0 EXECUTIVE SUMMARY

0.1 This Baseline Environmental Monitoring Report was prepared by Cinotech Consultants Ltd. for the Project of "Tai O Development – Sheltered Boat Anchorage". This report presents the baseline noise and water quality monitoring works performed between 10th March and 4th April 2003.

Noise

0.2 Baseline noise monitoring was conducted at four designated monitoring stations (N1, N9, N11 and N17) between 21st March 2003 and 4th April 2003. Noise levels at the four monitoring stations were measured continuously for 24 hours for a period of 14 days. The baseline noise monitoring data was processed according to the following three periods:

- Daytime: 0700-1900 hrs on normal weekdays
- Evening-time: 1900-2300 hrs on all other days and Holiday: 0700-1900 hrs on holidays
- Night-time: 2300-0700 of next day

Water Quality

0.3 The baseline water quality monitoring was conducted at seven monitoring stations (W1 to W5, A1 and A2) between 10th March 2003 and 4th March 2003 (three days per week). Monitoring was conducted for 12 days, during mid-ebb and mid-flood tides to monitor the dissolved oxygen, turbidity, suspended solids, pH, salinity and temperature. The data were processed, reviewed and analysed to establish the Action and Limit Levels for dissolved oxygen, turbidity and suspended solids during impact/compliance monitoring throughout the construction of the Project.

0.4 The baseline noise and water quality data established in this report are considered representative of the baseline conditions for the Project.

1 INTRODUCTION

Background

1.1 Tai O was formerly one of the largest fishing villages in Hong Kong and was a historical case for fishing boats in the western approaches of Lantau Island and the Pearl River estuary. However, the importance of the fishing industry in Tai O has declined in recent decades, which has resulted in a degradation of its population base.

1.2 The formation of the Tai O sheltered boat anchorage is fully supported by the Islands Provisional District Board members and is widely seen as a means of reviving the town's local fishing industry and contributing to the revitalization of Tai O.

1.3 Previous consultancies undertaken on behalf of the Civil Engineering Department (CED) to determine the feasibility of construction a sheltered boat anchorage (Agreement No. CE 41/98) Environmental and Drainage Impact Assessment for the Tai O Sheltered Boat Anchorage Study. The original development scheme comprised an 8 ha anchorage for 220 vessels and about 1 ha reclamation for boat maintenance facilities, parking area, bus terminus and a loading/unloading bay.

1.4 The original development scheme has been gazetted under the Foreshore & Sea-bed (Reclamations) Ordinance in December 2000. Following public consultation and interdepartmental discussion, the scope of the scheme was revised in the adoption of the current development scheme with a reduced area of boat anchorage, shortened breakwater and reduced area of reclamation.

1.5 The project now comprises construction of a 4 ha sheltered boat anchorage for small boats/fishing vessels and a breakwater of about 350 m length, formation of about 0.22 ha of land for a future bus terminus, construction of a 0.23 ha promenade, site formation and associated engineering works for a mangrove planting area and restoration of the existing historic seawall. The general layout of the project is shown in **Figure 1.1**.

1.6 An Environmental Permit No. EP-144/2002 was issued on 11 Sep 2002 for this project (EP) to the Civil Engineering Department as Permit Holder. An updated Environmental Monitoring and Audit Manual (the EM&A Manual) was prepared to fulfill requirement stipulated in Condition 2.3 of the EP.

1.7 Cinotech Consultants Limited was commissioned by the China Harbour Engineering Company (Group) (the Contractor) to undertake the Environmental Monitoring and Audit (EM&A) works for the Project. This Baseline Environmental Monitoring Report (the Report) is prepared by Cinotech for the Project prior to the commencement of any construction activity in accordance with the EM&A Manual.

Purpose of the Report

1.8 The purpose of this Baseline Environmental Monitoring Report is to set out baseline levels for the noise and water quality in accordance with the EM&A Manual. These baseline levels will be used as the basis for the impact and compliance monitoring during construction stage of the Project. This report presents the monitoring locations, equipment, period, methodology, results and observations for the noise and water quality measurements during the baseline period.

Structure of the Baseline Monitoring Report

1.9 The structure of the Report is as follows:

Section 1:	Introduction, purpose, background and the structure of the report.
Section 2:	Noise, which describes the baseline noise monitoring.
Section 3:	Water Quality, which describes the baseline water quality monitoring.
Section 4:	Revisions for inclusion in the EM&A Manual.
Section 5:	Conclusions.

