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**ACE Paper 11/2009**

***For advice on 6 July 2009***

# Report on the 108th Environmental Impact Assessment Subcommittee Meeting

## INTRODUCTION

On 15 June 2009, the Environmental Impact Assessment (EIA) Subcommittee considered the EIA report on "Hong Kong Offshore Wind Farm in Southeastern Waters" submitted by the Hong Kong Offshore Wind Limited (ACE-EIA Paper 6/2009 refers).

## ADVICE SOUGHT

2. Members are requested to consider the views of the Subcommittee and advise on the EIA report.

## THE PROJECT

### Need for the project

3. The EIA report points out that the Government has set a target of meeting 1% to 2% of Hong Kong's total electricity supply by renewable energy (RE) by 2012. This project has a capacity to produce about 1% of Hong Kong's annual electricity demand. The potential for large scale land-based wind farm development in HKSAR is limited owing to limited land space. With the availability of offshore technology, offshore waters offer more usable space for large scale wind farm development.

**Description of the project**

4. The project is located in the southeastern waters of Hong Kong. The project location and the cable alignment are shown in the figure at **Annex A**. Key elements of the project include –

(i) either 67 turbines each of 3 mega-watt (MW) power generation capacity or 40 turbines each of 5 MW power generation capacity;
(ii) an offshore transformer platform;
(iii) sub-sea collection and transmission cables; and
(iv) a research mast.

5. The EIA has assessed both options of 3 MW and 5 MW turbines. With either option, the project will be capable of producing a maximum output of approximately 200 MW of electricity, approximately equivalent to 1% of Hong Kong's total electricity needs. The final choice of turbines would be made at a later stage taking into consideration latest turbine technology development. The project constitutes a designated project under item D.1 of Schedule 2 (Public utility electricity power plant) of the EIA Ordinance.

**Consideration of alternative options**

6. The EIA has considered various options for project locations, turbine array alignments, transmission cable routings and construction methods. In particular, with the use of constraint mapping in the site selection, all environmental sensitive areas, such as important coral sites, core habitat for marine mammals and the proposed geopark (Geopark), have been avoided. The southeastern waters is considered to offer the best potential for a commercial scale offshore wind farm development given the large area of contiguous seabed, the relative lack of environmental sensitivity indicated by the site screening exercise and the anticipated higher relative wind speed.

7. The proposed use of suction caisson as foundation of turbines would avoid dredging and piling works for installation of turbines, and hence minimize water quality impacts.

## VIEWS OF THE SUBCOMMITTEE

8. Members noted that the public inspection period of the EIA report was from 3 June 2009 to 2 July 2009. Public comments received by the Environmental Protection Department (EPD) before the Subcommittee meeting were circulated to Members for reference before the meeting. Public comments received after the Subcommittee meeting were circulated to all Council Members for reference before the Council meeting. Separately, the written response of the project proponent to some Members' questions and comments was circulated to Subcommittee Members for information before the Subcommittee meeting.

9. A summary of issues discussed by the Subcommittee is at **Annex B**.

## RECOMMENDATION OF THE SUBCOMMITTEE

10. Having regard to the findings and recommendations of the EIA report and information provided by the project proponent, the Subcommittee agreed to recommend to the full Council that the EIA report could be endorsed with the following proposed conditions –

(a) the project proponent should submit to the Director of Environmental Protection (DEP) for approval, before commencing the construction of the project, the final layout of the wind farm turbines with demonstrations that the final layout, among the possible alternative layouts, has minimized the footprint of the project and maximized the distance of the turbines from Ninepin Group and Ung Kong Group;

(b) the project proponent should submit to the DEP for approval, before commencing the construction of the project, a fisheries enhancement plan incorporating measures, including deployment of artificial reefs, in consultation with the fishery sector and the Agriculture, Fisheries and Conservation Department;

(c) the project proponent should enhance the Environmental Monitoring and Audit on marine water quality covering the following items (as shown in the figure at **Annex C**) –

