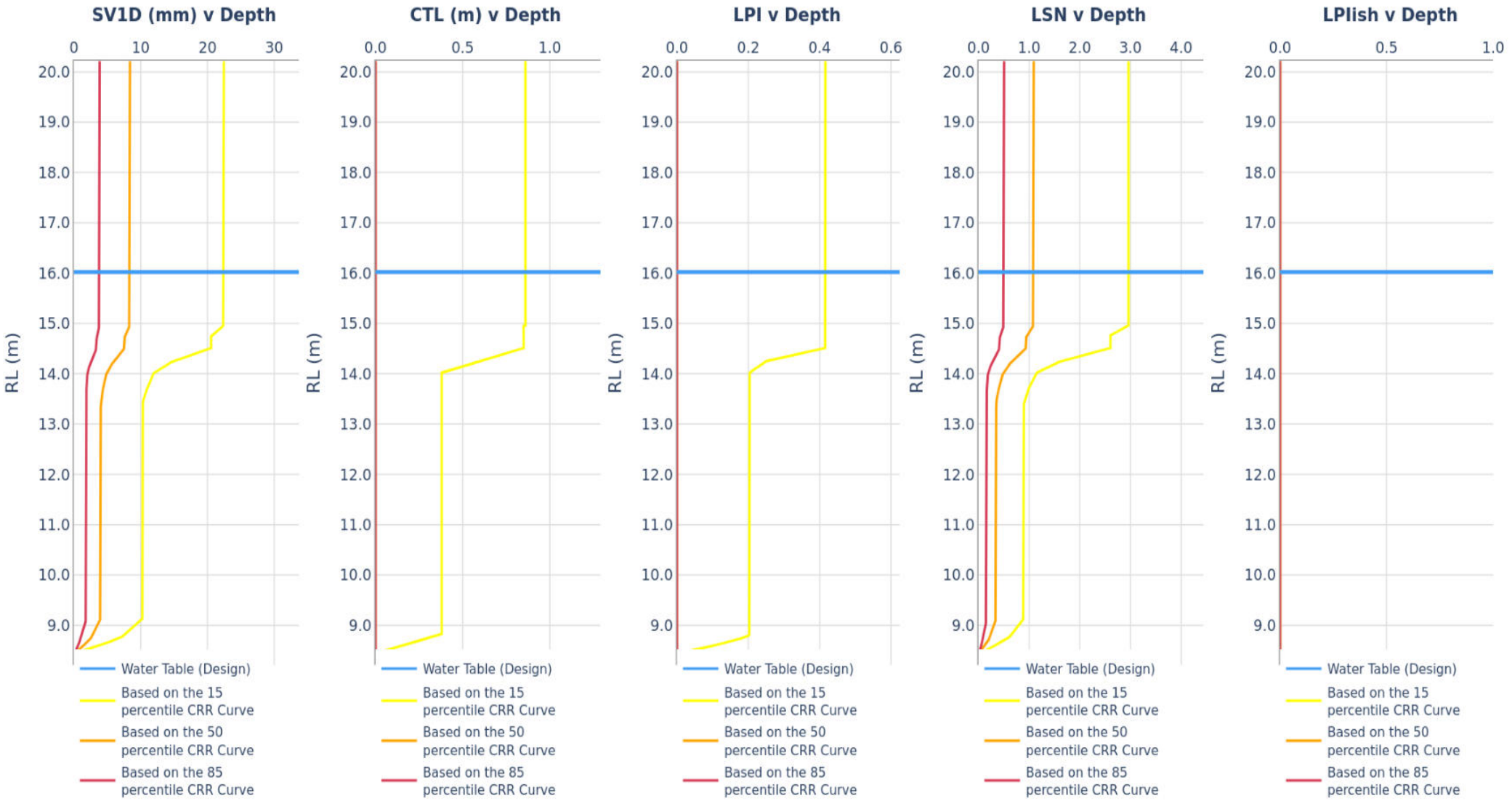
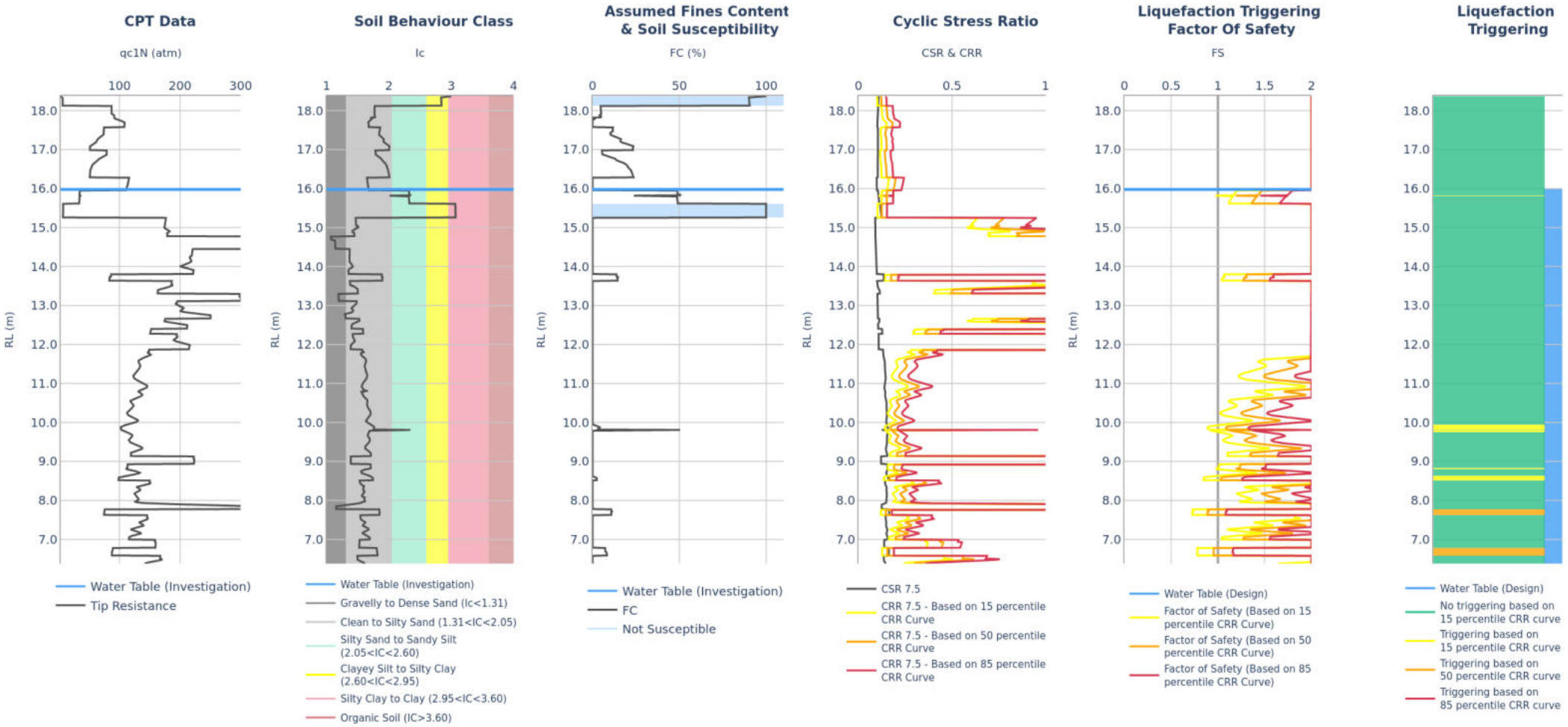
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT03	CPT_TT275203	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT04	CPT_TT275204	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

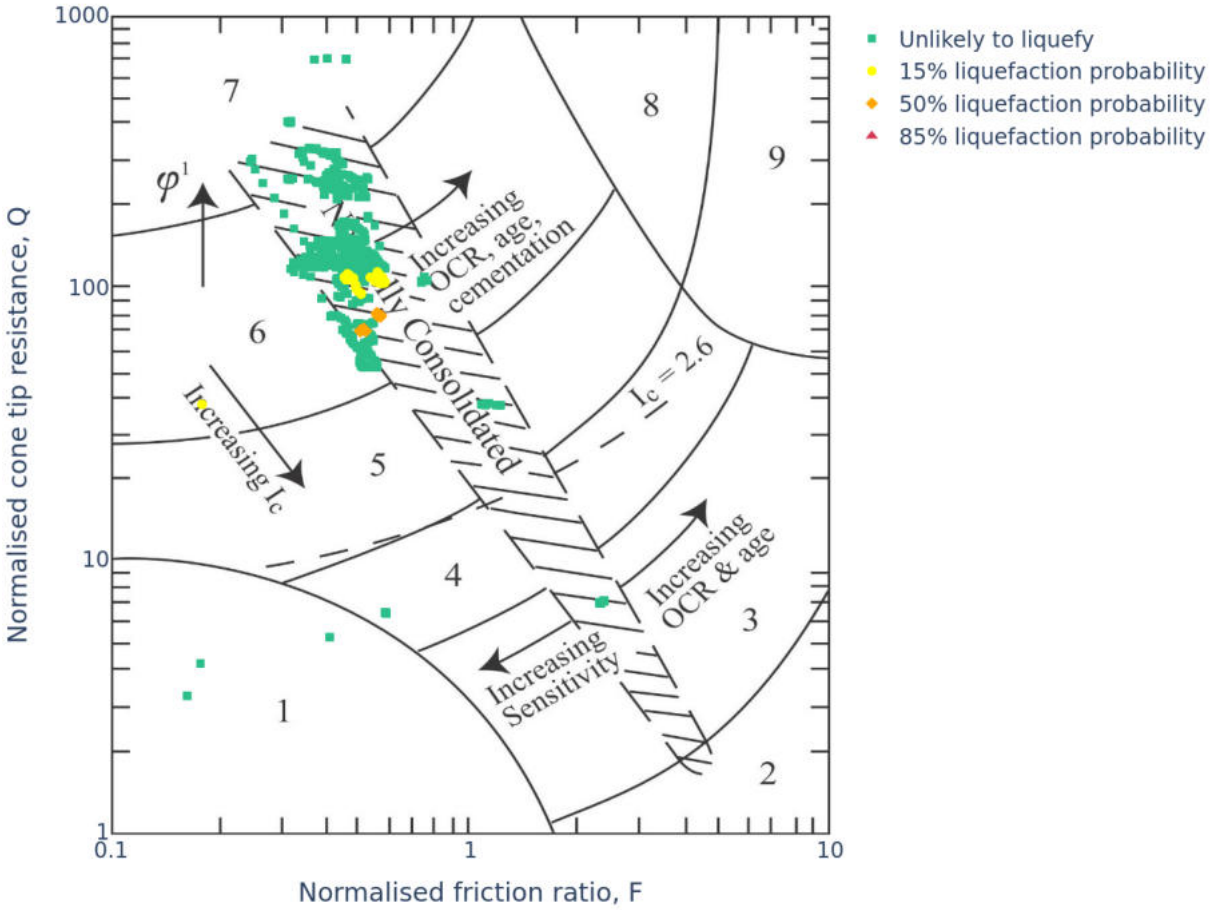
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	28	0.7	0	3	8.5	0
50%	14	0.4	0	1	10.7	0
85%	5	0.0	0	0	12.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT01 to CPT07 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 10/28*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

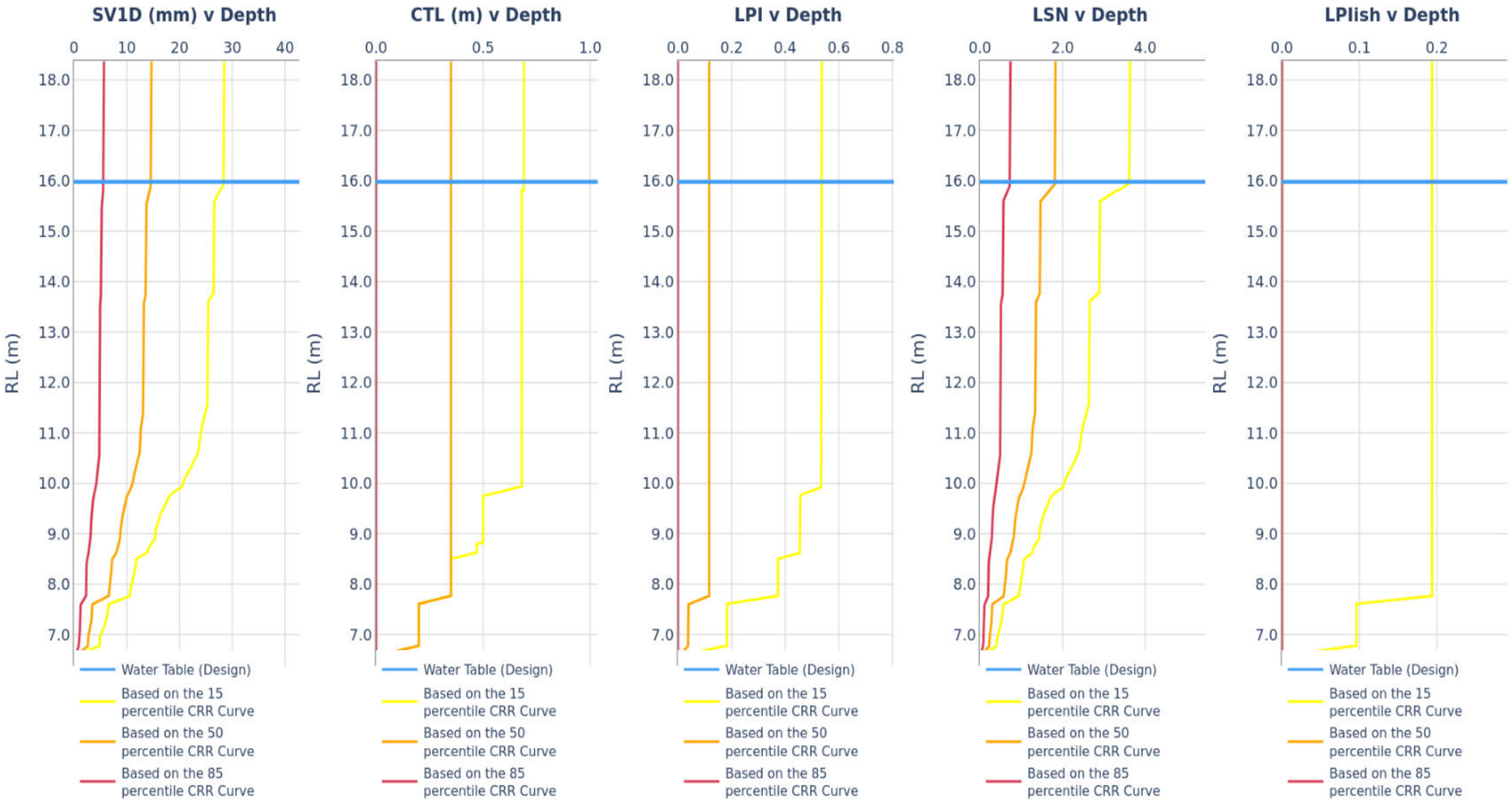


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

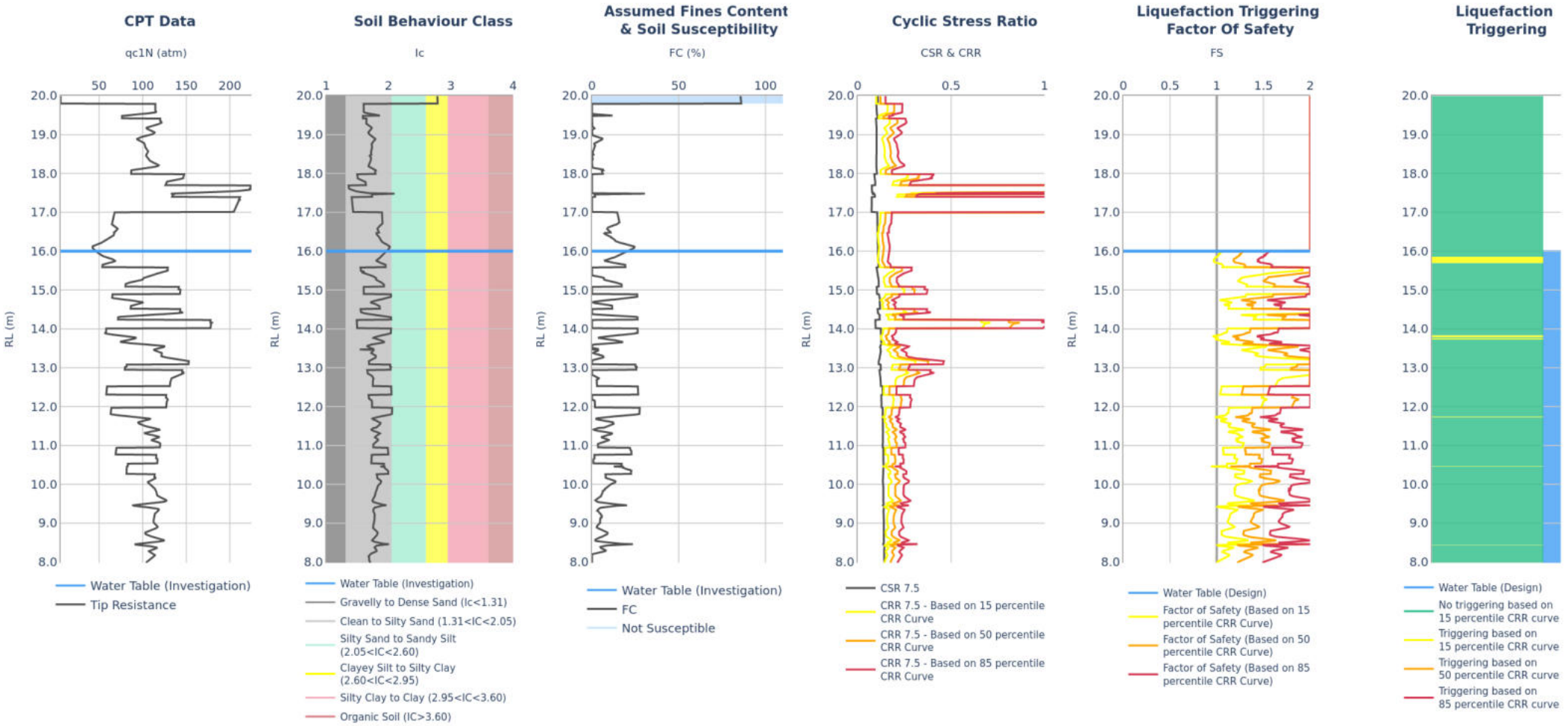
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT04	CPT_TT275204	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT05	CPT_TT275205	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

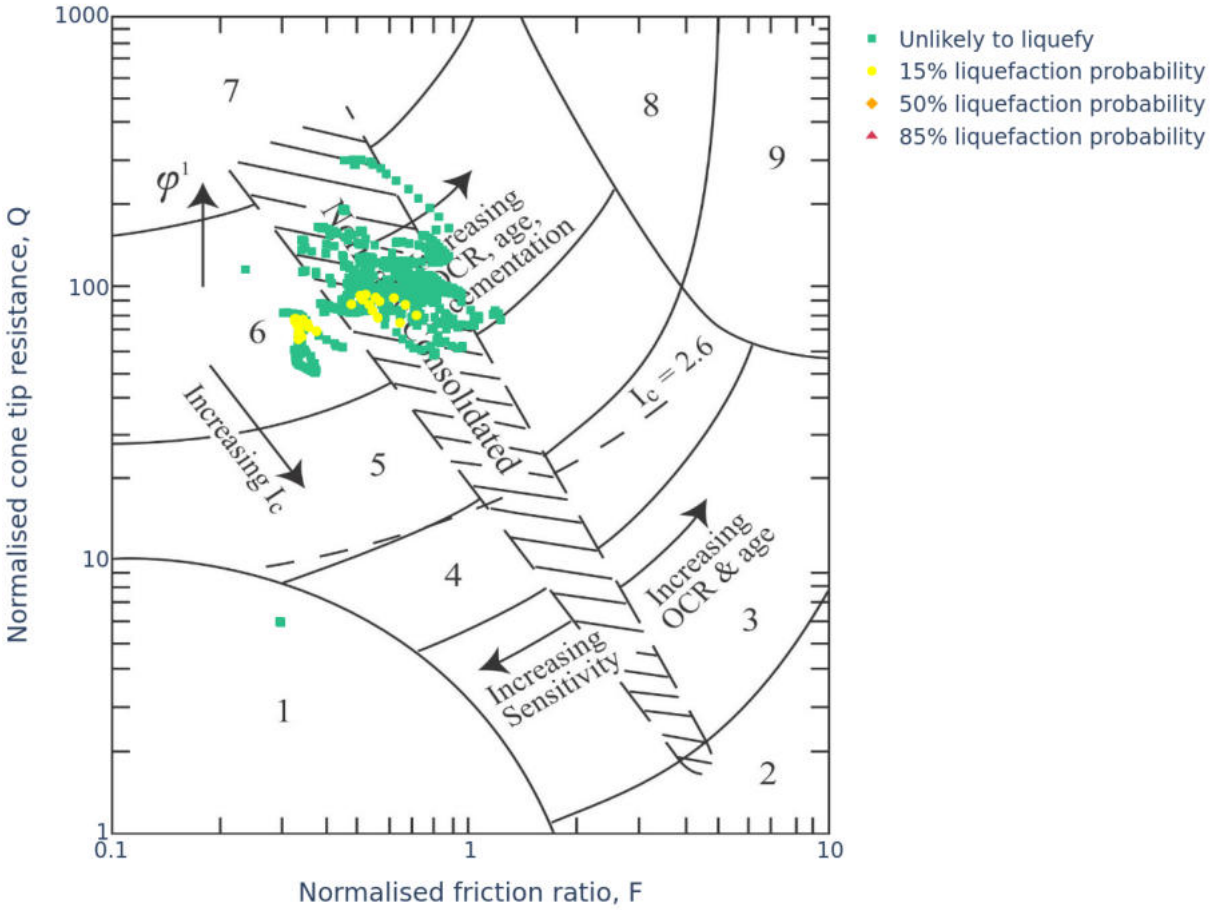
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	32	0.3	0	4	4.2	0
50%	15	0.0	0	2	12.0	0
85%	6	0.0	0	0	12.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT01 to CPT07 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 13/28*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



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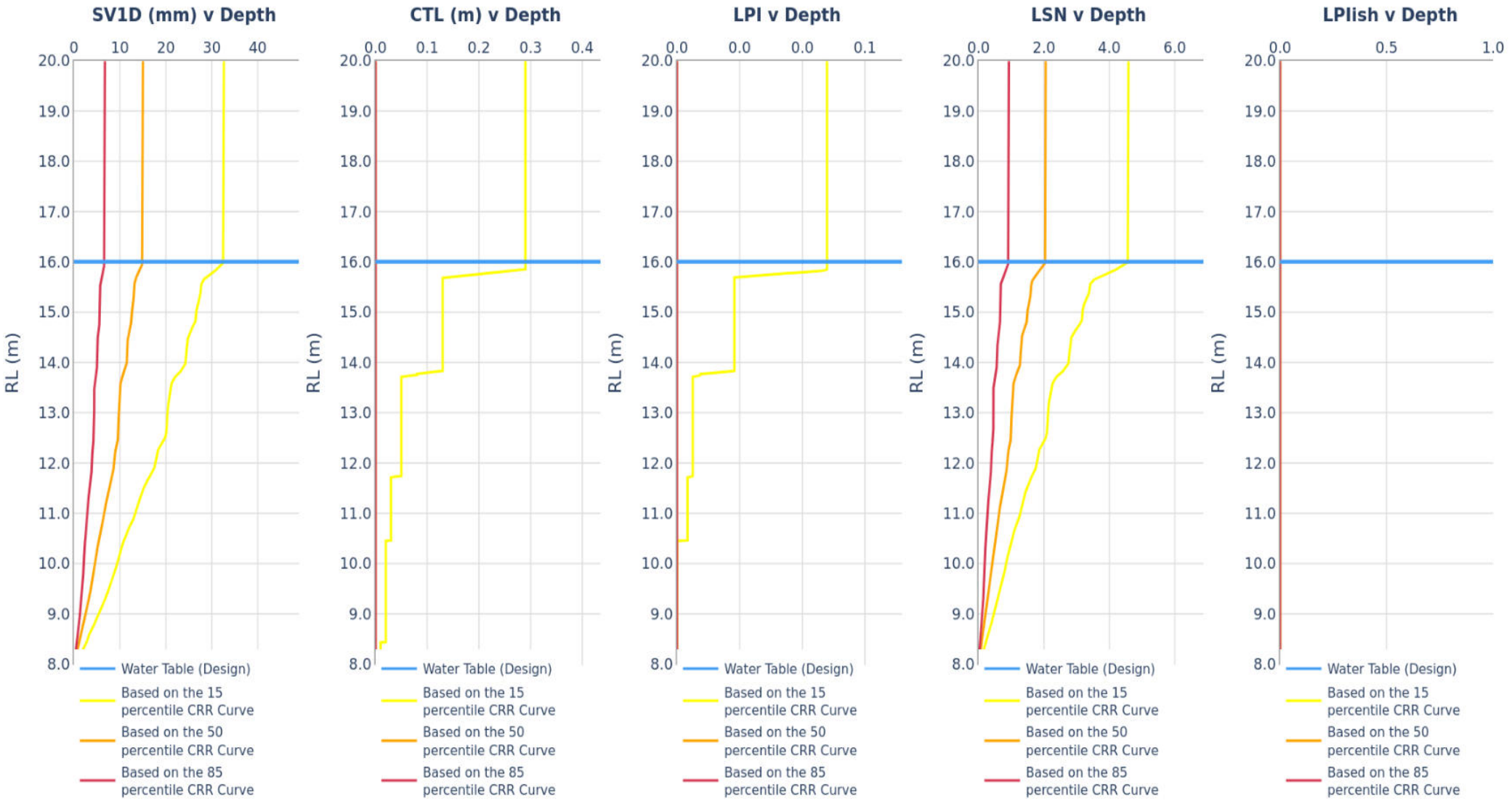
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