2 NOISE

Monitoring Requirements

2.1 Baseline noise monitoring was conducted for 14 days at 4 designated monitoring stations between 21st March 2003 and 4th April 2003. Logger function check and calibration was carried out according to manufacturer's recommendations. The equipment was checked and inspected not less than once every two days after the set up at each monitoring station.

Monitoring Locations

2.2 **Table 2.1** describes the location of the monitoring stations and their locations are shown in **Figures 2.1**.

Table 2.1 Location of Noise Monitoring Stations

Monitoring Station	Location
N1	At ground level of No. 26B Shek Tsai Po
N9	On roof of Tai O Primary School
N11	On roof of Lung Tin Court, Wing Tin House
N17	On roof of Nam Chung Tsuen

Monitoring Equipment

2.3 Integrating Sound Level Meters were used for noise monitoring. The meters are Type 1 sound level meters capable of giving a continuous readout of the noise level readings including equivalent continuous sound pressure level (L_{eq}) and percentile sound pressure level (L_x) and also complied with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1) specifications. **Table 2.2** summarizes the noise monitoring equipment being used. Copies of the calibration certificates are attached in **Appendix A1**.

Table 2.2 Noise Monitoring Equipment

Equipment	Model and Make	Quantity
Integrating Sound Level Meter	B&K Model 2238	4
Calibrator	B&K 4231	2

Monitoring Parameters, Frequency and Duration

2.4 In accordance with the EM&A Manual, baseline noise for the A-weighted levels L_{eq}, L_{10} and L_{90} was recorded at 5 minutes intervals. Data obtained from the baseline noise monitoring was processed and presented according to the following three periods:

- Daytime: 0700-1900 hrs on normal weekdays
- Evening time on all days (1900-2300 hrs) and Holidays (including Sundays) during the daytime and evening (0700-2300 hrs)
- Night-time: 2300-0700 hrs of next days

2.5 The frequency and parameters of noise measurement are presented in **Table 2.3**.

Table 2.3 Frequency and Parameters of Noise Monitoring

Time Period	Duration, min	Parameter
Daytime on normal weekdays (0700-1900 hrs)	30 (average of 6 consecutive L_{eq}(5min))	L_{eq}, L_{10} & L_{90}
Evening time on all days (1900-2300 hrs) and Holidays (including Sundays) during daytime and evening (0700-2300 hrs)	5	
All days during the night-time (2300-0700 hrs)		

Monitoring Methodology and QA/QC Procedures

2.6 **Table 2.4** summarizes the type of measurement undertaken in the four monitoring stations.

Table 2.4 Type of Measurement

Monitoring Station	Measurement
N1	Free Field measurement
N9	Façade measurement
N11	Façade measurement
N17	Façade measurement

2.7 Weather data was recorded during the baseline period and is presented in **Appendix C**. The mean air temperature, wind speed, wind direction and the mean relative humidity data was obtained from the Hong Kong Observatory Webpage.

Field monitoring

2.8 The monitoring procedures are as follows:

- For façade measurement, the microphone head of the head level meter was positioned 1m exterior of the Noise Sensitive Receivers and lowered sufficiently so that the building's external wall acts as a reflecting surface. The noise meter was also set as a position 1.2 m above the ground.
- For free field measurement, the meter was positioned away from any nearby reflective surfaces. All records for free field noise levels were adjusted with a correction of +3 dB(A).
- The battery condition was checked to ensure good functioning of the meter.
- Parameters such as frequency weighting, the time weighting and the measurement time was set as follows:

  - frequency weighting :A
  - time weighting :Fast
  - time measurement :5 minutes

- Prior to and after each noise measurement, the meter was calibrated using the calibrator for 94.0 dB at 1000 Hz. If the difference in the calibration level before and after measurement is more than 1.0 dB, the measurement was considered invalid and repeat of noise measurement was required after re-calibration or repair of the equipment.
- The wind speed was frequently checked with the portable wind meter.
- Noise monitoring was carried out continuously for 24 hours during the 14 days baseline monitoring period. Monitoring data was recorded and stored automatically within the sound level meter system. At the end of the monitoring period, all the Leq, L90 and L10 was recorded. In addition, site conditions and noise sources were recorded when the equipment were checked and inspected every two days.
- All the monitoring data within the sound level meter system was downloaded through the computer software, and all these data was checked and reviewed within the computer.
- Noise monitoring was cancelled in the presence of fog, rain, and wind with a steady speed exceeding 5 m/s, or wind with gusts exceeding 10m/s.