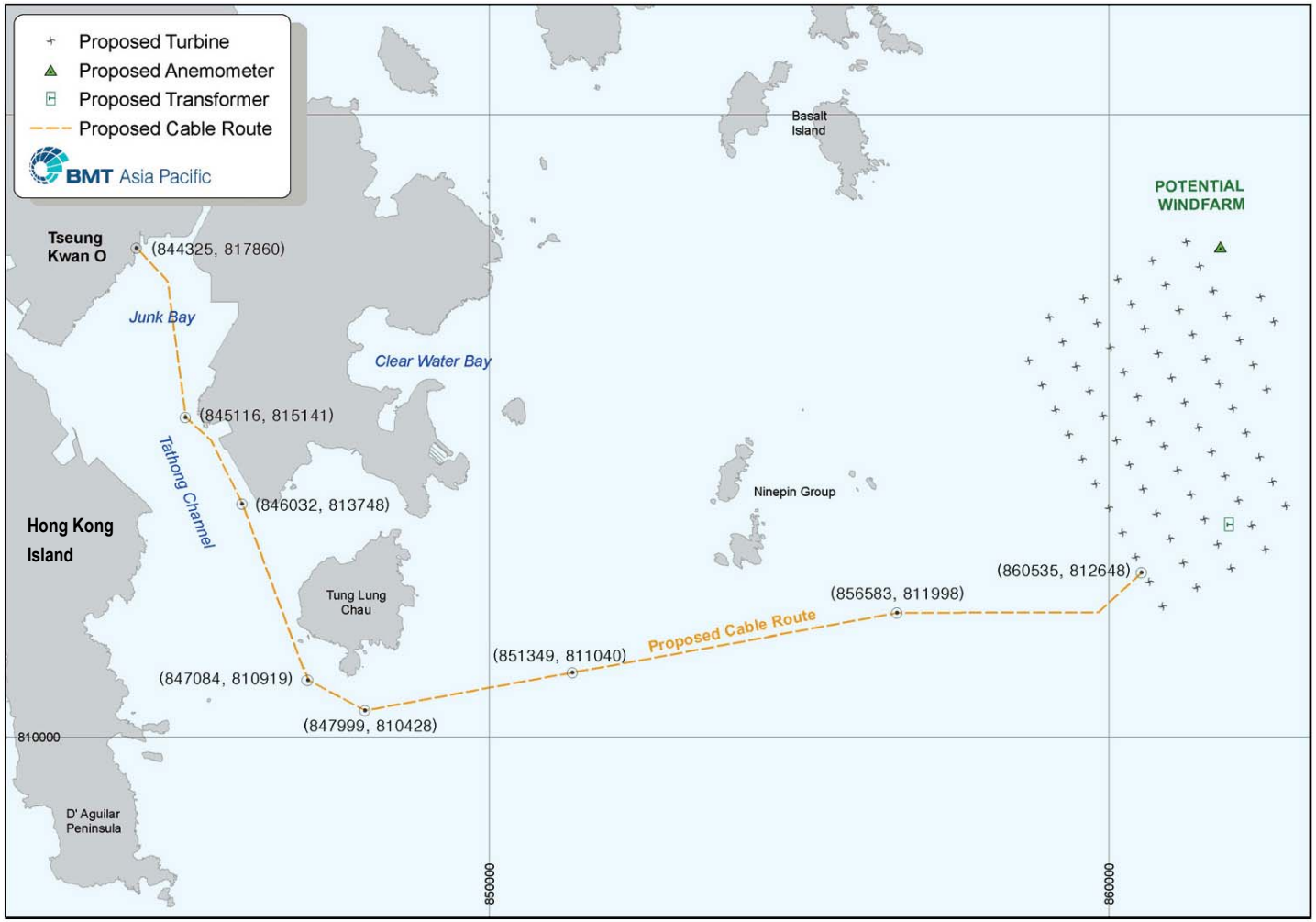
(I) For the construction phase monitoring:
  (i) adjust the location of the control station from C2 to C2';
  (ii) an additional station M10 to monitor the construction impact to the ecologically important Basalt Island; and
  (iii) additional four tidal current stations TC1 to TC4 to monitor the impact of the wind farm on the surrounding tidal current and salinity-temperature structure (hourly measurements for tide and current based on moored instruments, and vertical conductivity-temperature-depth profiles).