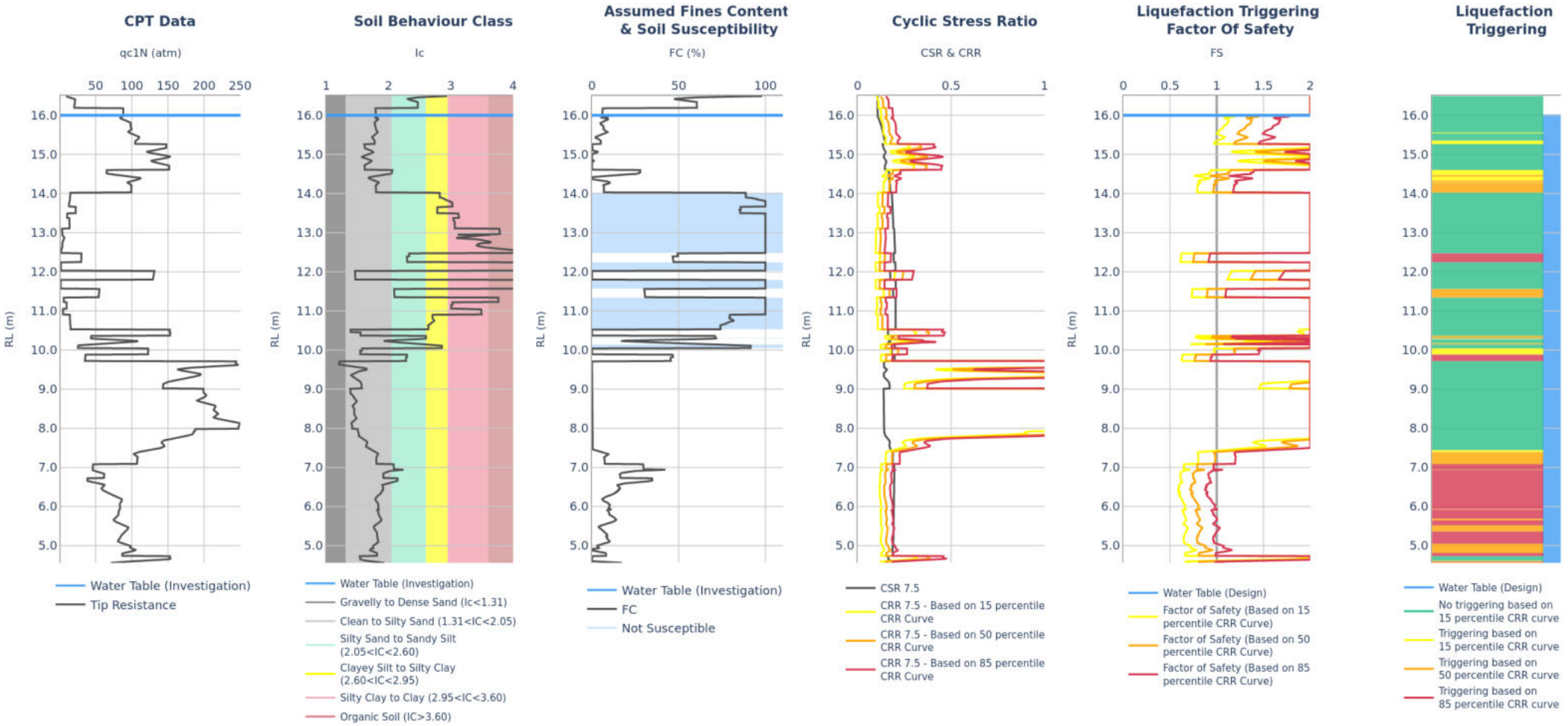
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT05	CPT_TT275205	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT06	CPT_TT275206	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

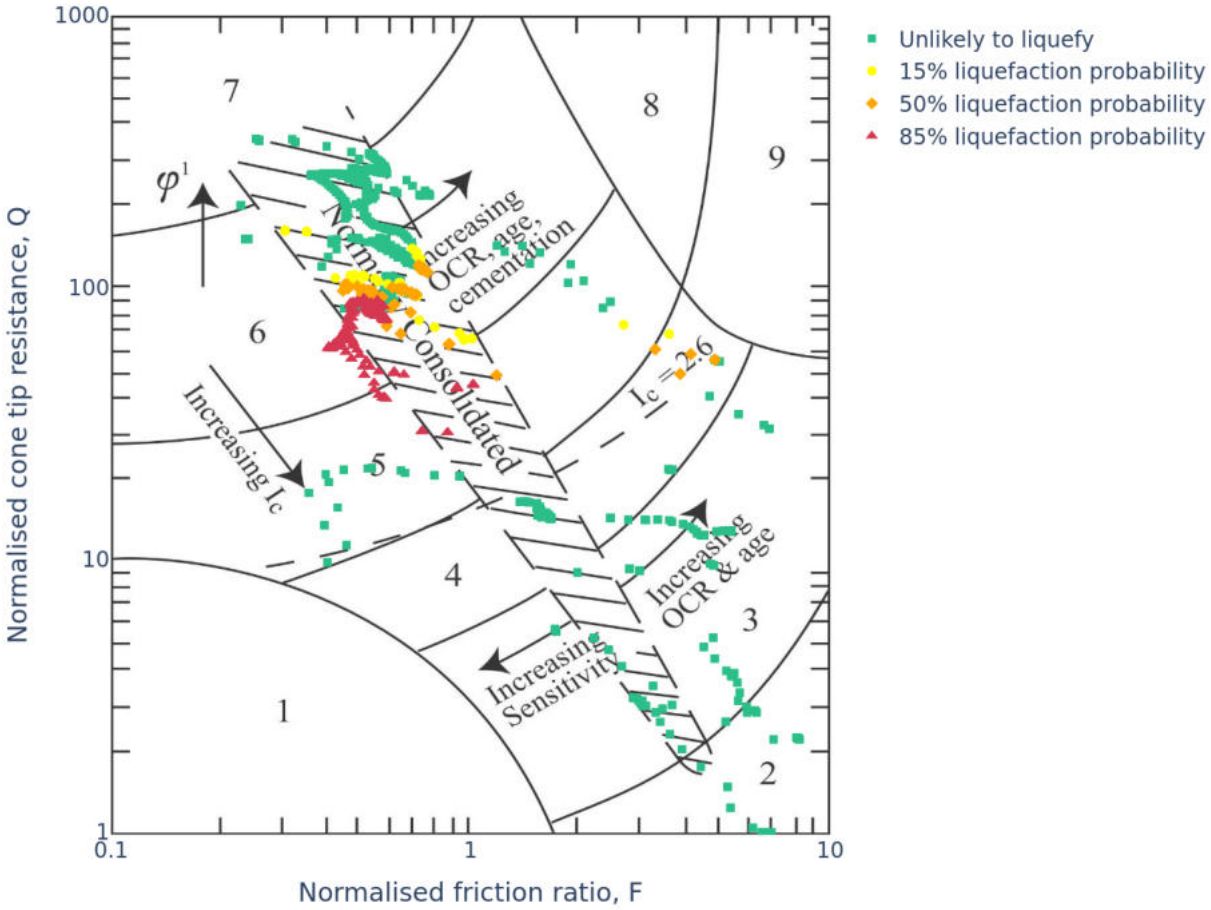
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	104	4.3	6	21	1.2	4
50%	84	3.8	3	14	2.2	1
85%	46	2.3	0	7	4.1	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



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2. Organic soils - peats
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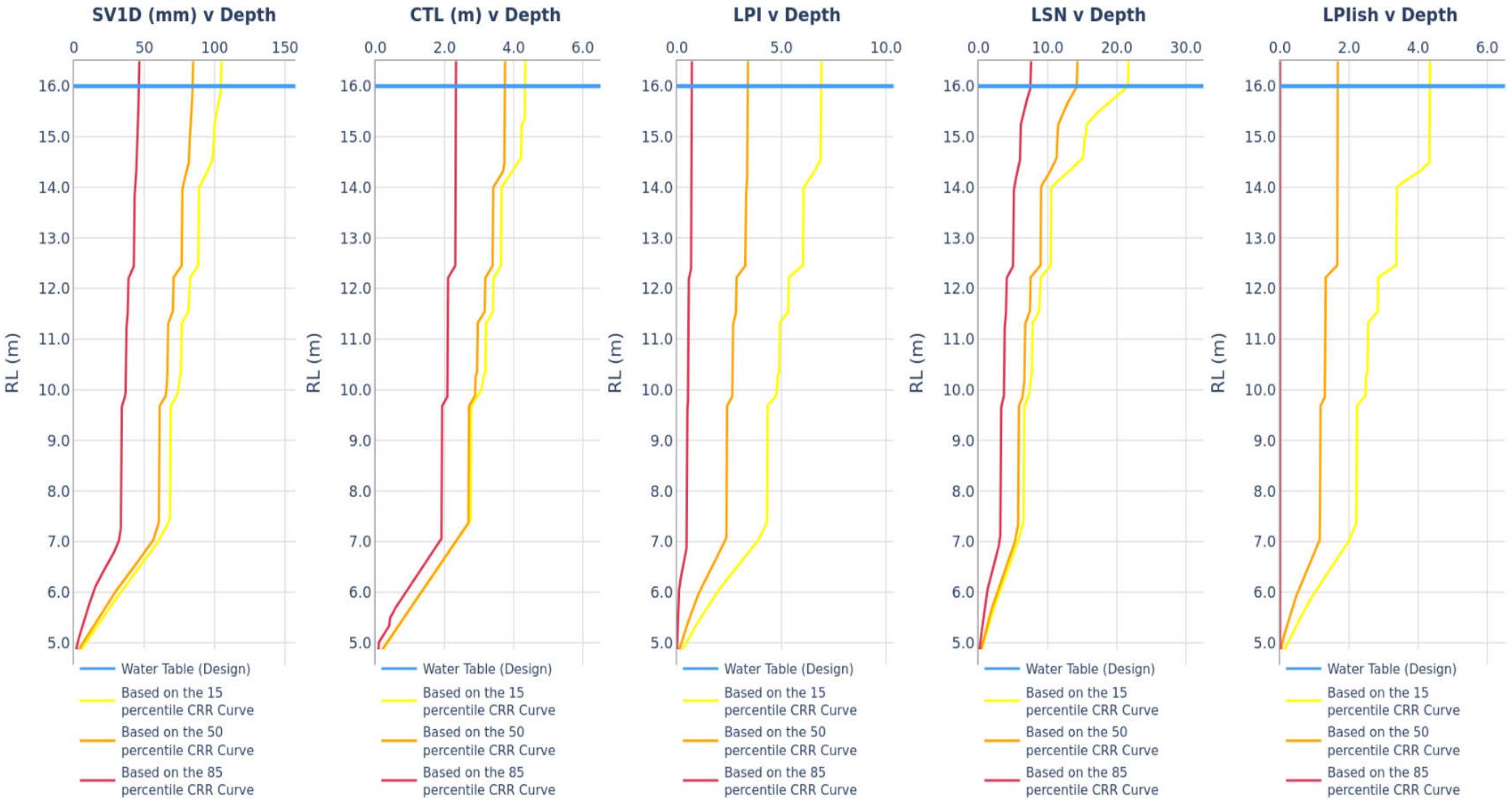
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

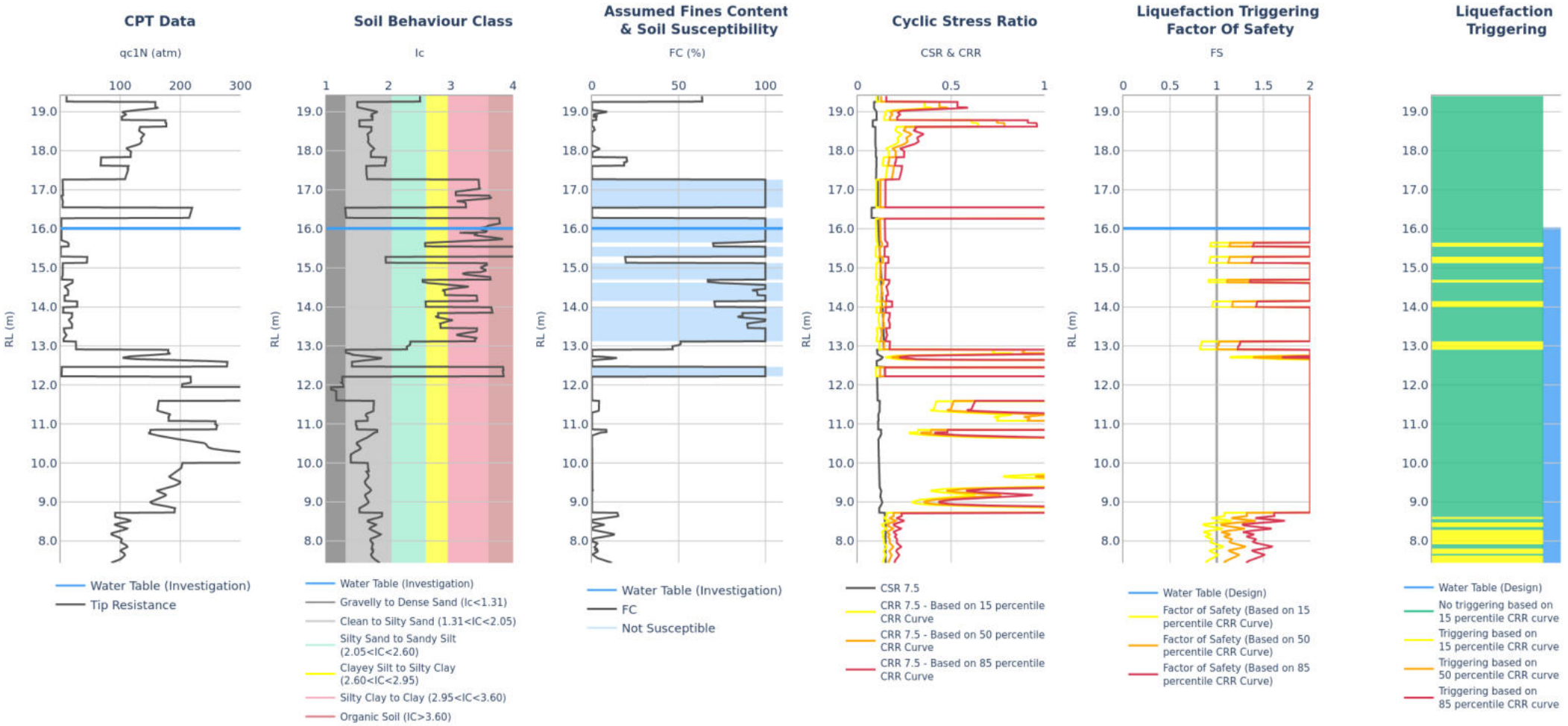
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT06	CPT_TT275206	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT07	CPT_TT275207	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

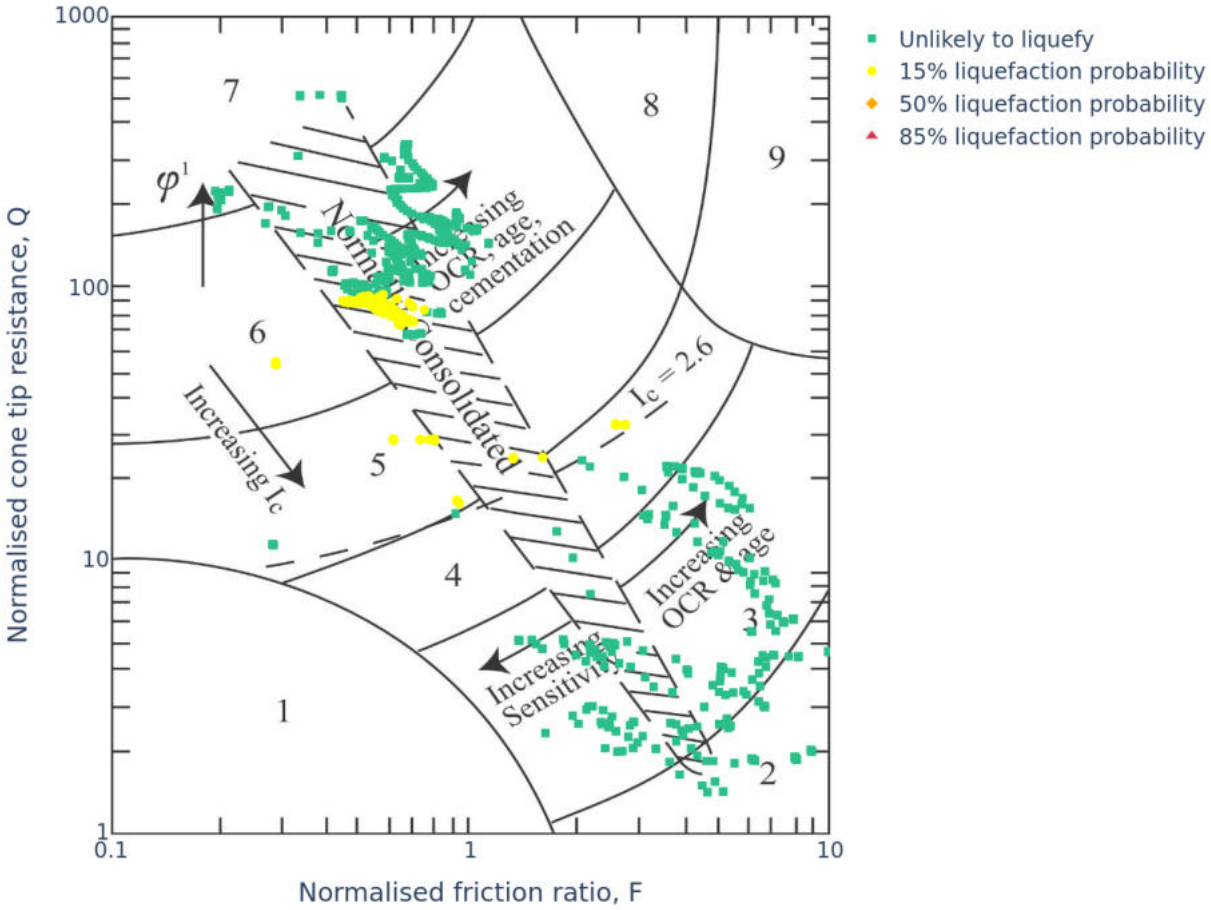
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	29	1.6	0	4	3.9	0
50%	10	0.0	0	1	12.0	0
85%	5	0.0	0	0	12.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT01 to CPT07 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 19/28*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



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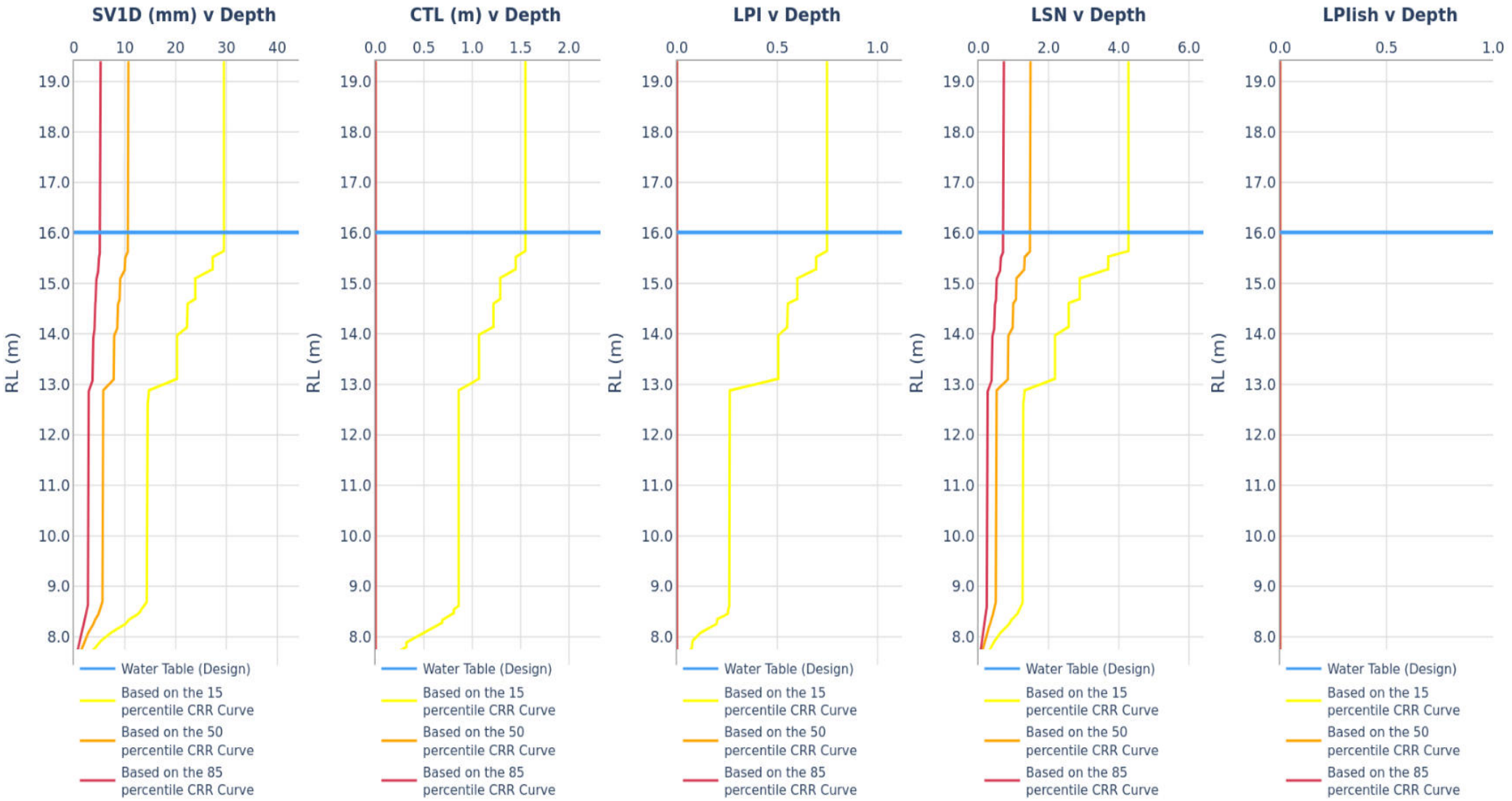
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

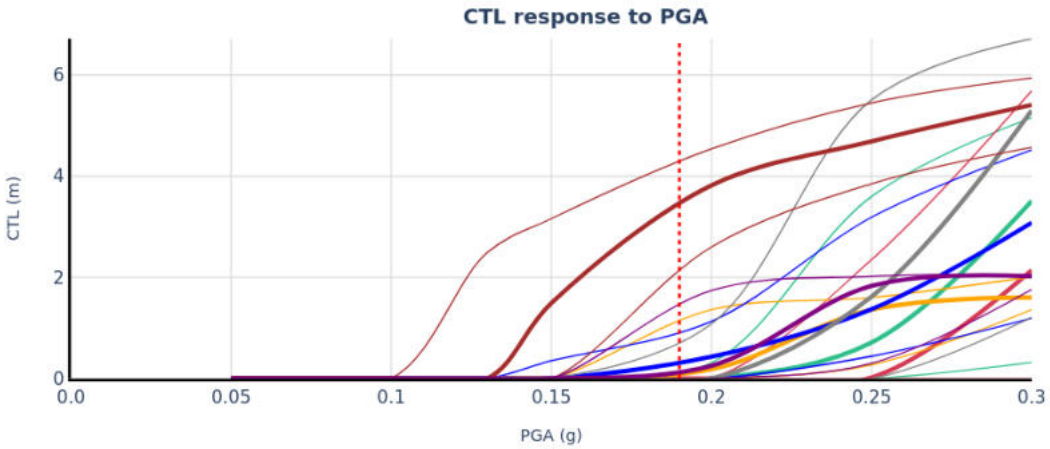
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

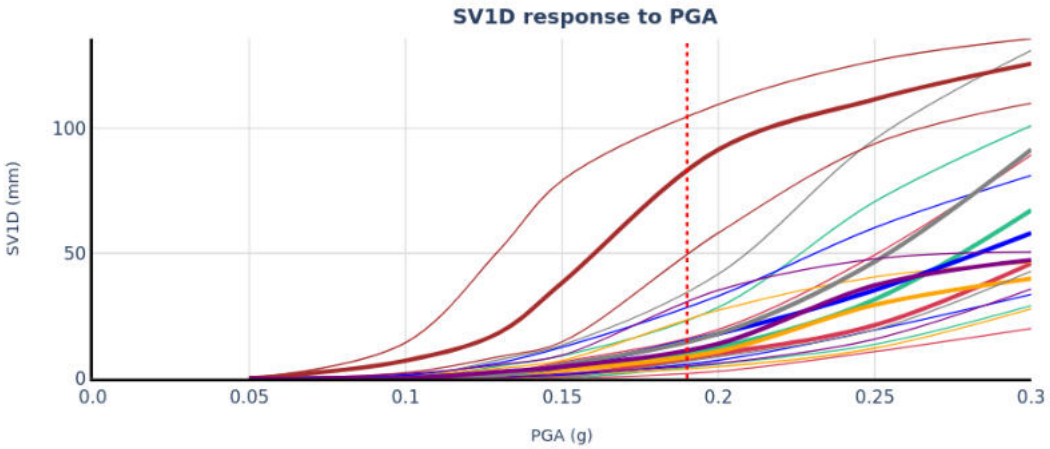


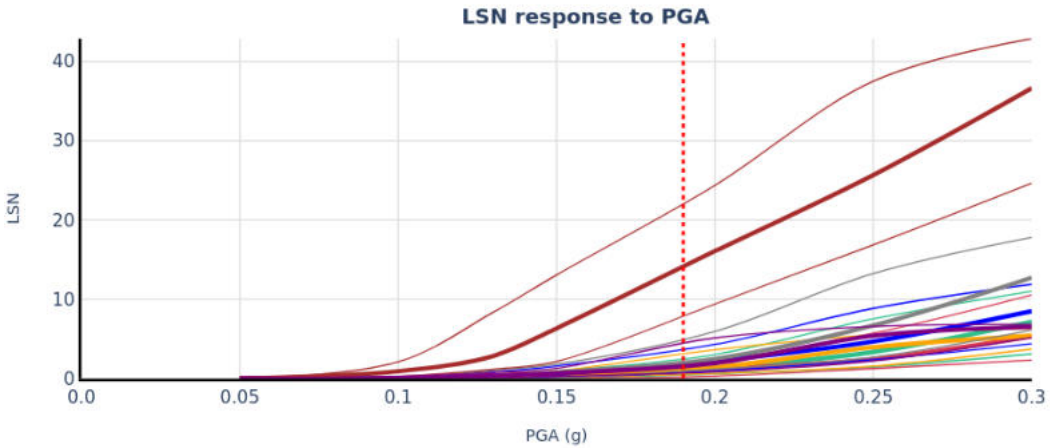
Input

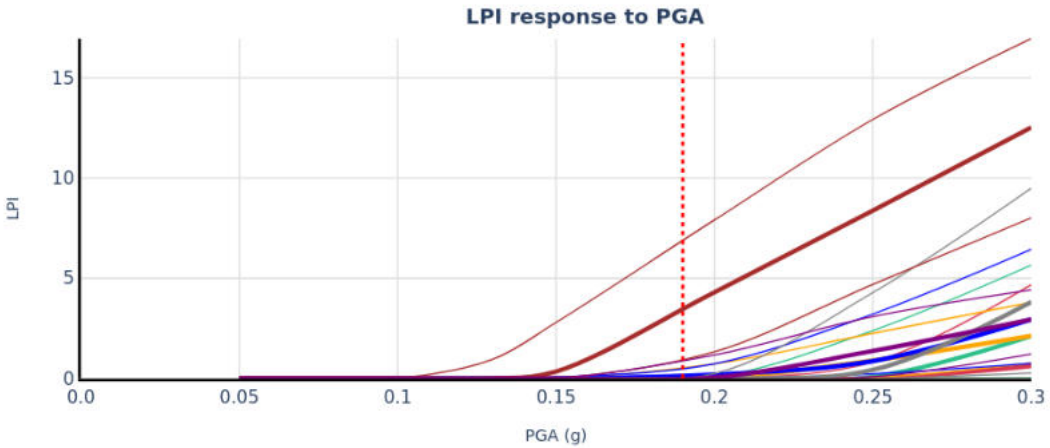
Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT07	CPT_TT275207	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT







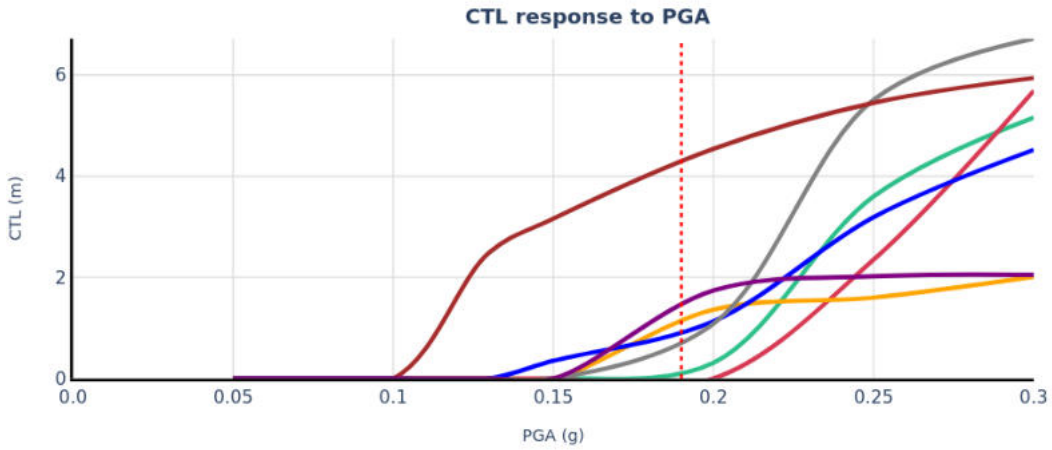


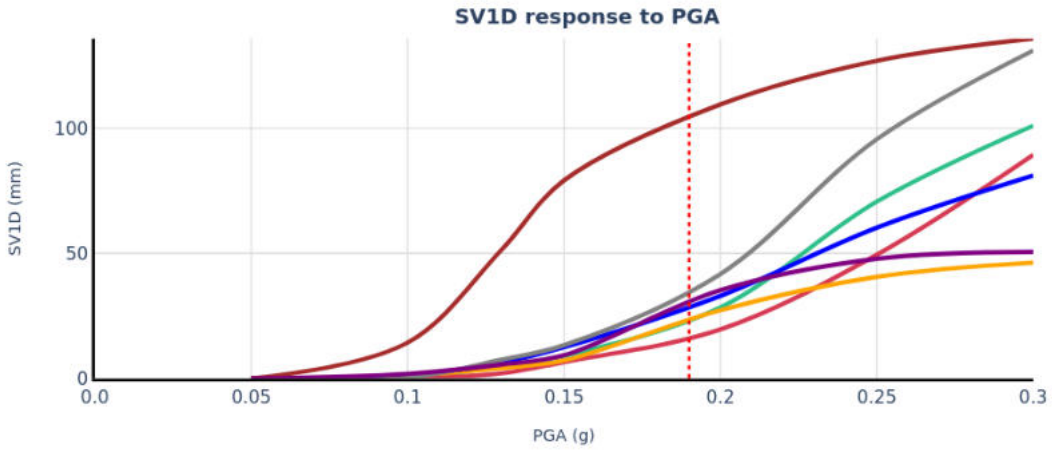
Input

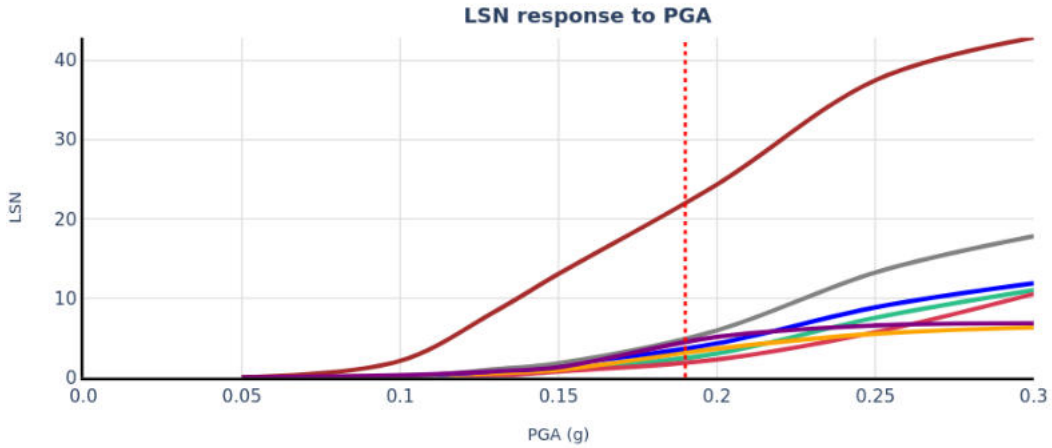
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT01	CPT_TT275201	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT02	CPT_TT275202	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT03	CPT_TT275203	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT04	CPT_TT275204	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT05	CPT_TT275205	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT06	CPT_TT275206	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT07	CPT_TT275207	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

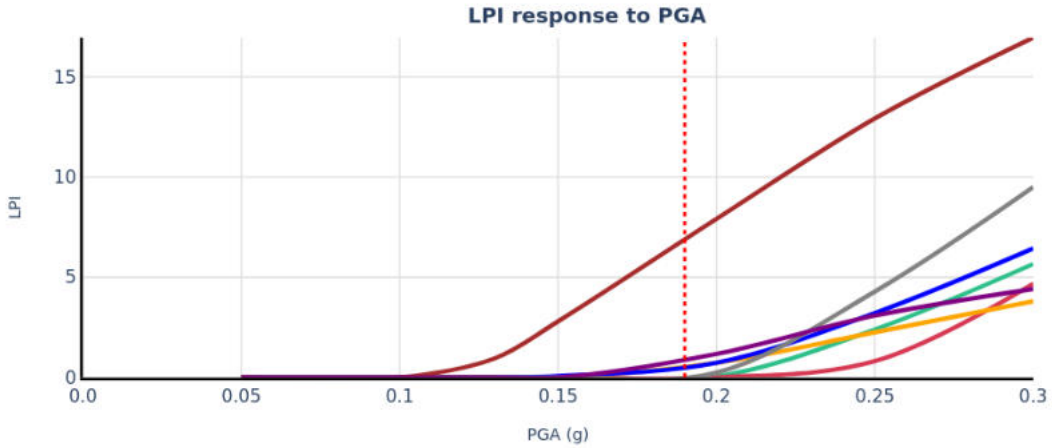
Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT BASED ON 15 PERCENTILE CRR CURVE









Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT01	CPT_TT275201	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT02	CPT_TT275202	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT03	CPT_TT275203	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT04	CPT_TT275204	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT05	CPT_TT275205	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT06	CPT_TT275206	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT07	CPT_TT275207	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 275201	TTGD 275202	TTGD 275203
CPT Name	CPT01	CPT02	CPT03
Run Description	CPT01	CPT02	CPT03
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	6.0	5.3	4.2
Depth to groundwater for design (m)	6.0	5.3	4.2
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	12.01	12.05	12.01
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	15	15	15
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 275201	CPT01	0.0	0.0	0.0
TTGD 275201	CPT01	0.0	10.0	2.6
TTGD 275201	CPT01	10.0	15.0	2.6
TTGD 275202	CPT02	0.0	0.0	0.0
TTGD 275202	CPT02	0.0	10.0	2.6
TTGD 275202	CPT02	10.0	15.0	2.6
TTGD 275203	CPT03	0.0	0.0	0.0
TTGD 275203	CPT03	0.0	10.0	2.6
TTGD 275203	CPT03	10.0	15.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 275201	CPT01	0.0	10.0	0.0 CFC
TTGD 275201	CPT01	10.0	15.0	0.0 CFC
TTGD 275202	CPT02	0.0	10.0	0.0 CFC
TTGD 275202	CPT02	10.0	15.0	0.0 CFC
TTGD 275203	CPT03	0.0	10.0	0.0 CFC
TTGD 275203	CPT03	10.0	15.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m³)
TTGD 275201	CPT01	0.0	0.0001	18.0
TTGD 275201	CPT01	0.0001	12.01	18.0
TTGD 275201	CPT01	12.01	15.0	18.0
TTGD 275202	CPT02	0.0	0.0001	18.0
TTGD 275202	CPT02	0.0001	12.01	18.0
TTGD 275202	CPT02	12.01	15.0	18.0
TTGD 275203	CPT03	0.0	0.0001	18.0
TTGD 275203	CPT03	0.0001	12.01	18.0
TTGD 275203	CPT03	12.01	15.0	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 275204	TTGD 275205	TTGD 275206
CPT Name	CPT04	CPT05	CPT06
Run Description	CPT04	CPT05	CPT06
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	2.4	4.0	0.5
Depth to groundwater for design (m)	2.4	4.0	0.5
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	12.0	12.02	11.94
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	15	15	15
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 275204	CPT04	0.0	0.0	0.0
TTGD 275204	CPT04	0.0	10.0	2.6
TTGD 275204	CPT04	10.0	15.0	2.6
TTGD 275205	CPT05	0.0	0.0	0.0
TTGD 275205	CPT05	0.0	10.0	2.6
TTGD 275205	CPT05	10.0	15.0	2.6
TTGD 275206	CPT06	0.0	0.0	0.0
TTGD 275206	CPT06	0.0	10.0	2.6
TTGD 275206	CPT06	10.0	15.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 275204	CPT04	0.0	10.0	0.0 CFC
TTGD 275204	CPT04	10.0	15.0	0.0 CFC
TTGD 275205	CPT05	0.0	10.0	0.0 CFC
TTGD 275205	CPT05	10.0	15.0	0.0 CFC
TTGD 275206	CPT06	0.0	10.0	0.0 CFC
TTGD 275206	CPT06	10.0	15.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m³)
TTGD 275204	CPT04	0.0	0.0001	18.0
TTGD 275204	CPT04	0.0001	12.01	18.0
TTGD 275204	CPT04	12.01	15.0	18.0
TTGD 275205	CPT05	0.0	0.0001	18.0
TTGD 275205	CPT05	0.0001	12.01	18.0
TTGD 275205	CPT05	12.01	15.0	18.0
TTGD 275206	CPT06	0.0	0.0001	18.0
TTGD 275206	CPT06	0.0001	12.01	18.0
TTGD 275206	CPT06	12.01	15.0	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 275207
CPT Name	CPT07
Run Description	CPT07
EQ PGA (g)	0.19
EQ Magnitude	6.5
Depth to groundwater at time of Investigation (m)	3.4
Depth to groundwater for design (m)	3.4
Pre-drill depth (m)	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)
Settlement method	ZRB-2002
Total depth of CPT (m)	11.97
Minimum depth of analysis (m)	0
Maximum depth of analysis (m)	15
Inverse filtering applied?	Yes (10 cm^2)
Cut/Fill Height	N/A
Surcharge load (kPa)	N/A
Fill unit weight (kN/m^3)	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 275207	CPT07	0.0	0.0	0.0
TTGD 275207	CPT07	0.0	10.0	2.6
TTGD 275207	CPT07	10.0	15.0	2.6

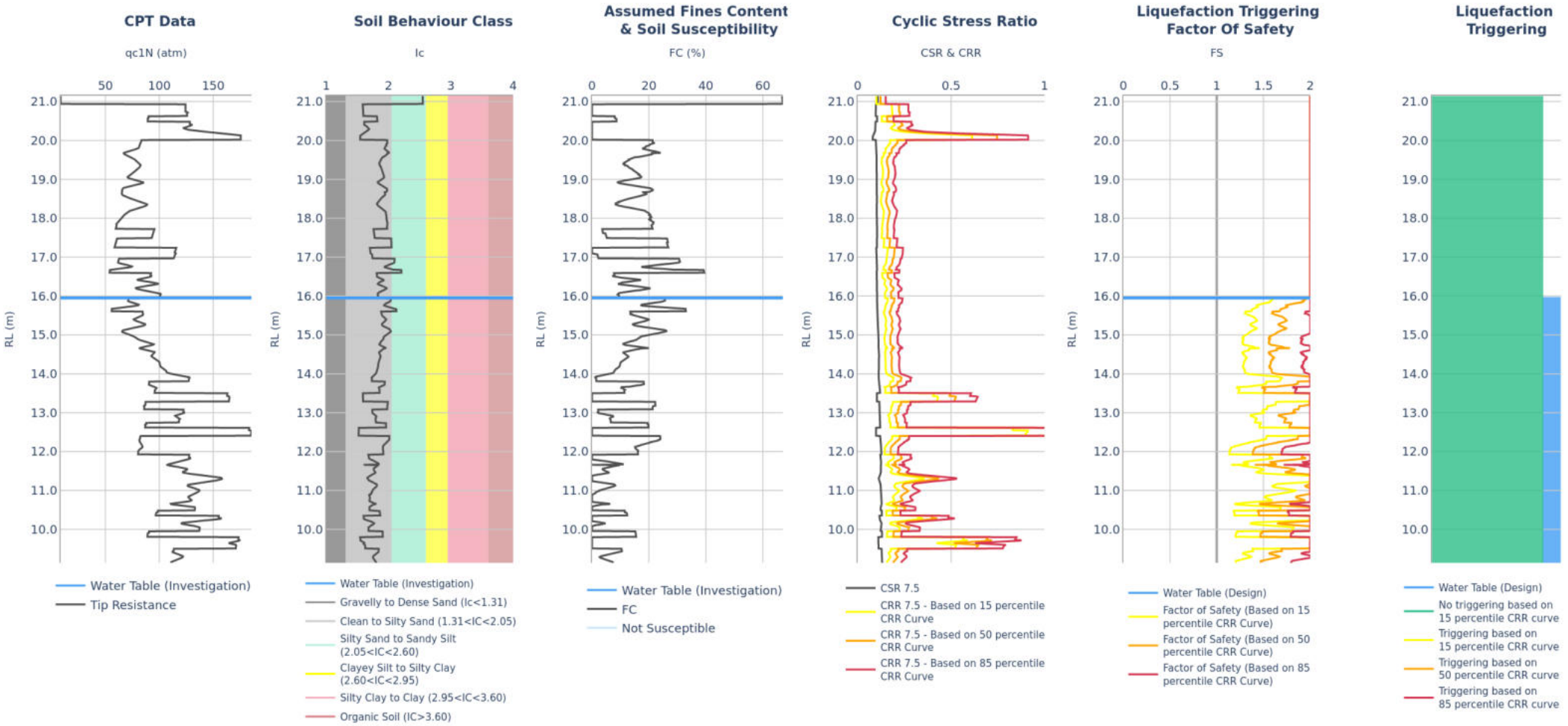
Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 275207	CPT07	0.0	10.0	0.0 CFC
TTGD 275207	CPT07	10.0	15.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 275207	CPT07	0.0	0.0001	18.0
TTGD 275207	CPT07	0.0001	12.01	18.0
TTGD 275207	CPT07	12.01	15.0	18.0

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT08	CPT_TT275208	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

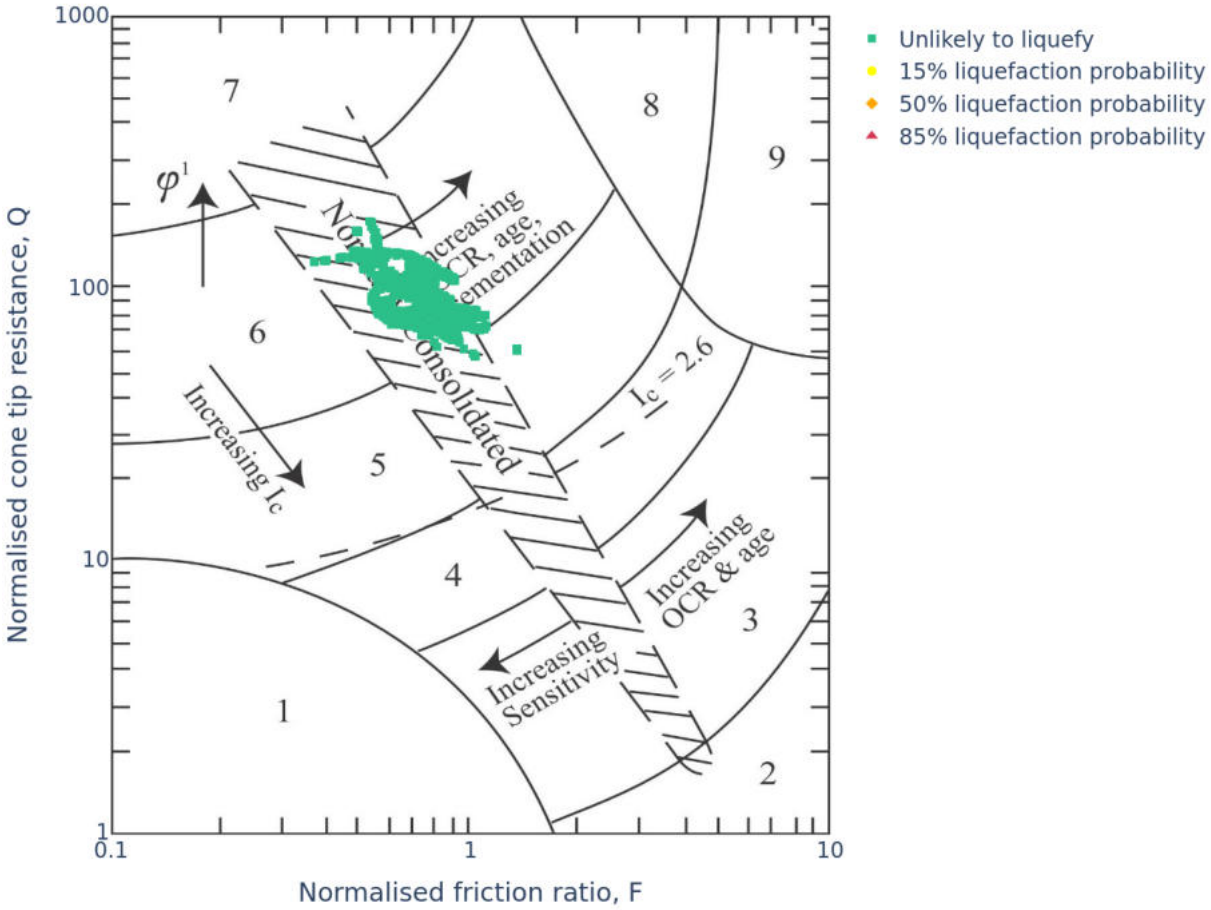
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	13	0.0	0	1	12.0	0
50%	6	0.0	0	0	12.0	0
85%	1	0.0	0	0	12.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT08 to CPT13 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 1/24*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

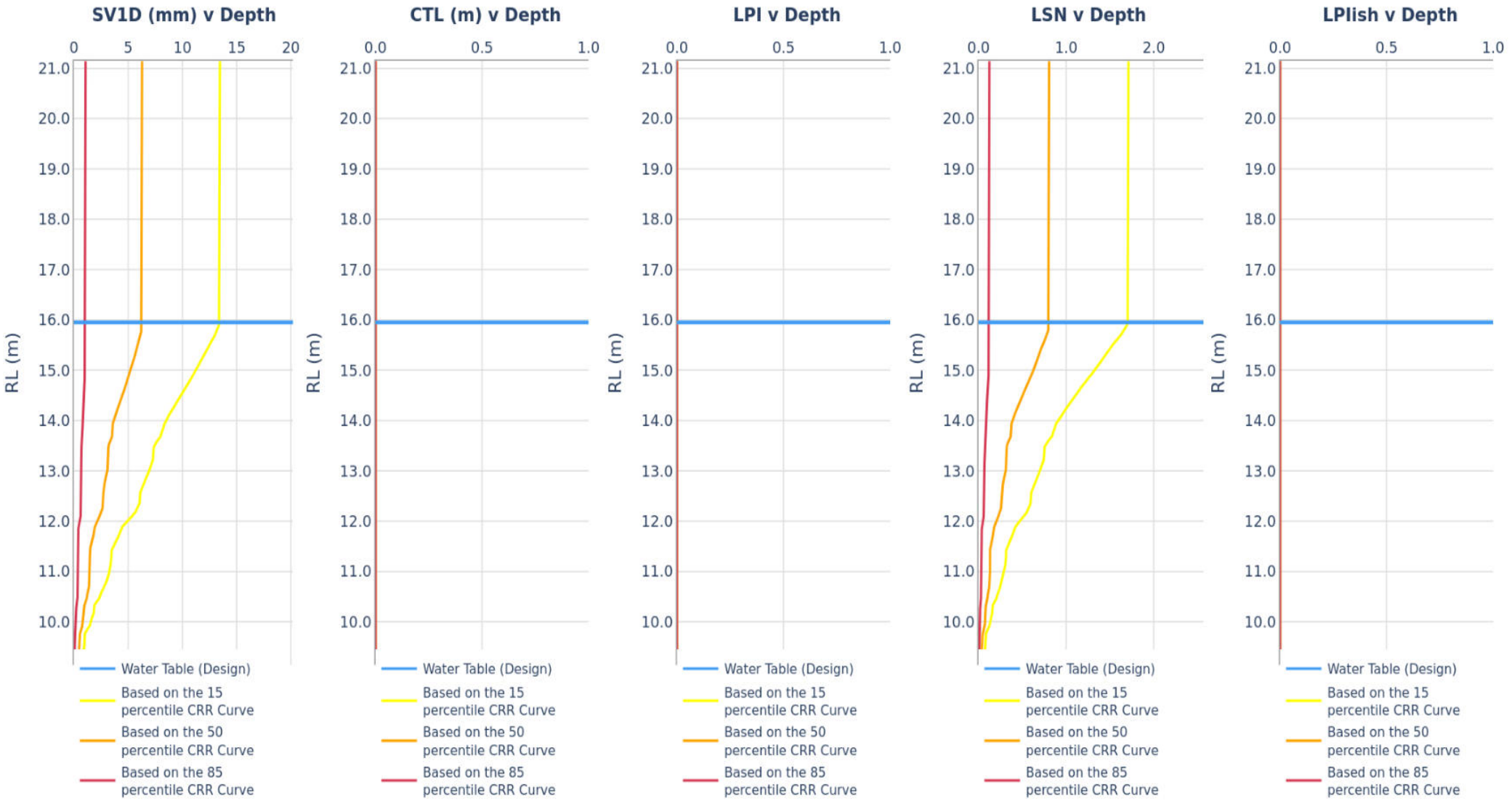


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

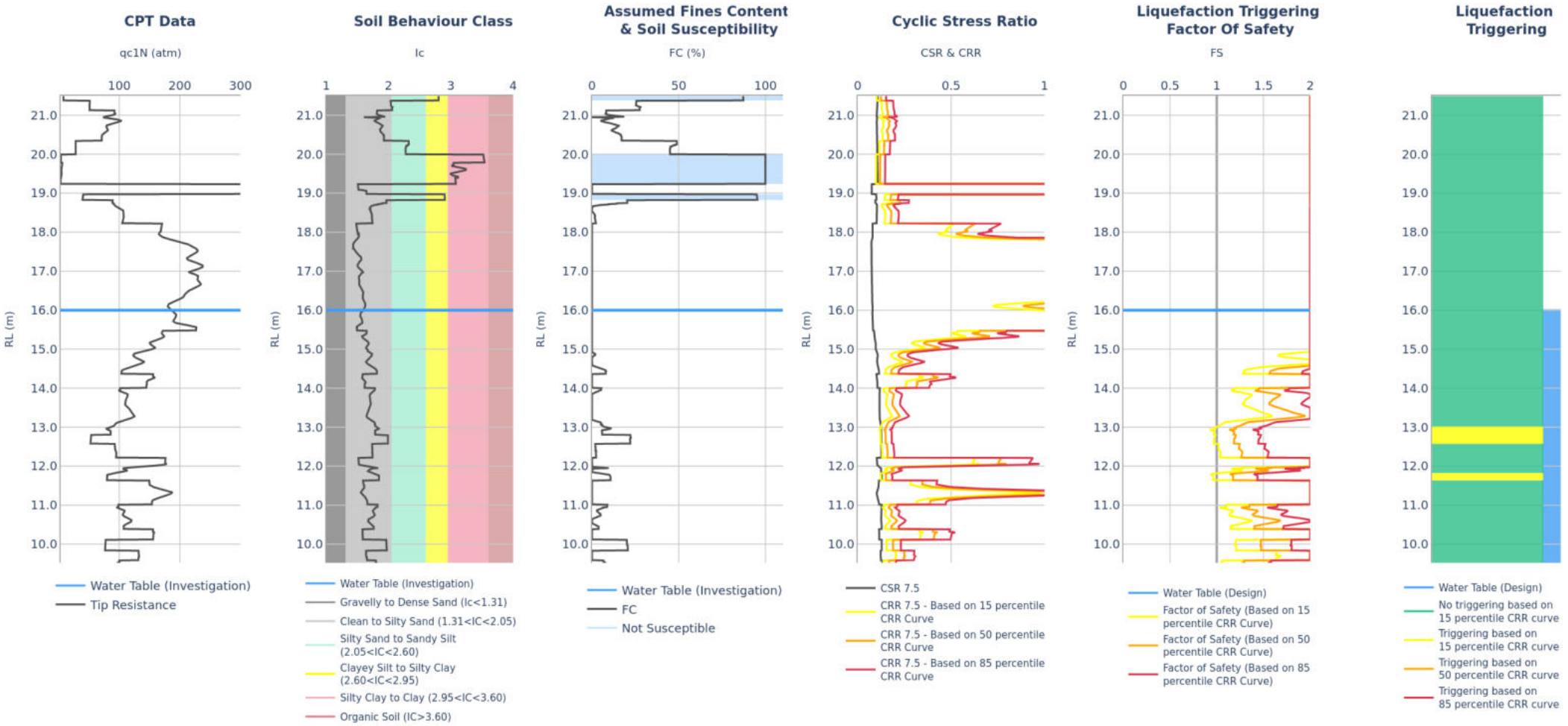
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT08	CPT_TT275208	15/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT09	CPT_TT275209	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