Maintenance and Calibration

2.9 Maintenance and Calibration procedures were as follows:

- The microphone head of the sound level meter and calibrator were cleaned with a soft cloth at quarterly intervals.
- The meter and calibrator were sent to WELLAB Ltd. to check and calibrate at yearly intervals.

Results and Observations

Results

2.10 Baseline noise monitoring at all designated stations was conducted between 21st March 2003 and 4th April 2003. The detailed monitoring schedule is shown in **Appendix D**.

2.11 The monitoring results are summarized in **Tables 2.5 to 2.7**. All baseline noise monitoring data at the four stations are given in **Appendices A2 to A5**. Graphical presentations of baseline noise monitoring are provided in **Appendix A6**. Weather conditions recorded at the monitoring locations during the baseline monitoring period are shown in **Appendix C**.

Table 2.5 Summary of Day-Time Noise Monitoring Results

Daytime 0700-1900 hrs on normal weekdays	**Range of Noise Level, dB(A)**								
	L_{eq} (30 min)			L_{10} (30 min)			L_{90} (30 min)		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
N1*	57.6	67.5	48.4	60.0	71.1	50.7	52.6	61.4	40.7
N9	59.6	72.3	47.6	62.4	75.8	50.4	61.3	62.3	41.1
N11	61.3	73.7	54.2	63.6	75.9	56.3	56.4	70.5	45.1
N17	58.1	67.1	41.3	61.4	71.0	44.1	46.5	63.6	35.5

*Free field noise levels were adjusted with a correction of +3 dB(A)

Table 2.6 Summary of Evening-Time and Holidays Noise Monitoring Results

Evening-time 1900-2300 hrs on all days & Holidays 0700-2300	**Range of Noise Level, dB(A)**								
	L_{eq} (5 min)			L_{10} (5 min)			L_{90} (5 min)		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
N1*	57.7	66.9	38.9	59.9	70.5	40.5	53.7	62.0	33.5
N9	53.2	66.6	36.5	55.9	70.5	37.5	46.7	60.0	33.5
N11	53.2	68.9	40.7	62.5	71.0	42.0	53.3	64.5	38.0
N17	53.2	66.4	33.0	53.9	69.5	34.0	42.1	61.5	30.5

*Free field noise levels were adjusted with a correction of +3 dB(A)

Table 2.7 Summary of Night-Time Noise Monitoring Results

Night-time 2300-0700 hrs of the next day	**Range of Noise Level, dB(A)**								
	L_{eq} (5 min)			L_{10} (5 min)			L_{90} (5 min)		
	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min
N1*	52.3	71.2	33.0	54.5	73.0	34.5	48.1	58.0	31.0
N9	52.1	66.6	34.0	56.1	71.0	34.5	42.3	52.0	31.0
N11	54.9	67.7	35.9	56.1	71.0	37.0	47.7	64.0	35.0
N17	50.4	67.5	29.7	56.1	73.0	30.5	40.3	54.5	27.5

*Free field noise levels were adjusted with a correction of +3 dB(A)

Observations

2.12 The weather was generally sunny or cloudy during the baseline monitoring periods. All monitoring was conducted with the wind speed below 5 m/s.

2.13 During the baseline noise monitoring period, the following observations were made which may affect the results:

- Noise from shipping traffic in Tai O Bay was identified as the major noise source for Station N1.
- The identified noise source for Station N9 included:
  - noise from the shipping traffic in Tai O Bay and the pier near the station;
  - noise from the people practicing Dragon Boats there; and
  - nosie from the market near the station.
- A bus stop was noted near Station N11 and the major noise source for Station N11 was traffic noise.
- No observable noise source for Station N17 was identified during the baseline monitoring period.

2.14 Except for the noise from the people practicing Dragon Boats, the noise source will still exist throughout the construction period. Therefore, the baseline monitoring results are considered representative to the ambient noise levels.

