

Calculation of Marine Emission Rates
(Construction Phase)

Emission Factors for Existing Marine Vessels Travelling Within the 500m Assessment Area

Existing Marine Vessels - From / To SkyPier

Main Engine (ME) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption						ME Emission Factor (g/kWh) ⁷				Effective Emission Factor (g/hr) ⁹			
		MVEIS Vessel Type	Operation Mode ²	ME Engine Type ³	Fuel Type ⁴	Total ME Power Rating (kW) ⁵	ME Load Factor ⁶	SO ₂ ⁸	NOx	PM10	PM2.5	SO ₂	NOx	PM10	PM2.5
Ferry between SkyPier and Macau Outer Harbour Ferry Terminal (XZM)															
Macau Ferry (Gas Turbine)	0	Macau Ferry (GT)	Hotelling	Gas Turbine	MGO	8664	0.000	0	0	0	0	0	0	0	0
Macau Ferry (Gas Turbine)	8	Macau Ferry (GT)	Maneuvering	Gas Turbine	MGO	8664	0.184	2.93	5.7	0.35	0.32	4.67E+03	9.08E+03	5.58E+02	5.10E+02
Macau Ferry (Gas Turbine)	12	Macau Ferry (GT)	Slow Cruise	Gas Turbine	MGO	8664	0.276	2.93	5.7	0.35	0.32	7.00E+03	1.36E+04	8.37E+02	7.65E+02
Macau Ferry (Diesel Engine)	0	Macau Ferry (DE)	Hotelling	Diesel	MGO	9280	0.000	0	0	0	0	0	0	0	0
Macau Ferry (Diesel Engine)	8	Macau Ferry (DE)	Maneuvering	Diesel	MGO	9280	0.188	2.08	11.35	0.31	0.29	3.63E+03	1.98E+04	5.42E+02	5.07E+02
Macau Ferry (Diesel Engine)	12	Macau Ferry (DE)	Slow Cruise	Diesel	MGO	9280	0.282	2.08	11.35	0.31	0.29	5.45E+03	2.97E+04	8.12E+02	7.60E+02
Ferry between SkyPier and Macau Taipa Ferry Terminal (YFT)															
Macau Ferry (Diesel Engine)	0	Macau Ferry (DE)	Hotelling	Diesel	MGO	9280	0.000	0	0	0	0	0	0	0	0
Macau Ferry (Diesel Engine)	8	Macau Ferry (DE)	Maneuvering	Diesel	MGO	9280	0.188	2.08	8.33	0.31	0.29	3.63E+03	1.46E+04	5.42E+02	5.07E+02
Macau Ferry (Diesel Engine)	12	Macau Ferry (DE)	Slow Cruise	Diesel	MGO	9280	0.282	2.08	8.33	0.31	0.29	5.45E+03	2.18E+04	8.12E+02	7.60E+02
Ferry between SkyPier and PRD (PRD)															
PRD Ferry	0	PRD Ferry	Hotelling	Diesel	MGO	3150	0.000	0	0	0	0	0	0	0	0
PRD Ferry	8	PRD Ferry	Maneuvering	Diesel	MGO	3150	0.260	2.08	4.89	0.31	0.29	1.70E+03	4.01E+03	2.54E+02	2.38E+02
PRD Ferry	12	PRD Ferry	Slow Cruise	Diesel	MGO	3150	0.390	2.08	4.89	0.31	0.29	2.56E+03	6.01E+03	3.81E+02	3.56E+02

Auxiliary Engine (AE) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption						AE Emission Factor (g/kWh) ⁷				Effective Emission Factor (g/hr) ⁹			
		MVEIS Vessel Type	Operation Mode ²	Fuel Type ⁴	Total AE Power Rating (kW) ¹⁰	AE Load Factor ¹¹	SO ₂ ⁸	NOx	PM10	PM2.5	SO ₂	NOx	PM10	PM2.5	
Ferry between SkyPier and Macau Outer Harbour Ferry Terminal (XZM)															
Macau Ferry (Gas Turbine)	0	Macau Ferry (GT)	Hotelling	MGO	326	0.450	2.93	5.70	0.35	0.32	4.30E+02	8.36E+02	5.13E+01	4.69E+01	
Macau Ferry (Gas Turbine)	8	Macau Ferry (GT)	Maneuvering	MGO	326	0.450	2.93	5.70	0.35	0.32	4.30E+02	8.36E+02	5.13E+01	4.69E+01	
Macau Ferry (Gas Turbine)	12	Macau Ferry (GT)	Slow Cruise	MGO	326	0.450	2.93	5.70	0.35	0.32	4.30E+02	8.36E+02	5.13E+01	4.69E+01	
Macau Ferry (Diesel Engine)	0	Macau Ferry (DE)	Hotelling	MGO	326	0.450	2.12	8.43	0.31	0.29	3.11E+02	1.24E+03	4.55E+01	4.25E+01	
Macau Ferry (Diesel Engine)	8	Macau Ferry (DE)	Maneuvering	MGO	326	0.450	2.12	8.43	0.31	0.29	3.11E+02	1.24E+03	4.55E+01	4.25E+01	
Macau Ferry (Diesel Engine)	12	Macau Ferry (DE)	Slow Cruise	MGO	326	0.450	2.12	8.43	0.31	0.29	3.11E+02	1.24E+03	4.55E+01	4.25E+01	
Ferry between SkyPier and Macau Taipa Ferry Terminal (YFT)															
Macau Ferry (Diesel Engine)	0	Macau Ferry (DE)	Hotelling	MGO	326	0.450	2.12	5.96	0.31	0.29	3.11E+02	8.74E+02	4.55E+01	4.25E+01	
Macau Ferry (Diesel Engine)	8	Macau Ferry (DE)	Maneuvering	MGO	326	0.450	2.12	5.96	0.31	0.29	3.11E+02	8.74E+02	4.55E+01	4.25E+01	
Macau Ferry (Diesel Engine)	12	Macau Ferry (DE)	Slow Cruise	MGO	326	0.450	2.12	5.96	0.31	0.29	3.11E+02	8.74E+02	4.55E+01	4.25E+01	
Ferry between SkyPier and PRD (PRD)															
PRD Ferry	0	PRD Ferry	Hotelling	MGO	188	0.450	2.12	5.75	0.31	0.29	1.79E+02	4.86E+02	2.62E+01	2.45E+01	
PRD Ferry	8	PRD Ferry	Maneuvering	MGO	188	0.450	2.12	5.75	0.31	0.29	1.79E+02	4.86E+02	2.62E+01	2.45E+01	
PRD Ferry	12	PRD Ferry	Slow Cruise	MGO	188	0.450	2.12	5.75	0.31	0.29	1.79E+02	4.86E+02	2.62E+01	2.45E+01	

Remarks

(1) Operation modes were referenced to Table 3-24, Study on Marine Vessels Emission Inventory (MVEIS) published by EPD in February 2012. According to Table 3-24, MVEIS, maximum vessel speed for operation mode of maneuvering of 8 knots and slow cruise of 12 knots are adopted as a conservative approach.

(2) Operation Mode was derived from Table 3-24, MVEIS.

(3) Engine Type refers to Table 4-17, MVEIS.

(4) Fuel Type refers to Section 4.2.26, MVEIS.

(5) Main Engine Power Rating refers to Appendix 5.3.12-3 Table 1 of AEIAR-185/2014 - Expansion of Hong Kong International Airport into a Three-Runway System and S4.2.8, MVEIS

(6) ME Loading Factor refers to Appendix 5.3.12-3 Table 3 of AEIAR-185/2014 - Expansion of Hong Kong International Airport into a Three-Runway System.

Mechanical Power = Force x Velocity Assume Force is constant, thus load factor is proportional to speed. (ME Loading Factor = Speed / Maximum Speed)

For Maneuvering,

For Slow Cruise,

ME Loading Factor - Macau Ferry (Gas Turbine) = 8 / 43.5

ME Loading Factor - Macau Ferry (Gas Turbine) = 12 / 43.5

ME Loading Factor - Macau Ferry (Diesel Engine) = 8 / 42.5

ME Loading Factor - Macau Ferry (Diesel Engine) = 12 / 42.5

ME Loading Factor - PRD Ferry = 8 / 30.75

ME Loading Factor - PRD Ferry = 12 / 30.75

(7) ME and AE Emission Factor refers to Table 4-17, MVEIS, except NOx Emission Factor of Diesel Engine. For ME and AE, average NOx Emission Factor of Diesel Engine are calculated based on the vessel inventory provided by AAHK and NOx Emission Factor in Table H.6., Ports Emissions Inventory Guidance published by USEPA in April 2022.

Route	Model Year	No. of Vessels	Corresponding NO _x Emission Factor (g/kWh)		Average NO _x Emission Factor (g/kWh)	
			ME	AE	ME	AE
XZM	Pre-2003	3	13.36	10.08	11.35	8.43
	2007-2012	2	8.33	5.96		
YFT	2007-2012	11	8.33	5.96	8.33	5.96
	Pre-2003	7	13.36	10.08		
PRD	2007-2012	11	8.33	5.96	4.89	5.75
	2013	1	8.33	5.66		
	2014-2018	28	1.3	4.58		

(8) Under the Air Pollution Control (Fuel for Vessels) Regulation, vessels are required to use compliant fuel (with sulphur content not exceeding 0.5%) within Hong Kong waters, thus adopted for calculation of emission factor for pleasure vessel.

(9) Effective Emission Factor = Power Rating x Load Factor, if applicable x Low Load Adjustment Multiplier, if applicable x Emission Factor

(10) Auxiliary Engine Power refers to Appendix 5.3.12-3 Table 2 of AEIAR-185/2014 - Expansion of Hong Kong International Airport into a Three-Runway System and S4.2.12 - S4.2.13, MVEIS.

(11) AE Loading Factor refers to Table 4-10, MVEIS

**Calculation of Marine Emission Rates
(Construction Phase)**

**Emission Rates for Existing Marine Vessels Travelling within the 500m Assessment Area
Breakdown of Marine Emission Rates for Existing Marine Vessels (From / To SkyPier)**

Vessel Type	Speed (knot) ¹	Operation Mode	Distance (km) ²	Time-in-mode (min) ³	No. of Activity per day ⁴	ME Emission (g/s)				AE Emission (g/s)				Subtotal (g/s)			
						SO ₂	NOx	PM10	PM2.5	SO ₂	NOx	PM10	PM2.5	SO ₂	NOx	PM10	PM2.5
Ferry between Skypier and Macau Outer Harbour Ferry Terminal																	
Macau Ferry (Gas Turbine)	0	Hotelling	0.00	30.00	6	0	0	0	0	3.58E-01	6.97E-01	4.28E-02	3.91E-02	3.58E-01	6.97E-01	4.28E-02	3.91E-02
Macau Ferry (Gas Turbine)	8	Maneuvering	0.22	0.90	6	1.17E-01	2.27E-01	1.39E-02	1.27E-02	1.07E-02	2.09E-02	1.28E-03	1.17E-03	1.27E-01	2.48E-01	1.52E-02	1.39E-02
Macau Ferry (Gas Turbine)	12	Slow Cruise	0.28	0.77	6	1.49E-01	2.90E-01	1.78E-02	1.63E-02	9.15E-03	1.78E-02	1.09E-03	9.99E-04	1.58E-01	3.08E-01	1.89E-02	1.73E-02
Macau Ferry (Diesel Engine)	0	Hotelling	0.00	30.00	3	0	0	0	0	1.30E-01	5.15E-01	1.89E-02	1.77E-02	1.30E-01	5.15E-01	1.89E-02	1.77E-02
Macau Ferry (Diesel Engine)	8	Maneuvering	0.22	0.90	3	4.54E-02	2.48E-01	6.77E-03	6.33E-03	3.89E-03	1.55E-02	5.68E-04	5.32E-04	4.93E-02	2.63E-01	7.34E-03	6.86E-03
Macau Ferry (Diesel Engine)	12	Slow Cruise	0.28	0.77	3	5.80E-02	3.16E-01	8.64E-03	8.09E-03	3.31E-03	1.32E-02	4.84E-04	4.53E-04	6.13E-02	3.30E-01	9.13E-03	8.54E-03
Ferry between Skypier and Macau Taipa Ferry Terminal																	
Macau Ferry (Diesel Engine)	0	Hotelling	0.00	30.00	12	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.18E-01	1.46E+00	7.58E-02	7.09E-02	5.18E-01	1.46E+00	7.58E-02	7.09E-02
Macau Ferry (Diesel Engine)	8	Maneuvering	0.22	0.90	12	1.82E-01	7.28E-01	2.71E-02	2.53E-02	1.56E-02	4.37E-02	2.27E-03	2.13E-03	1.97E-01	7.71E-01	2.93E-02	2.75E-02
Macau Ferry (Diesel Engine)	12	Slow Cruise	0.28	0.77	12	2.32E-01	9.29E-01	3.46E-02	3.23E-02	1.32E-02	3.72E-02	1.94E-03	1.81E-03	2.45E-01	9.66E-01	3.65E-02	3.42E-02
Ferry between Skypier and PRD																	
PRD Ferry	0	Hotelling	0.00	22.80	73	0	0	0	0	1.38E+00	3.75E+00	2.02E-01	1.89E-01	1.38E+00	3.75E+00	2.02E-01	1.89E-01
PRD Ferry	8	Maneuvering	0.37	1.50	73	8.64E-01	2.03E+00	1.29E-01	1.20E-01	9.09E-02	2.47E-01	1.33E-02	1.24E-02	9.55E-01	2.28E+00	1.42E-01	1.33E-01
PRD Ferry	12	Slow Cruise	0.14	0.37	73	3.16E-01	7.44E-01	4.72E-02	4.41E-02	2.22E-02	6.02E-02	3.25E-03	3.04E-03	3.39E-01	8.04E-01	5.04E-02	4.72E-02

Remarks

- Operation modes were referenced to Table 3-24, MVEIS. According to Table 3-24, MVEIS, maximum vessel speed for operation mode of maneuvering of 8 knots and slow cruise of 12 knots are adopted as a conservative approach.
- Distance refers to the distance of route considered within the Assessment Area, approximately 506m.
Distance travelled by Maneuvering Mode is calculated based on vessel speed and time-in-mode from Table 4-14, MVEIS.
Distance travelled by Slow Cruise Mode = Total Distance Travelled - Distance travelled by Maneuvering Mode
- Time-in-mode of slow cruise is estimated by the distance and vessel speed travelled in the corresponding mode, while time-in-mode of hotelling and maneuvering refers to Table 4-14 and Table 4-15, MVEIS.
- No. of activity per day refers to Daily Sailing Schedule in 2018 (i.e. typical operation year) provided by AA. Ferry with Diesel Engine and Ferry with Gas Turbine are involved in the services between Skypier and Macau Outer Harbour Ferry Terminal.
No. of activity per day for Ferry with Diesel Engine and Ferry with Gas Turbine between Skypier and Macau Outer Harbour Ferry Terminal are estimated based on the ratio on no. of services provided by Ferry with Diesel Engine (approx. 64%) and Ferry with Gas Turbine (approx. 36%) in 2018.
- Emission (g/s) = (Effective Emission factor × Time-in-mode/60 × No. of activity per day) / 3600

Emission Rate for Marine Point Sources

Vessel Type	Operation Mode	Source ID	No. of Point Source	Emission Rate (g/s)			
				SO ₂	NOx	PM10	PM2.5
Ferry between Skypier and Macau Outer Harbour Ferry Terminal							
Macau Ferry (Gas Turbine)	Hotelling	XZM0	1	3.58E-01	6.97E-01	4.28E-02	3.91E-02
Macau Ferry (Diesel Engine)	Hotelling	XZM0	1	1.30E-01	5.15E-01	1.89E-02	1.77E-02
Subtotal of Hotelling				4.88E-01	1.21E+00	6.17E-02	5.68E-02
Macau Ferry (Gas Turbine)	Maneuvering	XZM1-10	10	1.27E-02	2.48E-02	1.52E-03	1.39E-03
Macau Ferry (Diesel Engine)	Maneuvering	XZM1-10	10	4.93E-03	2.63E-02	7.34E-04	6.86E-04
Subtotal of Maneuvering				1.77E-02	5.11E-02	2.26E-03	2.08E-03
Macau Ferry (Gas Turbine)	Slow Cruise	XZM11-21	11	1.44E-02	2.80E-02	1.72E-03	1.57E-03
Macau Ferry (Diesel Engine)	Slow Cruise	XZM11-21	11	5.57E-03	3.00E-02	8.30E-04	7.76E-04
Subtotal of Slow Cruise				2.00E-02	5.79E-02	2.55E-03	2.35E-03
Ferry between Skypier and Macau Taipa Ferry Terminal							
Macau Ferry (Diesel Engine)	Hotelling	YFT0	1	5.18E-01	1.46E+00	7.58E-02	7.09E-02
Macau Ferry (Diesel Engine)	Maneuvering	YFT1-10	10	1.97E-02	7.71E-02	2.93E-03	2.75E-03
Macau Ferry (Diesel Engine)	Slow Cruise	YFT11-21	11	2.23E-02	8.78E-02	3.32E-03	3.11E-03
Ferry between Skypier and PRD							
PRD Ferry	Hotelling	PRD0	1	1.38E+00	3.75E+00	2.02E-01	1.89E-01
PRD Ferry	Maneuvering	PRD1-15	15	6.37E-02	1.52E-01	9.47E-03	8.86E-03
PRD Ferry	Slow Cruise	PRD16-21	6	5.64E-02	1.34E-01	8.40E-03	7.86E-03

Remark

Emission Rate for each Point Source = Emission / No.of Point Source

Calculation of Marine Emission Rates
(Construction Phase)