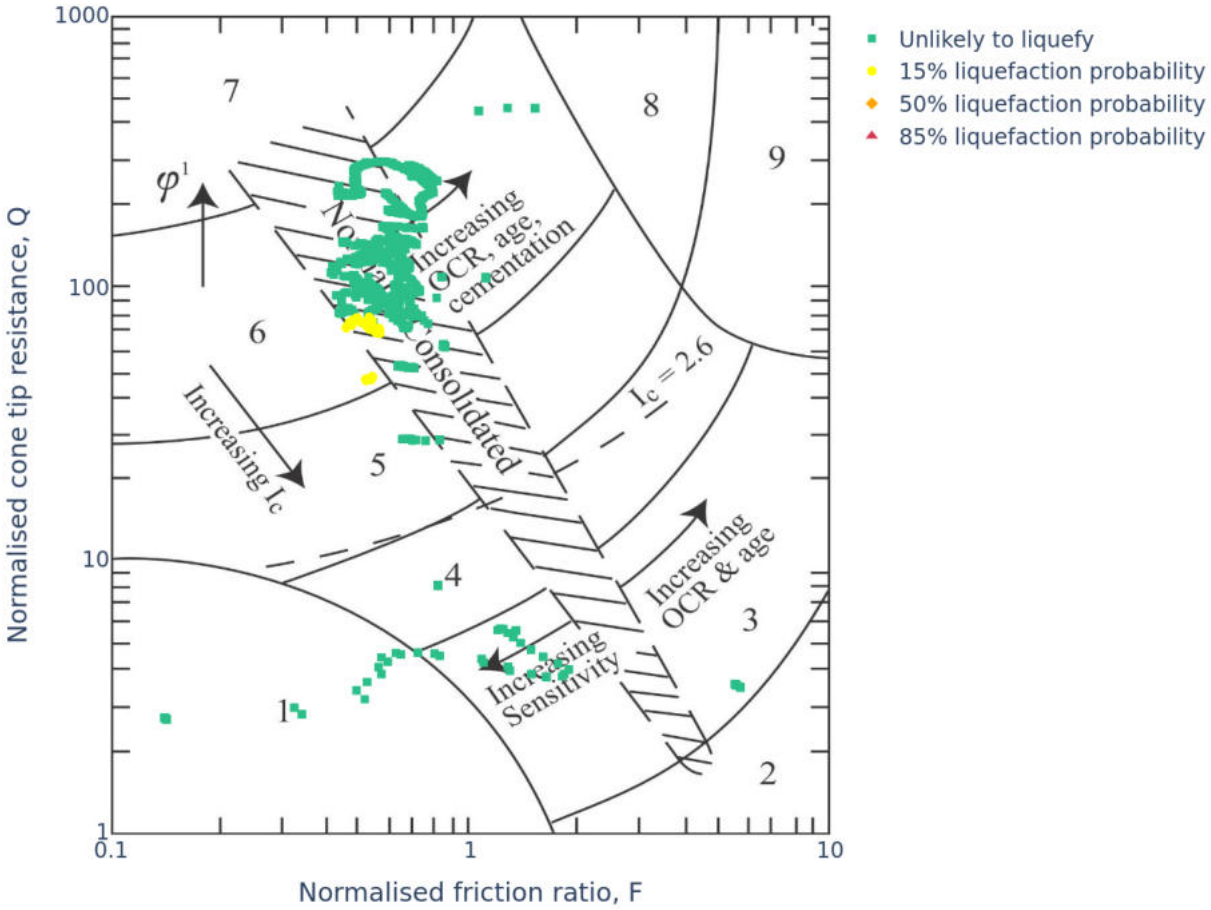
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	20	0.6	0	2	8.6	0
50%	8	0.0	0	0	12.0	0
85%	3	0.0	0	0	12.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



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5. Sand mixtures - silty sand to sandy silt
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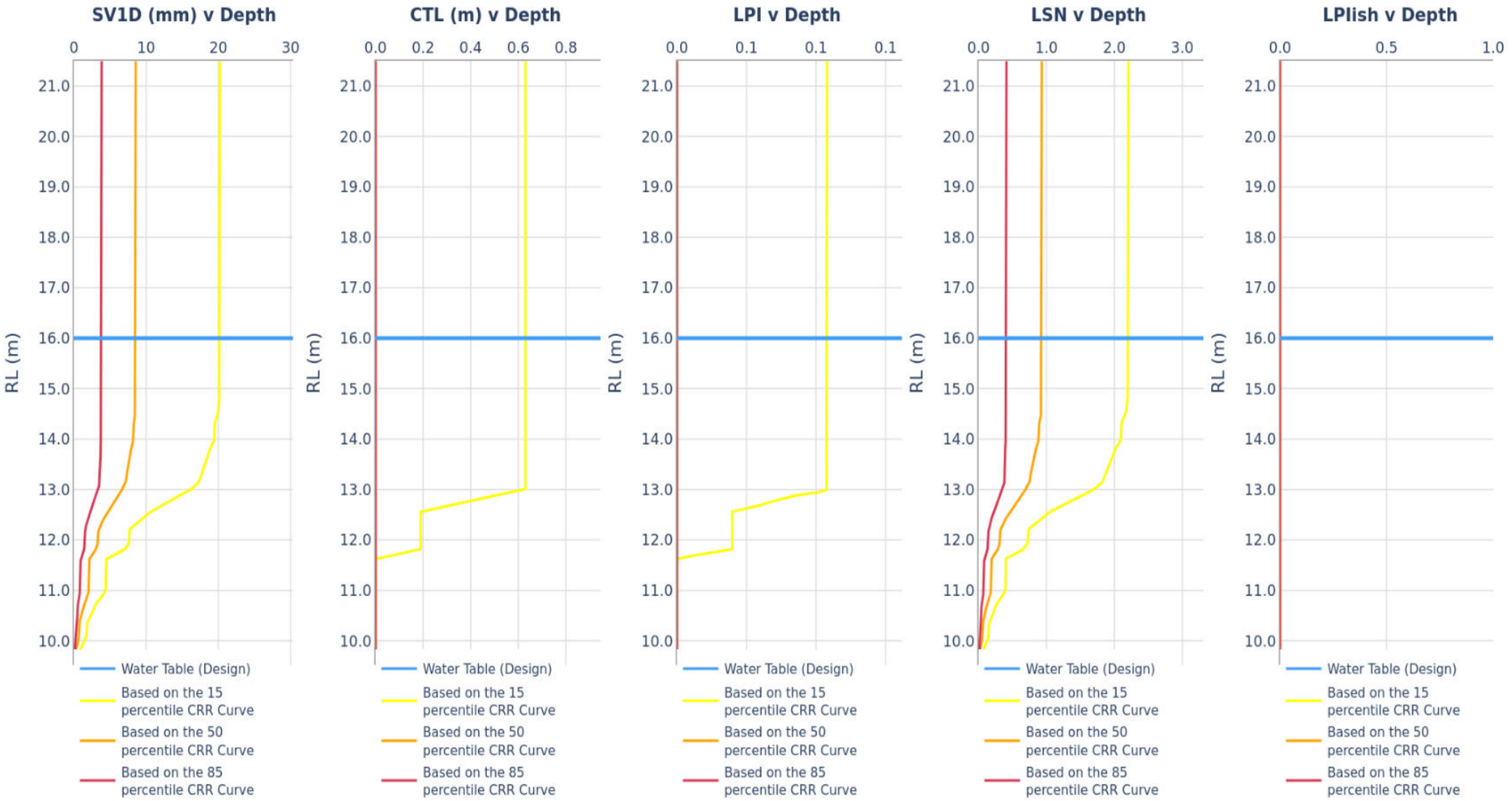
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

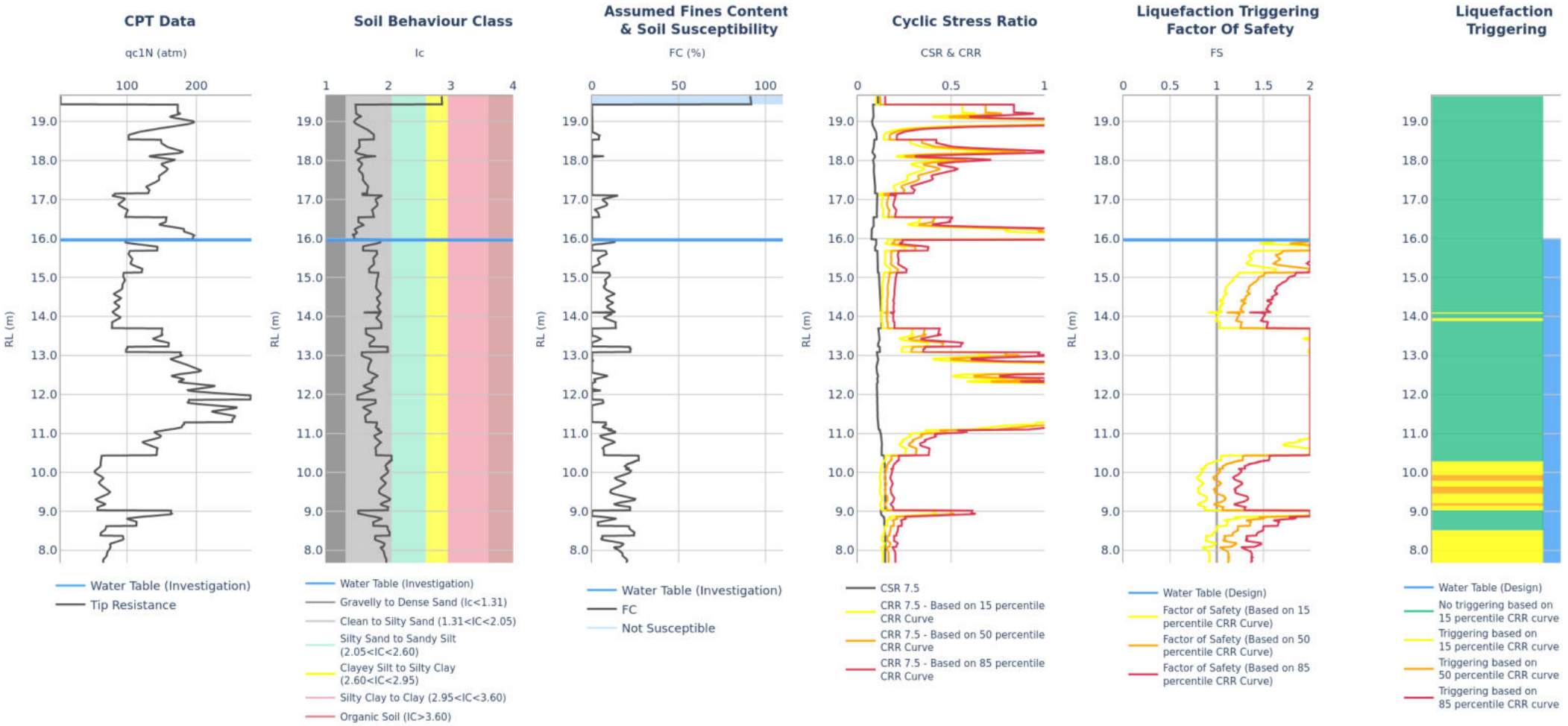
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT09	CPT_TT275209	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT10	CPT_TT275210	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

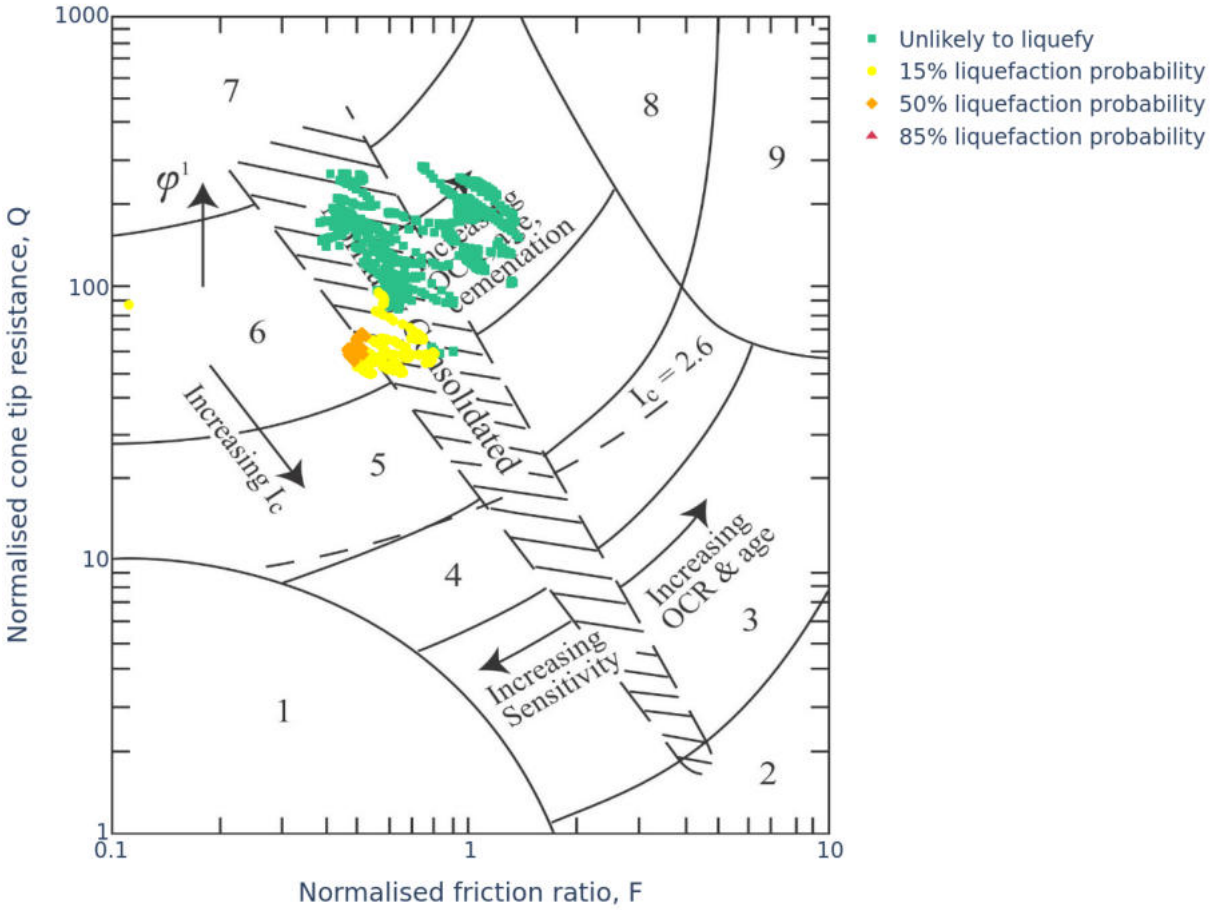
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	54	2.2	1	6	5.8	0
50%	22	0.4	0	2	9.8	0
85%	10	0.0	0	1	12.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



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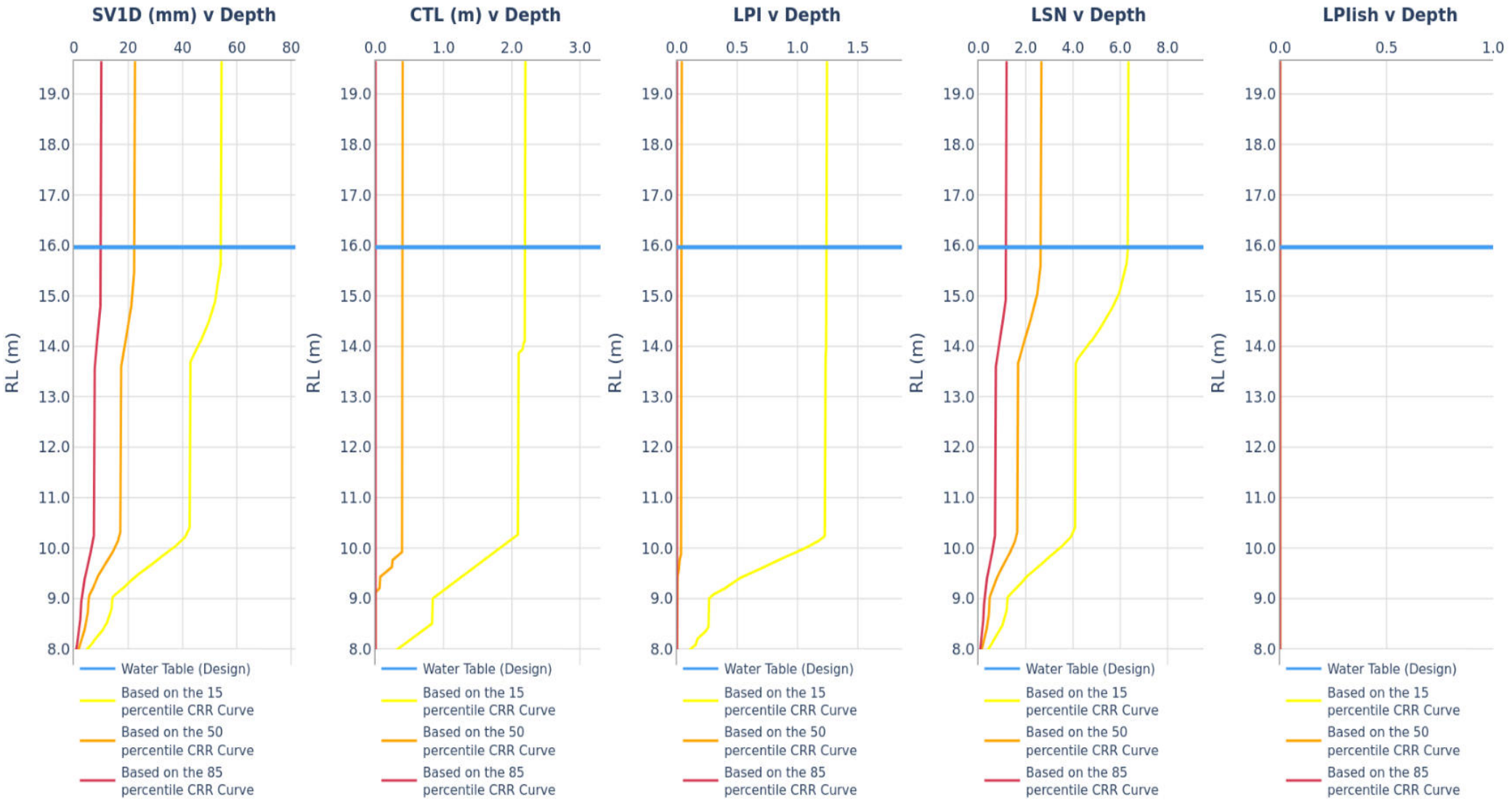
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

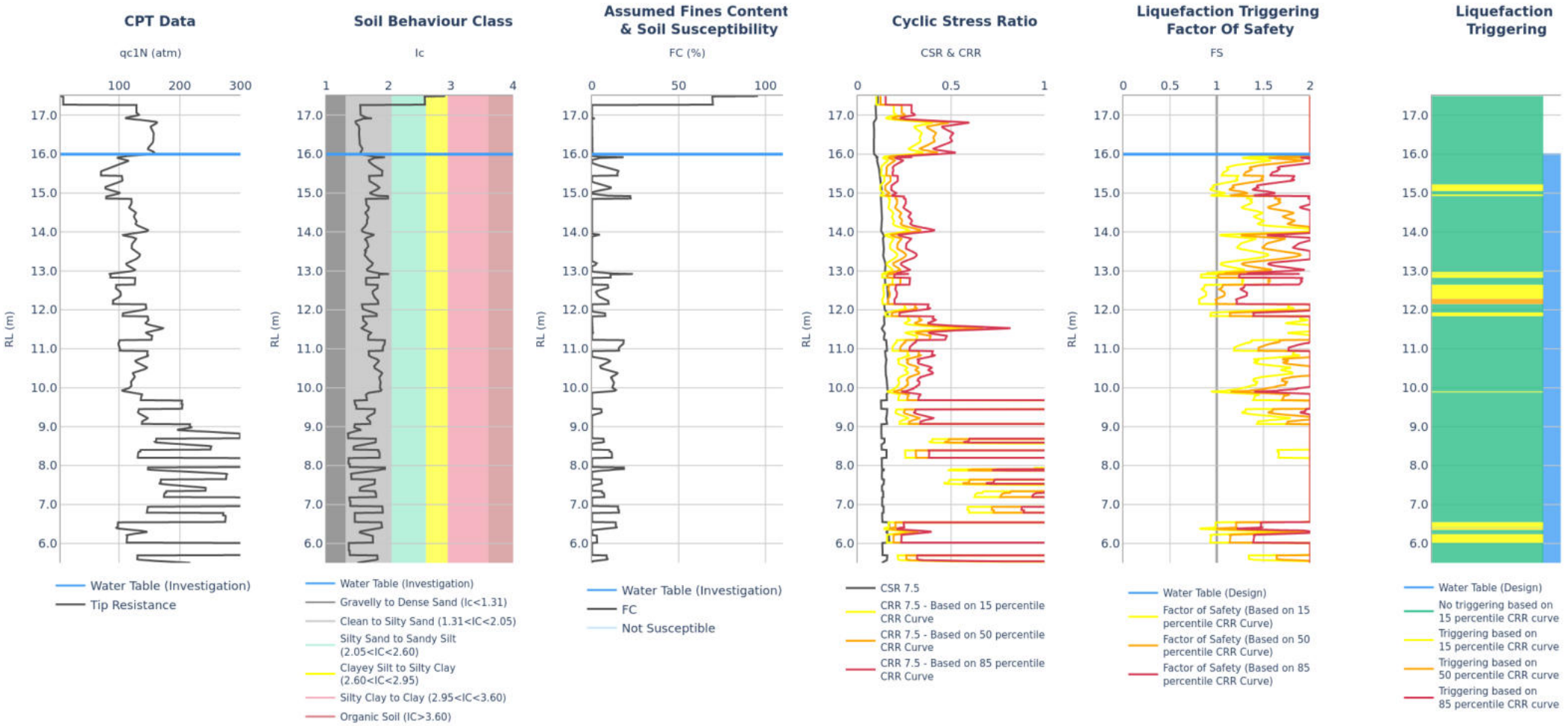
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT10	CPT_TT275210	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT11	CPT_TT275211	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

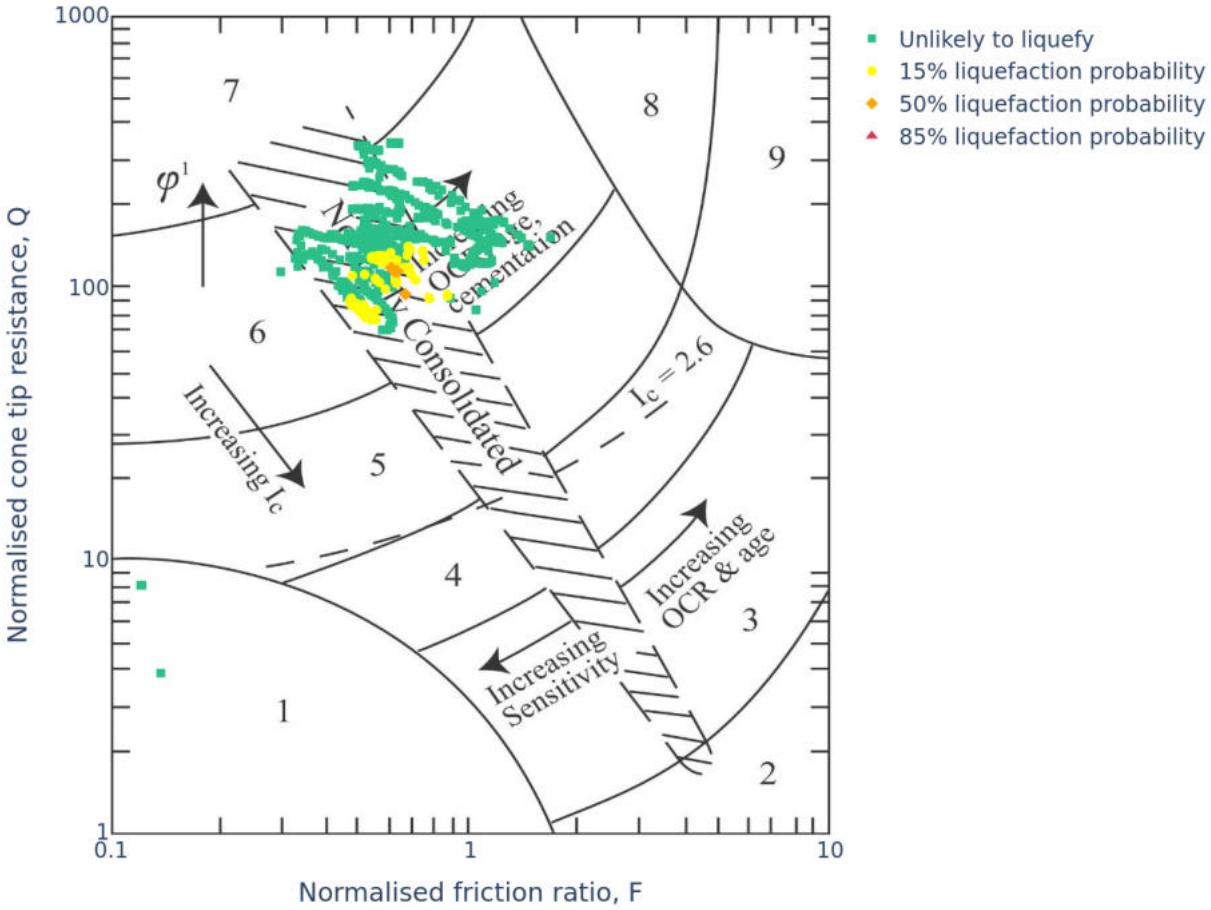
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	34	1.4	0	8	2.4	0
50%	14	0.1	0	3	5.3	0
85%	5	0.0	0	1	12.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



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8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

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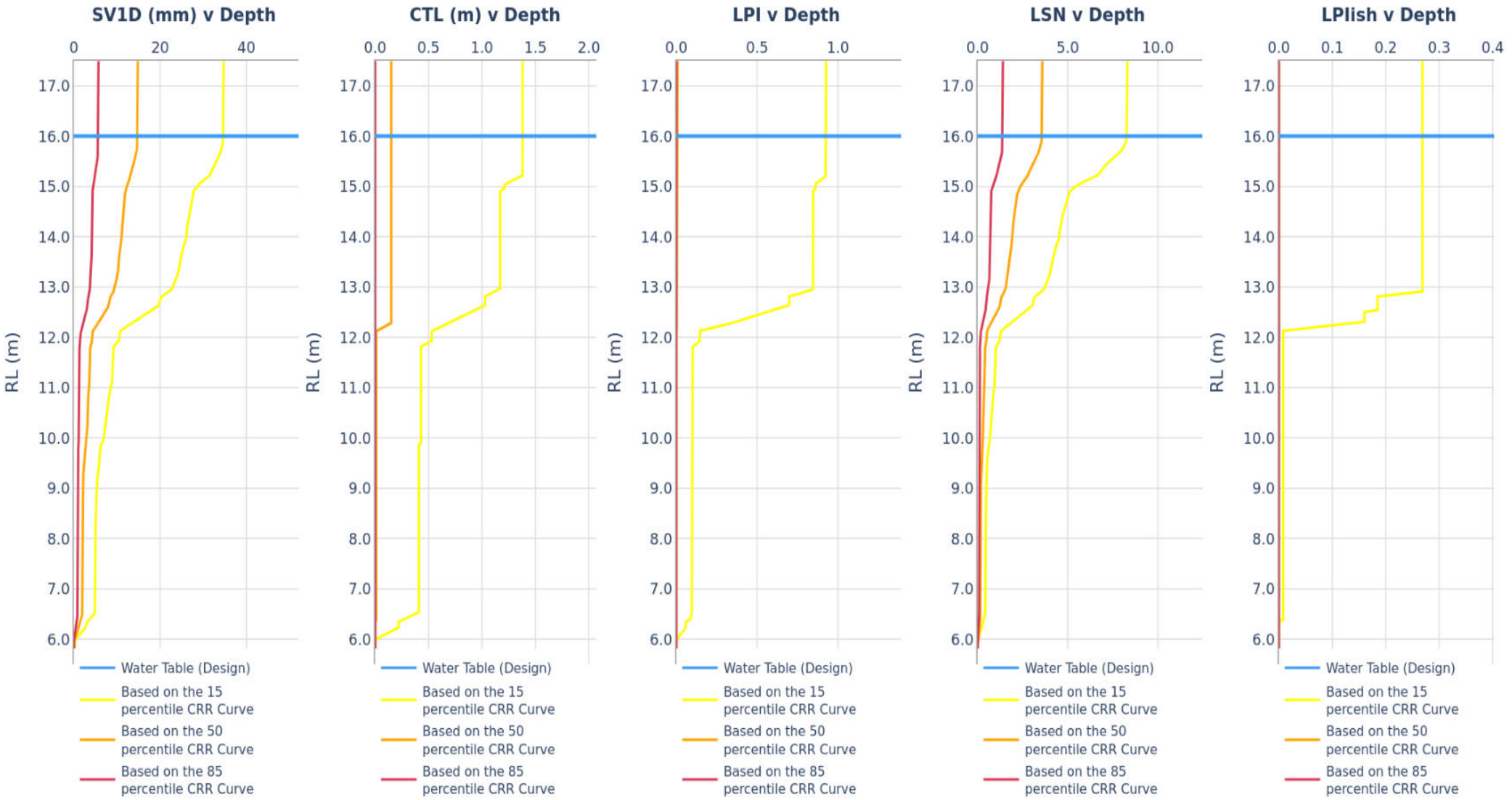
CPT-based soil behavior type classification chart by Robertson (1990)

