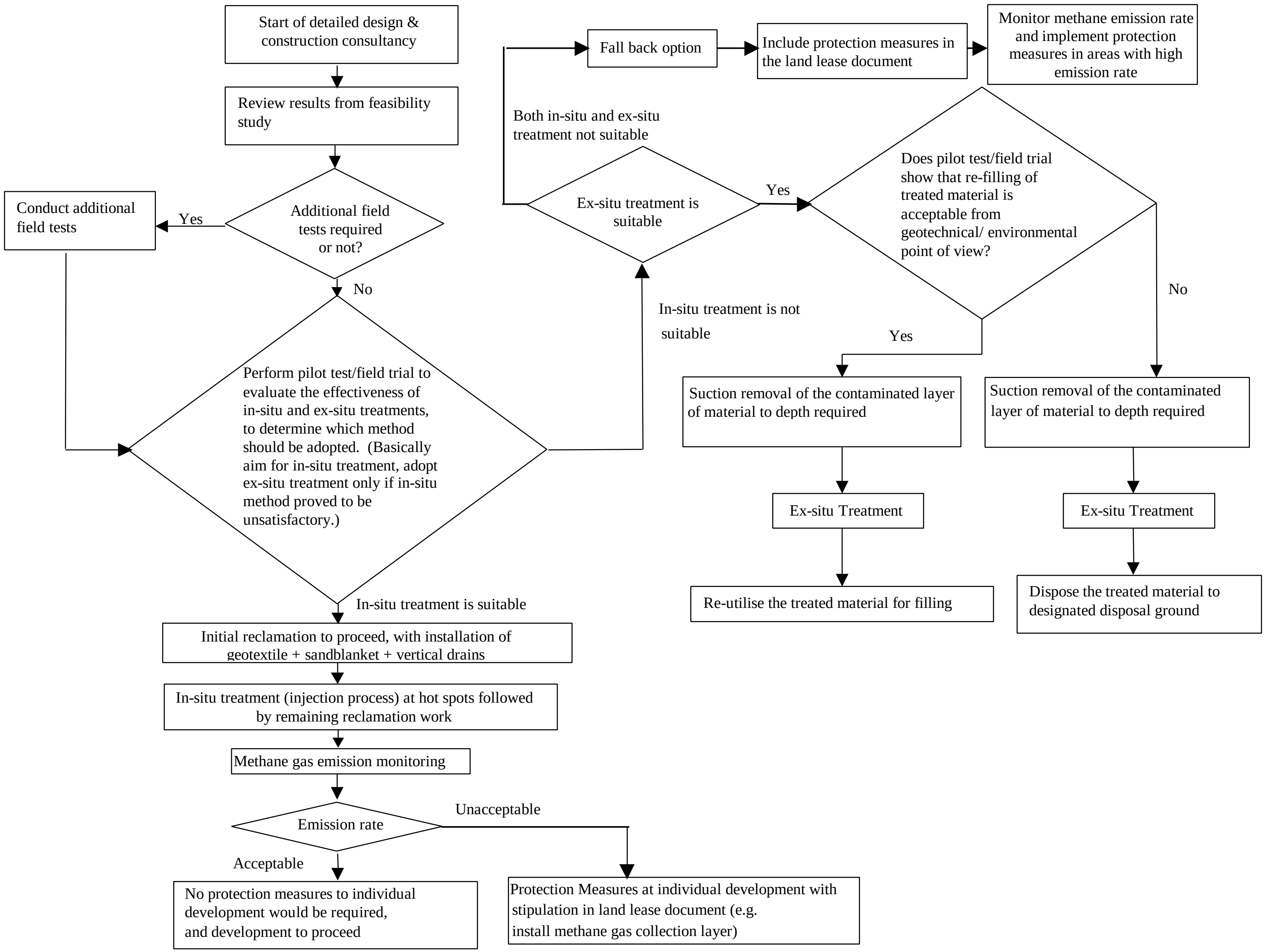

Figure 5I Proposed Procedures to deal with Biogas Problem

5.7.1.20 The KTAC may be used as a settling basin by blocking off the exit at the boundary between the KTAC and KTTS. The water inside the channel will be extracted by the suction dredging operation and then be returned back to the channel after the sediment washing process. There would be no discharge of the treated effluent into the open water. The suction dredging with injection of Fenton's Reagent and sediment washing oxidize most of the organic pollutants in the sediments. It is proposed to examine the contaminant level of the wastewater generated from the sediment washing process in the pilot tests so as to determine whether direct discharge of the wastewater back to the channel is acceptable. If not, suitable wastewater collection, treatment and disposal methods should be determined through the tests.