Emission Factors for Existing Marine Vessels Travelling Within the 500m Assessment Area
Existing Marine Vessels - Tung Chung Navigation Channel

Main Engine (ME) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption							ME Emission Factor (g/kWh) ⁸				Effective Emission Factor (g/hr) ¹³			
		MVEIS Vessel Type	Operation Mode ²	ME Engine Type ³	Fuel Type ⁴	ME Power Rating (kW) ⁵	ME Load Factor ⁶	BSFC (g/kWh) ⁷	SO ₂ ^{9,10}	NOx	PM10 ¹¹	PM2.5 ¹²	SO ₂	NOx	PM10	PM2.5
Local Ferry	0	Others	Hotelling	MSD	MGO	643	0.000	213	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Local Ferry	5	Others	Maneuvering	MSD	MGO	643	0.300	213	0.21	10.00	0.17	0.16	4.02E+01	1.93E+03	3.21E+01	3.11E+01
Local Ferry	10	Others	Slow Cruise	MSD	MGO	643	0.450	213	0.21	10.00	0.17	0.16	6.02E+01	2.89E+03	4.81E+01	4.67E+01
Local Ferry	14	Others	Fairway Cruise	MSD	MGO	643	0.450	213	0.21	10.00	0.17	0.16	6.02E+01	2.89E+03	4.81E+01	4.67E+01
Local Ferry	15	Others	Fairway Cruise	MSD	MGO	643	0.450	213	0.21	10.00	0.17	0.16	6.02E+01	2.89E+03	4.81E+01	4.67E+01
Small Craft	0	Others	Hotelling	MSD	MGO	643	0.000	213	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Small Craft	6	Others	Maneuvering	MSD	MGO	643	0.300	213	0.21	10.00	0.17	0.16	4.02E+01	1.93E+03	3.21E+01	3.11E+01

Auxiliary Engine (AE) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption							AE Emission Factor (g/kWh) ⁸				Effective Emission Factor (g/hr) ¹³			
		MVEIS Vessel Type	Operation Mode ²	Fuel Type ⁴	AE Power Rating (kW) ¹⁴	AE Load Factor ¹⁵	BSFC (g/kWh) ⁷	SO ₂ ^{9,10}	NOx	PM10 ¹¹	PM2.5 ¹²	SO ₂	NOx	PM10	PM2.5	
Local Ferry	0	Others	Hotelling	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00	
Local Ferry	5	Others	Maneuvering	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00	
Local Ferry	10	Others	Slow Cruise	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00	
Local Ferry	14	Others	Fairway Cruise	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00	
Local Ferry	15	Others	Fairway Cruise	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00	
Small Craft	0	Others	Hotelling	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00	
Small Craft	6	Others	Maneuvering	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00	

Remarks

- (1) Average speed was determined on the site survey.
- (2) Operation mode was derived from Table 3-24, MVEIS.
- (3) For local ferry and small craft, it was assumed that all ME are MSD with reference to S4.2.27, MVEIS
- (4) For local ferry and small craft, it was assumed that the marine fuel used are MGO refers to S4.2.26, MVEIS
- (5) Average Main Engine Power refers to Table 4-5, MVEIS
- (6) ME Loading Factor refers to Table 4-7, MVEIS
- (7) Brake Specific Fuel Consumption (BSFC) refers to Table 4-16, MVEIS
- (8) ME and AE Emission Factor refers to Table 4-16, MVEIS
- (9) Under the Air Pollution Control (Marine Light Diesel) Regulation, the statutory cap of sulphur content of locally supplied marine light diesel is 0.05%, thus adopted for calculation of emission factor for local ferry and small craft which are fueled in Hong Kong.
- (10) SO₂ Emission Factor = Brake Specific Fuel Consumption x 2 x 0.97753 x Fuel Sulphur Fraction with reference to 4.2.31, MVEIS
- (11) PM10 EF = 0.23 + BSFC x 7 x 0.02247 x (Fuel Sulphur Fraction - 0.0024) with reference to 4.2.31, MVEIS
- (12) PM2.5 emissions were estimated to be 97% of PM10 emissions with reference to 4.2.32, MVEIS
- (13) Effective Emission Factor = Power Rating x Load Factor, if applicable x Low Load Adjustment Multiplier, if applicable x Emission Factor
- (14) Auxiliary Engine Power refers to Table 4-6, MVEIS
- (15) AE Loading Factor refers to Table 4-10, MVEIS.

**Calculation of Marine Emission Rates
(Construction Phase)**

**Emission Rates for Existing Marine Vessels Travelling within the 500m Assessment Area
Breakdown of Marine Emission Rates for Existing Marine Vessels (Tung Chung Navigation Channel)**

Vessel Type	Speed (knot) ¹	Operation Mode	Distance (km) ²	Time-in-mode (min) ³	No. of Activity per day ⁴	ME Emission (g/s)				AE Emission (g/s)				Subtotal (g/s)			
						SO2	NOX	PM10	PM2.5	SO2	NOX	PM10	PM2.5	SO2	NOX	PM10	PM2.5
Ferry between Tuen Mun and Tung Chung																	
Local Ferry	0	Hotelling	0.000	3.0	4	0	0	0	0	3.28E-04	1.58E-02	2.62E-04	2.54E-04	3.28E-04	1.58E-02	2.62E-04	2.54E-04
Local Ferry	5	Maneuvering	0.052	0.4	24	1.64E-03	7.86E-02	1.31E-03	1.27E-03	2.41E-04	1.16E-02	1.92E-04	1.87E-04	1.88E-03	9.02E-02	1.50E-03	1.45E-03
Local Ferry	10	Slow Cruise	0.057	0.2	24	1.23E-03	5.89E-02	9.80E-04	9.51E-04	1.20E-04	5.78E-03	9.62E-05	9.33E-05	1.35E-03	6.47E-02	1.08E-03	1.04E-03
Local Ferry	15	Fairway Cruise	0.239	0.5	24	3.46E-03	1.66E-01	2.76E-03	2.68E-03	3.39E-04	1.63E-02	2.71E-04	2.63E-04	3.79E-03	1.82E-01	3.03E-03	2.94E-03
Ferry between Tung Chung and Sha Lo Wan																	
Local Ferry	0	Hotelling	0.000	3.0	26	0	0	0	0	2.13E-03	1.02E-01	1.70E-03	1.65E-03	2.13E-03	1.02E-01	1.70E-03	1.65E-03
Local Ferry	2	Maneuvering	0.030	0.6	26	2.66E-03	1.28E-01	2.12E-03	2.06E-03	3.91E-04	1.88E-02	3.13E-04	3.03E-04	3.05E-03	1.46E-01	2.44E-03	2.36E-03
Local Ferry	10	Slow Cruise	0.166	0.5	26	3.75E-03	1.80E-01	2.99E-03	2.90E-03	3.67E-04	1.76E-02	2.94E-04	2.85E-04	4.11E-03	1.98E-01	3.29E-03	3.19E-03
Local Ferry	14	Fairway Cruise	0.681	1.6	26	1.14E-02	5.49E-01	9.13E-03	8.86E-03	1.12E-03	5.38E-02	8.96E-04	8.69E-04	1.26E-02	6.03E-01	1.00E-02	9.73E-03
Ferry between Tuen Mun and Tai O																	
Local Ferry	15	Fairway Cruise	1.225	2.6	7	5.17E-03	2.48E-01	4.13E-03	4.00E-03	5.07E-04	2.43E-02	4.05E-04	3.93E-04	5.67E-03	2.72E-01	4.53E-03	4.40E-03
Vessels From / To Tung Chung																	
Small Craft	0	Hotelling	0.000	3.0	23	0	0	0	0	1.89E-03	9.07E-02	1.51E-03	1.46E-03	1.89E-03	9.07E-02	1.51E-03	1.46E-03
Small Craft	6	Maneuvering	1.225	6.6	171	2.10E-01	1.01E+01	1.68E-01	1.63E-01	3.09E-02	1.49E+00	2.47E-02	2.40E-02	2.41E-01	1.16E+01	1.93E-01	1.87E-01

- Remarks
- (1) Average speed was determined on the site survey.
 - (2) Distance refers to the distance of route considered within the Assessment Area.
 - (3) Time-in-modes for different operation modes was determined on the site survey.
 - (4) For Local Ferry, no. of activity per day has made reference to the schedule (Sundays and Public Holidays) of Tuen Mun - Tung Chung - Sha Lo Wan - Tai O, the "Franchised and Licensed Ferry Service Details" published by TD for a conservative approach.
For Small craft, no. of activity per day was provided by the Project Marine Traffic Consultant.
 - (5) Emission (g/s) = (Effective Emission factor × Time-in-mode/60 × No. of activity per day) / 3600

Emission Rate for Marine Point Sources

Vessel Type	Operation Mode	Source ID	No. of Point Source	Emission Rate (g/s)			
				SO ₂	NO _x	PM10	PM2.5
Ferry between Tuen Mun and Tung Chung							
Local Ferry	Hotelling	TMTC0	1	3.28E-04	1.58E-02	2.62E-04	2.54E-04
Local Ferry	Maneuvering	TMTC1-3	3	6.26E-04	3.01E-02	5.00E-04	4.85E-04
Local Ferry	Slow Cruise	TMTC4-6	3	4.49E-04	2.16E-02	3.59E-04	3.48E-04
Local Ferry	Fairway Cruise	TMTC7-15	9	4.22E-04	2.03E-02	3.37E-04	3.27E-04
Ferry between Tung Chung and Sha Lo Wan							
Local Ferry	Hotelling	TCSW0	1	2.13E-03	1.02E-01	1.70E-03	1.65E-03
Local Ferry	Maneuvering	TCSW1-2	2	1.53E-03	7.32E-02	1.22E-03	1.18E-03
Local Ferry	Slow Cruise	TCSW3-9	7	5.88E-04	2.82E-02	4.70E-04	4.55E-04
Local Ferry	Fairway Cruise	TCSW10-36	27	4.65E-04	2.23E-02	3.71E-04	3.60E-04
Ferry between Tuen Mun and Tai O							
Local Ferry	Fairway Cruise	TMTO1-50	50	1.13E-04	5.45E-03	9.06E-05	8.79E-05
From / To Tung Chung							
Small Craft	Hotelling	FTTC0	1	1.89E-03	9.07E-02	1.51E-03	1.46E-03
Small Craft	Maneuvering	FTTC1-50	50	4.83E-03	2.32E-01	3.85E-03	3.74E-03

Remark:
Emission Rate for each Point Source = Emission / No.of Point Source

**Calculation of Marine Emission Rates
(Construction Phase)**

**Emission Factors for Marine Vessels Travelling Within the 500m Assessment Area
Construction Vessels (Project-related)
Main Engine (ME) Emission**

Vessel Type	Speed (knot) ¹	MVEIS Assumption							ME Emission Factor (g/kWh) ⁸				Effective Emission Factor (g/hr) ¹³			
		MVEIS Vessel Type	Operation Mode ²	ME Engine Type ³	Fuel Type ⁴	ME Power Rating (kW) ⁵	ME Load Factor ⁶	BSFC (g/kWh) ⁷	SO ₂ ^{9,10}	NOx	PM10 ¹¹	PM2.5 ¹²	SO ₂	NOx	PM10	PM2.5
Tugboat	0	Tug	Hotelling	MSD	MGO	625	0.000	213	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tugboat	5	Tug	Maneuvering	MSD	MGO	625	0.300	213	0.21	13.20	0.17	0.16	3.90E+01	2.48E+03	3.12E+01	3.03E+01
Workboat	0	Others	Hotelling	MSD	MGO	643	0.000	213	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Workboat	5	Others	Maneuvering	MSD	MGO	643	0.300	213	0.21	10.00	0.17	0.16	4.02E+01	1.93E+03	3.21E+01	3.11E+01

Auxiliary Engine (AE) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption							AE Emission Factor (g/kWh) ⁸				Effective Emission Factor (g/hr) ¹³			
		MVEIS Vessel Type	Operation Mode ²	Fuel Type ⁴	AE Power Rating (kW) ¹⁴	AE Load Factor ¹⁵	BSFC (g/kWh) ⁷	SO ₂ ^{9,10}	NOx	PM10 ¹¹	PM2.5 ¹²	SO ₂	NOx	PM10	PM2.5	
Tugboat	0	Tug	Hotelling	MGO	33	0.430	213	0.21	10.00	0.17	0.16	2.95E+00	1.42E+02	2.36E+00	2.29E+00	
Tugboat	5	Tug	Maneuvering	MGO	33	0.430	213	0.21	10.00	0.17	0.16	2.95E+00	1.42E+02	2.36E+00	2.29E+00	
Workboat	0	Others	Hotelling	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00	
Workboat	5	Others	Maneuvering	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00	

Remarks

- (1) Vessel speed was advised by the Project Engineer.
- (2) Operation mode was derived from Table 3-24, MVEIS
- (3) For RTVs, it was assumed that all ME are MSD with reference to S4.2.27, MVEIS
- (4) For RTVs, it was assumed that the the marine fuel used are MGO refers to S4.2.26, MVEIS
- (5) Average Main Engine Power refers to Table 4-5, MVEIS
- (6) ME Loading Factor refers to Table 4-7, MVEIS
- (7) Brake Specific Fuel Consumption (BSFC) refers to Table 4-16, MVEIS
- (8) ME and AE Emission Factor refers to Table 4-16, MVEIS
- (9) Under the Air Pollution Control (Marine Light Diesel) Regulation, the statutory cap of sulphur content of locally supplied marine light diesel is 0.05%, thus adopted for calculation of emission factor for tug and workboat which are fueled in Hong Kong.
- (10) SO₂ Emission Factor = Brake Specific Fuel Consumption x 2 x 0.97753 x Fuel Sulphur Fraction with reference to 4.2.31, MVEIS
- (11) PM10 EF = 0.23 + BSFC x 7 x 0.02247 x (Fuel Sulphur Fraction – 0.0024) with reference to 4.2.31, MVEIS
- (12) PM2.5 emissions were estimated to be 97% of PM10 emissions with reference to 4.2.32, MVEIS
- (13) Effective Emission Factor = Power Rating x Load Factor, if applicable x Low Load Adjustment Multiplier, if applicable x Emission Factor
- (14) Auxiliary Engine Power refers to Table 4-6, MVEIS.
- (15) AE Loading Factor refers to Table 4-10, MVEIS.

**Calculation of Marine Emission Rates
(Construction Phase)**

**Emission Rates for Marine Vessels Travelling within the 500m Assessment Area
Breakdown of Marine Emission Rates for Construction Vessel (Project-related)**