Action and Limit Levels

2.15 The Action and Limit Levels were established in accordance with the EM&A Manual. The baseline noise level shall act as a basis for the correction to the impact noise monitoring. **Table 2.8** presents the Action and Limit Levels for construction noise.

Table 2.8 Action Limit Levels for Noise during Construction Period

Time Period	Action Level	Limit Level
0700-1900 hrs on normal weekdays	When one documented complaint is received	75* dB(A)
0700-2300 hrs on holidays; and 1900-2300 hrs on all other days		60/65/70** dB(A)
2300-0700 hrs of next day		45/50/55** dB(A)

Notes:
* reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.
** to be selected based on Area Sensitivity Rating.
If works are to be carried out during restricted hours, the conditions stipulated in the construction noise.

3 WATER QUALITY

Monitoring Requirements

3.1 Baseline water quality monitoring was conducted three times per weeks for four weeks at the designated monitoring stations between 10th March 2003 and 4th April 2003. Monitoring took place two times per monitoring day during mid ebb and mid flood tides at three depths (1 meter from surface, mid depth and 1 meter from the bottom). Dissolved oxygen (DO), suspended solids (SS), turbidity, salinity, pH and temperature were monitored in accordance with the EM&A Manual.

Monitoring Locations

3.2 In accordance with the EM&A Manual, five water quality monitoring locations (Stations W1 to W5) were specified for baseline water quality monitoring. Two more locations (Stations A1 and A2) were added for water quality monitoring upon requested by the Independent Environmental Checker (IEC) and agreed by the Engineer. **Table 3.2** describes the locations of the monitoring stations. The locations are also shown on **Figure 3.1**.

Table 3.1 Locations of Baseline Water Quality Monitoring Stations

ID	Locations	Co-ordinates	
		Easting	Northing
W1*	Outer Bay	802250	813200
W2*	Outer Bay	801900	812710
W3*	Outer Bay	801850	812060
W4*	Outer Bay	802050	811530
W5*	Mouth of Tai O Creek	803844	812839
A1**	Salt Pan	803799	812606
A2**	Salt Pan	803899	812198

Notes:
* In accordance with the EM&A Manual.
** Upon requested by IEC and agreed by the Engineer.

Monitoring Equipment

3.3 The water sampler used for water quality monitoring was Kahlsico Water-Bottle Model 135DW150, except at Stations A1 and A2. The sampler with associated equipment complied with the specifications stipulated in the EM&A Manual.

3.4 Due the shallow water depth at Stations A1 and A2, the above-mentioned water sampler could not be used for water sampling at these stations. Water samples at these two stations were directly taken into polyethylene bottles.

3.5 **Table 3.1** summarizes the equipment used in the baseline water quality monitoring program. All the monitoring equipment complied with the specifications stipulated in the EM&A Manual. Copies of the calibration certificates of are attached in **Appendix B1**.

Table 3.2 Water Quality Monitoring Equipment

Equipment	Model and Make	Qty.
Water Sampler*	Kahlsico Water-Bottle Model 135DW 150	1
Multi-parameter Water Quality System	YSI 6820	2
Monitoring Position Equipment	"Magellan" Handheld GPS Model GPS-320	1

Notes:
* For Stations W1 to W5 only.

Monitoring Parameters, Frequency and Duration

3.6 **Table 3.3** summarizes the monitoring parameters, monitoring period and frequencies of baseline water quality monitoring.

Table 3.3 Baseline Water Quality Monitoring Parameters and Frequency

Station	Parameters	Frequency	No. of depth	No. of samples
W1	DO, SS, turbidity, salinity, pH & temperature	3 times per week for 4 weeks	3	2 per monitoring day (1 for mid-ebb and 1 for mid-flood)
W2			3	
W3			3	
W4			3	
W5			1 or 2[2]	
A1[1]			1[3]	
A2[1]			1[3]	

Notes:
1. No monitoring was conducted at Stations A1 and A2 on 10th and 12th March 2003. The monitoring works were rescheduled to 19th and 21st March 2003.
2. Except on 20 and 24 March 2003, the recorded water depth at Station W5 was less that 3 m. Only 1 sample at the mid-depth was taken each time. For the monitoring during 20th and 24th March 2003, 2 samples at surface and bottom depth were taken each time, respectively, since the recorded water depths were greater than 3 m.
3. The recorded water depths at Stations A1 and A2 were less than 3 m during the baseline monitoring, only 1 sample at mid-depth was taken each time.