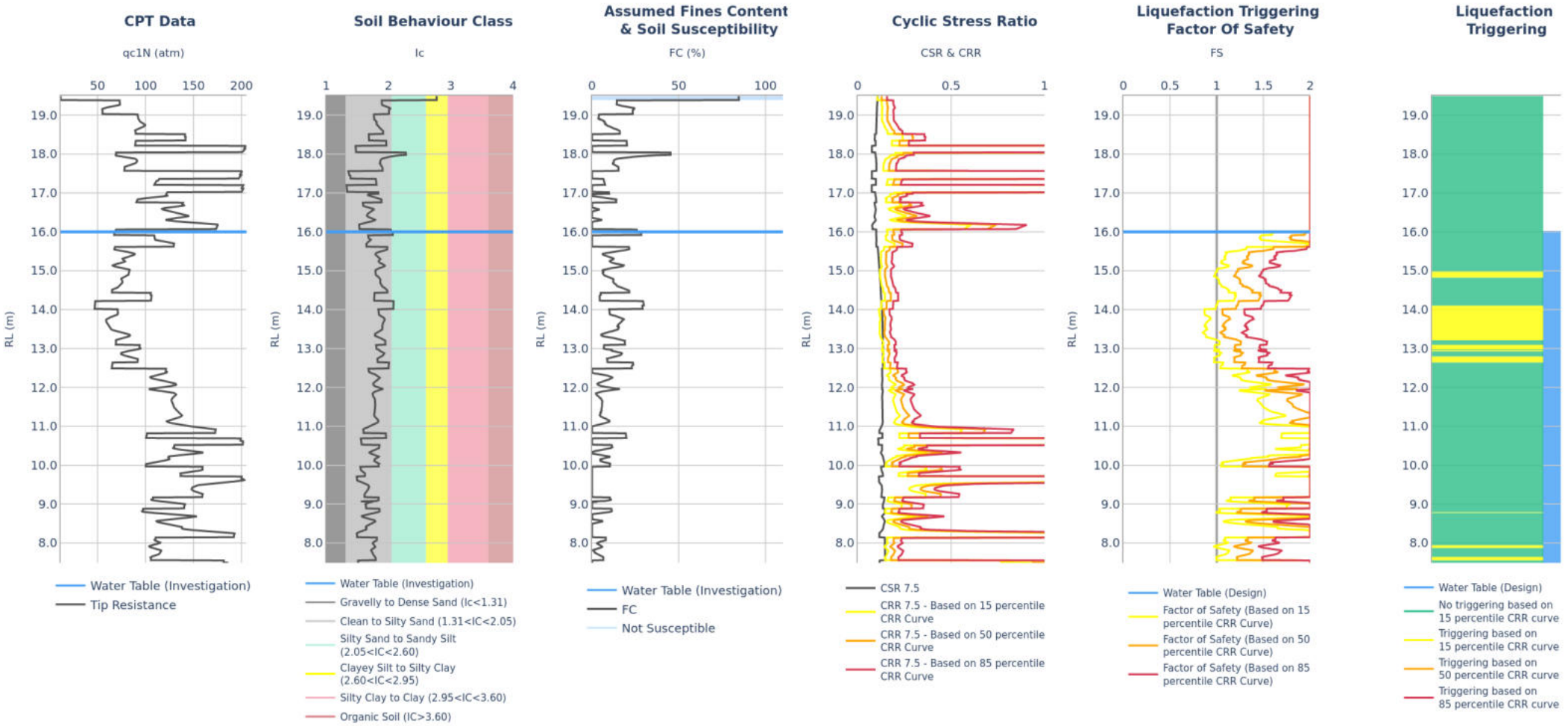
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT11	CPT_TT275211	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT12	CPT_TT275212	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

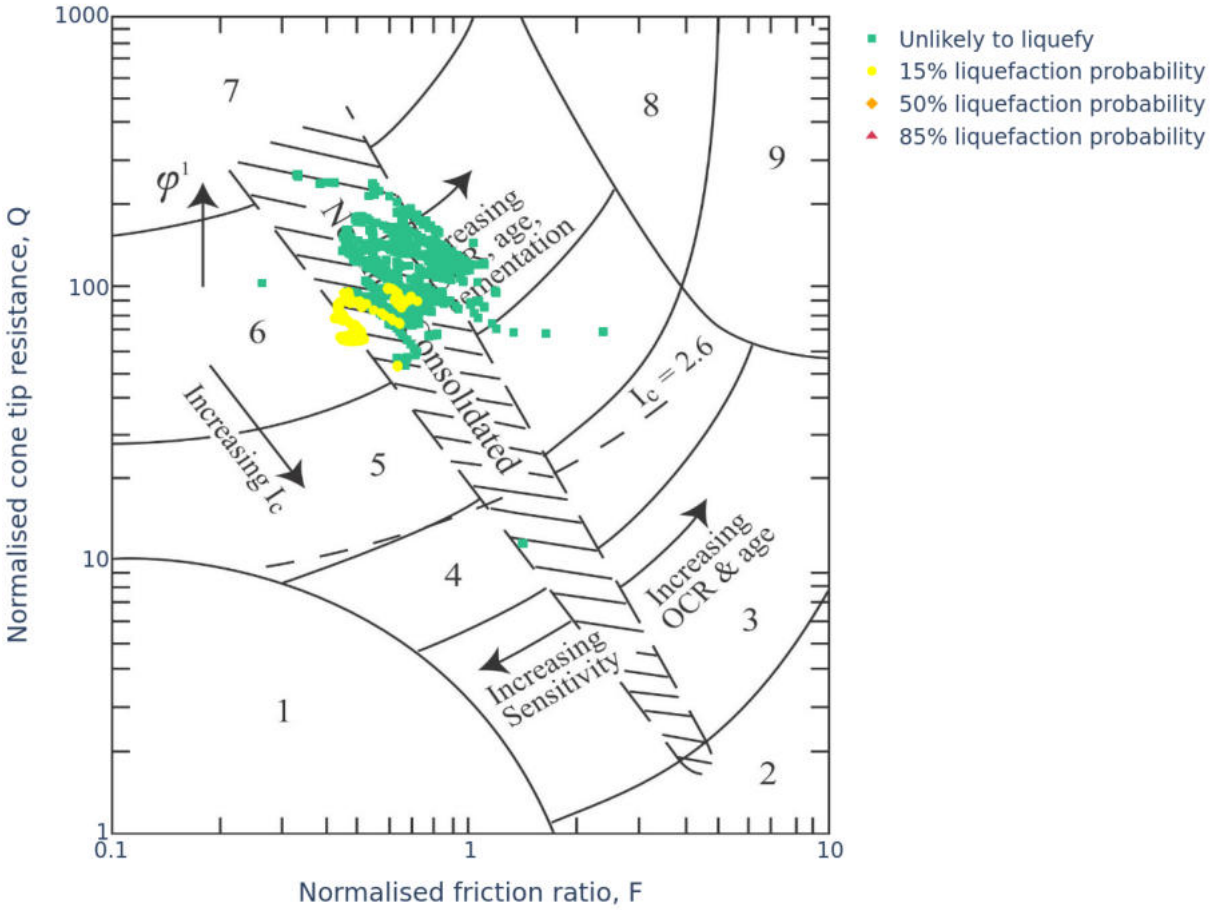
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	46	1.5	0	7	4.6	0
50%	18	0.0	0	2	12.0	0
85%	8	0.0	0	1	12.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT08 to CPT13 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



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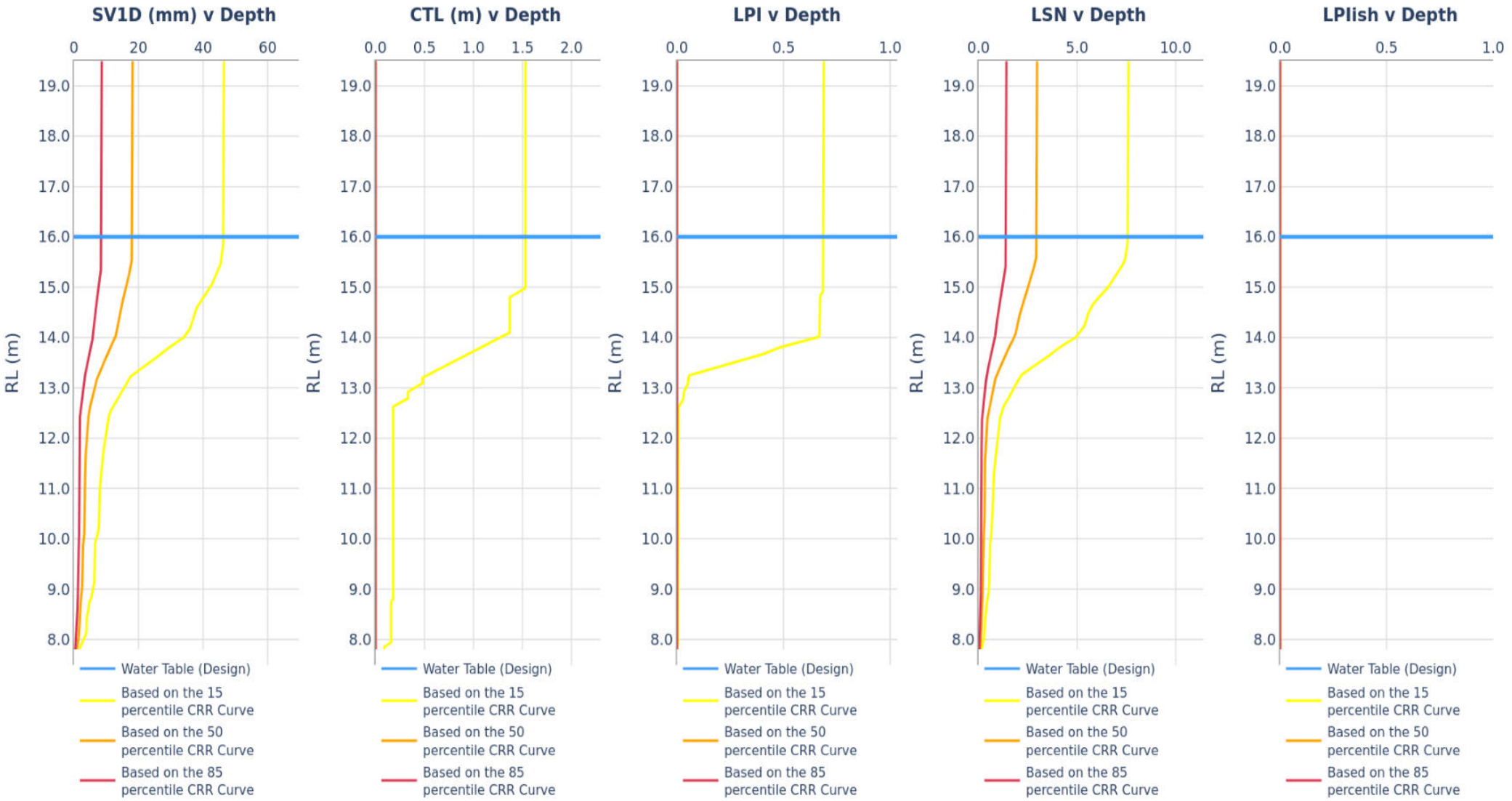
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

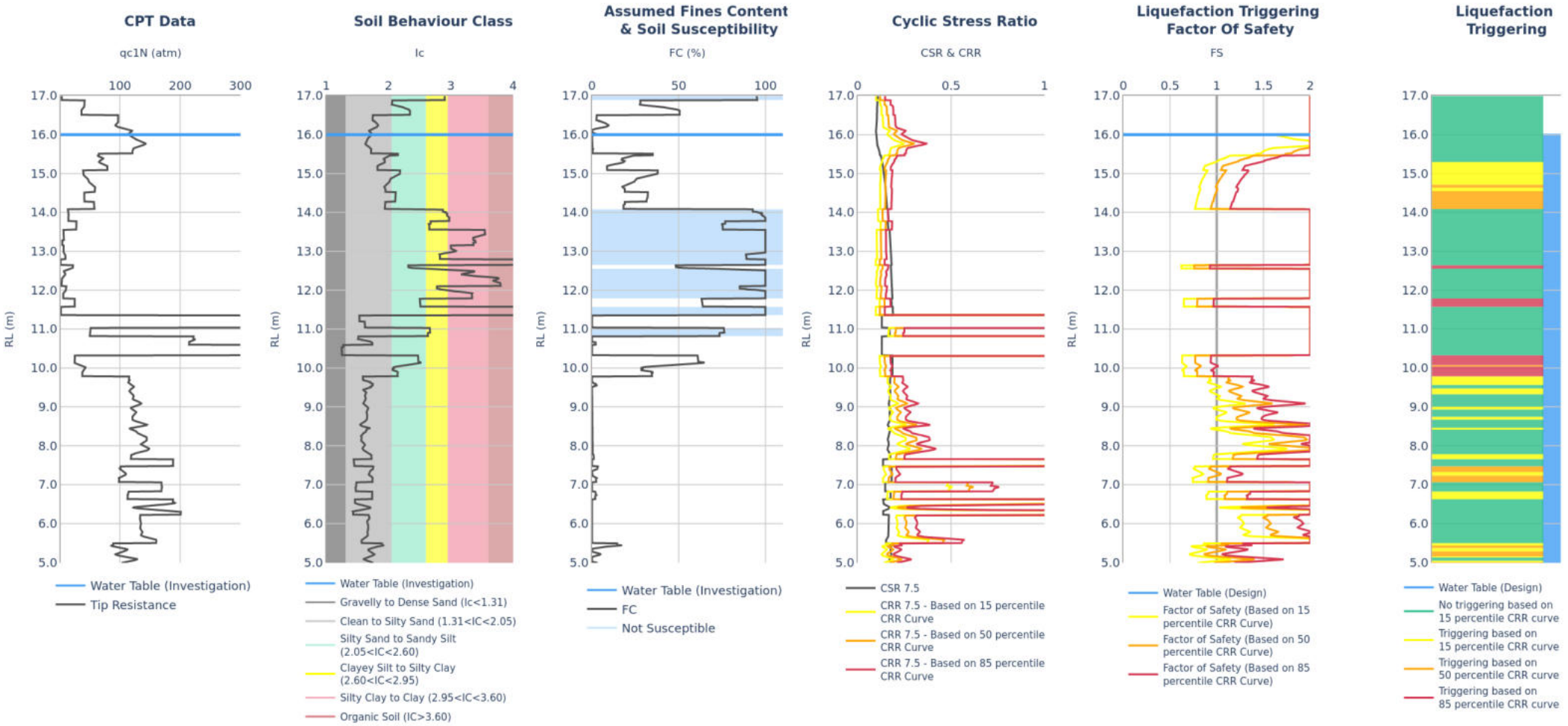
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT12	CPT_TT275212	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT13	CPT_TT275213	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

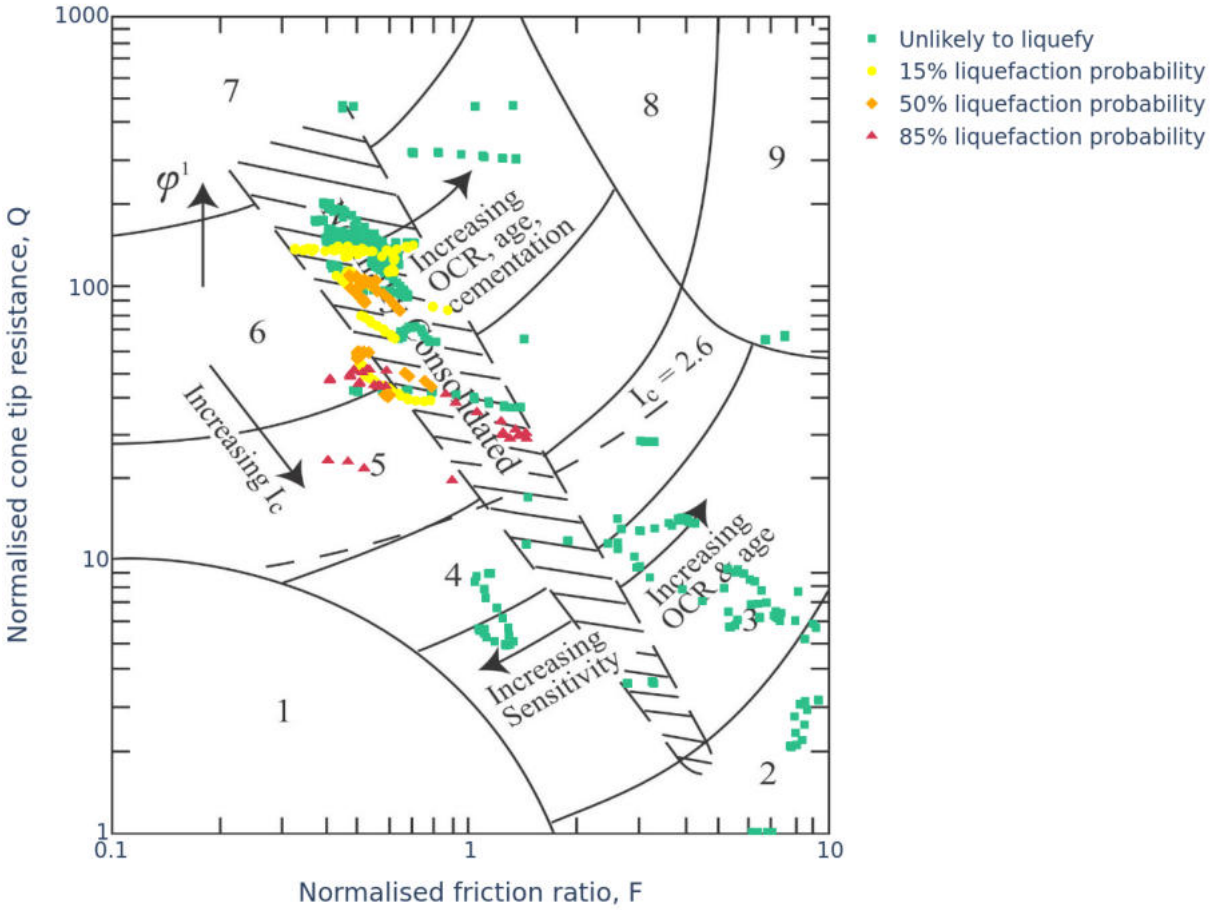
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	86	3.8	4	20	1.8	3
50%	52	1.9	1	11	2.5	0
85%	25	0.8	0	5	5.2	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT08 to CPT13 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 16/24*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



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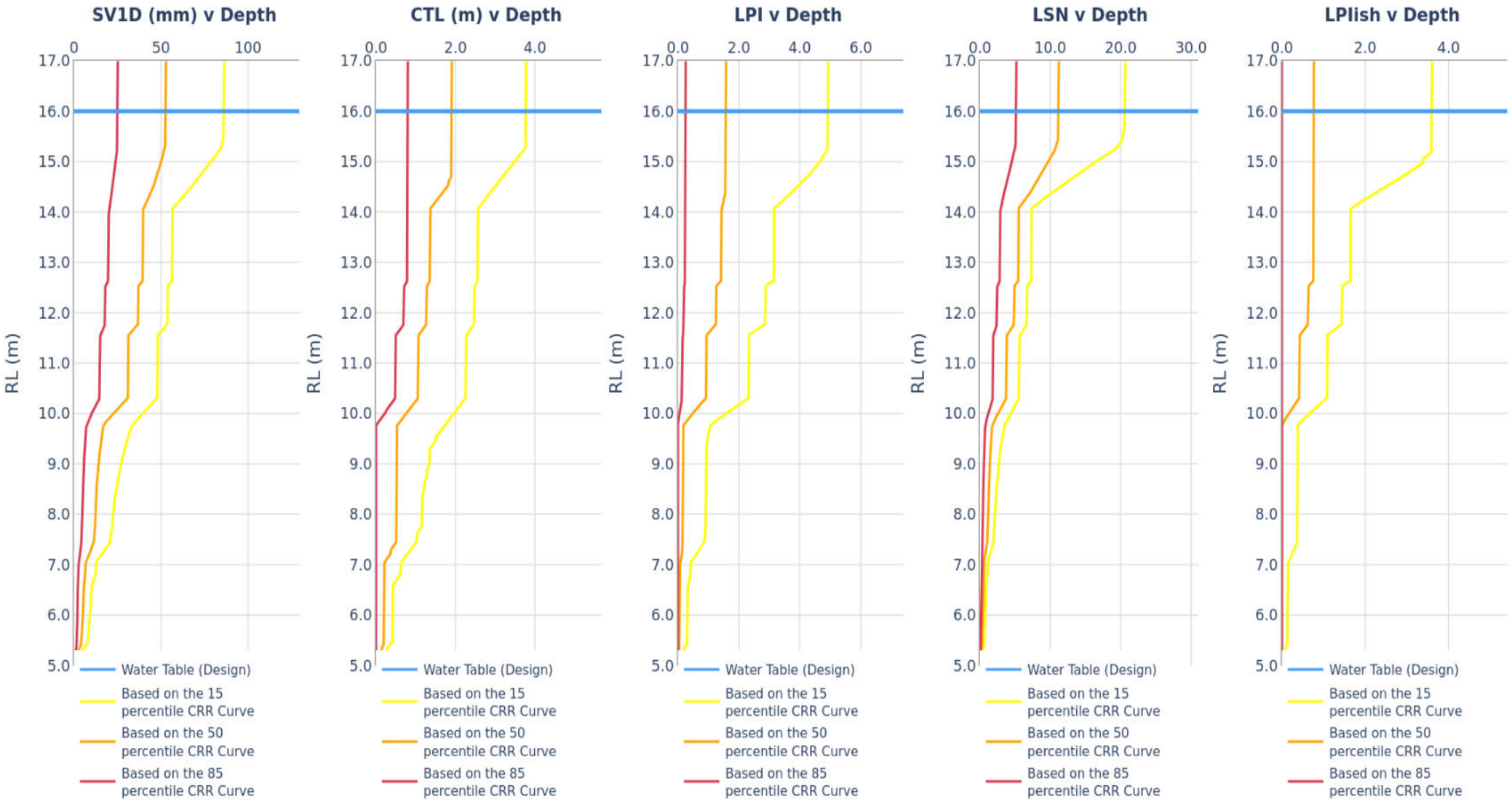
*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

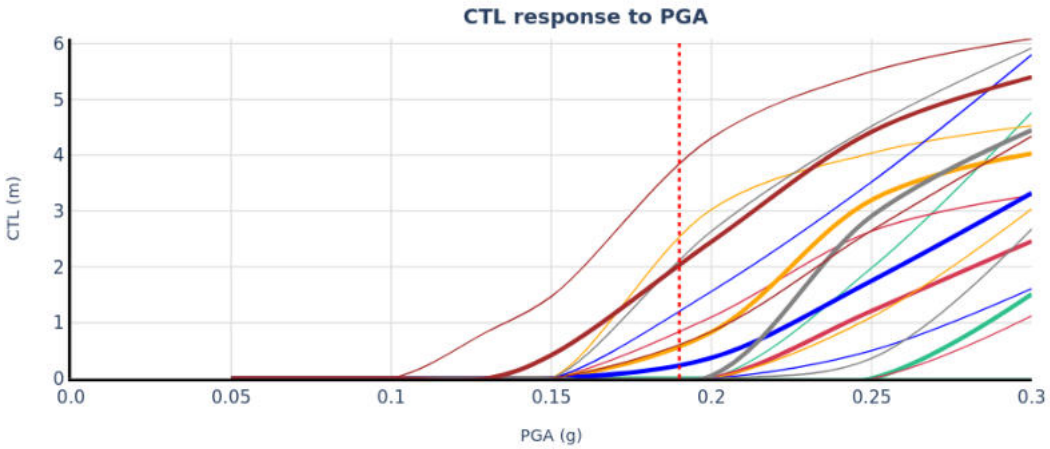
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