Vessel Type	Speed (knot) ¹	Operation Mode ²	Distance (km) ³	Time-in-mode (min) ⁴	No. of Activity per day ⁵	ME Emission (g/s) ⁶				AE Emission (g/s) ⁶				Subtotal (g/s)			
						SO2	NOX	PM10	PM2.5	SO2	NOX	PM10	PM2.5	SO2	NOX	PM10	PM2.5
From / to Works Area of the Pier																	
Tugboat	0	Hotelling	0.000	30.0	20	0	0	0	0	8.21E-03	3.94E-01	6.56E-03	6.36E-03	8.21E-03	3.94E-01	6.56E-03	6.36E-03
Tugboat	5	Maneuvering	0.650	4.2	4	3.04E-03	1.93E-01	2.43E-03	2.36E-03	2.30E-04	1.11E-02	1.84E-04	1.79E-04	3.28E-03	2.04E-01	2.62E-03	2.54E-03
Workboat	0	Hotelling	0.000	5.0	4	0	0	0	0	5.47E-04	2.63E-02	4.37E-04	4.24E-04	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	5	Maneuvering	0.650	4.2	4	3.13E-03	1.50E-01	2.50E-03	2.43E-03	4.61E-04	2.21E-02	3.68E-04	3.57E-04	3.59E-03	1.73E-01	2.87E-03	2.78E-03
From / to Works Area of the Berthing Facilities																	
Tugboat	0	Hotelling	0.000	30.0	20	0	0	0	0	8.21E-03	3.94E-01	6.56E-03	6.36E-03	8.21E-03	3.94E-01	6.56E-03	6.36E-03
Tugboat	5	Maneuvering	0.725	4.7	4	3.40E-03	2.15E-01	2.71E-03	2.63E-03	2.57E-04	1.23E-02	2.05E-04	1.99E-04	3.65E-03	2.28E-01	2.92E-03	2.83E-03
Workboat	0	Hotelling	0.000	5.0	4	0	0	0	0	5.47E-04	2.63E-02	4.37E-04	4.24E-04	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	5	Maneuvering	0.725	4.7	4	3.49E-03	1.68E-01	2.79E-03	2.71E-03	5.14E-04	2.47E-02	4.11E-04	3.98E-04	4.01E-03	1.92E-01	3.20E-03	3.11E-03
From / to Works Area F of ATCL																	
Tugboat	0	Hotelling	0.000	30.0	10	0	0	0	0	4.10E-03	1.97E-01	3.28E-03	3.18E-03	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	5	Maneuvering	0.575	3.7	4	2.69E-03	1.71E-01	2.15E-03	2.09E-03	2.04E-04	9.79E-03	1.63E-04	1.58E-04	2.90E-03	1.81E-01	2.31E-03	2.25E-03
Workboat	0	Hotelling	0.000	5.0	4	0	0	0	0	5.47E-04	2.63E-02	4.37E-04	4.24E-04	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	5	Maneuvering	0.575	3.7	4	2.77E-03	1.33E-01	2.21E-03	2.15E-03	4.08E-04	1.96E-02	3.26E-04	3.16E-04	3.18E-03	1.53E-01	2.54E-03	2.46E-03
From / to Works Area G of ATCL																	
Tugboat	0	Hotelling	0.000	30.0	10	0	0	0	0	4.10E-03	1.97E-01	3.28E-03	3.18E-03	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	5	Maneuvering	0.600	3.9	4	2.81E-03	1.78E-01	2.25E-03	2.18E-03	2.13E-04	1.02E-02	1.70E-04	1.65E-04	3.02E-03	1.88E-01	2.42E-03	2.34E-03
Workboat	0	Hotelling	0.000	5.0	4	0	0	0	0	5.47E-04	2.63E-02	4.37E-04	4.24E-04	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	5	Maneuvering	0.600	3.9	4	2.89E-03	1.39E-01	2.31E-03	2.24E-03	4.25E-04	2.04E-02	3.40E-04	3.30E-04	3.32E-03	1.59E-01	2.65E-03	2.57E-03
From / to Works Area H of ATCL																	
Tugboat	0	Hotelling	0.000	30.0	10	0	0	0	0	4.10E-03	1.97E-01	3.28E-03	3.18E-03	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	5	Maneuvering	0.625	4.0	4	2.93E-03	1.86E-01	2.34E-03	2.27E-03	2.22E-04	1.06E-02	1.77E-04	1.72E-04	3.15E-03	1.96E-01	2.52E-03	2.44E-03
Workboat	0	Hotelling	0.000	5.0	4	0	0	0	0	5.47E-04	2.63E-02	4.37E-04	4.24E-04	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	5	Maneuvering	0.625	4.0	4	3.01E-03	1.45E-01	2.41E-03	2.33E-03	4.43E-04	2.13E-02	3.54E-04	3.43E-04	3.46E-03	1.66E-01	2.76E-03	2.68E-03
From / to Works Area I of ATCL																	
Tugboat	0	Hotelling	0.000	30.0	10	0	0	0	0	4.10E-03	1.97E-01	3.28E-03	3.18E-03	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	5	Maneuvering	0.725	4.7	4	3.40E-03	2.15E-01	2.71E-03	2.63E-03	2.57E-04	1.23E-02	2.05E-04	1.99E-04	3.65E-03	2.28E-01	2.92E-03	2.83E-03
Workboat	0	Hotelling	0.000	5.0	4	0	0	0	0	5.47E-04	2.63E-02	4.37E-04	4.24E-04	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	5	Maneuvering	0.725	4.7	4	3.49E-03	1.68E-01	2.79E-03	2.71E-03	5.14E-04	2.47E-02	4.11E-04	3.98E-04	4.01E-03	1.92E-01	3.20E-03	3.11E-03
From / to Works Area M of ATCL																	
Tugboat	0	Hotelling	0.000	30.0	10	0	0	0	0	4.10E-03	1.97E-01	3.28E-03	3.18E-03	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	5	Maneuvering	0.500	3.2	4	2.34E-03	1.48E-01	1.87E-03	1.82E-03	1.77E-04	8.51E-03	1.42E-04	1.37E-04	2.52E-03	1.57E-01	2.01E-03	1.95E-03
Workboat	0	Hotelling	0.000	5.0	4	0	0	0	0	5.47E-04	2.63E-02	4.37E-04	4.24E-04	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	5	Maneuvering	0.500	3.2	4	2.41E-03	1.16E-01	1.93E-03	1.87E-03	3.55E-04	1.70E-02	2.83E-04	2.75E-04	2.76E-03	1.33E-01	2.21E-03	2.14E-03
From / to Works Area N of ATCL																	
Tugboat	0	Hotelling	0.000	30.0	10	0	0	0	0	4.10E-03	1.97E-01	3.28E-03	3.18E-03	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	5	Maneuvering	0.550	3.6	4	2.58E-03	1.63E-01	2.06E-03	2.00E-03	1.95E-04	9.36E-03	1.56E-04	1.51E-04	2.77E-03	1.73E-01	2.21E-03	2.15E-03
Workboat	0	Hotelling	0.000	5.0	4	0	0	0	0	5.47E-04	2.63E-02	4.37E-04	4.24E-04	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	5	Maneuvering	0.550	3.6	4	2.65E-03	1.27E-01	2.12E-03	2.05E-03	3.90E-04	1.87E-02	3.12E-04	3.02E-04	3.04E-03	1.46E-01	2.43E-03	2.36E-03
From / to Works Area D of ATCL																	
Tugboat	0	Hotelling	0.000	30.0	10	0	0	0	0	4.10E-03	1.97E-01	3.28E-03	3.18E-03	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	5	Maneuvering	0.500	3.2	6	3.51E-03	2.23E-01	2.81E-03	2.72E-03	2.66E-04	1.28E-02	2.12E-04	2.06E-04	3.78E-03	2.36E-01	3.02E-03	2.93E-03
Workboat	0	Hotelling	0.000	5.0	4	0	0	0	0	5.47E-04	2.63E-02	4.37E-04	4.24E-04	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	5	Maneuvering	0.500	3.2	4	2.41E-03	1.16E-01	1.93E-03	1.87E-03	3.55E-04	1.70E-02	2.83E-04	2.75E-04	2.76E-03	1.33E-01	2.21E-03	2.14E-03

Remarks

- (1) Vessel speed was advised by the Project Engineer.
- (2) Operation mode was derived from Table 3-24, MVEIS
- (3) Distance refers to the distance of route considered within the Assessment Area.
- (4) Time-in-mode of maneuvering is estimated by the distance and vessel speed travelled in the corresponding mode, while time-in-mode of hotelling was advised by the Project Engineer.
- (5) No. of activity per day was provided by the Project Engineer.
- (6) Emission (g/s) = (Effective Emission factor × Time-in-mode/60 × No. of activity per day) / 3600
- (7) No marine vessel emission would be generated from the barge, which is not propelled by an engine or mechanics. Tugboat would be used to haul the barge. Barge was excluded in the calculation.
- (8) For a conservative approach, construction activities are assumed to be concurrently undertaken at all works areas.

Emission Rate for Marine Point Sources













Vessel Type	Operation Mode	Source ID	No. of Point Source	Emission Rate (g/s)			
				SO ₂	NO _x	PM10	PM2.5
From / to Works Area of the Pier							
Tugboat	Hotelling	MFAT0	1	8.21E-03	3.94E-01	6.56E-03	6.36E-03
Tugboat	Maneuvering	MFAT1-27	27	1.21E-04	7.56E-03	9.69E-05	9.40E-05
Workboat	Hotelling	MFAW0	1	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	Maneuvering	MFAW1-27	27	1.33E-04	6.39E-03	1.06E-04	1.03E-04
From / to Works Area of the Berthing Facilities							
Tugboat	Hotelling	MFBT0	1	8.21E-03	3.94E-01	6.56E-03	6.36E-03
Tugboat	Maneuvering	MFBT1-30	30	1.22E-04	7.59E-03	9.73E-05	9.44E-05
Workboat	Hotelling	MFBW0	1	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	Maneuvering	MFBW1-30	30	1.34E-04	6.42E-03	1.07E-04	1.04E-04
From / to Works Area F of ATCL							
Tugboat	Hotelling	AFT0	1	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	Maneuvering	AFT1-24	24	1.21E-04	7.52E-03	9.64E-05	9.36E-05
Workboat	Hotelling	AFW0	1	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	Maneuvering	AFW1-24	24	1.32E-04	6.36E-03	1.06E-04	1.03E-04
From / to Works Area G of ATCL							
Tugboat	Hotelling	AGT0	1	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	Maneuvering	AGT1-25	25	1.21E-04	7.54E-03	9.66E-05	9.37E-05
Workboat	Hotelling	AGW0	1	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	Maneuvering	AGW1-25	25	1.33E-04	6.37E-03	1.06E-04	1.03E-04
From / to Works Area H of ATCL							
Tugboat	Hotelling	AHT0	1	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	Maneuvering	AHT1-26	26	1.21E-04	7.55E-03	9.68E-05	9.39E-05
Workboat	Hotelling	AHW0	1	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	Maneuvering	AHW1-26	26	1.33E-04	6.38E-03	1.06E-04	1.03E-04
From / to Works Area I of ATCL							
Tugboat	Hotelling	AIT0	1	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	Maneuvering	AIT1-30	30	1.22E-04	7.59E-03	9.73E-05	9.44E-05
Workboat	Hotelling	AIW0	1	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	Maneuvering	AIW1-30	30	1.34E-04	6.42E-03	1.07E-04	1.04E-04
From / to Works Area M of ATCL							
Tugboat	Hotelling	AMT0	1	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	Maneuvering	AMT1-21	21	1.20E-04	7.48E-03	9.58E-05	9.30E-05
Workboat	Hotelling	AMW0	1	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	Maneuvering	AMW1-21	21	1.32E-04	6.32E-03	1.05E-04	1.02E-04
From / to Works Area N of ATCL							
Tugboat	Hotelling	ANT0	1	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	Maneuvering	ANT1-23	23	1.20E-04	7.51E-03	9.63E-05	9.34E-05
Workboat	Hotelling	ANW0	1	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	Maneuvering	ANW1-23	23	1.32E-04	6.35E-03	1.06E-04	1.02E-04
From / to Works Area D of ATCL							
Tugboat	Hotelling	ADT0	1	4.10E-03	1.97E-01	3.28E-03	3.18E-03
Tugboat	Maneuvering	ADT1-21	21	1.80E-04	1.12E-02	1.44E-04	1.39E-04
Workboat	Hotelling	ADW0	1	5.47E-04	2.63E-02	4.37E-04	4.24E-04
Workboat	Maneuvering	ADW1-21	21	1.32E-04	6.32E-03	1.05E-04	1.02E-04

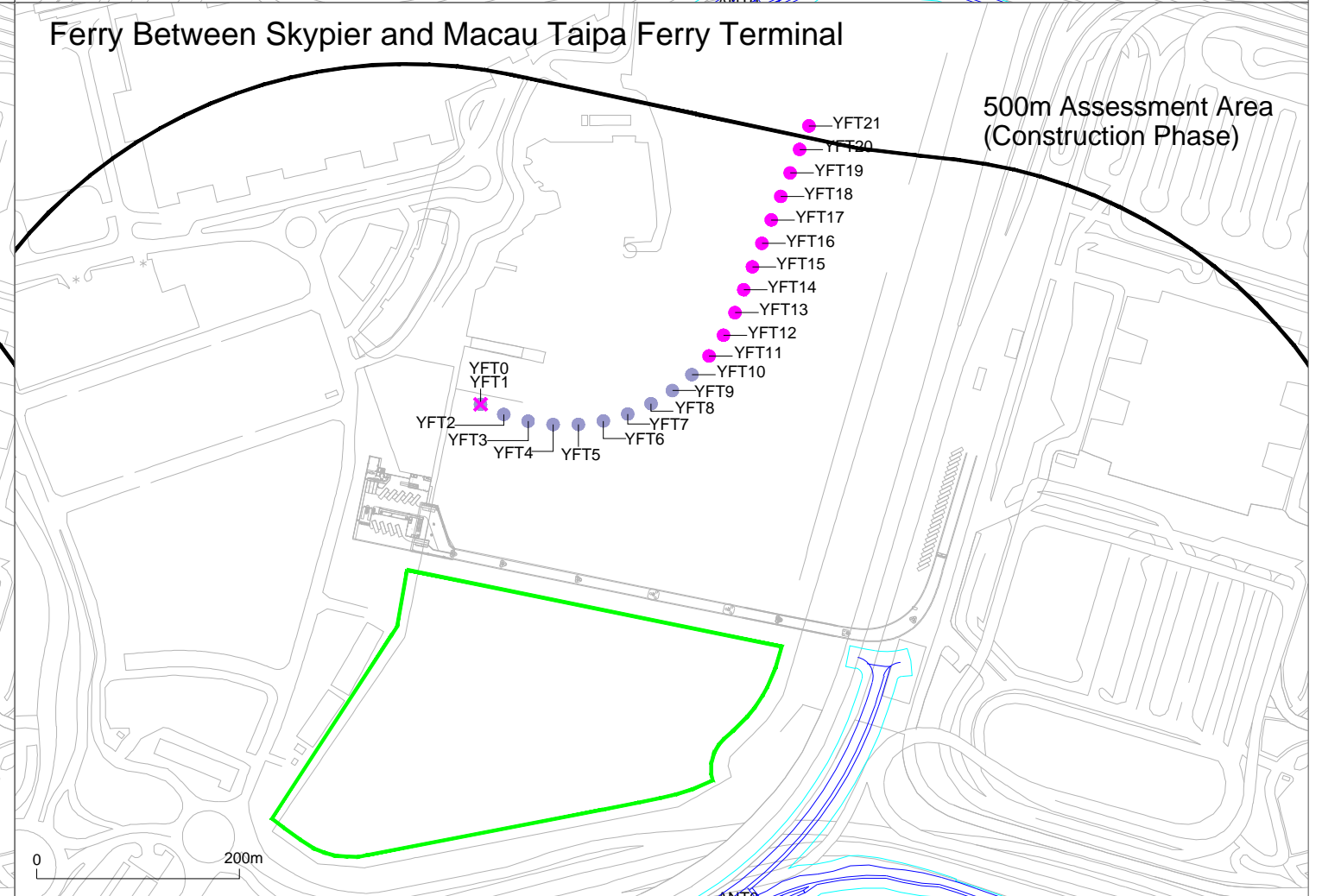
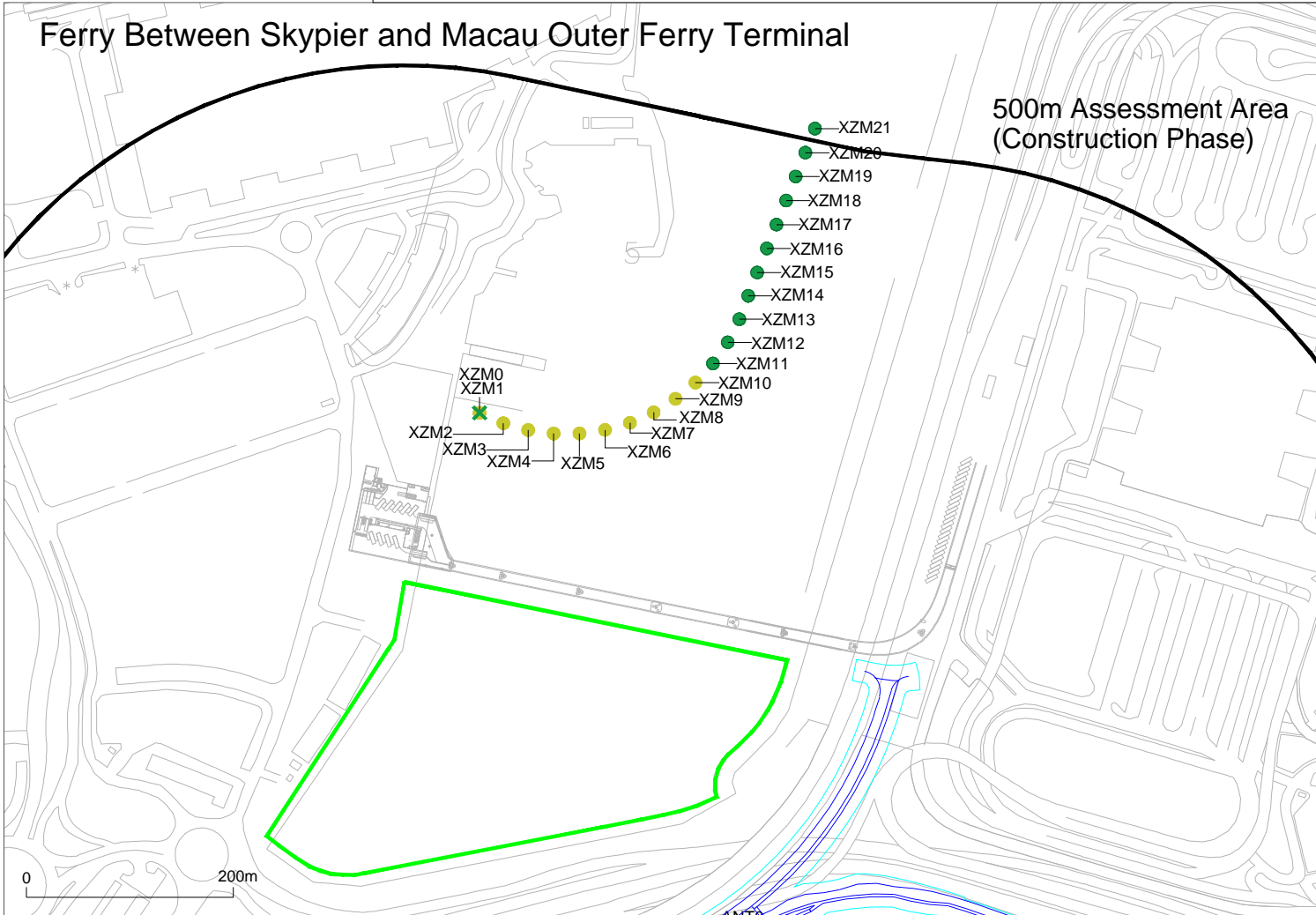
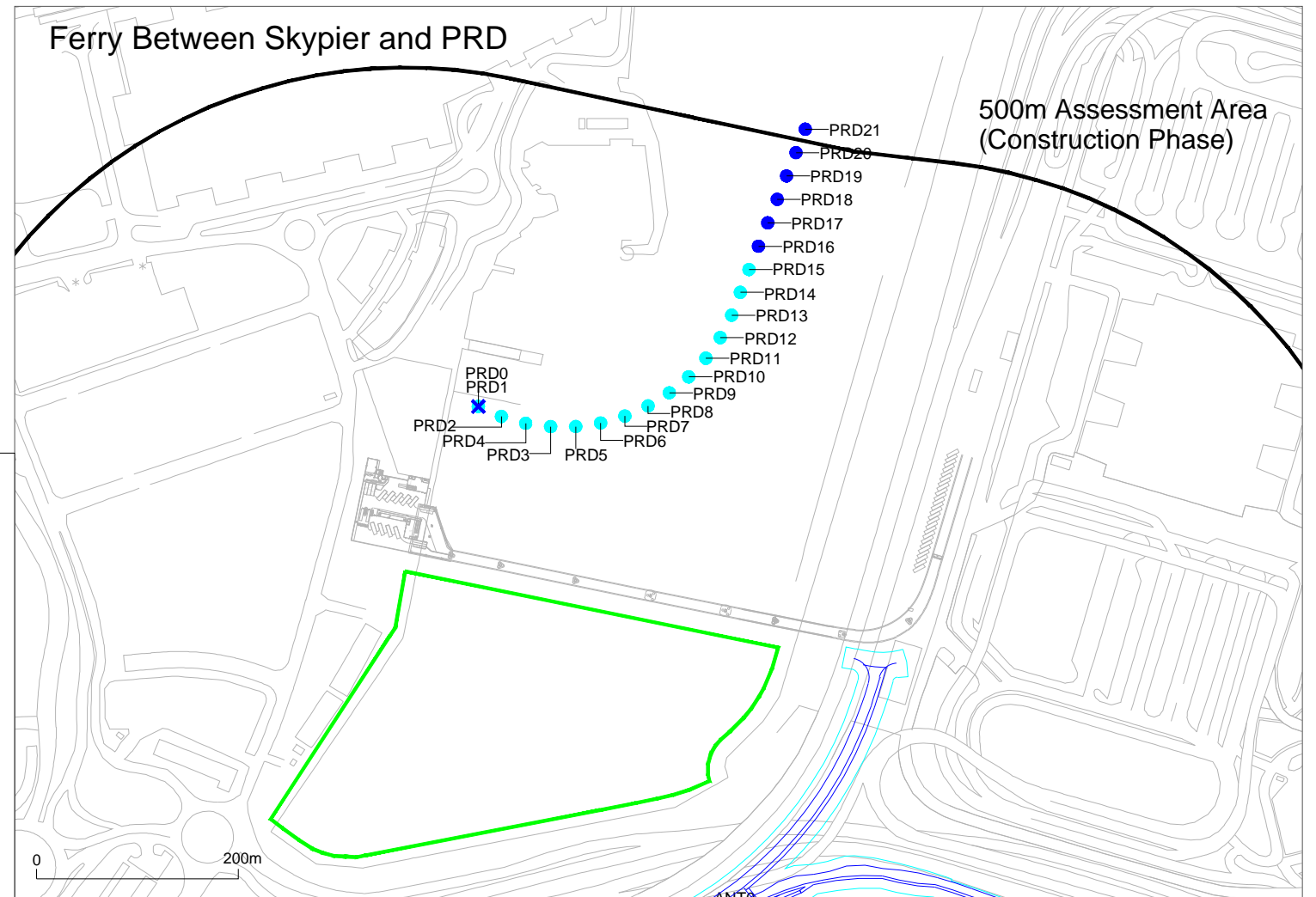
Remark:

Emission Rate for each Point Source = Emission / No.of Point Source

Locations of Marine Emissions Induced by Existing Marine Vessels -
From / To SkyPier
(Construction Phase)

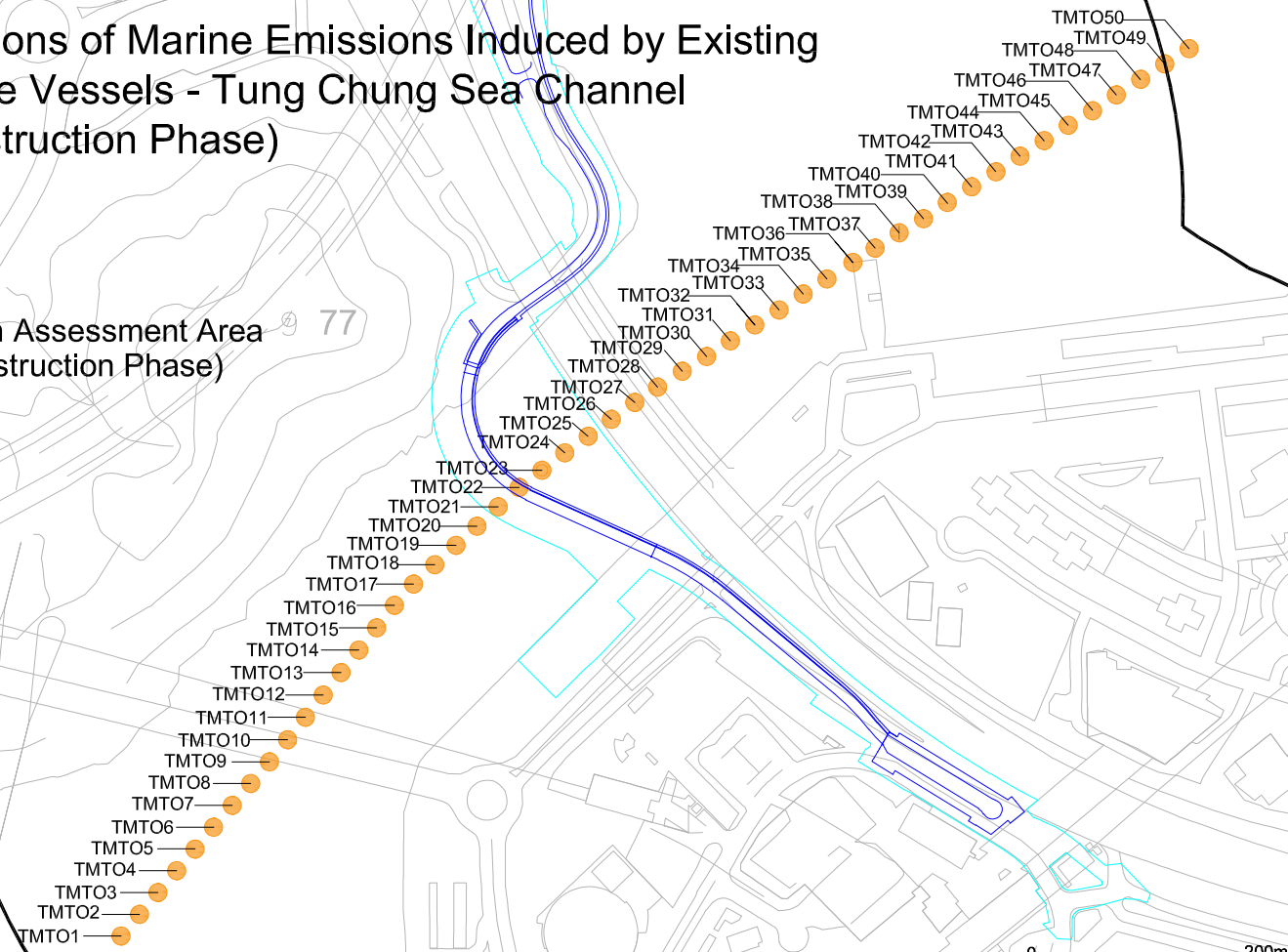
LEGEND

-  Proposed Alignment of Airport Tung Chung Link
-  Proposed Marine Facilities
-  Construction Site Boundary
-  Routing (Hotelling) - Ferry Traveling Between SkyPier and PRD
-  Routing (Maneuvering) - Ferry Traveling Between SkyPier and PRD
-  Routing (Slow Cruise) - Ferry Traveling Between SkyPier and PRD
-  Routing (Hotelling) - Ferry Traveling Between SkyPier and Macau Outer Harbour Ferry Terminal
-  Routing (Maneuvering) - Ferry Traveling Between SkyPier and Macau Outer Harbour Ferry Terminal
-  Routing (Slow Cruise) - Ferry Traveling Between SkyPier and Macau Outer Harbour Ferry Terminal
-  Routing (Hotelling) - Ferry Traveling Between SkyPier and Macau Taipa Ferry Terminal
-  Routing (Maneuvering) - Ferry Traveling Between SkyPier and Macau Taipa Ferry Terminal
-  Routing (Slow Cruise) - Ferry Traveling Between SkyPier and Macau Taipa Ferry Terminal



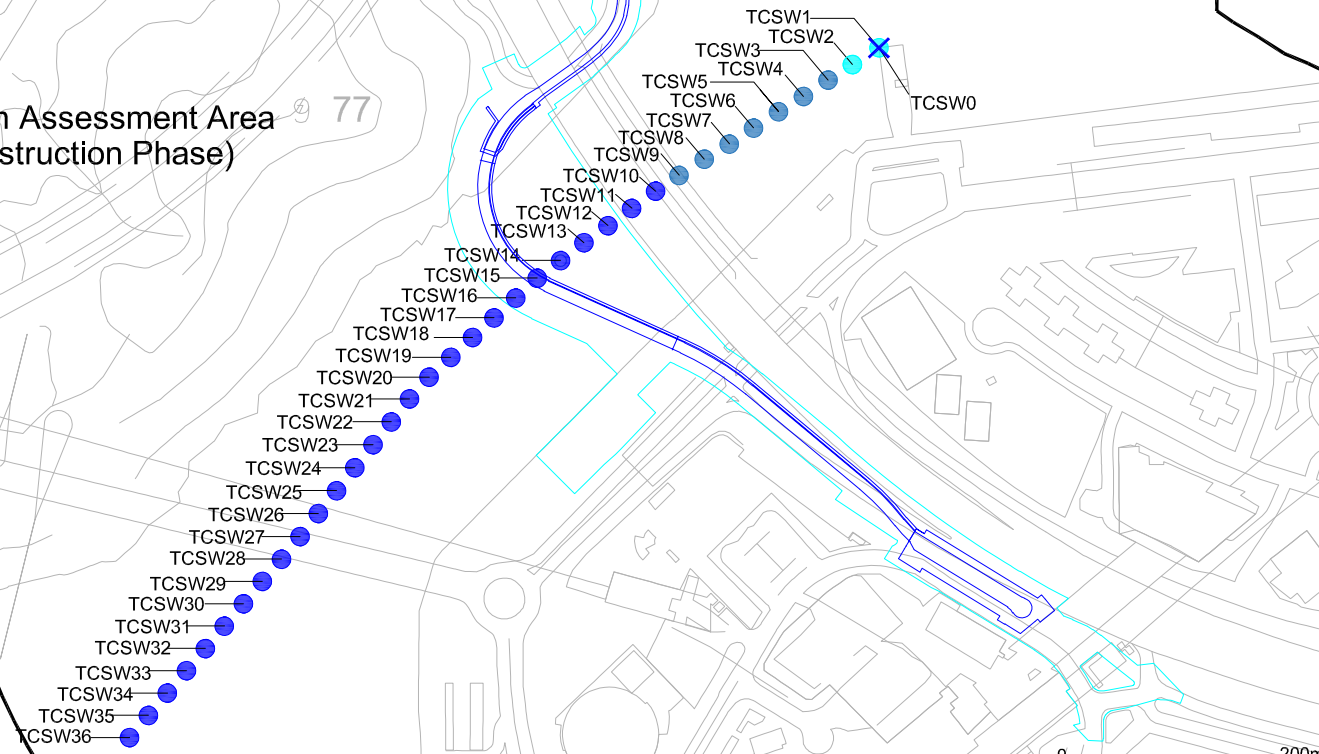
Locations of Marine Emissions Induced by Existing Marine Vessels - Tung Chung Sea Channel (Construction Phase)

500m Assessment Area (Construction Phase)



Ferry Between Tuen Mun and Tai O

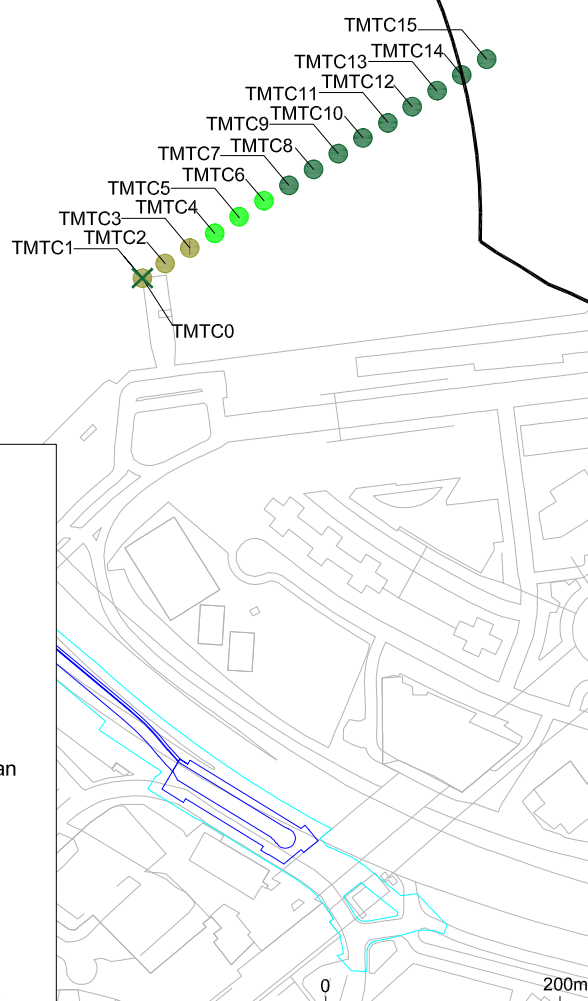
500m Assessment Area (Construction Phase)



Ferry Between Tung Chung and Sha Lo Wan

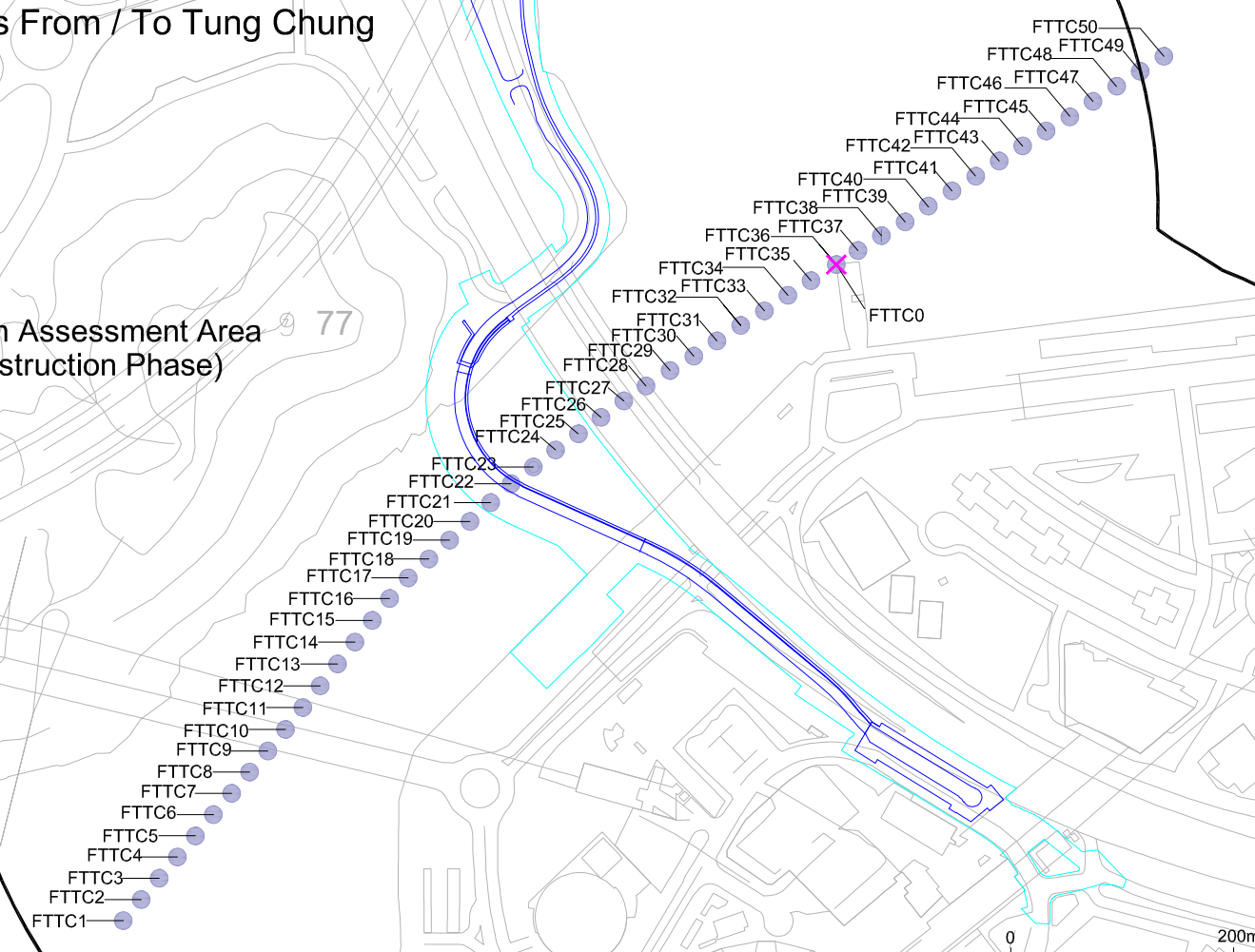
Ferry Between Tuen Mun and Tung Chung

500m Assessment Area (Construction Phase)



Vessels From / To Tung Chung

500m Assessment Area (Construction Phase)