(II) For the operational phase monitoring:
  (i) same measurements at TC1 to TC4 at least for one year; and
  (ii) similar measurements at two locations (TC5 and TC6) within the wind farm.

(d) to facilitate communications and consultation in respect of environmental impacts of the project, the project proponent should, within six months upon the issue of the Environmental Permit, set up a Stakeholder Liaison Group comprising representatives of concerned parties, including those related to fishery sector, environmental and hiking groups, to advise on the design, construction and operation of the project and should inform the Advisory Council on the Environment (ACE) and the DEP in writing the membership and terms of reference of the Stakeholder Liaison Group and should take into account ACE's views. The project proponent should place all minutes of meetings, relevant documents and associated papers of the Stakeholder Liaison Group on the dedicated website set up by the project proponent, within one month of the dates of the meetings.

11. The Subcommittee also recommended the Secretary for the Environment to closely monitor the fuel mix used for electricity generation by the CLP Power Hong Kong Limited to ensure that the burning of fossil fuels would be reduced proportionately with the generation of RE by wind power upon completion of the project.

**EIA Subcommittee Secretariat**
**June 2009**




**Project Title:** **Hong Kong Offshore Wind Farm in Southeastern Waters**

**Annex A:** **Location Plan (Reproduced from Figure 2.26 of the EIA Report)**

**Annex B**

**EIA report on "Hong Kong Offshore Wind Farm in Southeastern Waters"**
**A summary of issues discussed by the EIA Subcommittee**
**at the EIA Subcommittee meeting on 15 June 2009**

The Environmental Impact Assessment (EIA) Subcommittee discussed the EIA report on "Hong Kong Offshore Wind Farm in Southeastern Waters" at its meeting on 15 June 2009. The issues discussed are summarized below.

***Need for the project***

2. On the need of the project, the project proponent team explained that the Chief Executive stated in the Policy Address in May 2007 the target of meeting 1% to 2% of Hong Kong's total electricity supply with renewable energy (RE) by 2012. The project was built to meet this policy target and had a capacity to produce approximately equivalent to 1% of Hong Kong's annual total electricity needs. It was a global trend to develop RE to reduce greenhouse gas emissions.

3. On the choice of wind power instead of other forms of RE, the project proponent team explained that electricity generation technology by wind power was the most popular among various forms of RE technologies in the world up to the current stage. In 2008, about 50% of the RE electricity generation capacity in Europe and 40% of those in the United States were from wind power. The Mainland was developing wind power facilities at a fast pace as wind power was the most cost-effective RE facilities other than large scale hydroelectric power facilities. In Hong Kong, it would not be possible to achieve the near 1% target by developing other forms of RE facilities.

***Financial implications***

4. On the cost implications of the RE project, in particular on electricity tariffs, the project proponent team explained that the project was part of the business of the CLP Power Hong Kong Limited (CLP) in Hong Kong and thus fell into the regime of the Scheme of Control Agreements which included a provision in encouraging RE usage in their electricity generation. At the current stage, they

mainly focused on the assessment of technical and environmental acceptability of the project. A research mast would be constructed to collect wind and wave data to understand better the offshore environment. The data would be important for the assessment of the project on the economic aspect. In general, the cost of using RE in electricity generation would be higher than burning of fuels, such as coal and natural gas. Depending on the size of the wind farm, preliminary estimation showed that the potential cost implication would be less than 1% for a wind farm generating 50 MW of electricity to about 2% for a wind farm generating 200 MW of electricity.

5. On the estimated daily output of the wind farm assuming a wind speed of 5 metre/second (m/s), the project proponent team explained that the estimated output would hinge on the size of the project and type of turbine but these would depend very much on the characteristics of the wind regime at the site and the data had yet to be collected from the research mast. Based on available local wind data, the initial estimation was that the wind farm could produce electricity for about 80,000 local household consumption each year based on the 200 MW capacity.