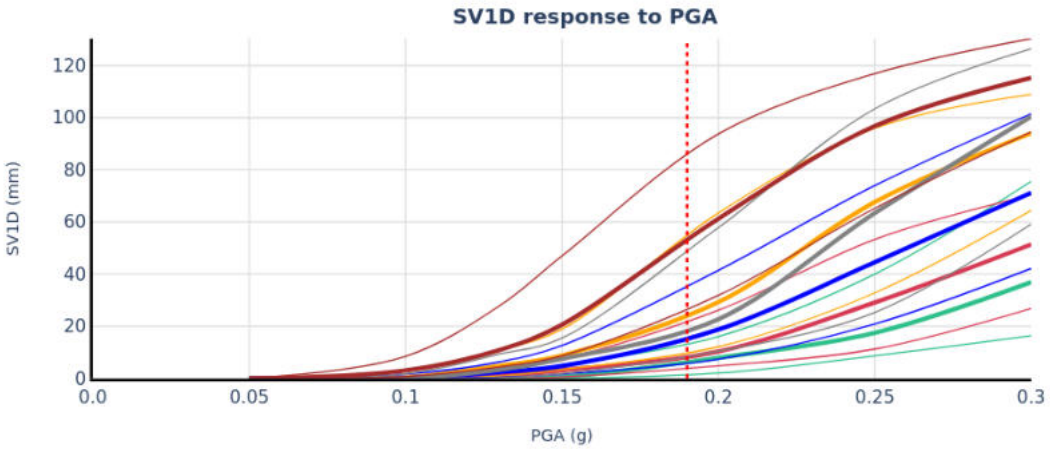


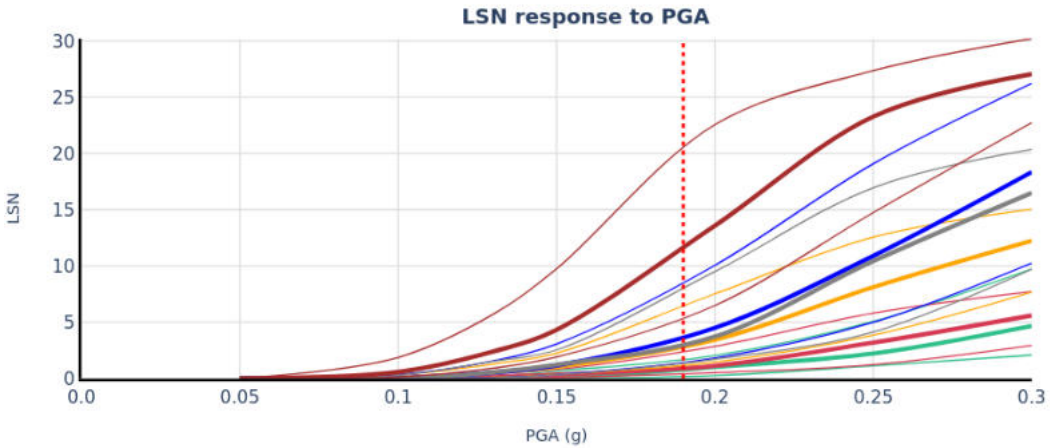
Input

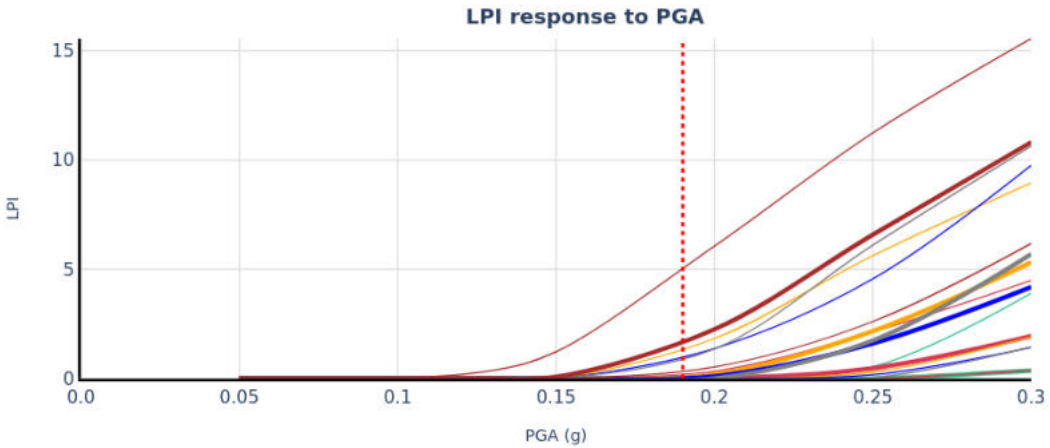
Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT13	CPT_TT275213	16/09/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT







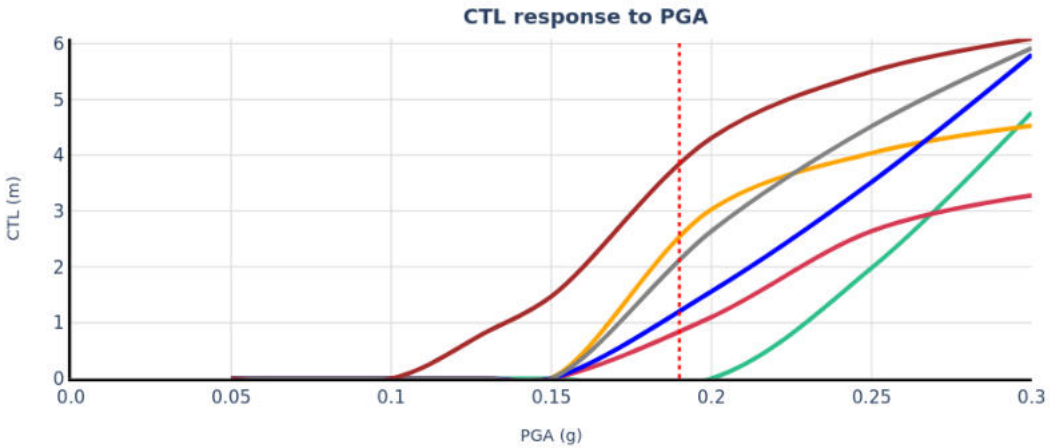


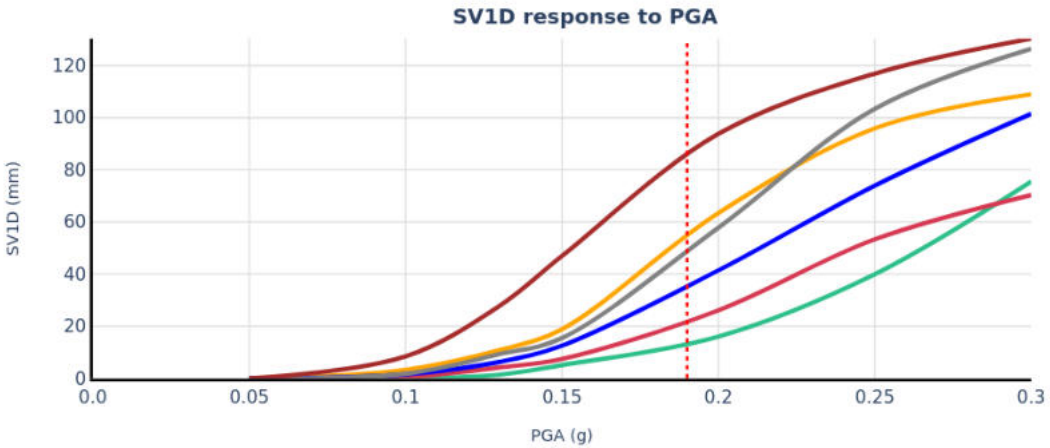
Input

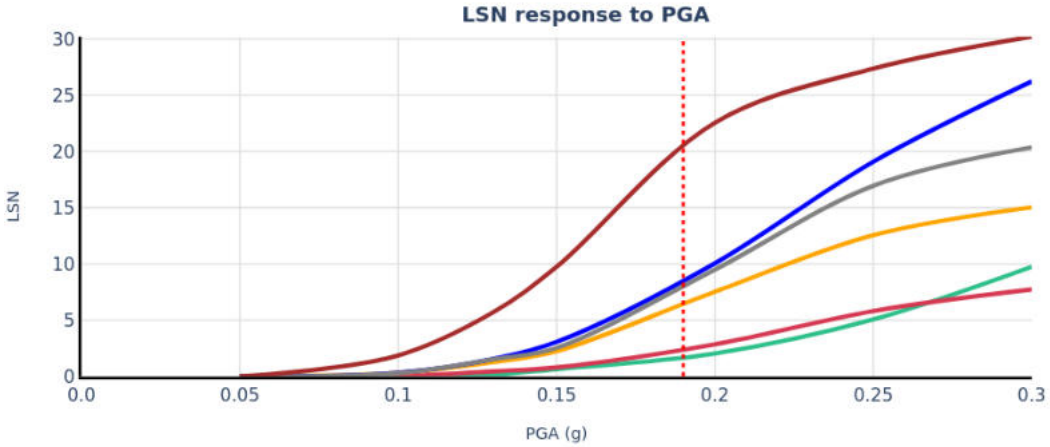
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT08	CPT_TT275208	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT09	CPT_TT275209	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT10	CPT_TT275210	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT11	CPT_TT275211	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT12	CPT_TT275212	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT13	CPT_TT275213	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

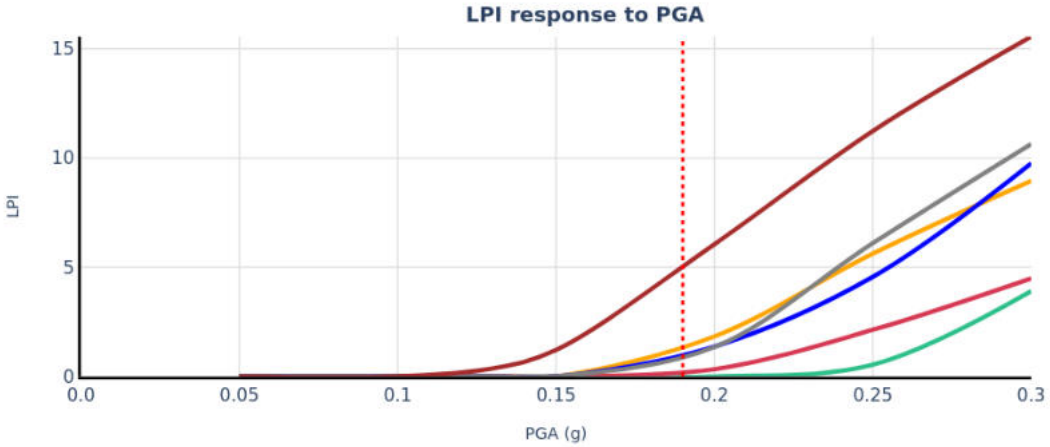
Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT BASED ON 15 PERCENTILE CRR CURVE









Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT08	CPT_TT275208	15/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT09	CPT_TT275209	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT10	CPT_TT275210	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT11	CPT_TT275211	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT12	CPT_TT275212	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT13	CPT_TT275213	16/09/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 275208	TTGD 275209	TTGD 275210
CPT Name	CPT08	CPT09	CPT10
Run Description	CPT08	CPT09	CPT10
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	5.2	5.5	3.7
Depth to groundwater for design (m)	5.2	5.5	3.7
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	12.01	11.98	11.98
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	15	15	15
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 275208	CPT08	0.0	0.0	0.0
TTGD 275208	CPT08	0.0	10.0	2.6
TTGD 275208	CPT08	10.0	15.0	2.6
TTGD 275209	CPT09	0.0	0.0	0.0
TTGD 275209	CPT09	0.0	10.0	2.6
TTGD 275209	CPT09	10.0	15.0	2.6
TTGD 275210	CPT10	0.0	0.0	0.0
TTGD 275210	CPT10	0.0	10.0	2.6
TTGD 275210	CPT10	10.0	15.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 275208	CPT08	0.0	10.0	0.0 CFC
TTGD 275208	CPT08	10.0	15.0	0.0 CFC
TTGD 275209	CPT09	0.0	10.0	0.0 CFC
TTGD 275209	CPT09	10.0	15.0	0.0 CFC
TTGD 275210	CPT10	0.0	10.0	0.0 CFC
TTGD 275210	CPT10	10.0	15.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m³)
TTGD 275208	CPT08	0.0	0.0001	18.0
TTGD 275208	CPT08	0.0001	12.01	18.0
TTGD 275208	CPT08	12.01	15.0	18.0
TTGD 275209	CPT09	0.0	0.0001	18.0
TTGD 275209	CPT09	0.0001	12.01	18.0
TTGD 275209	CPT09	12.01	15.0	18.0
TTGD 275210	CPT10	0.0	0.0001	18.0
TTGD 275210	CPT10	0.0001	12.01	18.0
TTGD 275210	CPT10	12.01	15.0	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 275211	TTGD 275212	TTGD 275213
CPT Name	CPT11	CPT12	CPT13
Run Description	CPT11	CPT12	CPT13
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	1.5	3.5	1.0
Depth to groundwater for design (m)	1.5	3.5	1.0
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	12.0	12.01	12.01
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	15	15	15
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 275211	CPT11	0.0	0.0	0.0
TTGD 275211	CPT11	0.0	10.0	2.6
TTGD 275211	CPT11	10.0	15.0	2.6
TTGD 275212	CPT12	0.0	0.0	0.0
TTGD 275212	CPT12	0.0	10.0	2.6
TTGD 275212	CPT12	10.0	15.0	2.6
TTGD 275213	CPT13	0.0	0.0	0.0
TTGD 275213	CPT13	0.0	10.0	2.6
TTGD 275213	CPT13	10.0	15.0	2.6

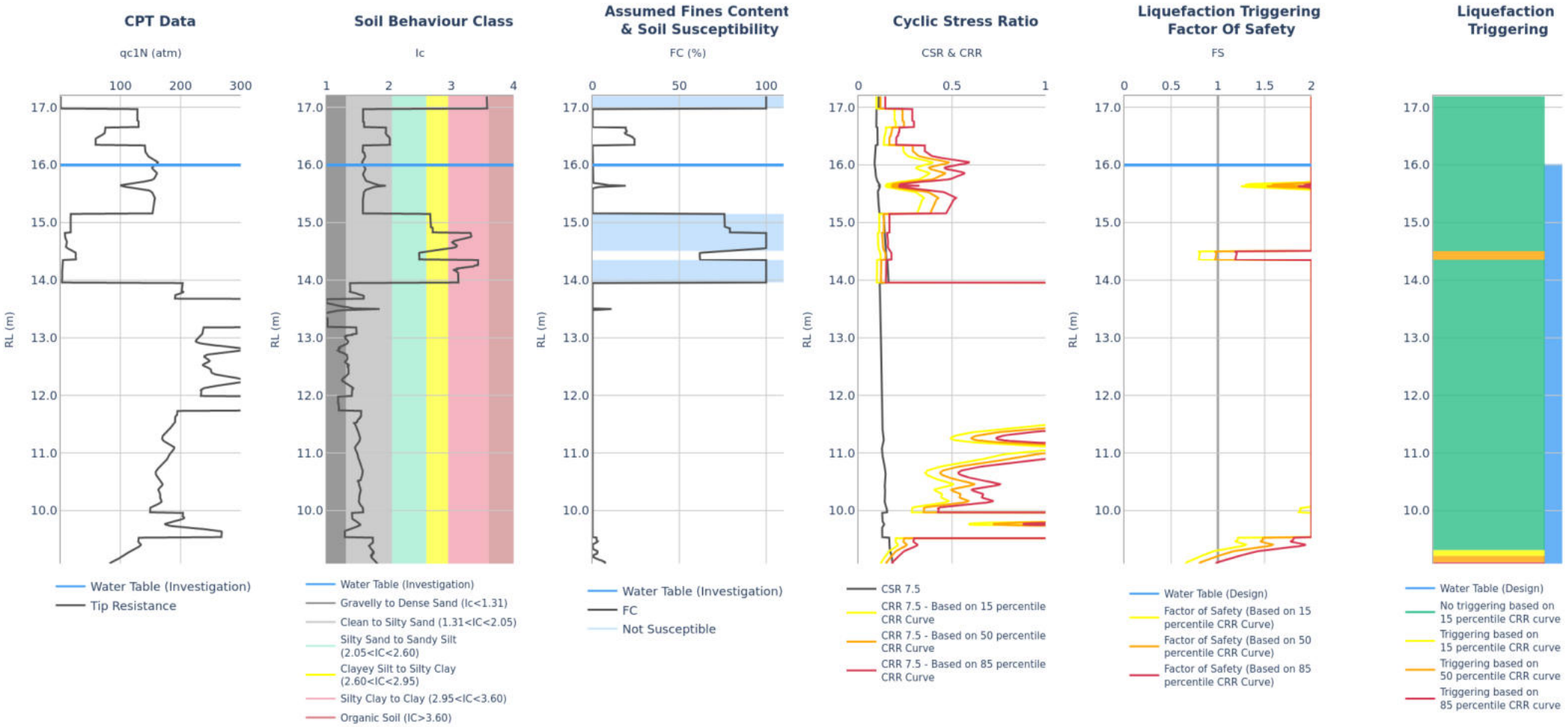
Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 275211	CPT11	0.0	10.0	0.0 CFC
TTGD 275211	CPT11	10.0	15.0	0.0 CFC
TTGD 275212	CPT12	0.0	10.0	0.0 CFC
TTGD 275212	CPT12	10.0	15.0	0.0 CFC
TTGD 275213	CPT13	0.0	10.0	0.0 CFC
TTGD 275213	CPT13	10.0	15.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m³)
TTGD 275211	CPT11	0.0	0.0001	18.0
TTGD 275211	CPT11	0.0001	12.01	18.0
TTGD 275211	CPT11	12.01	15.0	18.0
TTGD 275212	CPT12	0.0	0.0001	18.0
TTGD 275212	CPT12	0.0001	12.01	18.0
TTGD 275212	CPT12	12.01	15.0	18.0
TTGD 275213	CPT13	0.0	0.0001	18.0
TTGD 275213	CPT13	0.0001	12.01	18.0
TTGD 275213	CPT13	12.01	15.0	18.0

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT101	CPT_TT280727	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

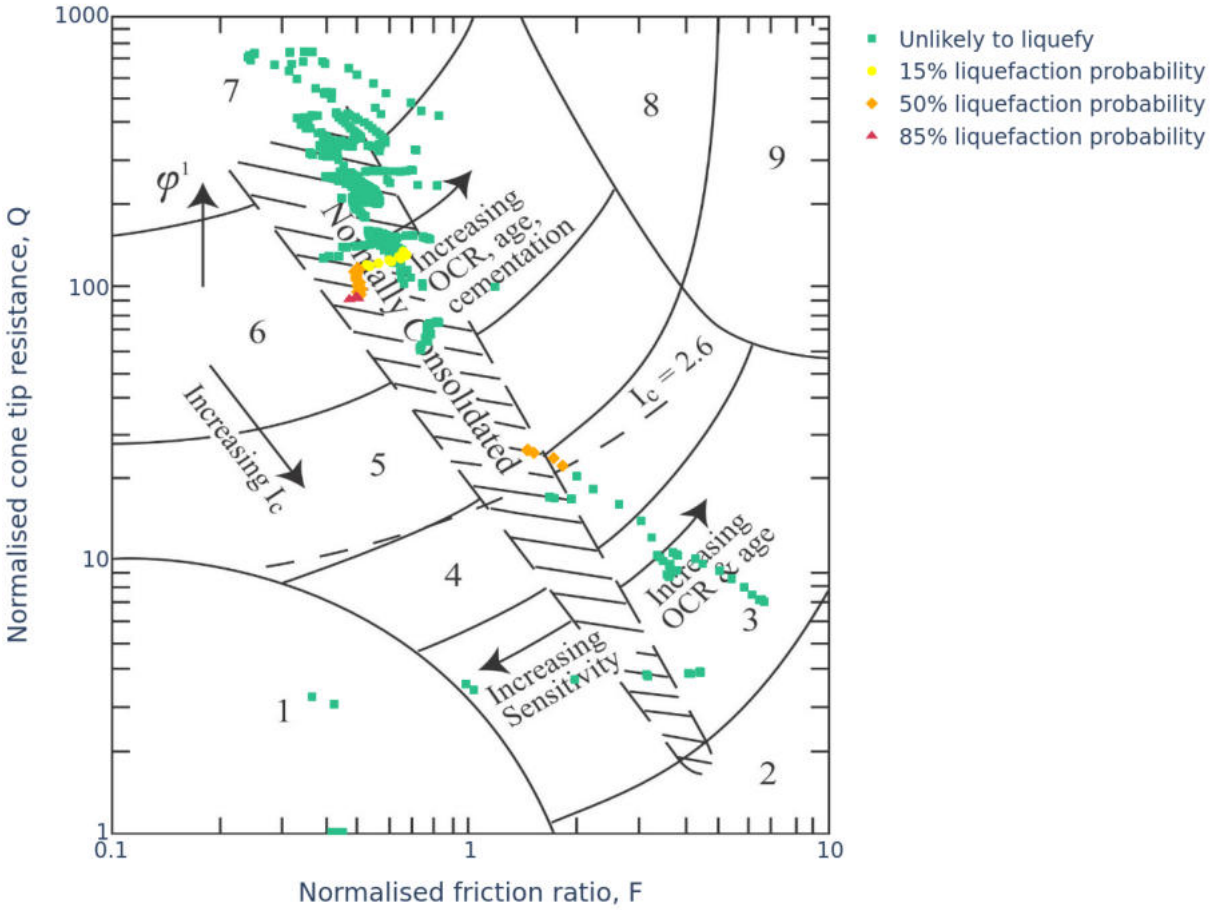
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	9	0.4	0	2	2.8	0
50%	5	0.3	0	1	2.8	0
85%	2	0.0	0	0	8.1	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT101 to CPT 105 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 1/19*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

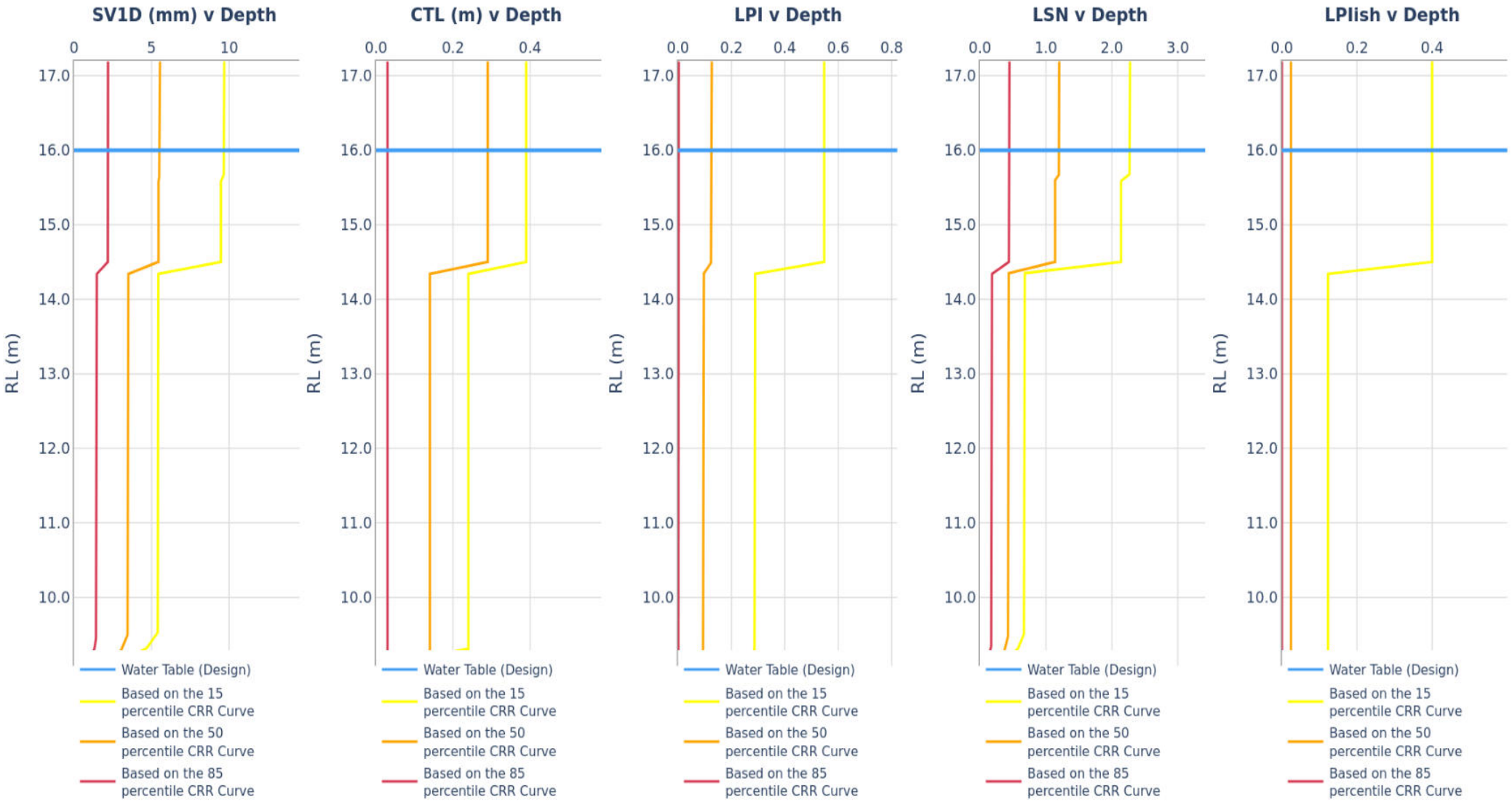


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

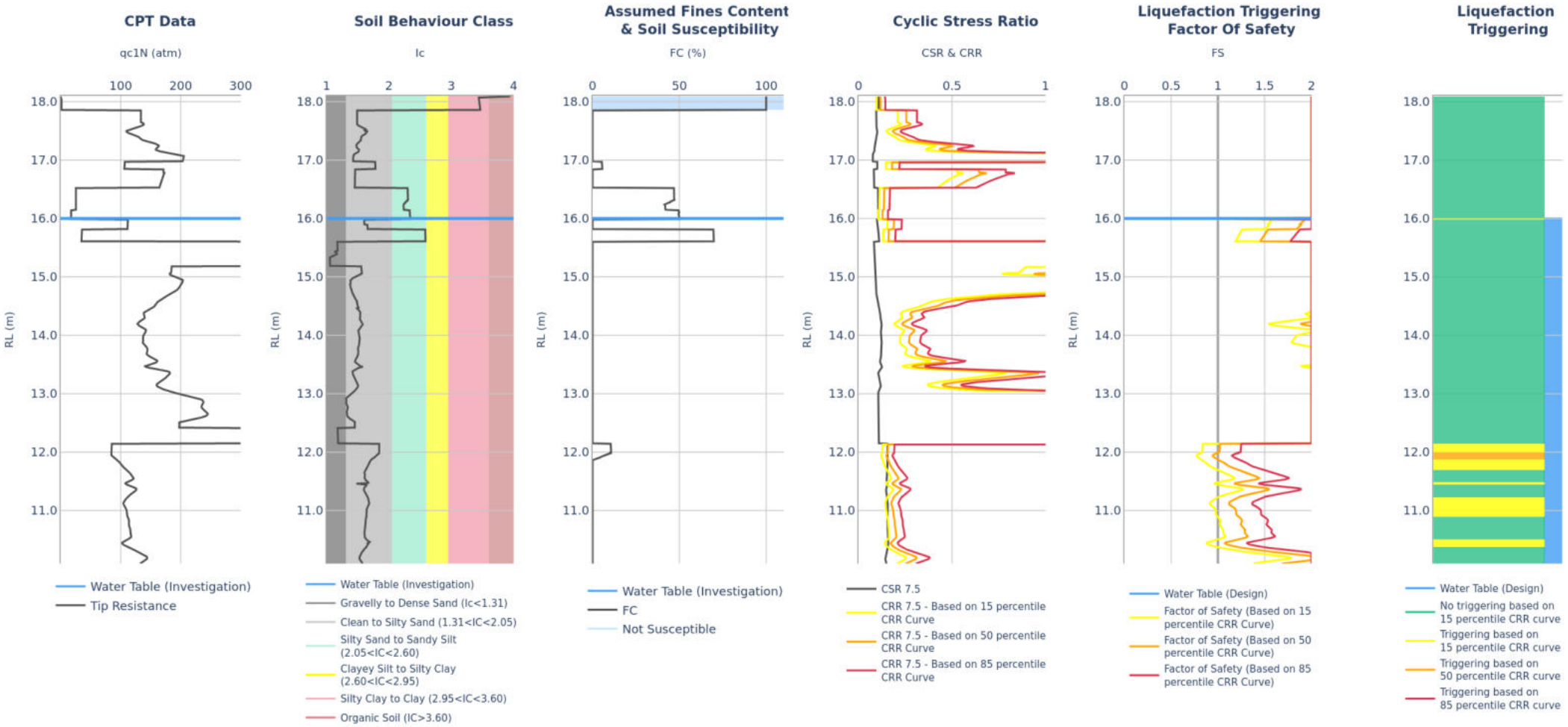
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT101	CPT_TT280727	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT102	CPT_TT280728	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