Monitoring Methodology and QA/QC Procedures

Instrumentation

3.7 A multi-parameter meter (Model YSI 6820 CE-C-M-Y) was used to measure DO, turbidity, salinity, pH and temperature.

Operating/Analytical Procedures

3.8 At each measurement, two consecutive measurements of salinity, turbidity, pH and temperature were taken. The probes were retrieved out of the water after the first measurement and then re-deployed for the second measurement. Where the difference in the value between the first and second readings of each set was more than 25% of the value of the first reading, the reading was discarded and further readings were taken.

3.9 For SS measurement, grab samples of mid-depth water were collected. Water samples of about 500 ml were collected and stored in polyethylene bottles. The sample bottles were packed into an ice-box and delivered to a HOKLAS Laboratory, WELLAB Ltd., for the analysis of suspended solids contents within 24 hours.

Maintenance and Calibration

3.10 Before each round of monitoring, a zero check in distilled water was performed with the turbidity probe of YSI 6820. The probe was then calibrated with a solution of known NTU.

3.11 QA/QC procedures as attached in **Appendix B4** are available for the SS analyzed in the HOKLAS-accredited laboratory, WELLAB Ltd.

Results and Observations

Results

3.12 Baseline water quality monitoring was conducted between 10th March 2003 and 4th April 2003. The monitoring results are shown in **Appendix B2**. Graphical presentation of water quality at the monitoring stations is given in **Appendix B3**. The results DO, SS and turbidity levels are summarized in **Tables 4.4 and 4.5**, which show the averages and ranges of readings recorded. **Table 4.6** shows that depth-averages results of DO, SS and turbidity levels. Detailed weather condition at the monitoring locations during the baseline monitoring period is shown in **Appendix C**.

Table 3.4 Baseline Water Quality Monitoring Results during Mid-Ebb

Station		DO (mg/L)			SS (mg/L)			Turbidity (NTU)		
		Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
W1	Surface	8.4	9.9	7.4	12.9	31.4	5.4	9.6	22.5	4.6
	Middle	8.3	9.6	7.1	17.7	37.2	7.4	15.0	25.4	5.4
	Bottom	8.1	9.7	7.0	18.9	63.5	6.0	39.4	91.2	12.5
W2	Surface	8.4	9.6	7.3	10.9	17.3	4.4	10.0	22.6	5.3
	Middle	8.2	9.8	7.1	20.2	58.8	7.6	17.7	43.4	6.1
	Bottom	8.2	10.2	7.0	31.3	77.3	5.0	49.5	137.8	9.3
W3	Surface	8.6	9.8	7.4	11.8	37.0	5.0	11.5	39.4	4.6
	Middle	8.4	9.9	7.1	21.4	89.7	8.2	20.1	67.7	8.1
	Bottom	7.4	7.1	7.1	45.4	188.0	7.0	78.6	476.9	11.4
W4	Surface	8.6	10.5	7.2	20.0	65.5	7.8	20.5	66.9	5.7
	Middle	8.5	10.4	7.1	29.9	95.0	8.0	34.9	110.1	5.4
	Bottom	8.4	10.4	7.1	37.4	97.0	9.4	62.9	228.9	6.5
W5	Surface	8.1	8.1	8.1	13.8	13.8	13.8	13.0	13.0	13.0
	Middle	7.5	9.5	6.1	16.8	23.8	10.9	16.9	26.7	8.8
	Bottom	8	8	8	14.5	14.5	14.5	15.0	15.0	15.0
A1	Middle	8.1	9.8	7.0	24.7	47.3	8.6	24.4	54.6	13.4
A2	Middle	8.1	10.0	6.4	43.15	69.7	19.8	39.2	65.0	16.2