6. On the possibility of reducing fossil fuels for electricity generation after operation of the wind farm project, the project proponent team indicated that coal was used by CLP as the final tier to meet the load demand. Coal burning would be reduced when electricity could be generated by wind power.

***Landscape and visual impacts***

7. On the visual impacts of the project, including impacts on hikers/visitors to the Sai Kung Country Park and the proposed geopark (Geopark) in Sai Kung area, the project proponent team explained that very few visual sensitive receivers (VSRs) were within the 5 km zone from the wind farm site as shown in Figure 10.28 of the EIA report (which used a 3-D modelling approach). Most of the VSRs were in the 15 km zone. When moving farther away from the site, the visual impacts of the wind farm within the range of view would diminish dramatically. VSRs within the 5 km zone were mainly boat users. In view of their brief stay in the area, the impacts would be very transient. The level of impacts in the worst case was categorized as "moderate" which mainly referred to visitors near the Ninepin Group. Based on the per year visitor estimates of about 110,000 to the Geopark in Sai Kung area provided by the Agriculture, Fisheries and Conservation Department (AFCD), it was estimated that the number of visitors to the 5 km zone would be around 50,000 to 100,000 per year as the boat trips would depend very much on weather conditions. In the 15 km zone, the level of significance of visual impacts on

residents of Silverstrand and Bella Vista was categorized as "moderate". While the residents would perceive the wind farm from a farther distance, the time of stay in the residence was longer. For other VSRs, the impacts were assessed to be "slight" or "insignificant". For the construction phase, the anticipated residual visual impacts were shown in Figure 10.27 of the EIA report. The level of impacts was generally slightly higher due to the construction activities around the site. The level of significance of visual impacts for visitors near Ninepin Group during the construction phase was categorized as "substantial".

8. The project proponent team indicated that visitors to the Geopark would travel on boat. The co-existence of the wind farm and Geopark would be complementary as visitors could enjoy the natural geology on one side while appreciating the environmentally-driven wind farm project on the opposite side. Overseas experience showed that offshore wind farm often became a site of tourist attraction in view of its positive blend with the natural seascape, such as the wind farm about 3 km from the popular beach resort of Great Yarmouth in the UK. As regards hikers of the Sai Kung Country Park, Figure 10.7a of the EIA report showed a computerised assessment of visibility of the turbine blades based on the contours of different viewpoint locations. It showed that the majority of Sai Kung Country Park would not be able to view the wind farm structures. The site selection process had considered a site far away from popular hiking areas.

9. On the footprint of the project by using 40 turbines (each of 5 MW) or 67 turbines (each of 3 MW), the project proponent team explained that the 5 MW turbines would be larger with longer blades but there would be slight difference in terms of footprint. If fewer turbines were used, they would be spaced further apart within a similar footprint area. In conducting the EIA study, both scenarios were taken into account and environmental impacts of the worst-case scenario were taken. As the technology of wind turbine was evolving at a fast pace, the flexibility of allowing different scenarios would enable them to use the most cost-effective technology with the least environmental impacts available at the time of construction.

10. The project proponent team referred to the layout plans in Figures 10.1a and 10.1b of the EIA report and explained that there was not much difference in terms of landscape and visual impacts for the two scenarios. International research showed that a clear majority of the public had more favourable responses towards the appearance of wind farms and accepted them as positive contributions to the landscape in the long run compared with other types of development. There

were also symbolic and psychological meanings attached to wind farms in representing efforts for sustainable development of RE.

11. On the possibility of reducing the footprint of the project, the project proponent team indicated that if the number of turbines was reduced, it should be possible to reduce the footprint of the project proportionately. Nonetheless, it should be noted that the output of 200 MW of electricity was a requirement to meet the Government's target.

12. On the suggestion of a shorter distance between the turbines in order to reduce the footprint and thus the visual impacts, the Planning Department advised that from the visual impacts point of view, different configurations and layouts of the turbines would have different visual impacts. While a more clustered layout with shorter distance between the turbines would reduce the footprint of the project, the visual impacts might not necessarily be reduced.