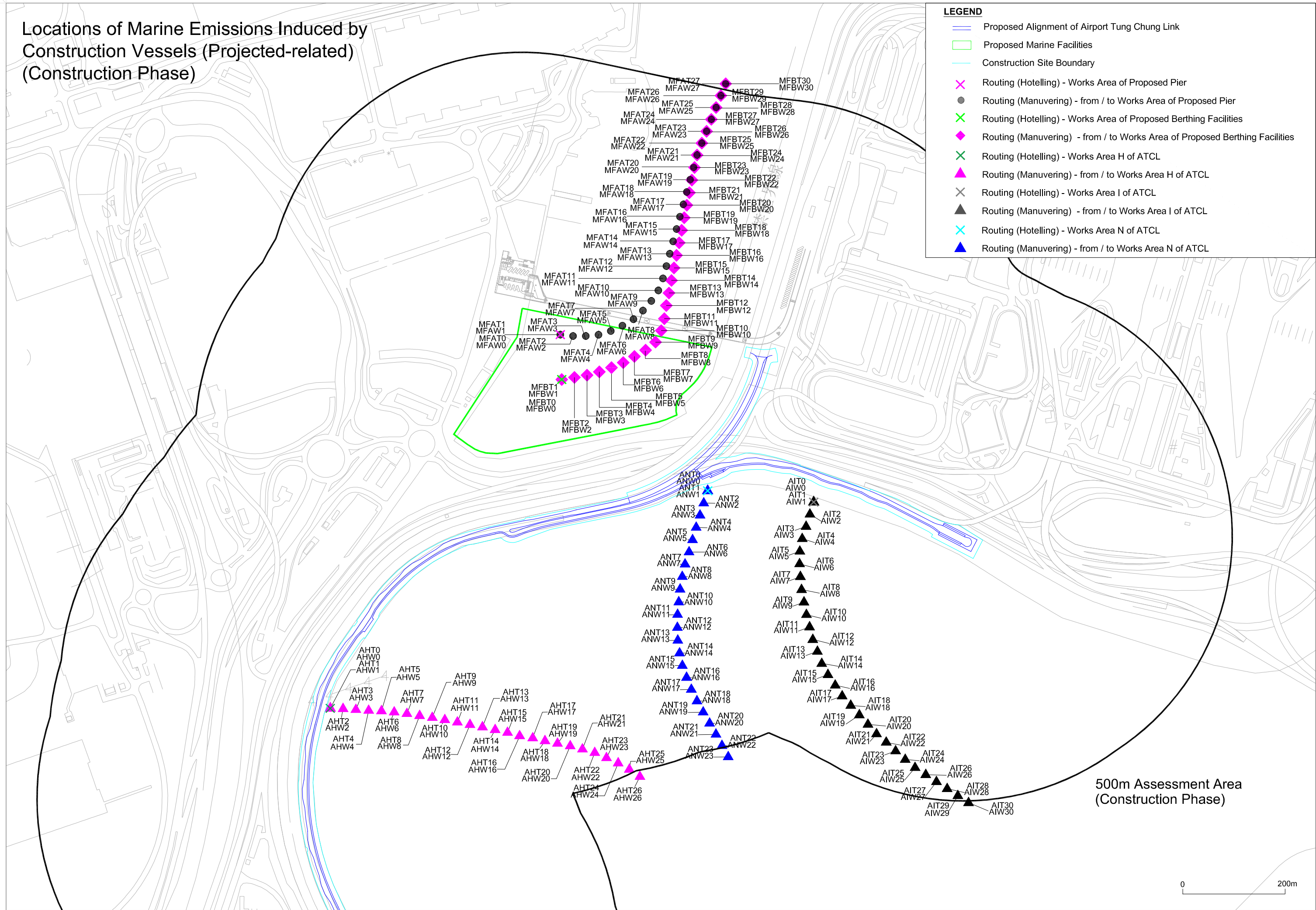
LEGEND

- Proposed Alignment of Airport Tung Chung Link
- Proposed Marine Facilities
- Construction Site Boundary
- Routing (Fairway Cruise) - Ferry Traveling Between Tuen Mun and Tai O
- ✕ Routing (Hotelling) - Ferry Traveling Between Tung Chung and Sha Lo Wan
- Routing (Maneuvering) - Ferry Traveling Between Tung Chung and Sha Lo Wan
- Routing (Slow Cruise) - Ferry Traveling Between Tung Chung and Sha Lo Wan
- Routing (Fairway Cruise) - Ferry Traveling Between Tung Chung and Sha Lo Wan
- ✕ Routing (Hotelling) - Ferry Traveling Between Tuen Mun and Tung Chung
- Routing (Maneuvering) - Ferry Traveling Between Tuen Mun and Tung Chung
- Routing (Slow Cruise) - Ferry Traveling Between Tuen Mun and Tung Chung
- Routing (Fairway Cruise) - Ferry Traveling Between Tuen Mun and Tung Chung
- ✕ Routing (Hotelling) - Vessels From / To Tung Chung
- Routing (Maneuvering) - Vessels From / To Tung Chung

Locations of Marine Emissions Induced by Construction Vessels (Projected-related) (Construction Phase)

LEGEND

- Proposed Alignment of Airport Tung Chung Link
- Proposed Marine Facilities
- Construction Site Boundary
- ✕ Routing (Hotelling) - Works Area of Proposed Pier
- Routing (Maneuvering) - from / to Works Area of Proposed Pier
- ✕ Routing (Hotelling) - Works Area of Proposed Berthing Facilities
- ◆ Routing (Maneuvering) - from / to Works Area of Proposed Berthing Facilities
- ✕ Routing (Hotelling) - Works Area H of ATCL
- ▲ Routing (Maneuvering) - from / to Works Area H of ATCL
- ✕ Routing (Hotelling) - Works Area I of ATCL
- ▲ Routing (Maneuvering) - from / to Works Area I of ATCL
- ✕ Routing (Hotelling) - Works Area N of ATCL
- ▲ Routing (Maneuvering) - from / to Works Area N of ATCL



500m Assessment Area (Construction Phase)



Locations of Marine Emissions Induced by Construction Vessels (Projected-related) (Construction Phase)












500m Assessment Area (Construction Phase)

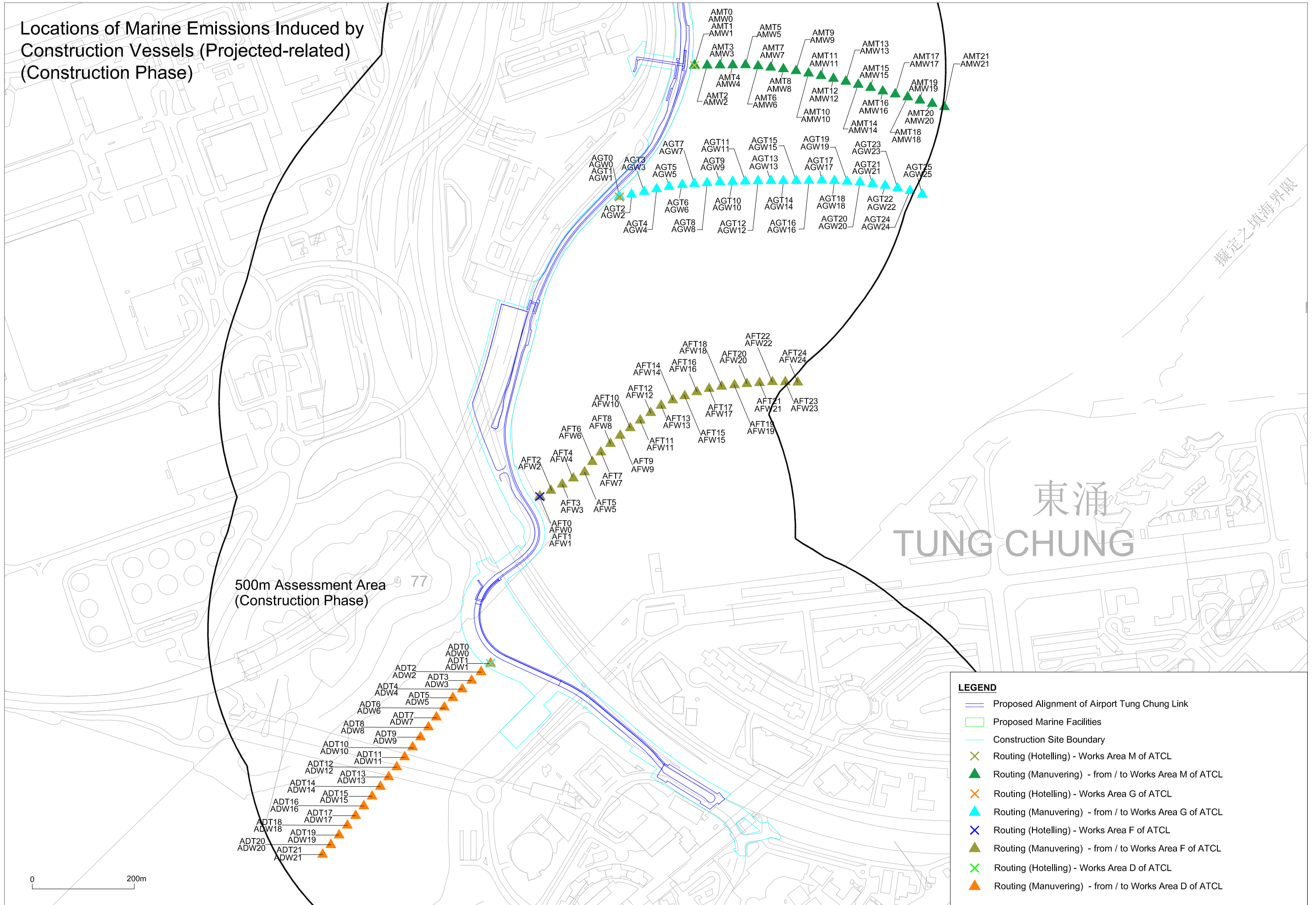
東涌
TUNG CHUNG

擬定之填海界限

0 200m

LEGEND

-  Proposed Alignment of Airport Tung Chung Link
-  Proposed Marine Facilities
-  Construction Site Boundary
-  Routing (Hotelling) - Works Area M of ATCL
-  Routing (Maneuvering) - from / to Works Area M of ATCL
-  Routing (Hotelling) - Works Area G of ATCL
-  Routing (Maneuvering) - from / to Works Area G of ATCL
-  Routing (Hotelling) - Works Area F of ATCL
-  Routing (Maneuvering) - from / to Works Area F of ATCL
-  Routing (Hotelling) - Works Area D of ATCL
-  Routing (Maneuvering) - from / to Works Area D of ATCL



Calculation of Marine Emission Rates
(Operational Phase)

Emission Factors for Existing Marine Vessels Travelling Within the 500m Assessment Area

Existing Marine Vessels - From / To SkyPier

Main Engine (ME) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption						ME Emission Factor (g/kWh) ⁷				Effective Emission Factor (g/hr) ⁹			
		MVEIS Vessel Type	Operation Mode ²	ME Engine Type ³	Fuel Type ⁴	Total ME Power Rating (kW) ⁵	ME Load Factor ⁶	SO ₂ ⁸	Nox	PM10	PM2.5	SO ₂	NOx	PM10	PM2.5
Ferry between SkyPier and Macau Outer Harbour Ferry Terminal (XZM)															
Macau Ferry (Gas Turbine)	0	Macau Ferry (GT)	Hotelling	Gas Turbine	MGO	8664	0.000	0	0	0	0	0	0	0	0
Macau Ferry (Gas Turbine)	8	Macau Ferry (GT)	Maneuvering	Gas Turbine	MGO	8664	0.184	2.93	5.7	0.35	0.32	4.67E+03	9.08E+03	5.58E+02	5.10E+02
Macau Ferry (Gas Turbine)	12	Macau Ferry (GT)	Slow Cruise	Gas Turbine	MGO	8664	0.276	2.93	5.7	0.35	0.32	7.00E+03	1.36E+04	8.37E+02	7.65E+02
Macau Ferry (Diesel Engine)	0	Macau Ferry (DE)	Hotelling	Diesel	MGO	9280	0.000	0	0	0	0	0	0	0	0
Macau Ferry (Diesel Engine)	8	Macau Ferry (DE)	Maneuvering	Diesel	MGO	9280	0.188	2.08	11.35	0.31	0.29	3.63E+03	1.98E+04	5.42E+02	5.07E+02
Macau Ferry (Diesel Engine)	12	Macau Ferry (DE)	Slow Cruise	Diesel	MGO	9280	0.282	2.08	11.35	0.31	0.29	5.45E+03	2.97E+04	8.12E+02	7.60E+02
Ferry between SkyPier and Macau Taipa Ferry Terminal (YFT)															
Macau Ferry (Diesel Engine)	0	Macau Ferry (DE)	Hotelling	Diesel	MGO	9280	0.000	0	0	0	0	0	0	0	0
Macau Ferry (Diesel Engine)	8	Macau Ferry (DE)	Maneuvering	Diesel	MGO	9280	0.188	2.08	8.33	0.31	0.29	3.63E+03	1.46E+04	5.42E+02	5.07E+02
Macau Ferry (Diesel Engine)	12	Macau Ferry (DE)	Slow Cruise	Diesel	MGO	9280	0.282	2.08	8.33	0.31	0.29	5.45E+03	2.18E+04	8.12E+02	7.60E+02
Ferry between SkyPier and PRD (PRD)															
PRD Ferry	0	PRD Ferry	Hotelling	Diesel	MGO	3150	0.000	0	0	0	0	0	0	0	0
PRD Ferry	8	PRD Ferry	Maneuvering	Diesel	MGO	3150	0.260	2.08	4.89	0.31	0.29	1.70E+03	4.01E+03	2.54E+02	2.38E+02
PRD Ferry	12	PRD Ferry	Slow Cruise	Diesel	MGO	3150	0.390	2.08	4.89	0.31	0.29	2.56E+03	6.01E+03	3.81E+02	3.56E+02

Auxiliary Engine (AE) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption						AE Emission Factor (g/kWh) ⁷				Effective Emission Factor (g/hr) ⁹			
		MVEIS Vessel Type	Operation Mode ²	Fuel Type ⁴	Total AE Power Rating (kW) ¹⁰	AE Load Factor ¹¹	SO ₂ ⁸	Nox	PM10	PM2.5	SO ₂	NOx	PM10	PM2.5	
Ferry between SkyPier and Macau Outer Harbour Ferry Terminal															
Macau Ferry (Gas Turbine)	0	Macau Ferry (GT)	Hotelling	MGO	326	0.450	2.93	5.70	0.35	0.32	4.30E+02	8.36E+02	5.13E+01	4.69E+01	
Macau Ferry (Gas Turbine)	8	Macau Ferry (GT)	Maneuvering	MGO	326	0.450	2.93	5.70	0.35	0.32	4.30E+02	8.36E+02	5.13E+01	4.69E+01	
Macau Ferry (Gas Turbine)	12	Macau Ferry (GT)	Slow Cruise	MGO	326	0.450	2.93	5.70	0.35	0.32	4.30E+02	8.36E+02	5.13E+01	4.69E+01	
Macau Ferry (Diesel Engine)	0	Macau Ferry (DE)	Hotelling	MGO	326	0.450	2.12	8.43	0.31	0.29	3.11E+02	1.24E+03	4.55E+01	4.25E+01	
Macau Ferry (Diesel Engine)	8	Macau Ferry (DE)	Maneuvering	MGO	326	0.450	2.12	8.43	0.31	0.29	3.11E+02	1.24E+03	4.55E+01	4.25E+01	
Macau Ferry (Diesel Engine)	12	Macau Ferry (DE)	Slow Cruise	MGO	326	0.450	2.12	8.43	0.31	0.29	3.11E+02	1.24E+03	4.55E+01	4.25E+01	
Ferry between SkyPier and Macau Taipa Ferry Terminal															
Macau Ferry (Diesel Engine)	0	Macau Ferry (DE)	Hotelling	MGO	326	0.450	2.12	5.96	0.31	0.29	3.11E+02	8.74E+02	4.55E+01	4.25E+01	
Macau Ferry (Diesel Engine)	8	Macau Ferry (DE)	Maneuvering	MGO	326	0.450	2.12	5.96	0.31	0.29	3.11E+02	8.74E+02	4.55E+01	4.25E+01	
Macau Ferry (Diesel Engine)	12	Macau Ferry (DE)	Slow Cruise	MGO	326	0.450	2.12	5.96	0.31	0.29	3.11E+02	8.74E+02	4.55E+01	4.25E+01	
Ferry between SkyPier and PRD															
PRD Ferry	0	PRD Ferry	Hotelling	MGO	188	0.450	2.12	5.75	0.31	0.29	1.79E+02	4.86E+02	2.62E+01	2.45E+01	
PRD Ferry	8	PRD Ferry	Maneuvering	MGO	188	0.450	2.12	5.75	0.31	0.29	1.79E+02	4.86E+02	2.62E+01	2.45E+01	
PRD Ferry	12	PRD Ferry	Slow Cruise	MGO	188	0.450	2.12	5.75	0.31	0.29	1.79E+02	4.86E+02	2.62E+01	2.45E+01	

Remarks

(1) Operation modes were referenced to Table 3-24, Study on Marine Vessels Emission Inventory (MVEIS) published by EPD in February 2012. According to Table 3-24, MVEIS, maximum vessel speed for operation mode of maneuvering of 8 knots and slow cruise of 12 knots are adopted as a conservative approach.

(2) Operation Mode was derived from Table 3-24, MVEIS.

(3) Engine Type refers to Table 4-17, MVEIS.

(4) Fuel Type refers to Section 4.2.26, MVEIS.

(5) Main Engine Power Rating refers to Appendix 5.3.12-3 Table 1 of AEIAR-185/2014 - Expansion of Hong Kong International Airport into a Three-Runway System and S4.2.8, MVEIS

(6) ME Loading Factor refers to Appendix 5.3.12-3 Table 3 of AEIAR-185/2014 - Expansion of Hong Kong International Airport into a Three-Runway System.