Table 3.5 Baseline Water Quality Monitoring Results during Mid-Flood

Station		DO (mg/L)			SS (mg/L)			Turbidity (NTU)		
		Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.
W1	Surface	8.4	9.9	7.4	13.5	34.7	4.6	14.8	47.0	5.8
	Middle	8.3	9.6	7.1	24.0	67.3	8.0	26.1	62.6	7.0
	Bottom	8.0	9.7	7.0	54.5	154.7	11.0	79.3	207.2	7.6
W2	Surface	8.5	10.4	7.2	18.1	57.0	7.6	15.3	44.5	5.5
	Middle	8.4	10.1	7.1	23.3	76.0	9.0	33.0	88.1	4.9
	Bottom	8.3	10.1	7.0	76.0	224.0	10.8	92.0	282.0	8.1
W3	Surface	8.7	11.5	7.2	17.1	50.0	5.2	14.2	42.9	4.7
	Middle	8.5	10.4	7.1	21.1	61.7	6.4	31.1	91.9	6.4
	Bottom	8.4	10.8	7.1	54.7	172.5	8.2	79.7	264.9	7.9
W4	Surface	8.8	10.9	7.3	19.8	37.0	7.0	17.5	38.2	5.5
	Middle	8.5	10.8	7.1	23.6	45.3	5.6	28.2	57.3	8.1
	Bottom	8.4	11.1	7.0	38.9	95.0	11.0	55.2	154.1	10.2
W5	Surface	9.4	9.4	9.3	27.2	30.3	24.0	28.3	29.3	27.3
	Middle	7.7	10.9	6.4	21.0	58.6	11.0	20.1	28.2	35.4
	Bottom	9.4	9.4	9.4	32.0	32.7	31.3	31.3	35.4	27.2
A1	Middle	8.2	10.1	6.8	31.2	131.0	12.8	23.0	42.6	10.9
A2	Middle	7.9	9.3	6.5	33.6	65.3	10.4	41.9	68.6	27.4

Observations

3.13 During the baseline water quality monitoring period, the following observations were made:

- Discharge from two outfalls observed near Station A2 was identified as the major pollution source influencing water quality at Station A2.

- Although no observable pollution source was identified at Stations W1 to W4 during the baseline monitoring period, the SS and turbidity levels at these stations were exceptionally high. Moreover, it was observed the SS and turbidity levels at bottom levels at these stations were significantly higher that those at surface and middle levels. In order to verify these abnormal monitoring results and check whether the results were due to improper sampling, the following observations were noted to confirm the validity of the monitoring data:
  - The monitoring results showed that when high SS levels (> 50 mg/L) were recorded, high turbidity levels were observed. While there is no good correlation between SS and turbidity, one would normally expect that turbidity would be high if SS were high;
  - When high SS and turbidity levels were observed at one monitoring station, same trend of results were also recorded at other stations.
- The observations may confirm the validity of the monitoring data. The high SS and turbidity levels at Stations W1 to W4 may be due to the fact the Tai O lies on the western edge of Lantau Island in the Pearl River Estuary (Lingdingyang). The marine water there is strongly influenced by the Pearl River flows.

- For Station W5, the recorded water depth was less than 3 m except for the monitoring during flood tide on 20th and 24th March 2003 and ebb tide on 24th March 2003. Only 1 sample at mid-depth was taken during each monitoring. However, during the above-mentioned 3 monitoring periods, the recorded water depths were greater 3 m, 2 samples at surface and mid-depth were taken during each monitoring. In accordance with the EM&A Manual, the action level for DO has to be divided into two groups, "the pooled data at surface and middle depths" and "pooled data at bottom depth". However, since the number of data of DO at bottom levels at Station W5 was too little, average of the results at the two depths in the above-mentioned data points will be taken. These depth-averaged data of DO will be used to derive the Action / Limit Levels.

3.14 Since no observable pollution activity was observed except for Station A2, and the pollution source observed at Station A2 will exist throughout the construction period, the baseline monitoring results are considered representative to the ambient water quality levels.

Statistical Analysis

3.15 One way Analysis of Variance (ANOVA) was applied to test for the differences in the baseline monitoring data of Dissolved Oxygen, Turbidity and Suspended Solid between the 7 designated water quality monitoring locations. The analysis results, as presented in **Table 3.6**, show that no significant difference can be found among the 7 monitoring locations except for turbidity.

Table 3.6 Summary of the Results of ANOVA

Parameter	Stations involved	Sample Size	Degree of Freedom	P-value	F-value
DO (suface and middle)	All	168	6	0.053	2.120
DO (bottom)	W1 to W4	96	3	0.610	0.610
SS	All	168	6	0.094	1.838
Turbidity	All	168	6	**0.045**	2.205

3.16 As significant results for turbidity levels were obtained, statistical analysis was further conducted for different groups of monitoring stations in accordance with their locations. Based on the statistically analysis results, the following groups of pooled baseline monitoring data for deriving Action and Limit Levels are provided as below:

- Stations W1 to W5;
- Stations A1 and A2.