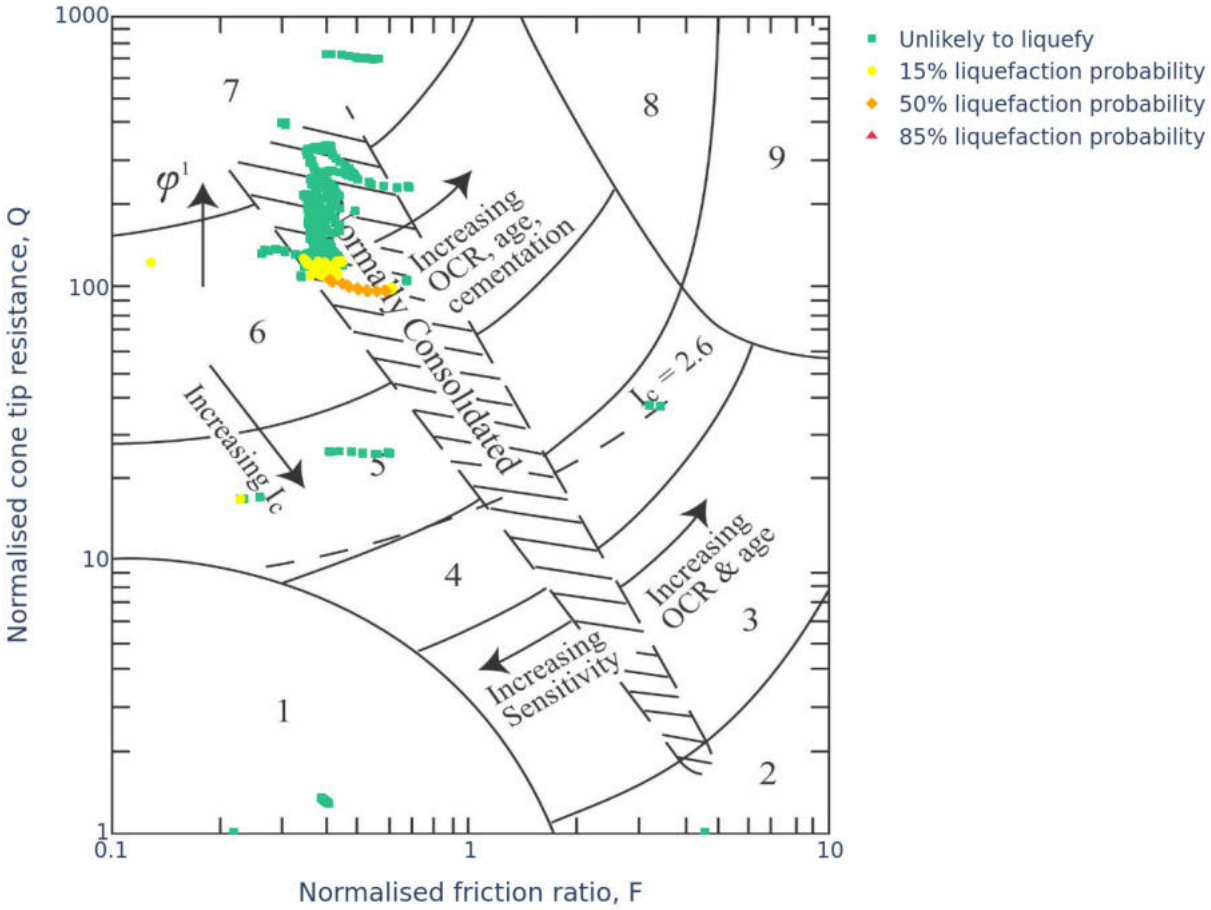
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	21	1.0	0	3	6.0	0
50%	9	0.1	0	1	6.2	0
85%	4	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

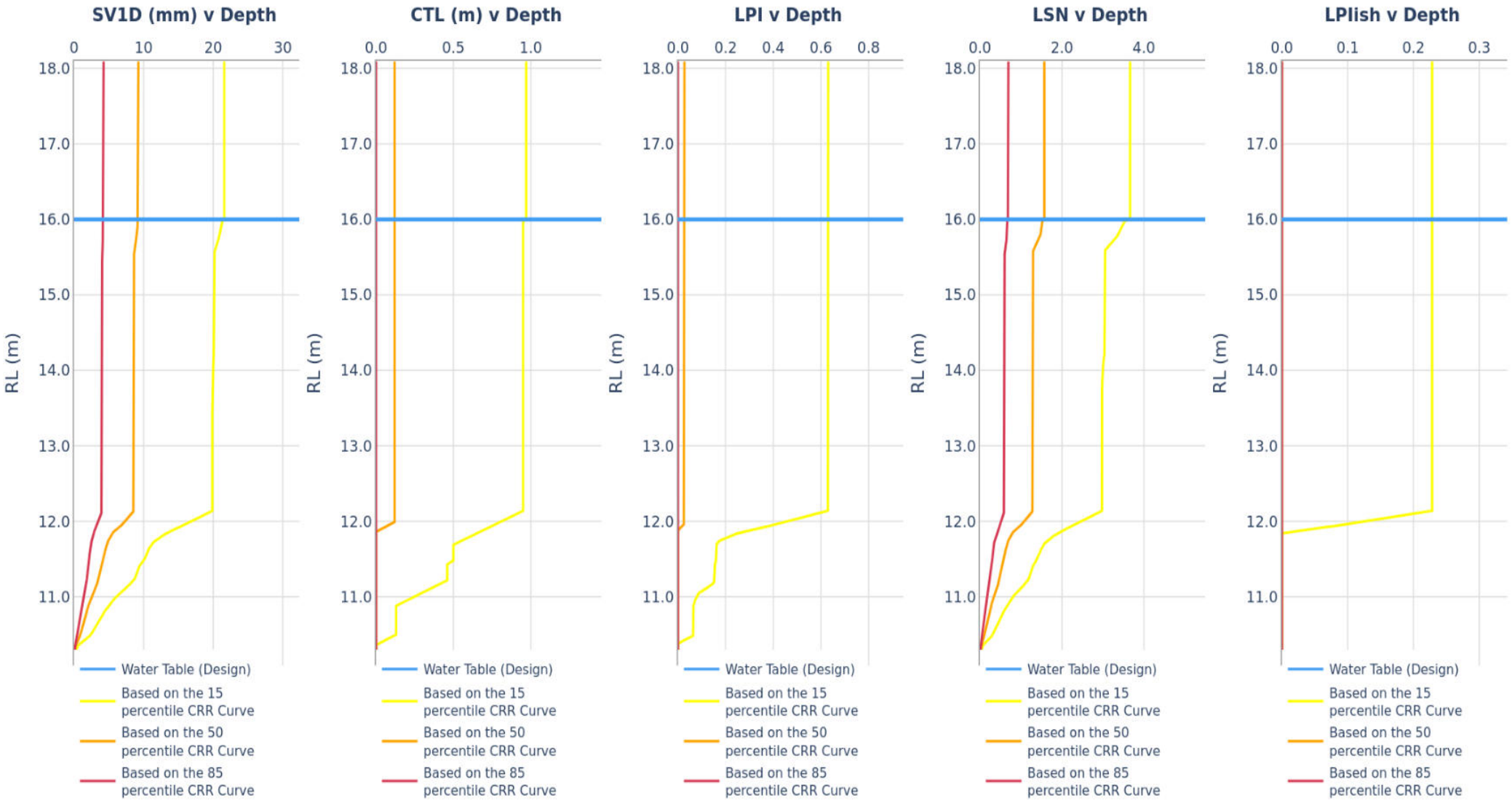


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

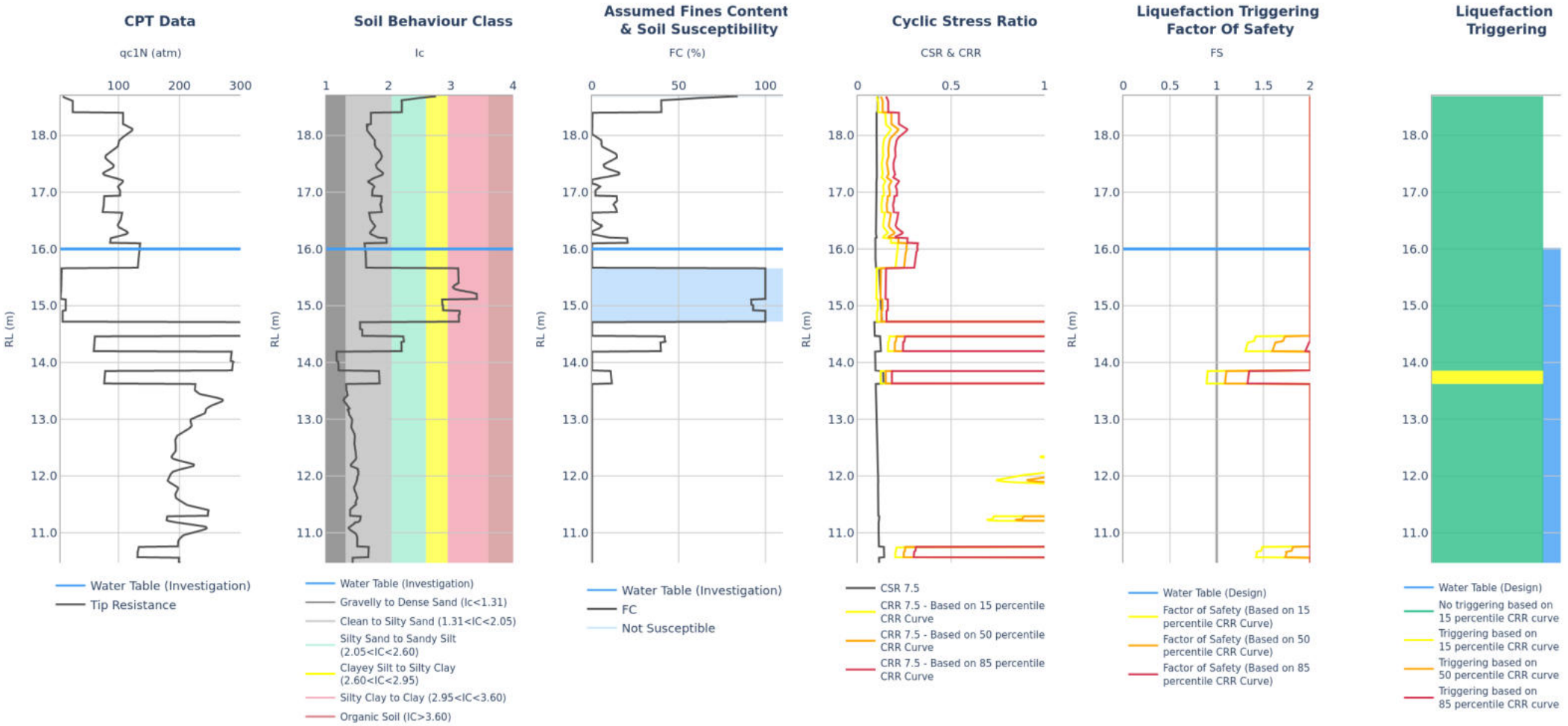
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT102	CPT_TT280728	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT103	CPT_TT280729	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

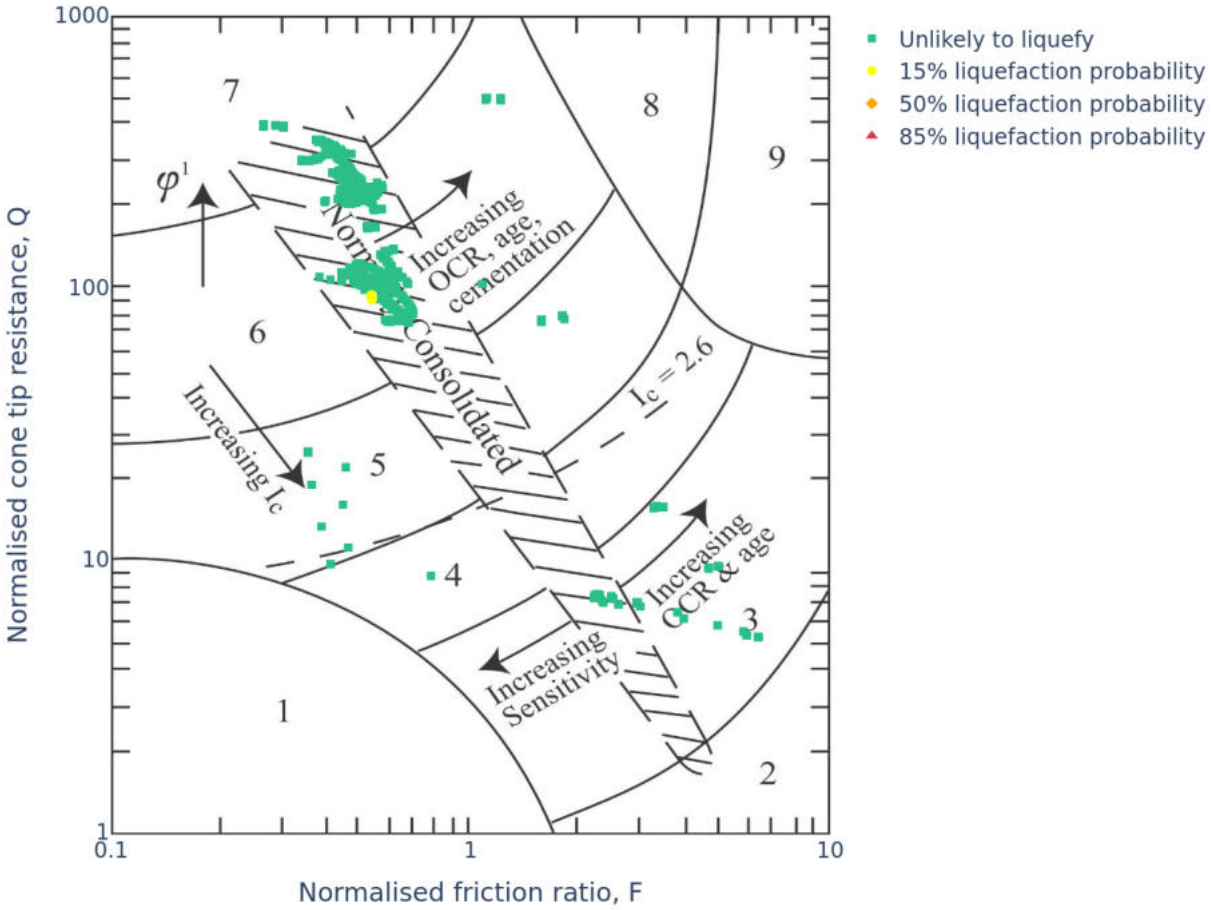
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	5	0.2	0	1	4.9	0
50%	1	0.0	0	0	8.2	0
85%	0	0.0	0	0	8.2	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

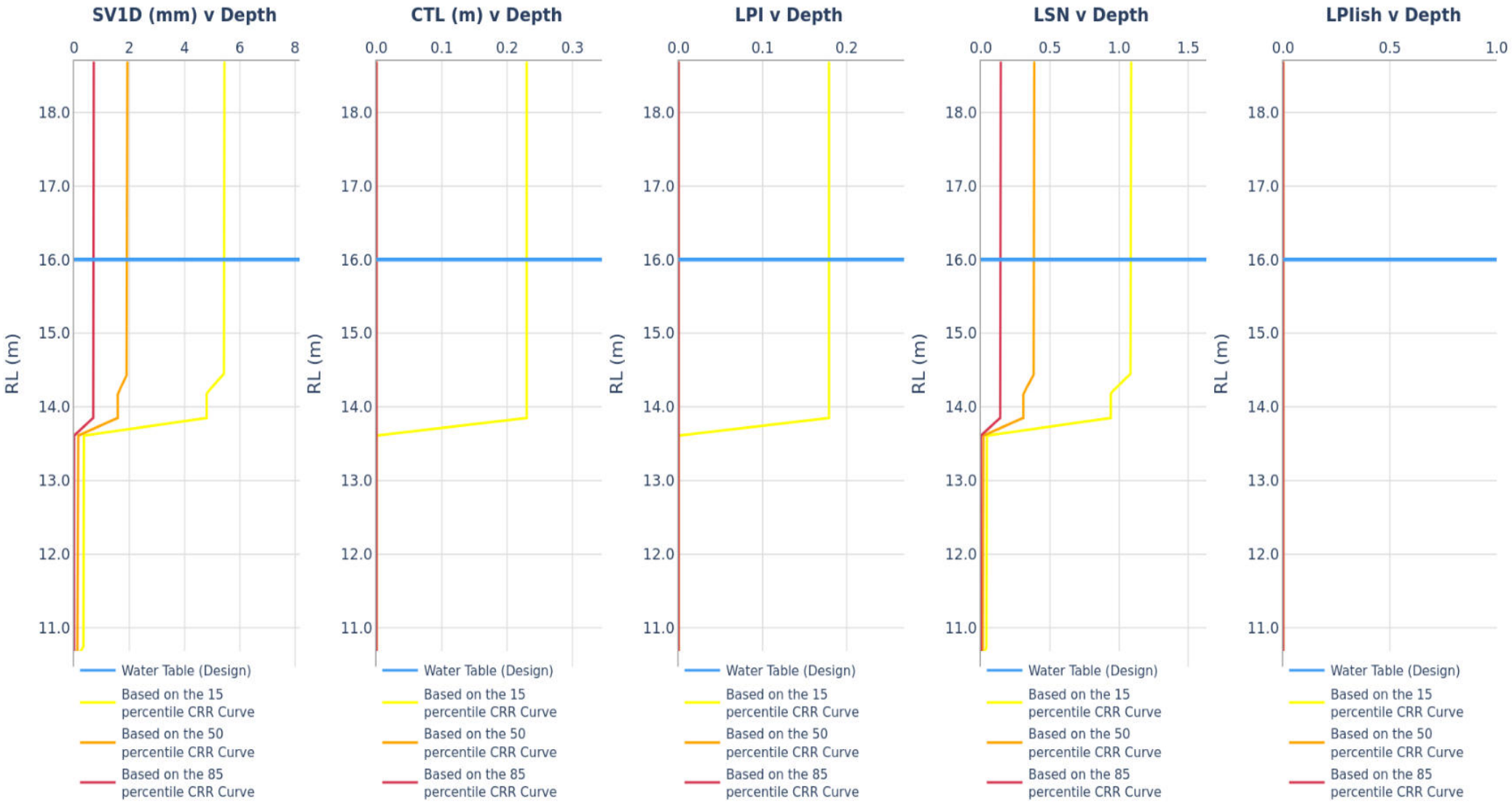


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

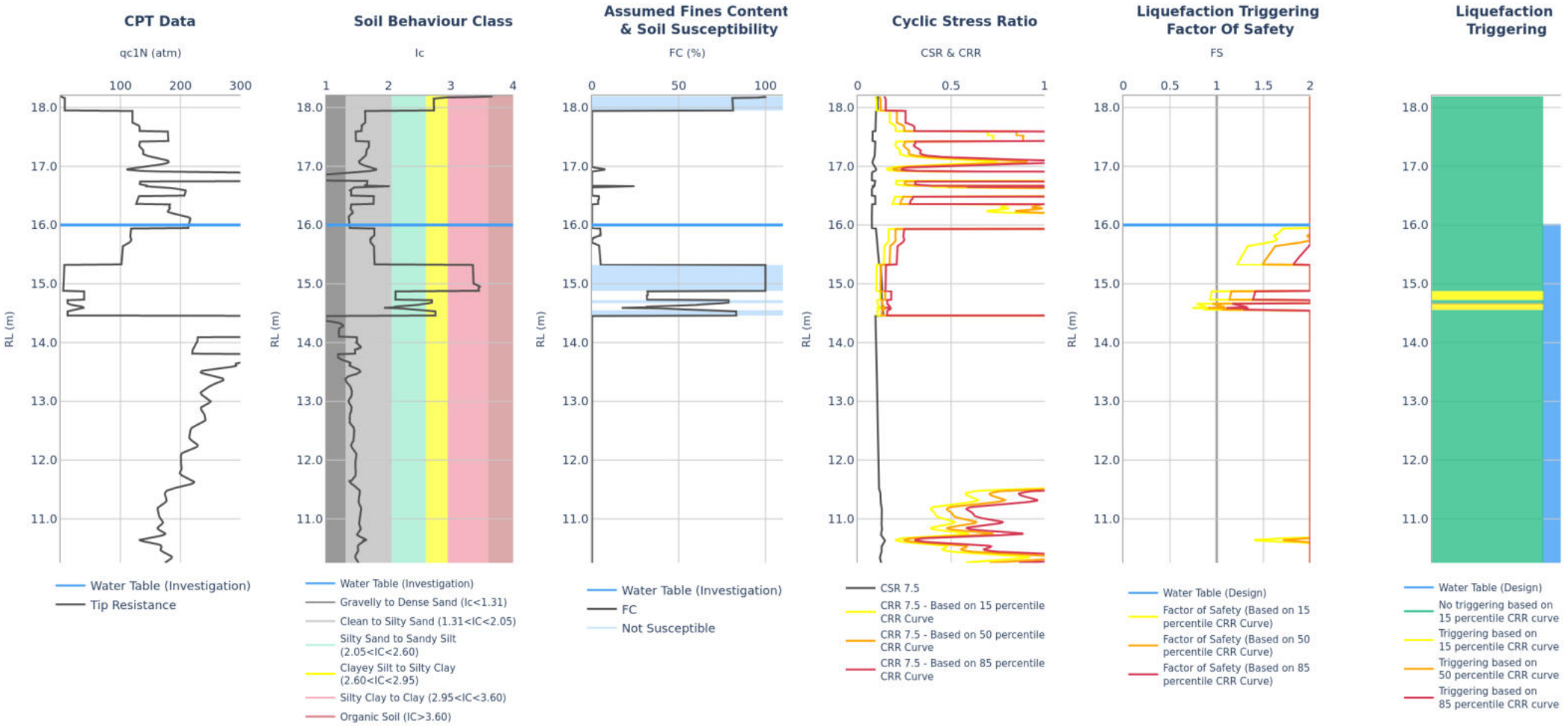
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT103	CPT_TT280729	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT104	CPT_TT280730	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

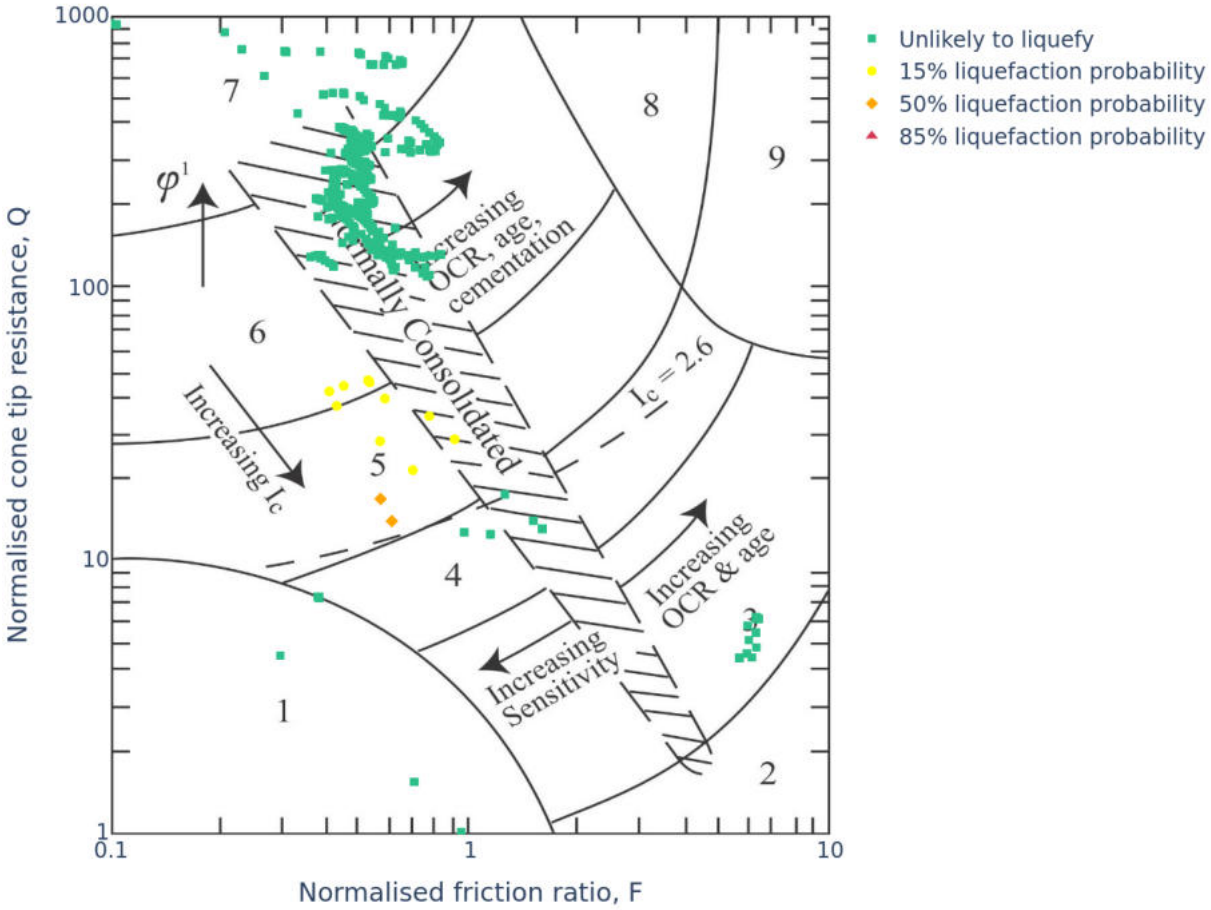
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	6	0.3	0	2	3.4	0
50%	2	0.0	0	0	8.0	0
85%	1	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