Mechanical Power = Force x Velocity Assume Force is constant, thus load factor is proportional to speed. (ME Loading Factor = Speed / Maximum Speed)

For Maneuvering, ME Loading Factor - Macau Ferry (Gas Turbine) = 8 / 43.5

ME Loading Factor - Macau Ferry (Diesel Engine) = 8 / 42.5

ME Loading Factor - PRD Ferry = 8 / 30.75

ME Loading Factor - PRD Ferry = 8 / 30.75

(7) ME and AE Emission Factor refers to Table 4-17, MVEIS, except NOx Emission Factor of Diesel Engine. For ME and AE, average NOx Emission Factor of Diesel Engine are calculated based on the vessel inventory provided by AAHK and NOx Emission Factor in Table H.6., Ports Emissions Inventory Guidance published by USEPA in April 2022.

Route	Model Year	No. of Vessels	Corresponding NO _x Emission Factor (g/kWh)		Average NO _x Emission Factor (g/kWh)	
			ME	AE	ME	AE
XZM	Pre-2003	3	13.36	10.08	11.35	8.43
	2007-2012	2	8.33	5.96		
YFT	2007-2012	11	8.33	5.96	8.33	5.96
	Pre-2003	7	13.36	10.08		
PRD	2007-2012	11	8.33	5.96	4.89	5.75
	2013	1	8.33	5.66		
	2014-2018	28	1.3	4.58		

(8) Under the Air Pollution Control (Fuel for Vessels) Regulation, the sulphur content of marine fuel is limited to 0.5%.

(9) Effective Emission Factor = Power Rating x Load Factor, if applicable x Low Load Adjustment Multiplier, if applicable x Emission Factor

(10) Auxiliary Engine Power refers to Appendix 5.3.12-3 Table 2 of AEIAR-185/2014 - Expansion of Hong Kong International Airport into a Three-Runway System and S4.2.12 - S4.2.13, MVEIS.

(11) AE Loading Factor refers to Table 4-10, MVEIS

(12) For ME and AE, Average NOx Emission Factor of Diesel Engine are calculated based on the vessel inventory provided by AAHK and NOx Emission Factor in Table H.6., Ports Emissions Inventory Guidance published by USEPA in April 2022.

Calculation of Marine Emission Rates
(Operational Phase)

Emission Rates for Existing Marine Vessels Travelling within the 500m Assessment Area
Breakdown of Marine Emission Rates for Existing Marine Vessels (From / To SkyPier)

Vessel Type	Speed (knot) ¹	Operation Mode	Distance (km) ²	Time-in-mode (min) ³	No. of Activity per day ⁴	ME Emission (g/s)				AE Emission (g/s)				Subtotal (g/s)			
						SO ₂	NOx	PM10	PM2.5	SO ₂	NOx	PM10	PM2.5	SO ₂	NOx	PM10	PM2.5
Ferry between Skypier and Macau Outer Harbour Ferry Terminal																	
Macau Ferry (Gas Turbine)	0	Hotelling	0.00	30.00	6	0	0	0	0	3.58E-01	6.97E-01	4.28E-02	3.91E-02	3.58E-01	6.97E-01	4.28E-02	3.91E-02
Macau Ferry (Gas Turbine)	8	Maneuvering	0.22	0.90	6	1.17E-01	2.27E-01	1.39E-02	1.27E-02	1.07E-02	2.09E-02	1.28E-03	1.17E-03	1.27E-01	2.48E-01	1.52E-02	1.39E-02
Macau Ferry (Gas Turbine)	12	Slow Cruise	0.28	0.77	6	1.49E-01	2.90E-01	1.78E-02	1.63E-02	9.15E-03	1.78E-02	1.09E-03	9.99E-04	1.58E-01	3.08E-01	1.89E-02	1.73E-02
Macau Ferry (Diesel Engine)	0	Hotelling	0.00	30.00	3	0	0	0	0	1.30E-01	5.15E-01	1.89E-02	1.77E-02	1.30E-01	5.15E-01	1.89E-02	1.77E-02
Macau Ferry (Diesel Engine)	8	Maneuvering	0.22	0.90	3	4.54E-02	2.48E-01	6.77E-03	6.33E-03	3.89E-03	1.55E-02	5.68E-04	5.32E-04	4.93E-02	2.63E-01	7.34E-03	6.86E-03
Macau Ferry (Diesel Engine)	12	Slow Cruise	0.28	0.77	3	5.80E-02	3.16E-01	8.64E-03	8.09E-03	3.31E-03	1.32E-02	4.84E-04	4.53E-04	6.13E-02	3.30E-01	9.13E-03	8.54E-03
Ferry between Skypier and Macau Taipa Ferry Terminal																	
Macau Ferry (Diesel Engine)	0	Hotelling	0.00	30.00	12	0	0	0	0	5.18E-01	1.46E+00	7.58E-02	7.09E-02	5.18E-01	1.46E+00	7.58E-02	7.09E-02
Macau Ferry (Diesel Engine)	8	Maneuvering	0.22	0.90	12	1.82E-01	7.28E-01	2.71E-02	2.53E-02	1.56E-02	4.37E-02	2.27E-03	2.13E-03	1.97E-01	7.71E-01	2.93E-02	2.75E-02
Macau Ferry (Diesel Engine)	12	Slow Cruise	0.28	0.77	12	2.32E-01	9.29E-01	3.46E-02	3.23E-02	1.32E-02	3.72E-02	1.94E-03	1.81E-03	2.45E-01	9.66E-01	3.65E-02	3.42E-02
Ferry between Skypier and PRD																	
PRD Ferry	0	Hotelling	0.00	22.80	73	0	0	0	0	1.38E+00	3.75E+00	2.02E-01	1.89E-01	1.38E+00	3.75E+00	2.02E-01	1.89E-01
PRD Ferry	8	Maneuvering	0.37	1.50	73	8.64E-01	2.03E+00	1.29E-01	1.20E-01	9.09E-02	2.47E-01	1.33E-02	1.24E-02	9.55E-01	2.28E+00	1.42E-01	1.33E-01
PRD Ferry	12	Slow Cruise	0.14	0.37	73	3.16E-01	7.44E-01	4.72E-02	4.41E-02	2.22E-02	6.02E-02	3.25E-03	3.04E-03	3.39E-01	8.04E-01	5.04E-02	4.72E-02

Remarks

- Operation modes were referenced to Table 3-24, MVEIS. According to Table 3-24, MVEIS, maximum vessel speed for operation mode of maneuvering of 8 knots and slow cruise of 12 knots are adopted as a conservative approach.
- Distance refers to the distance of route considered within the Assessment Area, approximately 506m.
Distance travelled by Maneuvering Mode is calculated based on vessel speed and time-in-mode from Table 4-14, MVEIS.
Distance travelled by Slow Cruise Mode = Total Distance Travelled - Distance travelled by Maneuvering Mode
- Time-in-mode of slow cruise is estimated by the distance and vessel speed travelled in the corresponding mode, while time-in-mode of hotelling and maneuvering refers to Table 4-14 and Table 4-15, MVEIS.
- No. of activity per day refers to Daily Sailing Schedule in 2018 (i.e. typical operation year) provided by AA. Ferry with Diesel Engine and Ferry with Gas Turbine are involved in the services between Skypier and Macau Outer Harbour Ferry Terminal.
No. of activity per day for Ferry with Diesel Engine and Ferry with Gas Turbine between Skypier and Macau Outer Harbour Ferry Terminal are estimated based on the ratio on no. of services provided by Ferry with Diesel Engine (approx. 64%) and Ferry with Gas Turbine (approx. 36%) in 2018.
- Emission (g/s) = (Effective Emission factor × Time-in-mode/60 × No. of activity per day) / 3600

Emission Rate for Marine Point Sources

Vessel Type	Operation Mode	Source ID	No. of Point Source	Emission Rate (g/s)			
				SO ₂	NOx	PM10	PM2.5
Ferry between Skypier and Macau Outer Harbour Ferry Terminal							
Macau Ferry (Gas Turbine)	Hotelling	XZM0	1	3.58E-01	6.97E-01	4.28E-02	3.91E-02
Macau Ferry (Diesel Engine)	Hotelling	XZM0	1	1.30E-01	5.15E-01	1.89E-02	1.77E-02
Subtotal of Hotelling				4.88E-01	1.21E+00	6.17E-02	5.68E-02
Macau Ferry (Gas Turbine)	Maneuvering	XZM1-10	10	1.27E-02	2.48E-02	1.52E-03	1.39E-03
Macau Ferry (Diesel Engine)	Maneuvering	XZM1-10	10	4.93E-03	2.63E-02	7.34E-04	6.86E-04
Subtotal of Maneuvering				1.77E-02	5.11E-02	2.26E-03	2.08E-03
Macau Ferry (Gas Turbine)	Slow Cruise	XZM11-21	11	1.44E-02	2.80E-02	1.72E-03	1.57E-03
Macau Ferry (Diesel Engine)	Slow Cruise	XZM11-21	11	5.57E-03	3.00E-02	8.30E-04	7.76E-04
Subtotal of Slow Cruise				2.00E-02	5.79E-02	2.55E-03	2.35E-03
Ferry between Skypier and Macau Taipa Ferry Terminal							
Macau Ferry (Diesel Engine)	Hotelling	YFT0	1	5.18E-01	1.46E+00	7.58E-02	7.09E-02
Macau Ferry (Diesel Engine)	Maneuvering	YFT1-10	10	1.97E-02	7.71E-02	2.93E-03	2.75E-03
Macau Ferry (Diesel Engine)	Slow Cruise	YFT11-21	11	2.23E-02	8.78E-02	3.32E-03	3.11E-03
Ferry between Skypier and PRD							
PRD Ferry	Hotelling	PRD0	1	1.38E+00	3.75E+00	2.02E-01	1.89E-01
PRD Ferry	Maneuvering	PRD1-15	15	6.37E-02	1.52E-01	9.47E-03	8.86E-03
PRD Ferry	Slow Cruise	PRD16-21	6	5.64E-02	1.34E-01	8.40E-03	7.86E-03

Remark

Emission Rate for each Point Source = Emission / No.of Point Source

Calculation of Marine Emission Rates
(Operational Phase)

Emission Factors for Marine Vessels Travelling Within the 500m Assessment Area

Proposed Marine Facilities - From / To Pier (Project-related)

Main Engine (ME) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption							ME Emission Factor (g/kWh) ⁸				Effective Emission Factor (g/hr) ¹³			
		MVEIS Vessel Type	Operation Mode ²	ME Engine Type ³	Fuel Type ⁴	ME Power Rating (kW) ⁵	ME Load Factor ⁶	BSFC (g/kWh) ⁷	SO ₂ ^{9,10}	NOx	PM10 ¹¹	PM2.5 ¹²	SO ₂	NOx	PM10	PM2.5
Local Ferry	0	Others	Hotelling	MSD	MGO	643	0.000	213	0	0	0	0	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Local Ferry	5	Others	Maneuvering	MSD	MGO	643	0.300	213	0.21	10.00	0.17	0.16	4.02E+01	1.93E+03	3.21E+01	3.11E+01

Auxiliary Engine (AE) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption					AE Emission Factor (g/kWh) ⁸				Effective Emission Factor (g/hr) ¹³				
		MVEIS Vessel Type	Operation Mode ²	Fuel Type ⁴	AE Power Rating (kW) ¹⁴	AE Load Factor ¹⁵	BSFC (g/kWh) ⁷	SO ₂ ^{9,10}	NOx	PM10 ¹¹	PM2.5 ¹²	SO ₂	NOx	PM10	PM2.5
Local Ferry	0	Others	Hotelling	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00
Local Ferry	5	Others	Maneuvering	MGO	66	0.430	213	0.21	10.00	0.17	0.16	5.91E+00	2.84E+02	4.72E+00	4.58E+00

Remarks

- (1) Vessel speed was advised by the Project Marine Traffic Consultant.
- (2) Operation mode was derived from Table 3-24, MVEIS
- (3) For local ferry, it was assumed that all ME are MSD with reference to S4.2.27, MVEIS
- (4) For local ferry, it was assumed that the marine fuel used are MGO refers to S4.2.26, MVEIS
- (5) Average Main Engine Power refers to Table 4-5, MVEIS
- (6) ME Loading Factor refers to Table 4-7, MVEIS
- (7) Brake Specific Fuel Consumption (BSFC) refers to Table 4-16, MVEIS
- (8) ME and AE Emission Factor refers to Table 4-16, MVEIS
- (9) Under the Air Pollution Control (Marine Light Diesel) Regulation, the statutory cap of sulphur content of locally supplied marine light diesel is 0.05%, thus adopted for calculation of emission factor for local ferry which are fueled in Hong Kong.
- (10) SO₂ Emission Factor = Brake Specific Fuel Consumption x 2 x 0.97753 x Fuel Sulphur Fraction with reference to 4.2.31, MVEIS
- (11) PM10 EF = 0.23 + BSFC x 7 x 0.02247 x (Fuel Sulphur Fraction - 0.0024) with reference to 4.2.31, MVEIS
- (12) PM2.5 emissions were estimated to be 97% of PM10 emissions with reference to 4.2.32, MVEIS
- (13) Effective Emission Factor = Power Rating x Load Factor, if applicable x Low Load Adjustment Multiplier, if applicable x Emission Factor
- (14) Auxiliary Engine Power refers to Table 4-6, MVEIS
- (15) AE Loading Factor refers to Table 4-10, MVEIS.

**Calculation of Marine Emission Rates
(Operational Phase)**

**Emission Rates for Marine Vessels Travelling within the 500m Assessment Area
Breakdown of Marine Emission Rates for Marine Vessels - Pier (Project-related)**

Vessel Type	Speed (knot) ¹	Operation Mode	Distance (km) ²	Time-in-mode (min) ³	No. of Activity per day ⁴	ME Emission (g/s)				AE Emission (g/s)				Subtotal (g/s)			
						SO2	NOX	PM10	PM2.5	SO2	NOX	PM10	PM2.5	SO2	NOX	PM10	PM2.5
Local Ferry	0	Hotelling	0.000	3.00	30	0	0	0	0	2.46E-03	1.18E-01	1.97E-03	1.91E-03	2.46E-03	1.18E-01	1.97E-03	1.91E-03
Local Ferry	5	Maneuvering	0.628	4.07	30	2.27E-02	1.09E+00	1.81E-02	1.76E-02	3.34E-03	1.60E-01	2.67E-03	2.59E-03	2.60E-02	1.25E+00	2.08E-02	2.02E-02

Remarks

- (1) Vessel speed was advised by the Project Marine Traffic Consultant.
- (2) Distance refers to the distance of route considered within the Assessment Area.
- (3) For operation mode of hotelling, time-in-mode was made reference to the local ferry at Tung Chung Navigation Channel.
For operation mode of maneuvering, time-in-mode is estimated by the distance and vessel speed travelled in the corresponding mode, Time in mode = Distance x 1000 / (0.514444 x Speed in Knots) / 60.
- (4) No. of activity per day was provided by the Project Marine Traffic Consultant.
- (5) Emission (g/s) = (Effective Emission factor x Time-in-mode/60 x No. of activity per day) / 3600

Emission Rate for Marine Point Sources

Vessel Type	Operation Mode	Source ID	No. of Point Source	Emission Rate (g/s)			
				SO ₂	NOx	PM10	PM2.5
Local Ferry	Hotelling	SCP0	1	2.46E-03	1.18E-01	1.97E-03	1.91E-03
Local Ferry	Maneuvering	SCP1-26	26	1.00E-03	4.81E-02	8.00E-04	7.76E-04

Remark

Emission Rate for each Point Source = Emission / No.of Point Source

Calculation of Marine Emission Rates
(Operational Phase)

Emission Factors for Marine Vessels Travelling Within the 500m Assessment Area
Proposed Marine Facilities - From / To Berthing Facilities (Project-related)
Main Engine (ME) Emission

Vessel Type	Speed (knot) ¹	MVEIS Assumption							ME Emission Factor (g/kWh) ⁸				Low Load Adjustment Multiplier ¹³				Effective Emission Factor (g/hr) ¹⁴			
		MVEIS Vessel Type	Operation Mode ²	ME Engine Type ³	Fuel Type ⁴	ME Power Rating (kW) ⁵	ME Load Factor ⁶	BSFC (g/kWh) ⁷	SO ₂ ^{9,10}	NOx	PM10 ¹¹	PM2.5 ¹²	SO ₂	NOx	PM10	PM2.5	SO ₂	NOx	PM10	PM2.5
Pleasure Vessel	5	Pleasure Vessel	Maneuvering	HSD	MDO	786	0.020	203	1.98	13.20	0.31	0.30	1.00	4.63	7.29	7.29	3.12E+01	9.61E+02	3.59E+01	3.48E+01

Vessel Type	Speed (knot) ¹	MVEIS Assumption							AE Emission Factor (g/kWh) ¹⁸				Effective Emission Factor (g/hr) ¹⁴			
		MVEIS Vessel Type	Operation Mode ²	Fuel Type ⁴	AE Power Rating (kW) ¹⁵	AE Load Factor ¹⁶	BSFC (g/kWh) ¹⁷	SO ₂ ^{9,10}	NOx	PM10 ¹¹	PM2.5 ¹²	SO ₂	NOx	PM10	PM2.5	
Pleasure Vessel	5	Pleasure Vessel	Maneuvering	MDO	60	0.320	217	2.12	13.90	0.32	0.31	4.07E+01	2.67E+02	6.12E+00	5.94E+00	