Action and Limit Levels

3.17 The Action and Limit levels for DO, SS & Turbidity have been set in compliance with the EM&A Manual, which are summarized in **Table 3.7**.

Table 3.7 Action and Limit Levels for Water Quality

Parameter (unit)	Action	Limit
Dissolved Oxygen (mg/L) (surface, middle, bottom)	*Surface and middle* 5%-ile of baseline for surface and middle layers *Bottom* 5%-ile of baseline for bottom layer	*Surface and middle* 4 mg/L or 1%-ile of baseline for surface and middle layers *Bottom* 2 mg/L or 1%-ile of baseline for bottom layer
SS (mg/L) Depth average	95%-ile of baseline data or 120% of upstream control station's SS at the same tide of the same day	99%-ile of baseline or 130% of SS readings at the upstream control station at the same tide of same day and specific sensitive receiver water quality requirements
Turbidity (NTU) (depth average)	95%-ile of baseline data or 120 % of upstream control station's turbidity at the same tide of the same day	99%-ile of baseline or 130% of turbidity at the upstream control station at the same tide of same day

3.18 Following these criteria, the Action and Limit Levels for water quality impact monitoring have been set as **Table 3.6**.

Table 3.8 Calculated Action and Limit Levels for Water Quality

<table>
<tr><th colspan="2">Parameter</th><th colspan="2">Action</th><th colspan="2">Limit</th></tr>
<tr><td rowspan="2">DO, mg/L</td><td>Surface and middle</td><td colspan="2">6.8</td><td colspan="2">6.4</td></tr>
<tr><td>Bottom</td><td colspan="2">7.1</td><td colspan="2">7.0</td></tr>
<tr><td colspan="2">SS, mg/L</td><td colspan="2">69.8 or 120% of upstream control station's SS at the same tide of the same day</td><td colspan="2">96.8 or 130% of SS readings at the upstream control station at the same tide of same day and specific sensitive receiver water quality requirements</td></tr>
<tr><td colspan="2" rowspan="2">Turbidity, NTU</td><td>W1 to W5:
101.4</td><td>A1 & A2:
64.2</td><td>W1 to W5:
134.5</td><td>A1 & A2:
66.9</td></tr>
<tr><td colspan="2">or 120 % of upstream control station's turbidity at the same tide of the</td><td colspan="2">or 130% of turbidity at the upstream control station at the same</td></tr>
</table>

4 REVISIONS FOR INCLUSION IN THE EM&A MANUAL

4.1 The baseline environmental monitoring was conducted according to the EM&A Manual for noise and water quality.

4.2 The monitoring methodology, parameters monitored, and monitoring locations are in line with the EM&A Manual except the water quality monitoring at Stations A1 and A2, which are not specified in the EM&A Manual, but requested by IEC and approved by the Engineer.

4.3 Due to the shallow water depth at Stations A1 and A2, the water sampler as specified in the EM&A Manual could not be used. Water samples at these two stations were directly taken into polyethylene bottles.

5 CONCLUSIONS

5.1 The baseline environmental monitoring was conducted between 10th March 2003 and 4th April 2003. The monitoring results were used to establish the Action and Limit Levels for the relevant parameters during impact/compliance monitoring throughout construction periods.

5.2 Baseline noise monitoring was conducted at 4 designated monitoring stations (N1, N9, N11 and N17) between 21st March 2003 and 4th April 2003. The major noise sources identified at the monitoring Stations N1 and N9 were shipping traffic in Tai O Bay. Road traffic noise from the bus stop was considered as the major noise source for Station N11. The baseline monitoring results are considered representative to the ambient noise level.

5.3 Baseline water quality monitoring was conducted at 7 monitoring stations between 10th March 2003 and 4th April 2003. Five of the monitoring stations (W1 to W5) were in accordance with the EM&A Manual while 2 (A1 and A2) were requested by IEC and agreed by the Engineer. Pollution identified at Station A2 was mainly from outfall discharges near the station. No observable pollution source was observed at other stations.