5.7.1.21 It has been shown that *ex-situ* bioremediation method, i.e. Daramend™ Bioremediation process, could reduce the organic contaminants to a low contaminant level. If required, the remaining solids generated from the sediment washing process would be further degraded by the bioremediation process to an acceptable level for reuse as fill material in the KTAC reclamation. Some of the contaminated sediments that cannot be dredged would be treated by *in-situ* treatment. A fluid injection system and a strong oxidizing reagent would be applied in the concerned areas.

5.7.1.22 The KTAC would be divided into a number of cells when carrying out *ex-situ* treatment. Greenhouse type units may need to be constructed for carrying out the biotreatment of the contaminated soil piles, if generated. It is estimated that three totally self-contained sediment washing units would be required. A total land area of approximately 5 to 6 ha is needed for setting up the sediment washing and bioremediation units. This land area is relatively small when compared to the total land area in Kai Tak Airport. The North Apron is one of the suitable locations to accommodate the *ex-situ* treatment facilities. The required area for setting up the plant for *ex-situ* treatment and biotreatment has been checked with DLO and consent has been obtained from DLO to include these constraints in the development schedule. The final location to place the *ex-situ* treatment facilities will be confirmed in the later stage of the implementation of *ex-situ* treatment.

5.7.1.23 The period for *ex-situ* treatment would be slightly longer than *in-situ* treatment. It is estimated that the time required for completing *ex-situ* treatment in the entire KTAC area would be 1.5 to 2 years (including monitoring period). Increase in the number of treatment units could shorten the overall treatment period. When suction dredging of the KTAC sediments is completed in the first cell, reclamation could be carried out in that cell. It is anticipated that the early start of the reclamation at KTAC could be carried out within 3 months after the commencement of *ex-situ* treatment.

5.7.1.24 After the application of *ex-situ* treatment, it is anticipated that methane gas monitoring may not be necessary, as most of the organic contaminants would have been removed from the sediments. Protection measures would not be required for the reclamation option with full dredging of sediments for *ex-situ* treatment. Long term settlement at the reclaimed land would not be a critical issue for this reclamation option when applying appropriate surcharge and vertical drains within the reclamation area.

5.7.1.25 The potential impacts of sediment plume dispersion and odour emission arising from sediment dredging at KTAC should be mitigated and these have been addressed in the preceding section on dredge for *ex-situ* treatment reclamation option. It is anticipated that both *in-situ* treatment and *ex-situ* treatment would not cause adverse odour impacts as a result of the use of a strong oxidant, i.e. Fenton's Reagent, to rapidly remove much of the AVS in the sediments.

Minimum Dredged Reclamation – *In-situ* Treatment and/or *Ex-situ* Treatment

5.7.1.26 The minimum dredged reclamation option would be applicable if temporary sea wall is to be constructed for the KTAC reclamation. The contaminant levels of the dredged sediments in the temporary sea wall location determine whether the sediments are acceptable for direct off-site disposal, i.e. confined marine disposal, or *ex-situ* treatment would be required to lower the sediment contaminant levels prior to the off-site disposal. The proposed procedures to deal with the dredged sediments are presented in a flowchart in **Figure 5J**.

5.7.1.27 For the undredged sediments, the preferred approach is to first carry out the reclamation at KTAC. *In-situ* treatment would be applied to remediate the contaminant levels of the undredged sediments. The need for provision of protection measures would be determined through the implementation of monitoring of methane gas emission after the *in-situ* treatment and reclamation.