Remarks

- (1) Vessel speed was advised by the Project Marine Traffic Consultant.
- (2) Operation mode was derived from Table 3-24, MVEIS. Pleasure vessel using the berthing facilities will be required to turn off the engines when they are parked at the berthing facilities, and hence no hotelling emission is expected.
- (3) Engine type refers to Table 3-17, MVEIS. For Pleasure Vessel, no emission factor for ME engine type of HSD is available in Table 3-27, MVEIS. Therefore, the emission factor for ME engine type of MSD was adopted.
- (4) Fuel type was advised by the Project Marine Traffic Consultant.
- (5) Average Main Engine Power refers to Table 3-15, MVEIS
- (6) ME Loading Factor refers to Table 3-18, MVEIS
- (7) Brake Specific Fuel Consumption (BSFC) refers to Table 3-27, MVEIS
- (8) ME Emission Factor refers to Table 3-27, MVEIS
- (9) Under the Air Pollution Control (Fuel for Vessels) Regulation, vessels are required to use compliant fuel (with sulphur content not exceeding 0.5%) within Hong Kong waters, thus adopted for calculation of emission factor for pleasure vessel.
- (10) SO₂ Emission Factor = Brake Specific Fuel Consumption x 2 x 0.97753 x Fuel Sulphur Fraction with reference to 4.2.31, MVEIS
- (11) PM10 EF = 0.23 + BSFC x 7 x 0.02247 x (Fuel Sulphur Fraction - 0.0024) with reference to 4.2.31, MVEIS
- (12) PM2.5 emissions were estimated to be 97% of PM10 emissions with reference to 4.2.32, MVEIS
- (13) Low load adjustment multipliers refer to Table 3-30, MVEIS
- (14) Effective Emission Factor = Power Rating x Load Factor, if applicable x Low Load Adjustment Multiplier, if applicable x Emission Factor
- (15) Average Auxiliary Engine Power refers to Table 3-20, MVEIS
- (16) AE Loading Factor refers to Table 3-21, MVEIS
- (17) Brake Specific Fuel Consumption (BSFC) refers to Table 3-28, MVEIS
- (18) AE Emission Factor refers to Table 3-28, MVEIS

Calculation of Marine Emission Rates
(Operational Phase)

Emission Rates for Marine Vessels Travelling within the 500m Assessment Area
Breakdown of Marine Emission Rates for Marine Vessels - Berthing Facilities (Project-related)

Vessel Type	Speed (knot) ¹	Operation Mode	Distance (km) ²	Time-in-mode (min) ³	Daily Flow ⁴	ME Emission (g/s)				AE Emission (g/s)				Subtotal (g/s)			
						SO ₂	NO _x	PM10	PM2.5	SO ₂	NO _x	PM10	PM2.5	SO ₂	NO _x	PM10	PM2.5
Route A inside the Berthing Facilities																	
Pleasure Vessel	5	Maneuvering	0.200	1.30	8	1.50E-03	4.61E-02	1.72E-03	1.67E-03	1.95E-03	1.28E-02	2.94E-04	2.85E-04	3.45E-03	5.89E-02	2.02E-03	1.96E-03
Route B inside the Berthing Facilities																	
Pleasure Vessel	5	Maneuvering	0.166	1.08	17	2.64E-03	8.13E-02	3.04E-03	2.95E-03	3.45E-03	2.26E-02	5.18E-04	5.02E-04	6.09E-03	1.04E-01	3.55E-03	3.45E-03
Route C inside the Berthing Facilities																	
Pleasure Vessel	5	Maneuvering	0.175	1.13	20	3.28E-03	1.01E-01	3.77E-03	3.65E-03	4.28E-03	2.80E-02	6.43E-04	6.23E-04	7.55E-03	1.29E-01	4.41E-03	4.28E-03
Route outside the Berthing Facilities																	
Pleasure Vessel	5	Maneuvering	0.771	4.99	45	3.25E-02	1.00E+00	3.73E-02	3.62E-02	4.24E-02	2.78E-01	6.37E-03	6.18E-03	7.48E-02	1.28E+00	4.37E-02	4.24E-02

Remarks

- (1) Vessel speed was advised by the Project Marine Traffic Consultant.
- (2) Distance refers to the distance of route considered within the Assessment Area.
- (3) Time-in-mode is estimated by the distance and vessel speed travelled in the corresponding mode, Time in mode = Distance x 1000 / (0.514444 x Speed in Knots) / 60.
- (4) No. of activity per day was provided by the Project Marine Traffic Consultant.
- (5) Emission (g/s) = (Effective Emission factor x Time-in-mode/60 x No. of activity per day) / 3600
- (6) For the assessment purpose, the marine traffic activity of pleasure vessels to/from the proposed berthing facilities of 45 vessel movements per day was adopted.

Emission Rate for Marine Point Sources

Vessel Type	Operation Mode	Source ID	No. of Point Source	Emission Rate (g/s)			
				SO ₂	NO _x	PM10	PM2.5
Route A inside the Berthing Facilities							
Pleasure Vessel	Maneuvering	PVA01-08	8	4.32E-04	7.37E-03	2.52E-04	2.44E-04
Route B inside the Berthing Facilities							
Pleasure Vessel	Maneuvering	PVB01-07	7	8.70E-04	1.48E-02	5.08E-04	4.93E-04
Route C inside the Berthing Facilities							
Pleasure Vessel	Maneuvering	PVC01-07	7	1.08E-03	1.84E-02	6.30E-04	6.11E-04
Route outside the Berthing Facilities							
Pleasure Vessel	Maneuvering	PV10-41	32	2.34E-03	3.99E-02	1.37E-03	1.32E-03

Remark

Emission Rate for each Point Source = Emission / No.of Point Source

Marine Emission Sources (Existing Marine Vessels) Listing in AERMOD
(Operational Phase)

Routing	Vessel Type	Mode	Source ID	Type	X	Y	Stack Parameter ^{1,2}				Emission Rate (g/s)			
							Release Height (mAG)	Exit Temp (K)	Exit Velocity (m/s)	Effective Exhaust Diameter (m)	SO ₂	NO _x	PM10	PM2.5
Ferry between Skypier and Macau Outer Harbour Ferry Terminal	Macau Ferry	Hotelling	XZM0	POINTHOR	812313.08	819912.91	0.0	773.0	8.0	0.7	4.88E-01	1.21E+00	6.17E-02	5.68E-02
	Macau Ferry	Maneuvering	XZM1	POINTHOR	812313.08	819912.91	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Maneuvering	XZM2	POINTHOR	812336.00	819903.00	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Maneuvering	XZM3	POINTHOR	812360.07	819896.31	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Maneuvering	XZM4	POINTHOR	812384.83	819892.97	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Maneuvering	XZM5	POINTHOR	812409.81	819893.05	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Maneuvering	XZM6	POINTHOR	812434.55	819896.54	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Maneuvering	XZM7	POINTHOR	812458.57	819903.38	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Maneuvering	XZM8	POINTHOR	812481.58	819913.51	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Maneuvering	XZM9	POINTHOR	812502.72	819926.52	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Maneuvering	XZM10	POINTHOR	812521.94	819942.33	0.0	773.0	8.0	0.7	1.77E-02	5.11E-02	2.26E-03	2.08E-03
	Macau Ferry	Slow Cruise	XZM11	POINTHOR	812538.95	819960.75	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
	Macau Ferry	Slow Cruise	XZM12	POINTHOR	812553.22	819981.25	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
	Macau Ferry	Slow Cruise	XZM13	POINTHOR	812564.56	820003.51	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
	Macau Ferry	Slow Cruise	XZM14	POINTHOR	812573.19	820026.15	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
	Macau Ferry	Slow Cruise	XZM15	POINTHOR	812581.82	820048.80	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
	Macau Ferry	Slow Cruise	XZM16	POINTHOR	812591.14	820072.00	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
	Macau Ferry	Slow Cruise	XZM17	POINTHOR	812600.45	820095.20	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
	Macau Ferry	Slow Cruise	XZM18	POINTHOR	812609.77	820118.42	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
	Macau Ferry	Slow Cruise	XZM19	POINTHOR	812619.08	820141.64	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
	Macau Ferry	Slow Cruise	XZM20	POINTHOR	812628.40	820164.86	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03
Macau Ferry	Slow Cruise	XZM21	POINTHOR	812637.72	820188.07	0.0	773.0	8.0	0.7	2.00E-02	5.79E-02	2.55E-03	2.35E-03	
Ferry between Skypier and Macau Taipa Ferry Terminal	Macau Ferry	Hotelling	YFT0	POINTHOR	812313.08	819912.91	0.0	773.0	8.0	0.7	5.18E-01	1.46E+00	7.58E-02	7.09E-02
	Macau Ferry	Maneuvering	YFT1	POINTHOR	812313.08	819912.91	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Maneuvering	YFT2	POINTHOR	812336.00	819903.00	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Maneuvering	YFT3	POINTHOR	812360.07	819896.31	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Maneuvering	YFT4	POINTHOR	812384.83	819892.97	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Maneuvering	YFT5	POINTHOR	812409.81	819893.05	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Maneuvering	YFT6	POINTHOR	812434.55	819896.54	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Maneuvering	YFT7	POINTHOR	812458.57	819903.38	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Maneuvering	YFT8	POINTHOR	812481.58	819913.51	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Maneuvering	YFT9	POINTHOR	812502.72	819926.52	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Maneuvering	YFT10	POINTHOR	812521.94	819942.33	0.0	773.0	8.0	0.7	1.97E-02	7.71E-02	2.93E-03	2.75E-03
	Macau Ferry	Slow Cruise	YFT11	POINTHOR	812538.95	819960.75	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
	Macau Ferry	Slow Cruise	YFT12	POINTHOR	812553.22	819981.25	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
	Macau Ferry	Slow Cruise	YFT13	POINTHOR	812564.56	820003.51	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
	Macau Ferry	Slow Cruise	YFT14	POINTHOR	812573.19	820026.15	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
	Macau Ferry	Slow Cruise	YFT15	POINTHOR	812581.82	820048.80	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
	Macau Ferry	Slow Cruise	YFT16	POINTHOR	812591.14	820072.00	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
	Macau Ferry	Slow Cruise	YFT17	POINTHOR	812600.45	820095.20	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
	Macau Ferry	Slow Cruise	YFT18	POINTHOR	812609.77	820118.42	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
	Macau Ferry	Slow Cruise	YFT19	POINTHOR	812619.08	820141.64	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
	Macau Ferry	Slow Cruise	YFT20	POINTHOR	812628.40	820164.86	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03
Macau Ferry	Slow Cruise	YFT21	POINTHOR	812637.72	820188.07	0.0	773.0	8.0	0.7	2.23E-02	8.78E-02	3.32E-03	3.11E-03	
Ferry between Skypier and PRD	PRD Ferry	Hotelling	PRD0	POINTHOR	812313.08	819912.91	0.0	773.0	8.0	0.7	1.38E+00	3.75E+00	2.02E-01	1.89E-01
	PRD Ferry	Maneuvering	PRD1	POINTHOR	812313.08	819912.91	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD2	POINTHOR	812336.00	819903.00	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD3	POINTHOR	812360.07	819896.31	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD4	POINTHOR	812384.83	819892.97	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD5	POINTHOR	812409.81	819893.05	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD6	POINTHOR	812434.55	819896.54	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD7	POINTHOR	812458.57	819903.38	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD8	POINTHOR	812481.58	819913.51	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD9	POINTHOR	812502.72	819926.52	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD10	POINTHOR	812521.94	819942.33	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD11	POINTHOR	812538.95	819960.75	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD12	POINTHOR	812553.22	819981.25	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD13	POINTHOR	812564.56	820003.51	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD14	POINTHOR	812573.19	820026.15	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Maneuvering	PRD15	POINTHOR	812581.82	820048.80	0.0	773.0	8.0	0.7	6.37E-02	1.52E-01	9.47E-03	8.86E-03
	PRD Ferry	Slow Cruise	PRD16	POINTHOR	812591.14	820072.00	0.0	773.0	8.0	0.7	5.64E-02	1.34E-01	8.40E-03	7.86E-03
	PRD Ferry	Slow Cruise	PRD17	POINTHOR	812600.45	820095.20	0.0	773.0	8.0	0.7	5.64E-02	1.34E-01	8.40E-03	7.86E-03
	PRD Ferry	Slow Cruise	PRD18	POINTHOR	812609.77	820118.42	0.0	773.0	8.0	0.7	5.64E-02	1.34E-01	8.40E-03	7.86E-03
	PRD Ferry	Slow Cruise	PRD19	POINTHOR	812619.08	820141.64	0.0	773.0	8.0	0.7	5.64E-02	1.34E-01	8.40E-03	7.86E-03
	PRD Ferry	Slow Cruise	PRD20	POINTHOR	812628.40	820164.86	0.0	773.0	8.0	0.7	5.64E-02	1.34E-01	8.40E-03	7.86E-03
PRD Ferry	Slow Cruise	PRD21	POINTHOR	812637.72	820188.07	0.0	773.0	8.0	0.7	5.64E-02	1.34E-01	8.40E-03	7.86E-03	

Remarks












- (1) For Macau and PRD Ferry, exit temperature, exit velocity and exhaust diameter refer to the approved EIA report (AEIAR-185/2014) for Expansion of Hong Kong International Airport into a Three-Runway System.
 (2) As no stack was visible for majority of Macau and PRD Ferry surveyed, the exhausts were assumed to emit at water level, i.e. 0mAG.

Hourly Emission Profile

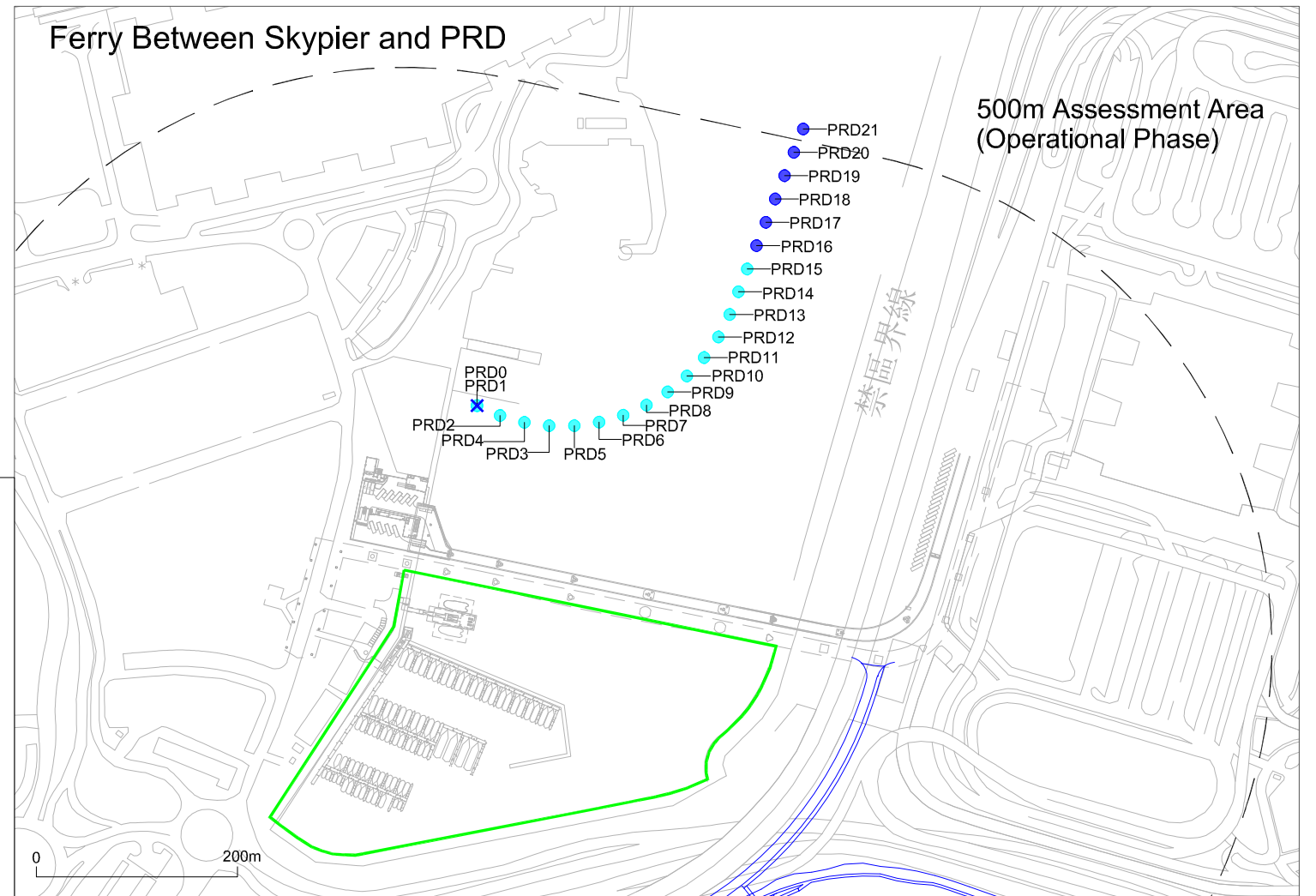
Hour	Ferry between Skypier and Macau Outer Harbour Ferry Terminal (XZM)	Ferry between Skypier and Macau Taipa Ferry Terminal (YFT)	Ferry between Skypier and PRD (PRD)	Proposed Marine Facilities - Pier (Project-related) (SCP)	Proposed Marine Facilities - Berthing Facilities (Project-related) (PV)
	Hotelling / Maneuvering / Slow Cruise	Hotelling / Maneuvering / Slow Cruise	Hotelling / Maneuvering / Slow Cruise	Hotelling / Maneuvering	Hotelling
1	0%	0%	0%	0%	0%
2	0%	0%	0%	0%	0%
3	0%	0%	0%	0%	0%
4	0%	0%	0%	0%	0%
5	0%	0%	0%	0%	0%
6	0%	0%	0%	0%	1%
7	0%	0%	0%	0%	1%
8	0%	0%	0%	0%	2%
9	11%	8%	3%	0%	4%
10	0%	8%	10%	7%	9%
11	22%	8%	10%	7%	9%
12	0%	8%	4%	10%	10%
13	11%	17%	8%	7%	4%
14	11%	0%	8%	10%	4%
15	0%	17%	8%	7%	4%
16	0%	0%	7%	10%	3%
17	11%	17%	10%	7%	4%
18	11%	0%	7%	7%	9%
19	0%	8%	8%	10%	12%
20	0%	0%	8%	7%	9%
21	11%	8%	5%	7%	7%
22	11%	0%	4%	7%	4%
23	0%	0%	0%	0%	1%
24	0%	0%	0%	0%	0%
Total	100%	100%	100%	100%	100%