13. On the availability of information on the perception of wind farms in the local context or perception to specific groups of people, such as hikers and nature lovers, the project proponent team indicated that no specific information was available on these aspects. Nonetheless, there was information from local residents of Scotland expressing that the wind farm gave calming effects on the residents as a part of the landscape. According to some famous landscape architects, the visual impacts of a large scale structure in a wide landscape would not be significant given that there was no identifiable object in the vicinity to give the structure a sense of scale. In the local context, the project would have a symbolic meaning for Hong Kong as a landmark of better environment.

14. Regarding public engagement on the impacts of the project in particular on the aspect of visual impacts, the project proponent team explained that they had an extensive stakeholder consultation process through meetings, briefings and site visits. The general response was quite favourable. They would continue to liaise with stakeholders to enhance communication and facilitate understanding of the project. Some Members suggested that the hiking groups should be included.

15. Some Members noted that there were concerns over the planned application of the Geopark for being listed as a United Nations Educational, Scientific and Cultural Organization (UNESCO) Global Geopark due to the existence of a wind farm about 5 km away. The project proponent team explained that while the wind farm was about 5 km away from the Ninepin Group, it was about

10 km away from most sites of the Geopark. The project had avoided environmentally sensitive areas including the Geopark. Neither the proposed wind farm development nor the proposed cable alignment fell within the buffer area of the Geopark.

16. AFCD advised that the proposed Geopark would include two regions covering eight locations, including the Ninepin Group, Ung Kong Group, Tung Ping Chau and Double Haven. The Ninepin Group consisted of islands out at the east waters. The islands were famous for its imposing hexagonal columns which measured over 2 metres in diameter, ranking first in the region. Application had been made to the Mainland Authority for the proposed Geopark to be listed as a National Geopark by end 2009.

17. AFCD advised that given the immense scale of the project, large footprint area of the development site, the pristine natural seascape of East Sai Kung, any visual impact arising from the proposed wind farm on visitors to the Geopark, in particular the geosite at Ninepin Group would be of great concern. As such, AFCD had provided updated information to the project proponent, including the proposed development plan, location map and estimated number of visitors of the Geopark, to allow an accurate and robust assessment be made in the EIA report. In light of the concern over visual impacts, AFCD had invited the project proponent to present the project proposal in the Country and Marine Parks Board held on 18 June 2009.

***Water quality impacts***

18. Some Members pointed out that in Hong Kong, it was known that red tide and algal bloom patches might be formed in Mirs Bay and be carried by the tidal current to the south of Hong Kong through the proposed wind farm location. As the model results indicated reduction in flow velocities within the wind farm, the effect of the wind farm upon the mass transport through the wind farm location and its vicinity remained to be evaluated.

19. The project proponent team explained that conservative assumptions were adopted in the EIA study by using the 3-D hydrodynamic models. Based on the modelings, the absolute value of reductions in current speed was only about 0.1 m/s within the wind farm footprint. The small deviations in current speeds inside the wind farm were localized, which would not cause abrupt changes to the flushing capacities in major channels. The difference in velocity at agreed coastal locations before and after the project was found to be negligible. The water quality

was not likely to be changed due to the small variations in velocities at the wind farm site.

20. Some Members considered that the footprint of the wind farm was quite large (4 km x 4 km) and it was located close to precious coastal waters of excellent water quality and high marine conservation interest. While the impact assessment of the wind farm on flow and water quality had been carried out, it was considered that other impacts in the same general area would need to be further studied after operation. As there were uncertainties on the operational impact of the wind farm, it was strongly advisable for monitoring in the operational phase to be carried out. The availability of such data would reduce substantially the uncertainty of the model predictions.

21. On examples of offshore wind farm projects of similar scale in overseas countries, the project proponent team indicated that the biggest offshore wind farm was a project with an output of 630 MW of electricity and there was experience around the world in building large scale offshore wind farms near urban waters.