5.7.1.28 With regard to ground improvement, vertical drain and surcharge would be one of the suitable methods to minimise the settlement in the undredged area.

5.7.1.29 **Kwun Tong Typhoon Shelter (KTTS)**

5.7.1.30 The methane potential of the sediments in KTTS is much lower than that in the KTAC. The estimated methane flux based on TOC with a half-life cycle of 2 years is about 4 times higher than the maximum safe rate of gas emission immediately after reclamation. It would take approximately 4 to 5 years for the methane flux to drop to an acceptable level. However, the estimated methane flux using a half-life cycle of 5 years is below the maximum safe rate of gas emission after two years of reclamation. It is worth noting that the rate of methane emission estimated based on TOC, which is a measure of the total organic carbon, gives a higher end result as some of the total organic carbon may not be biodegradable. In view of the conservative assumptions of the assessment, a different approach can be applied to deal with the sediments in area where the estimated methane emission rate is not exceptionally high. *In-situ* treatment would only be required at the hotspots. Based on the SI results, the potential hotspots are likely to be present in areas covered by KT1 and KT2.

5.7.1.31 The stability of marine structures is another issue that needs to be dealt with for the reclamation. Dredging of the soft marine deposits in the sea wall and breakwater locations would be required from an engineering standpoint. Adoption of the minimum dredged reclamation is therefore recommended. Depending on the contaminant levels of the dredged sediments, off-site disposal or *ex-situ* treatment may be applied. The treated material should be reused as fill material for reclamation as far as possible. The sediments left in place may require *in-situ* treatment to degrade the contaminant levels in the KTTS sediments; hence the methane potential can be reduced. It is recommended to first confirm the suitability of *in-situ* treatment. If the pilot tests prove to be feasible, the preferred approach is to remove the sediments in the breakwater and sea wall locations and then to carry out reclamation. *In-situ* treatment should subsequently be implemented at the potential hot spots. Monitoring of methane emission rate in the reclaimed land should be carried out immediately after the reclamation to confirm whether the treatment at the hotspots achieves the target levels and to determine the existence of any additional hotspots in the reclaimed land. *In-situ* treatment needs to be applied to the newly identified hot spots. It is recommended to install a total of approximately 10 monitoring boreholes in the KTTS reclamation area to detect the actual methane emission rate and to locate any additional hot spots. The boreholes should be evenly distributed across the area. **Drawing No. 22936/EN/145** shows the locations of the proposed monitoring boreholes. When high methane emission rate is detected in a particular area, additional monitoring boreholes should be installed to give a better indication of the actual methane emission rate in the area of concern.

5.7.1.32 In areas where methane emission rate is low and within the acceptable limit, no treatment or protection measures would be required. This in turn minimises the need for full treatment or full protection of the entire KTTS reclamation area. The procedures to deal with the undredged sediments and dredged sediments from the locations where major marine structures are to be constructed are shown in **Figures 5I** and **5J**.

5.7.1.33 The hotspot areas in KTTS would be divided into a number of cells for application of *in-situ* treatment. A strong reagent, e.g. Fenton's reagent, would be injected into the KTTS sediments at a number of injection points in each of the cells from a land-based operation. A fluid injection system would be used to delivery the reagent into the contaminated sediments. In the area near the existing KTTS, an injection depth of about 2m below the existing seabed level would be required. If hotspots are present in the area near Cha Kwo Ling, the fluid injection system may need to deliver the reagent to a level 4m below the existing seabed.

5.7.1.34 A theoretical estimation on the TOC reduction has indicated that a reduction rate of 80% of TOC in the KTTS sediments would reduce the methane potential to a level below the maximum safe rate of gas emission immediately after treatment. Using the 75% biodegradable carbon of the sediments from the SI results, the TOC level in the KTTS sediments would be reduced to 0.73% (dry weight). The estimated methane potential based on TOC with a half-life of 2 years would be lower than the maximum safe rate of gas emission within a year after the reclamation. It is therefore anticipated that after implementing sediment treatment at the hot spots, the methane hazards to the future developments at KTTS would be reduced to acceptable levels. It may take less than 1 year (including monitoring period) to complete the *in-situ* treatment at KTTS.