Locations of Marine Emissions Induced by Existing Marine Vessels -
From / To SkyPier
(Operational Phase)

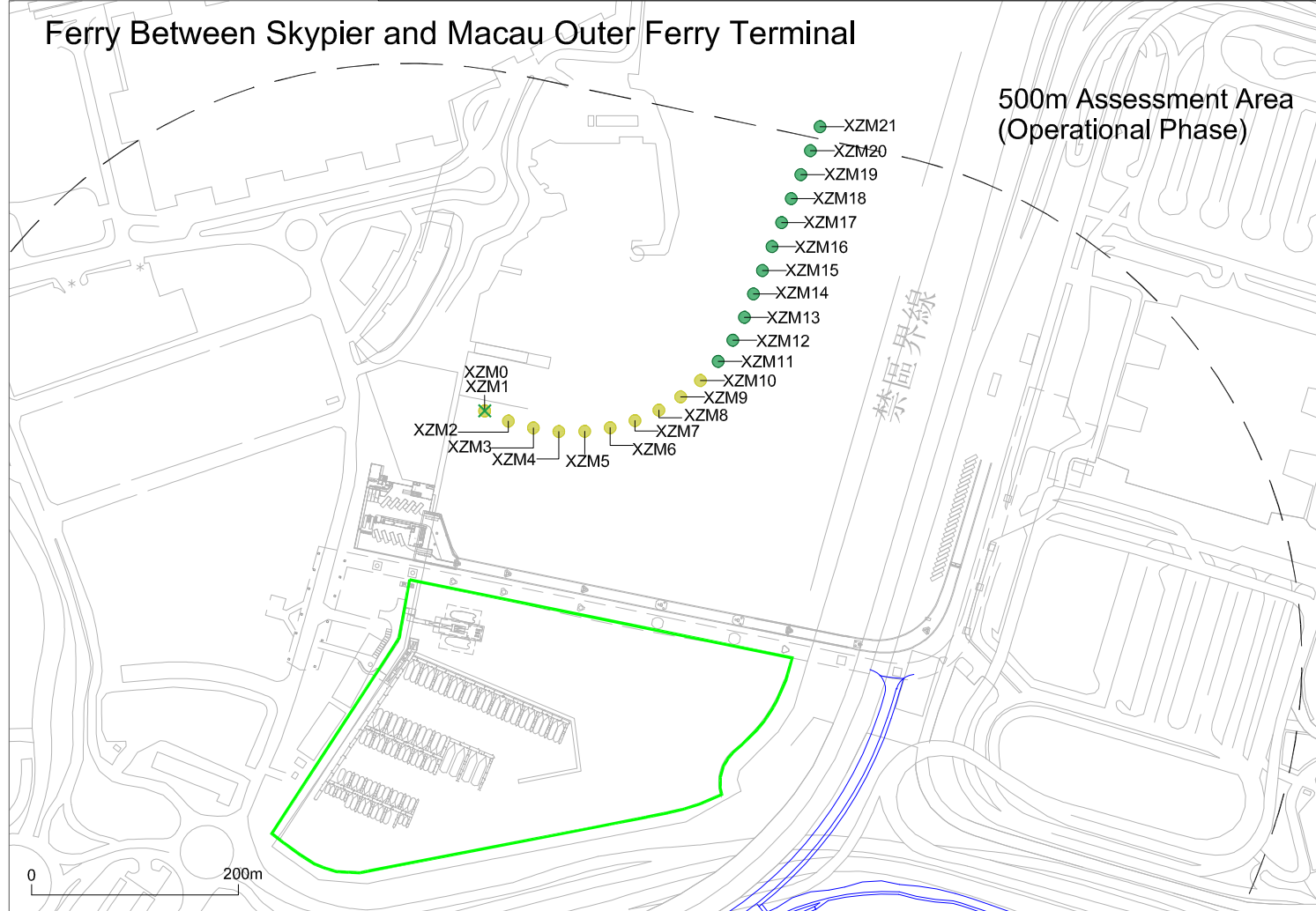
LEGEND

-  Proposed Alignment of Airport Tung Chung Link
-  Proposed Marine Facilities
-  Routing (Hotelling) - Ferry Traveling Between SkyPier and PRD
-  Routing (Maneuvering) - Ferry Traveling Between SkyPier and PRD
-  Routing (Slow Cruise) - Ferry Traveling Between SkyPier and PRD
-  Routing (Hotelling) - Ferry Traveling Between SkyPier and Macau Outer Harbour Ferry Terminal
-  Routing (Maneuvering) - Ferry Traveling Between SkyPier and Macau Outer Harbour Ferry Terminal
-  Routing (Slow Cruise) - Ferry Traveling Between SkyPier and Macau Outer Harbour Ferry Terminal
-  Routing (Hotelling) - Ferry Traveling Between SkyPier and Macau Taipa Ferry Terminal
-  Routing (Maneuvering) - Ferry Traveling Between SkyPier and Macau Taipa Ferry Terminal
-  Routing (Slow Cruise) - Ferry Traveling Between SkyPier and Macau Taipa Ferry Terminal

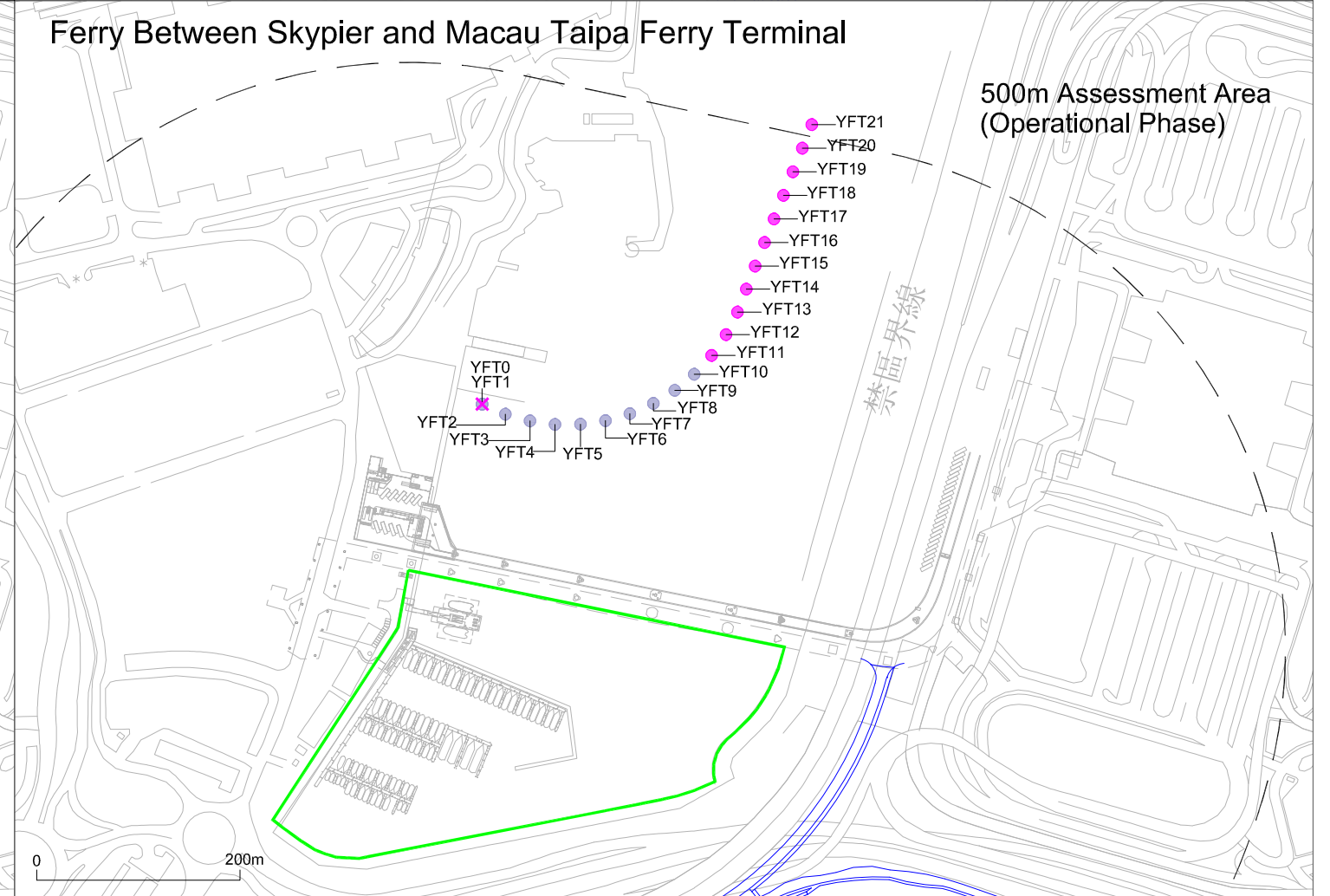
Ferry Between SkyPier and PRD



Ferry Between SkyPier and Macau Outer Ferry Terminal








Ferry Between SkyPier and Macau Taipa Ferry Terminal



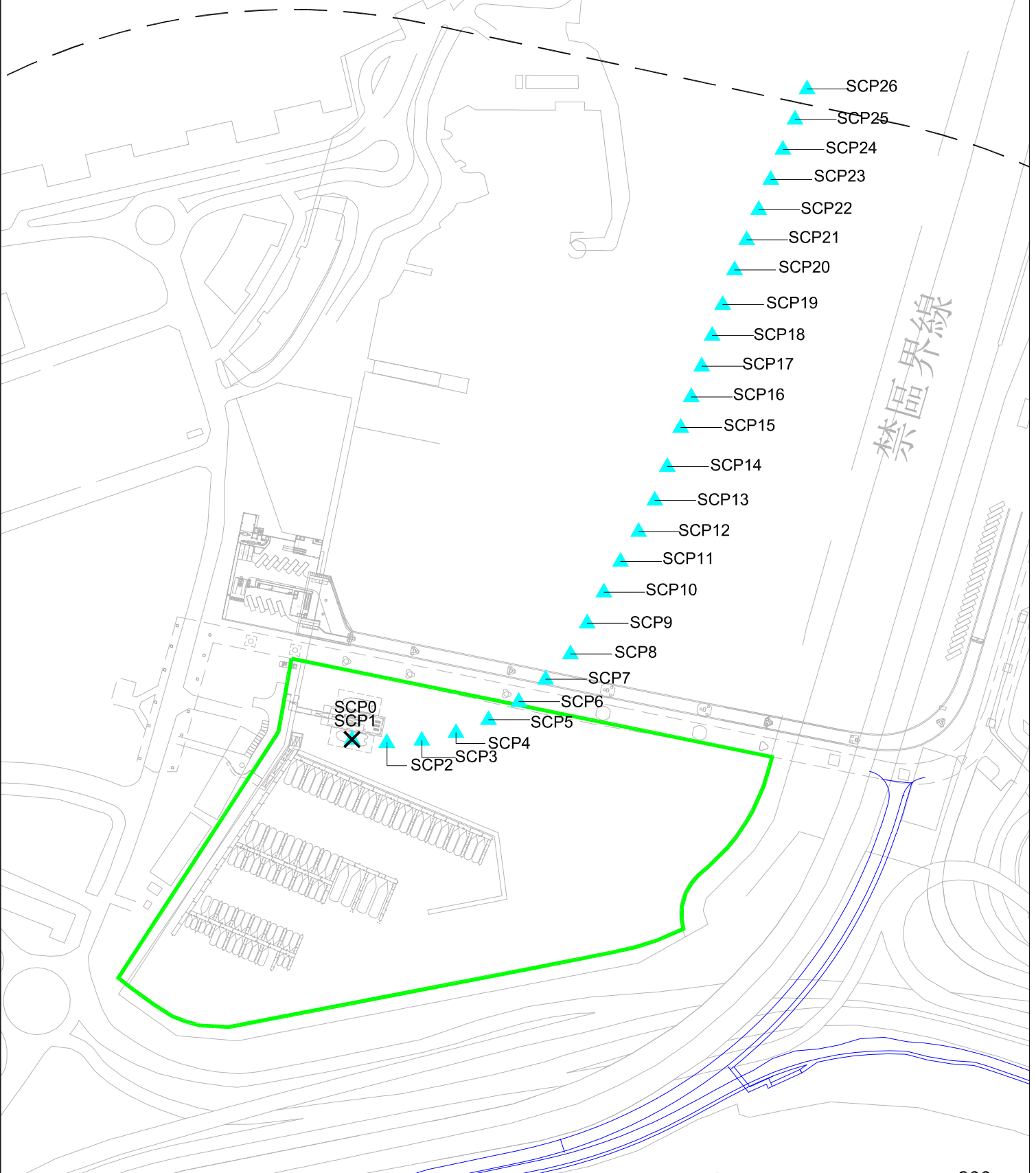
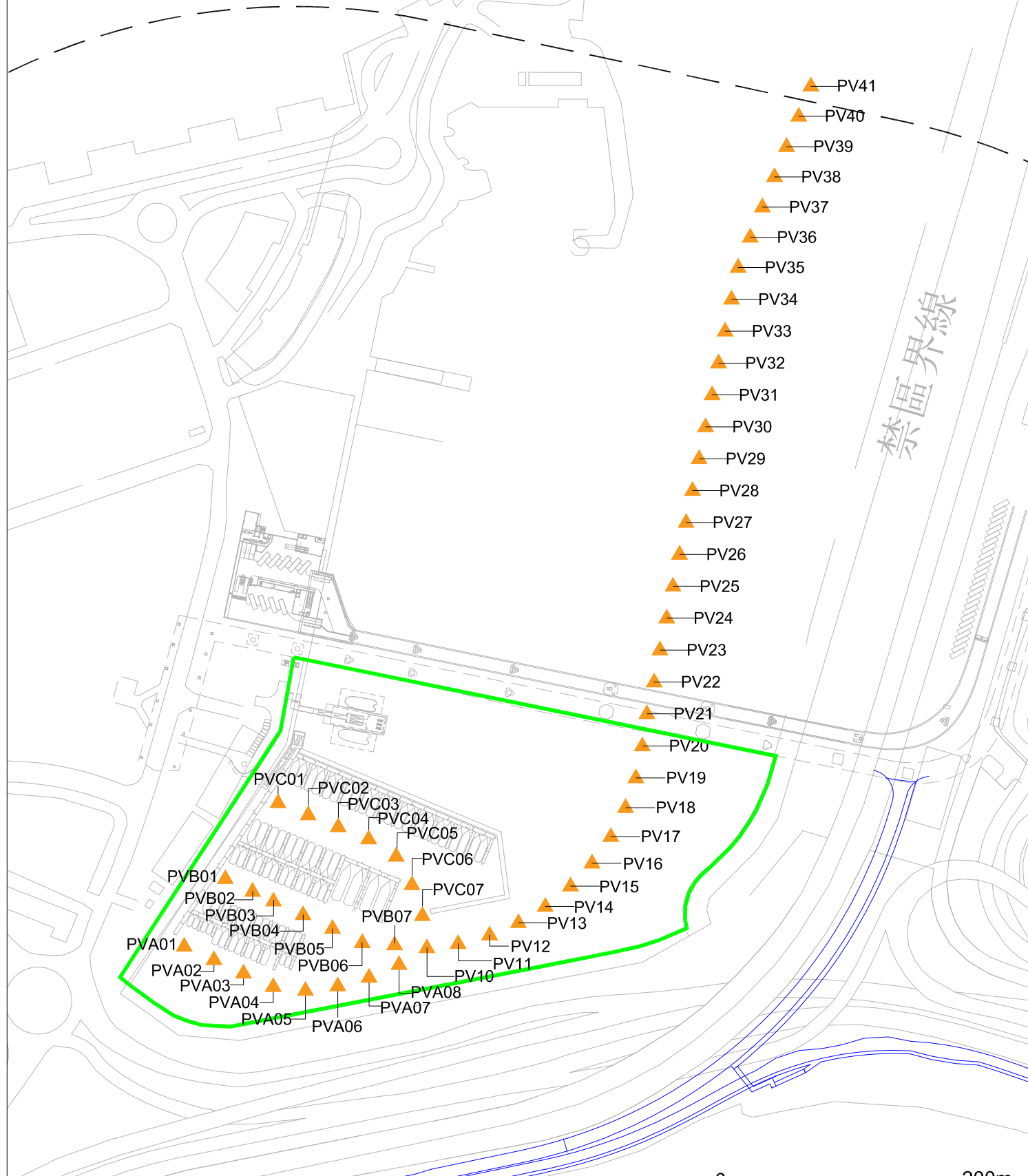
Locations of Marine Emissions Induced by Proposed Marine Facilities (Projected-related) (Operational Phase)

LEGEND

-  Proposed Alignment of Airport Tung Chung Link
-  Proposed Marine Facilities
-  Routing (Maneuvering) - From / To the Proposed Berthing Facilities
-  Routing (Hotelling) - From / To the Proposed Pier
-  Routing (Maneuvering) - From / To the Proposed Pier

500m Assessment Area
(Operational Phase)

500m Assessment Area
(Operational Phase)



Marine Vessels Induced by Proposed Berthing Facilities

Marine Vessels Induced by Proposed Pier