***Fisheries***

22. Some Members noted that only information on fishing intensity in June and July was presented in the EIA report. The project proponent team explained that radar data was illustrated for June to July to illustrate busy summer fishing activities. The EIA study also included review of relevant available information, such as port surveys of AFCD, interviews with fishery sector, visual surveys at the site and studies by radar tracking during site selection exercise. The information collected was consistent with previous studies that the area was not a major fishing area and productivity of capture fisheries was relatively low as the site was mainly silty mud bed with low ecological value.

23. Some Members noted that overseas experience showed that turbine foundations could serve as artificial reef substrate for colonization by benthic epifauna which was likely to benefit the overall abundance and diversity of fisheries resources in the area. On the suggestion of liaising with the fishery sector on opportunities for fishery enhancement activities, the project proponent team indicated that they had been liaising with the fishery sector on the project and a boat trip to the site would be arranged. They would continue to work with them closely on the potential impacts and opportunities of the project.

***Geological impacts***

24. On the study of geological impacts of the site, the project proponent team explained that there would not be physical interference, including laying of cables, between the project and the Geopark. With the use of suction caisson foundation, the impacts on the surface sediment area would be minimized as no dredging and piling would be required. The construction works would not intrude into the rock layer of the seabed or affect the permanent geology of the site. The wind farm structures would have a service life of about 20 to 25 years and the setting could be fully reversible.

***Avifauna***

25. Some Members noted that only day time surveys of birds were conducted in the EIA study. The project proponent team explained that a review of literature and previous seabird surveys had been conducted on the bird movement in the area. It was found that birds were sparsely populated in the study area. Birds identified were mainly species active dominantly in the day time and there were no migratory routes. Conducting night time surveys with radars would not be able to capture bird activities of identified bird species. Findings of the EIA study were consistent with previous seabird studies.

***Light pollution***

26. On possible impacts of the navigation lighting of turbines, especially impacts on star gazing activities at Sai Kung, the project proponent team explained that the rays of navigation lighting would have a range of up to 5 nautical miles and they would not be visible along most parts of the shoreline at Sai Kung. The aviation lighting would mainly be at the top of the turbines pointing upwards with low to medium intensity. They were working closely with the Civil Aviation Department to ensure that the lighting installations would comply with the requirements and minimize light pollution.

***Noise impacts***

27. On the noise impacts of the turbine operation, especially on boat users, the project proponent team explained that noise impact assessments on marine mammals and birds were included in the EIA report. It was not a requirement in the Study Brief to assess the noise impacts on boat users. As indicated in a noise

contour plot shown (based on a typical noise emission of 105.1 dB(A) in a wind speed of 8 m/s at 10 m above ground level), the noise level diminished away from the wind farm. The noise level at the east of Ninepin Group would be less than 20 dB(A) which would be less than the background noise of the ocean. On the request of Members, the project proponent provided the noise contour plot as shown at **Annex D**.

28. On the tonal character of the noise from the turbine operation, the project proponent team explained that the characteristic of the noise was sub-tonality which would not be annoying in the offshore context. The noise generated from modern wind turbines was minimal as the design of the nacelle was sound proof to minimize mechanical sound.