5.7.1.35 After the application of *in-situ* treatment, the continuous monitoring of methane gas emission rate can confirm the effectiveness of the treatment. The recommended criteria for methane gas monitoring in Section 5.5.3 "Sub-option 2: Monitoring and Protection Measures" should be adopted to determine whether protection measures would still be required in some specific areas in the reclaimed land.

5.7.1.36 Settlement of the reclaimed land would be minimized through the application of ground improvement techniques such as vertical drain and surcharge methods.

Hoi Sham

5.7.1.37 The estimated methane potential in Hoi Sham is the lowest amongst the three proposed reclamation areas. The estimated methane flux based on TOC with a half-life cycle of 2 years is about 3.5 times higher than the maximum safe rate of gas emission immediately after reclamation. In this worst case scenario, the relatively high methane potential would pose a risk to the development in Hoi Sham. As indicated in the preceding sections, the broad assumptions adopted in the assessment may give a conservative estimate on the methane emission rate. *In-situ* treatment should therefore only be applied at the hotspot areas. An initial estimate of the potential hotspots at Hoi Sham is based on the SI results. High methane potential is likely to be present in the locations along the coastline in the Hoi Sham area and along the coastline of the disused airport runway. The potential hotspots would be well represented by the sampling points KB1, KB3, KB6 and KB7.

5.7.1.38 Similar to the KTTS reclamation, it is recommended to adopt the minimum dredged reclamation option for the Hoi Sham reclamation. Both the contaminated and uncontaminated sediments in the sea wall, breakwater and tunnel locations would be dredged away unless suitable foundation improvement techniques, e.g. DCM, are to be applied to consolidate the foundation of the structures. Dredging may also be carried out in the location where earth bund is to be constructed. The dredged sediments after being treated, should be reused as fill material for reclamation as far as possible.

5.7.1.39 The preferred approach is to first carry the reclamation at Hoi Sham. Upon completion of each phase of the reclamation, *in-situ* treatment would be carried out at the hotspots with high methane potential. Monitoring of the actual emission rate of methane gas should also be implemented immediately after the each phase of the Hoi Sham reclamation. In addition to the monitoring at the identified hot spots, a total of approximately 20 monitoring boreholes would be required for the Hoi Sham reclamation. The boreholes should be evenly distributed across the area. The locations of the proposed monitoring boreholes are shown in **Drawing No. 22936/EN/145**. The monitoring results provide information to confirm whether the *in-situ* treatment target has been achieved and to further identify the locations of any additional hotspots with high methane potential. *In-situ* treatment would be applied to remediate the additional hotspots in the Hoi Sham area. In area where methane emission rate is low, application of *in-situ* treatment and provision of protection measures would not be required.

5.7.1.40 The procedures to deal with the undredged sediments and dredged sediments in the locations where major marine structures are to be constructed are shown in **Figures 5I** and **5J**. **Drawing No. 22936/EN/355** shows the potential hot spot areas in the SEKD.

5.7.1.41 *In-situ* treatment by injecting an oxidizing reagent into the sediments in Hoi Sham area would be carried out in a number of cells at the identified hot spots. According to the reclamation sequence, the first cell is best to be located near the disused Kai Tak Airport runway and the last cell is to be allocated near Hung Hom. A reduction rate of about 72% of TOC in the Hoi Sham sediments would reduce the potential methane flux below the maximum safe rate of gas emission immediately after treatment. Use of the reduction rate of 72% gives a theoretical estimation on the TOC reduction. This value is, however, lower than the 75% biodegradable carbon of the sediments from the SI results. It is anticipated that the sediments in the Hoi Sham area can be remediated by application of suitable *in-situ* treatment to lower the methane potential. Once the treatment target is achieved, *in-situ* treatment can proceed to the hotspots in the second cell. The implementation of *in-situ* treatment and reclamation would be carried out in sequence until the hotspots in the last cell are fully treated.