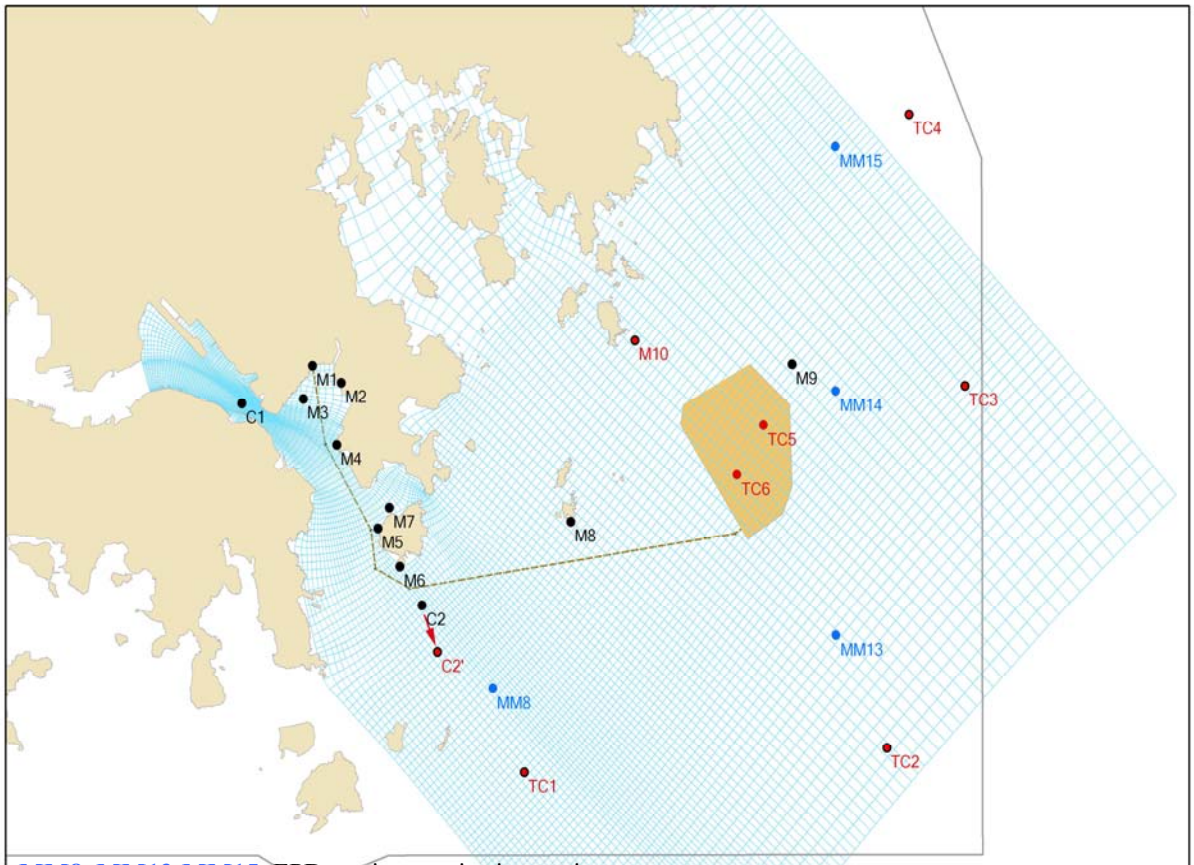
***Other issues***

29. On the sewage generated by workers during the operation phase, the project proponent team explained that the maintenance works would only involve temporary stay of a few workers on the platform being transported by boats. The workers were not expected to stay overnight in the emergency accommodation. They would ensure that the requirements on waste management, including sewage generated by workers, would be fully complied with.

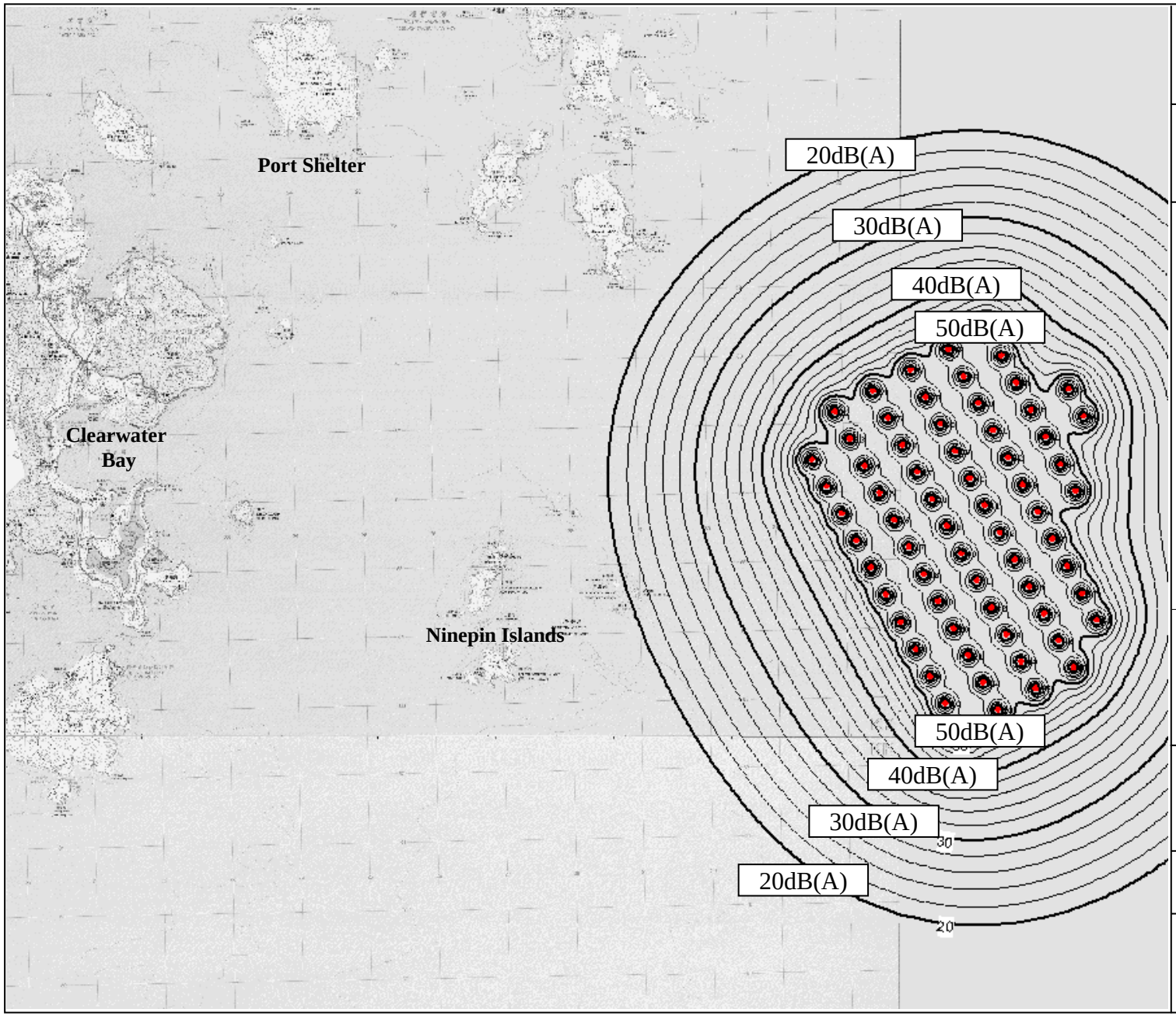
30. On the use of the diesel tank of 100 $m^3$ in the offshore transformer station, the project proponent team explained that the diesel would be used for the generator at the transformer platform for back-up use. The size of the diesel tank was similar to that for a large fishing boat.

**Annex C**

# Proposed locations for marine water quality monitoring stations for Hong Kong Offshore Wind Farm in Southeastern Waters




**MM8, MM13-MM15**: EPD marine monitoring stations
**M1-M9**: Baseline and construction monitoring stations proposed by BMT
**M10**: Suggested baseline and construction monitoring station
**TC1-TC6**: Suggested baseline and post-project monitoring stations of tidal current & density profile




**Hong Kong Offshore Wind Farm**

**Noise Contour Plot**
**201MW layout, 67 x 3MW**

The noise contour plot has been generated using a typical noise emission of 105.1dB(A) measured in a wind speed of 8 m/s at 10m above ground level (the IEA standard).

N

Scale

4km

Map is based upon various data sources and data from the Survey & mapping Office, Lands Department, HKSAR

Prepared by:
AKT 17/06/09

**Prepared by:**
**Wind Prospect (HK) Limited**

Note : The Noise Contour Plot is for the 67 turbine layout scenario. The 40 turbine layout would have a reduced noise profile and this plot is the "worst-case" scenario.