5.7.1.42 The continuous monitoring of methane emission rate at the boreholes would determine whether protection measures are still required after *in-situ* treatment. The recommended criteria for methane gas monitoring in Section 5.5.3 “Sub-option 2: Monitoring and Protection Measures” should be adopted, if necessary. Suitable ground improvement techniques, i.e. vertical drain and surcharge, would be applied to minimize settlement on the reclaimed land.

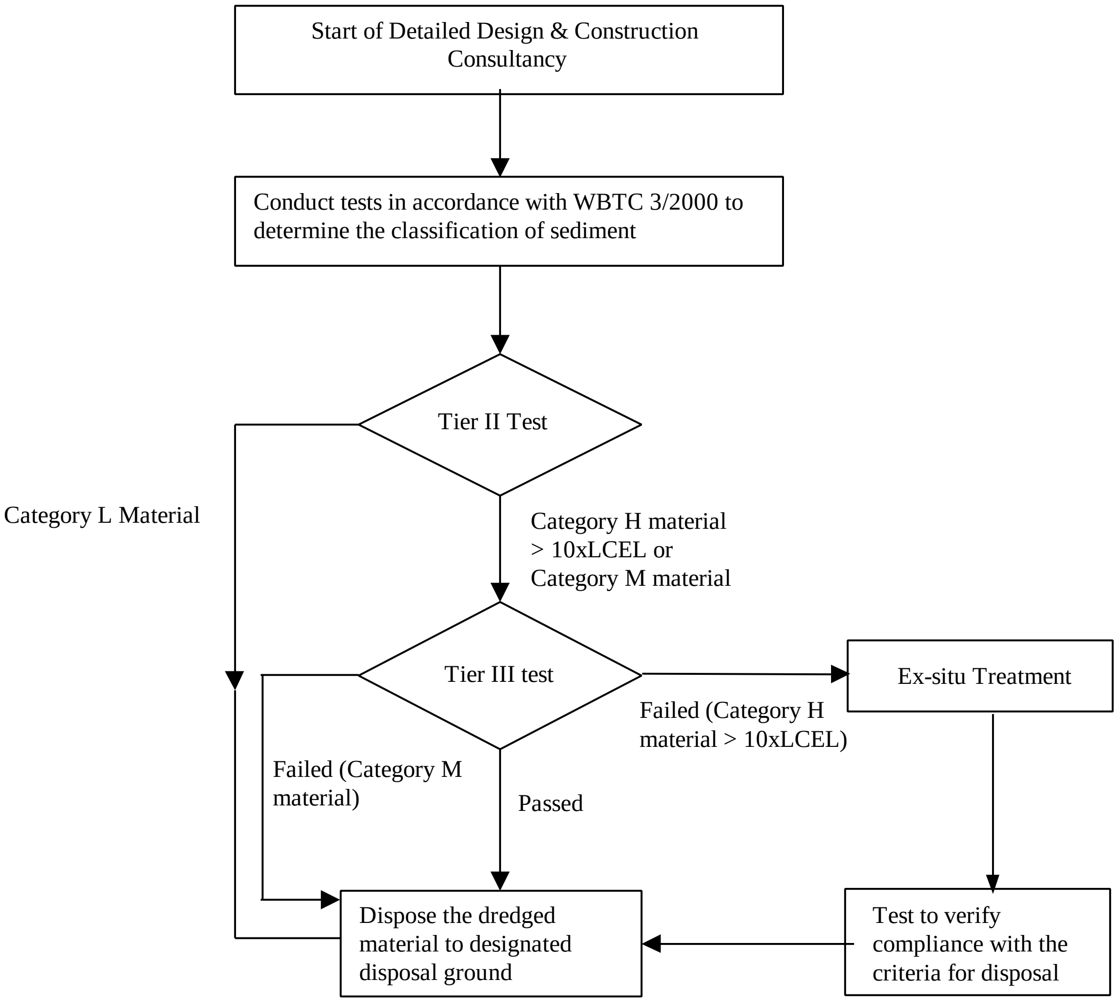

Figure 5J Proposed Procedures to Treat the Dredged Sediments from the Major Marine Structures