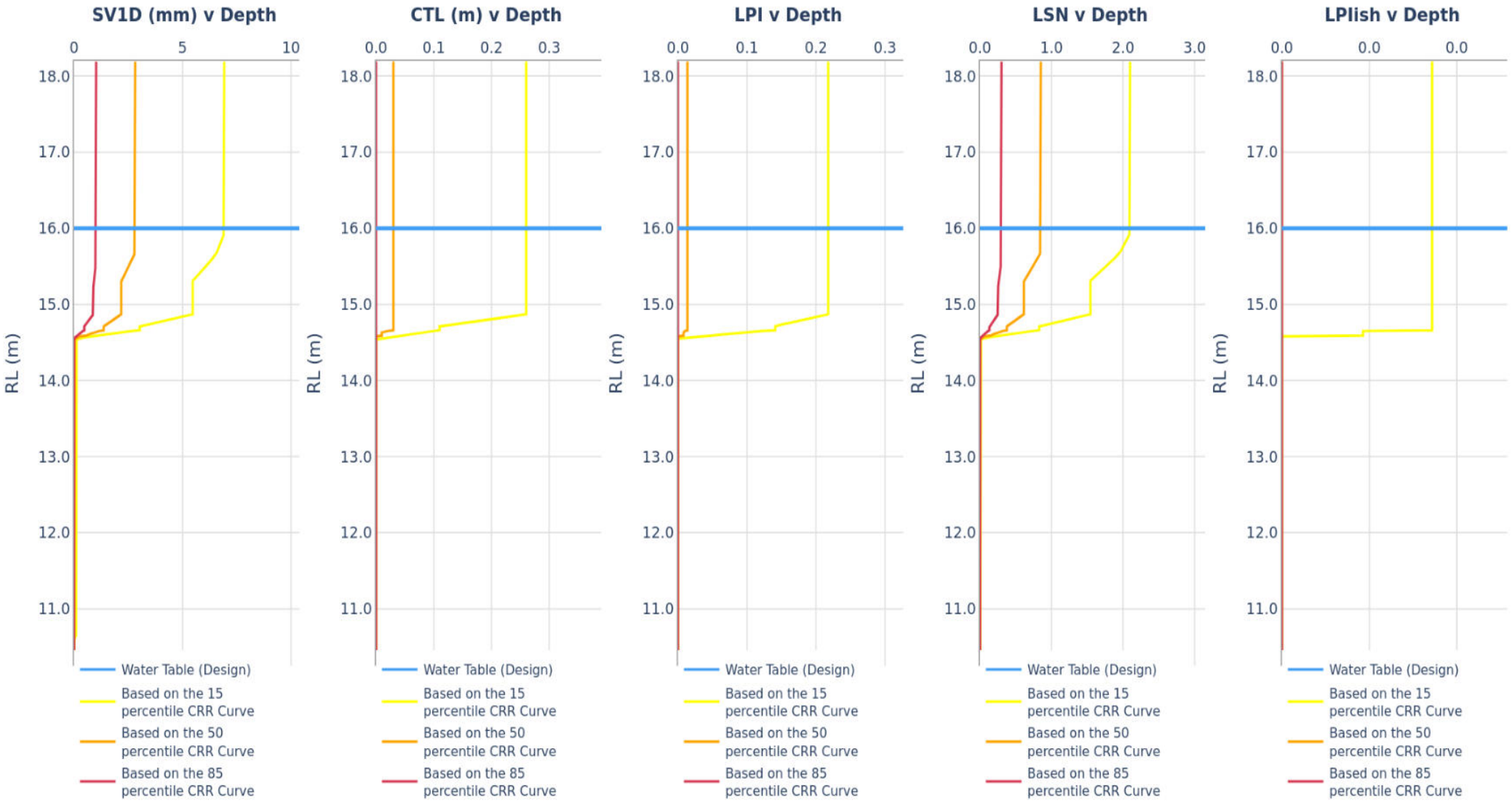


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

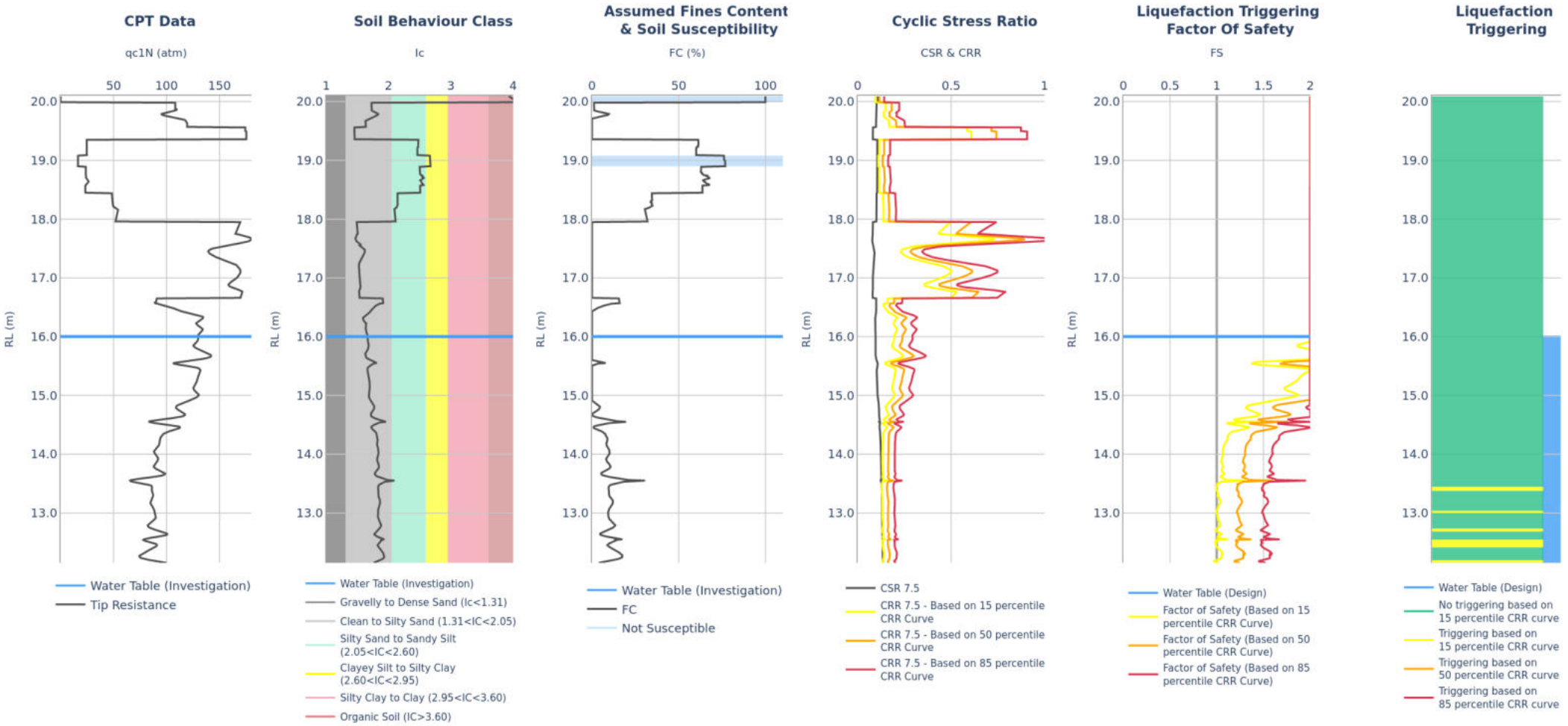
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT104	CPT_TT280730	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT105	CPT_TT280731	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

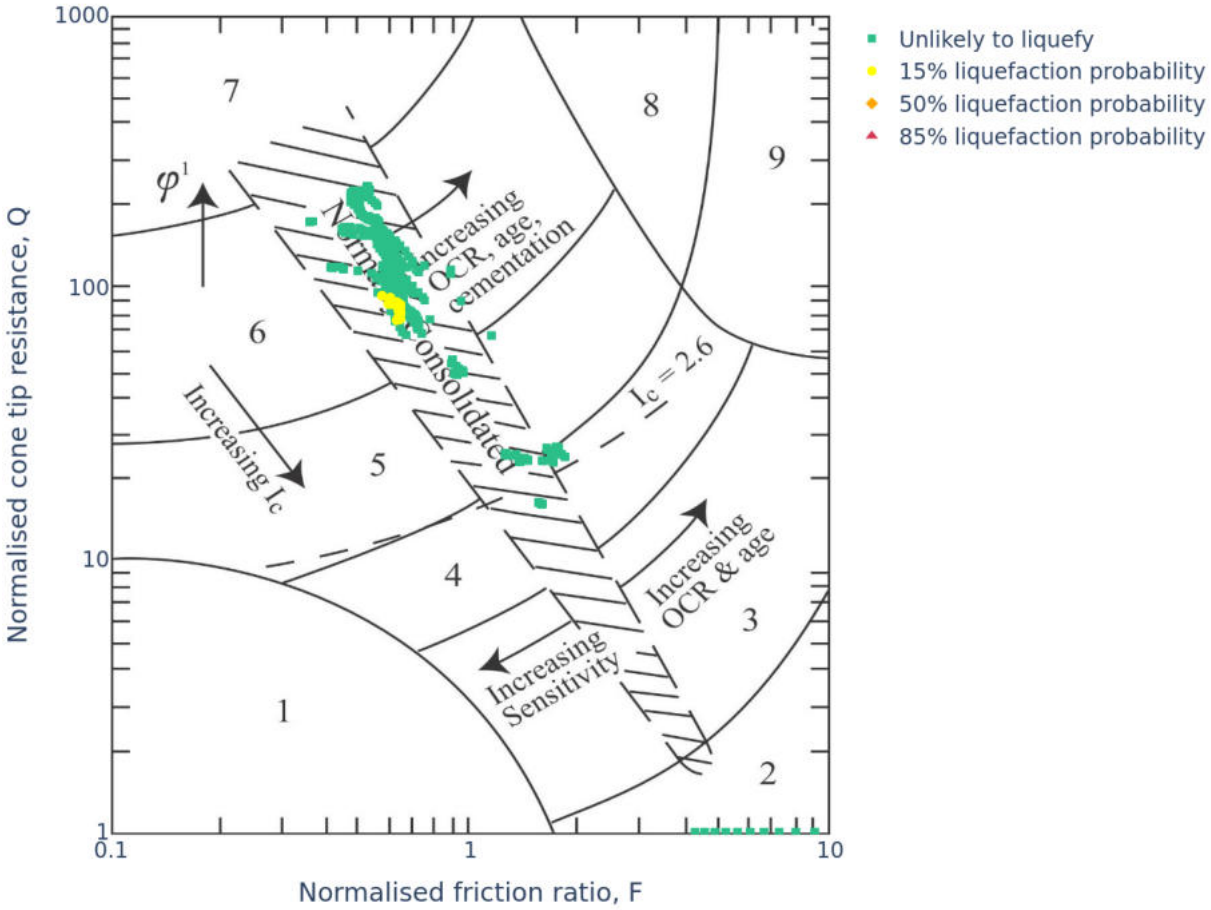
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	19	0.3	0	2	7.1	0
50%	8	0.0	0	1	8.0	0
85%	4	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT101 to CPT 105 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 13/19*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

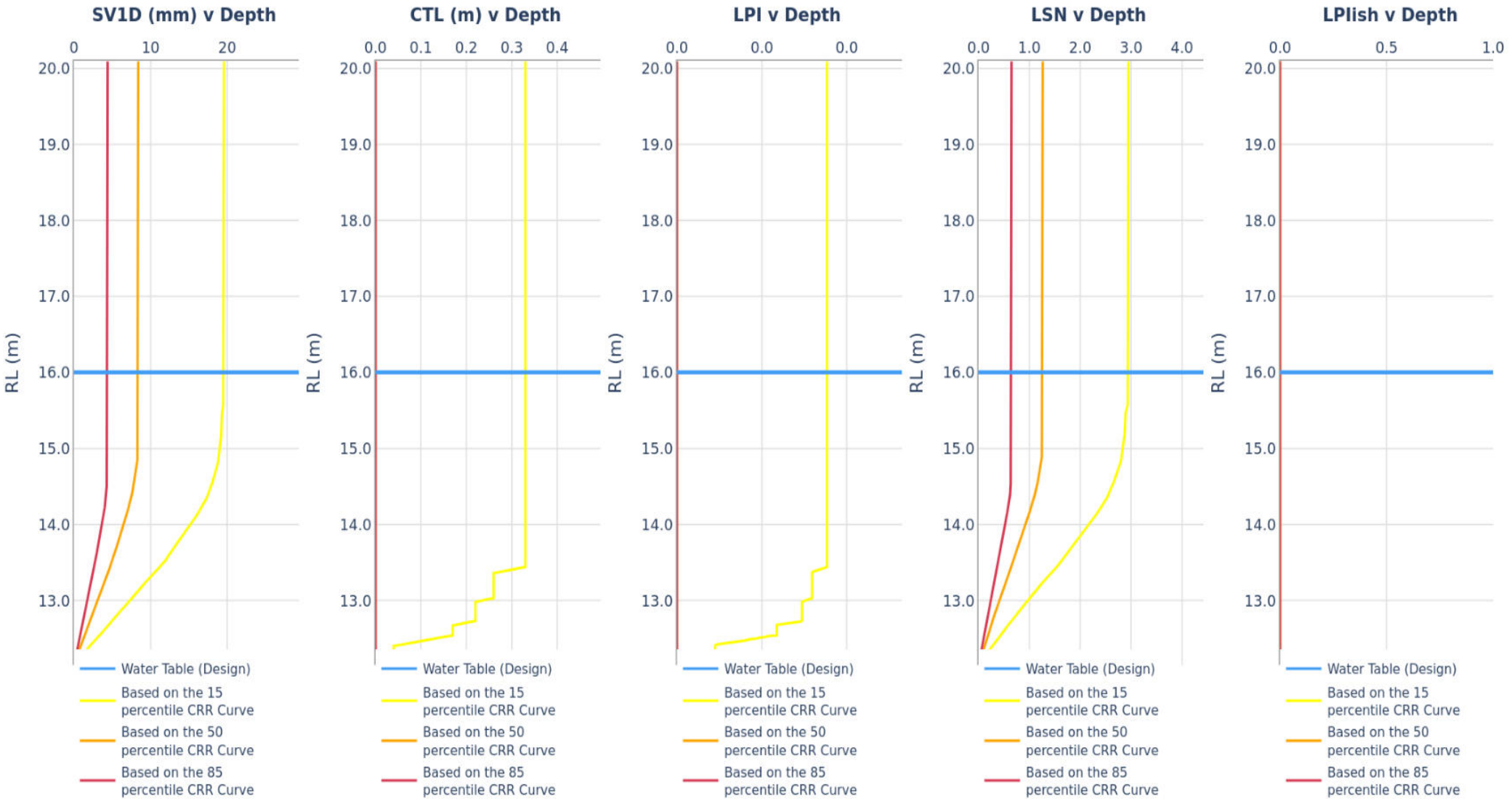


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

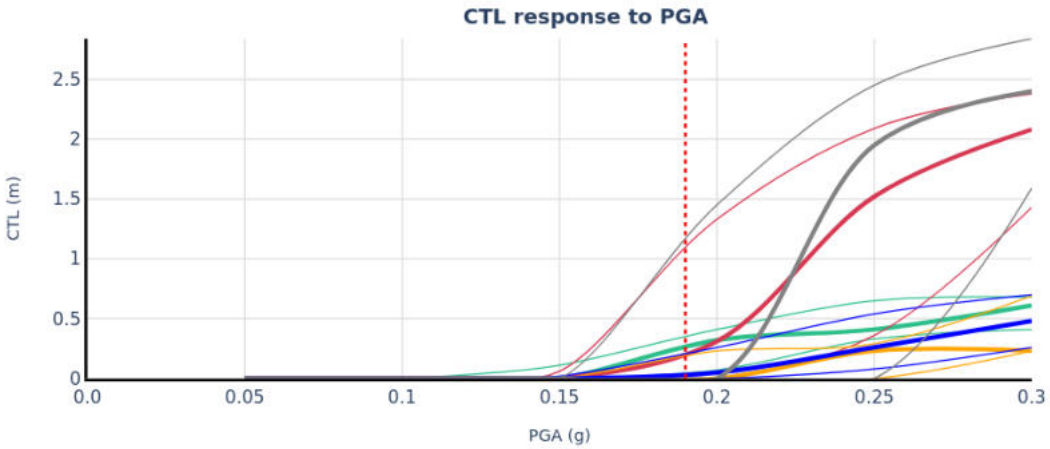
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

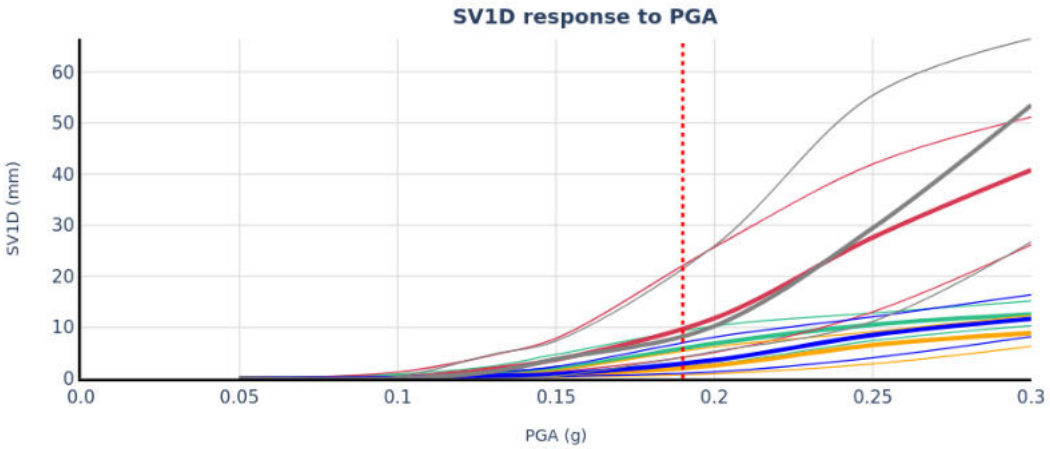


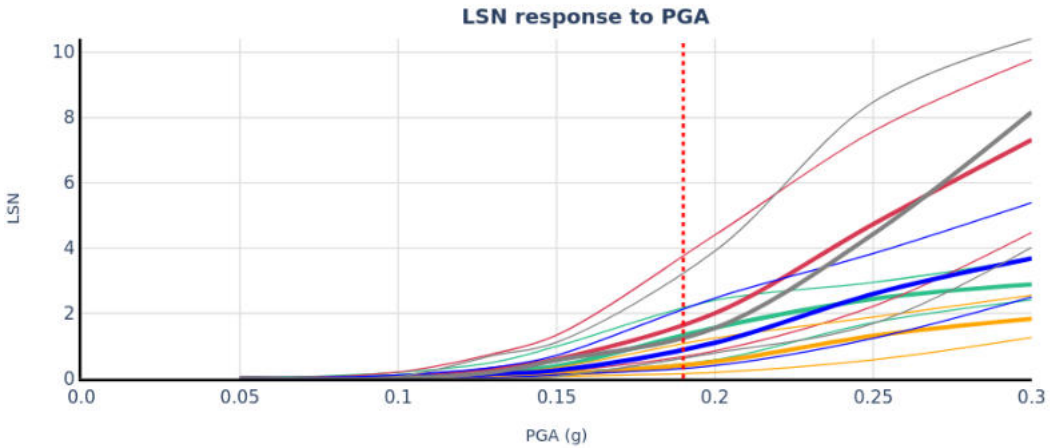
Input

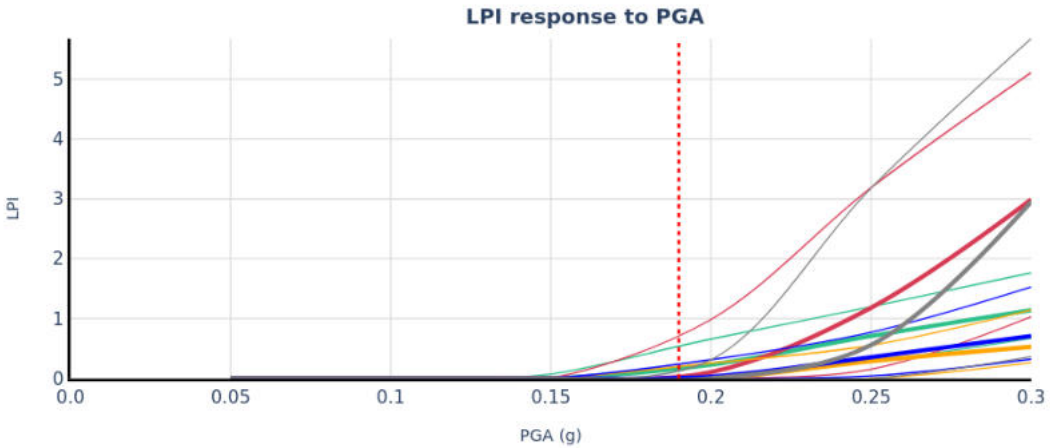
Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT105	CPT_TT280731	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT







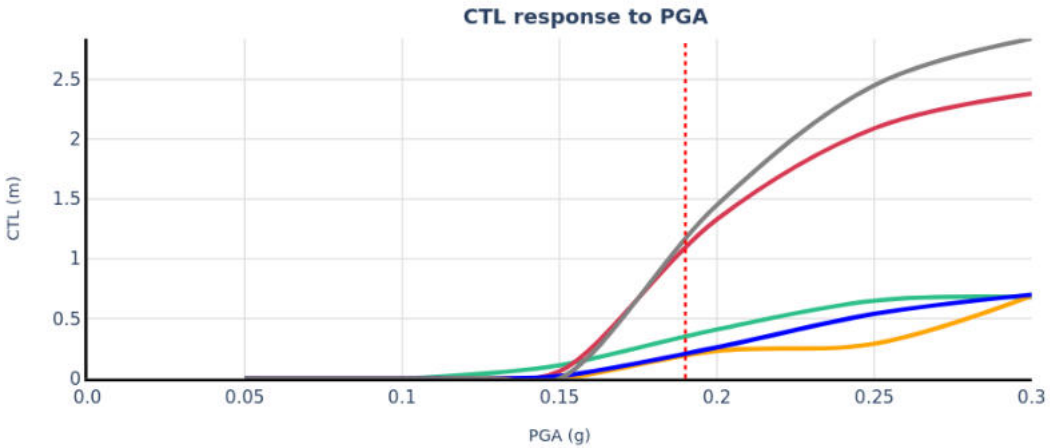


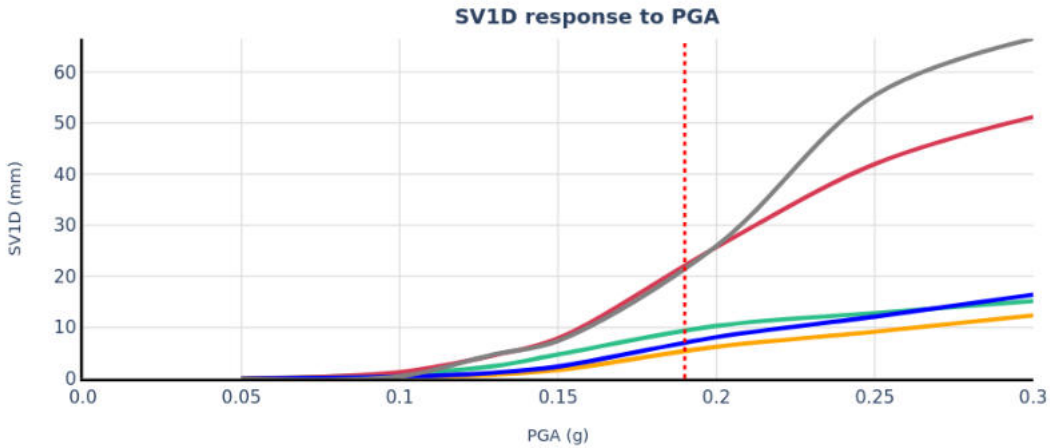
Input

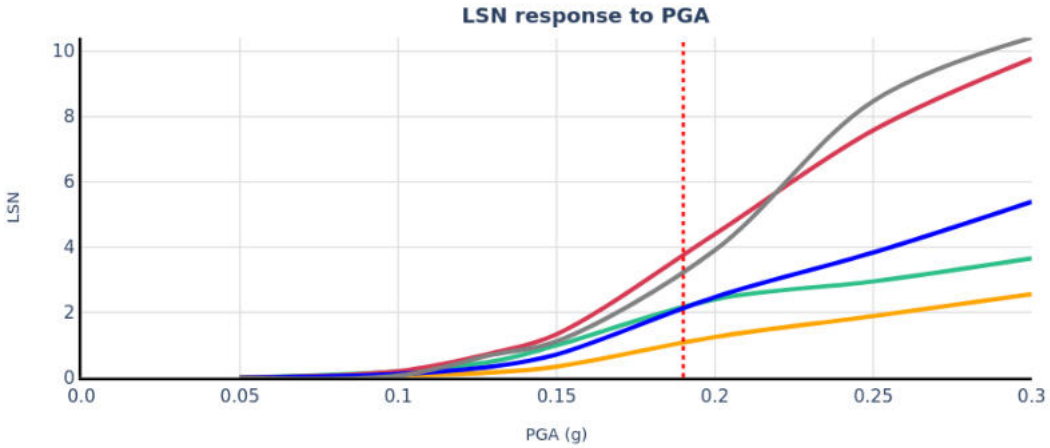
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT101	CPT_TT280727	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT102	CPT_TT280728	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT103	CPT_TT280729	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT104	CPT_TT280730	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT105	CPT_TT280731	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

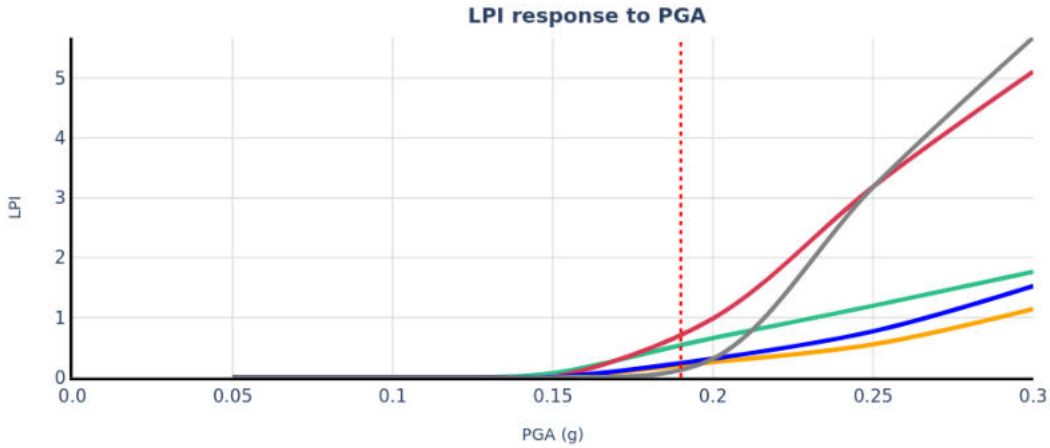
Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT BASED ON 15 PERCENTILE CRR CURVE









Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT101	CPT_TT280727	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT102	CPT_TT280728	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT103	CPT_TT280729	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT104	CPT_TT280730	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT105	CPT_TT280731	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280727	TTGD 280728	TTGD 280729
CPT Name	CPT101	CPT102	CPT103
Run Description	CPT101	CPT102	CPT103
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	1.2	2.1	2.7
Depth to groundwater for design (m)	1.2	2.1	2.7
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	8.12	8.01	8.23
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	10	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280727	CPT101	0.0	0.0	0.0
TTGD 280727	CPT101	0.0	10.0	2.6
TTGD 280728	CPT102	0.0	0.0	0.0
TTGD 280728	CPT102	0.0	10.0	2.6
TTGD 280729	CPT103	0.0	0.0	0.0
TTGD 280729	CPT103	0.0	10.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280727	CPT101	0.0	10.0	0.0 CFC
TTGD 280728	CPT102	0.0	10.0	0.0 CFC
TTGD 280729	CPT103	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280727	CPT101	0.0	0.0001	18.0
TTGD 280727	CPT101	0.0001	8.12	18.0
TTGD 280728	CPT102	0.0	0.0001	18.0
TTGD 280728	CPT102	0.0001	8.12	18.0
TTGD 280729	CPT103	0.0	0.0001	18.0
TTGD 280729	CPT103	0.0001	8.23	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280730	TTGD 280731
CPT Name	CPT104	CPT105
Run Description	CPT104	CPT105
EQ PGA (g)	0.19	0.19
EQ Magnitude	6.5	6.5
Depth to groundwater at time of Investigation (m)	2.2	4.1
Depth to groundwater for design (m)	2.2	4.1
Pre-drill depth (m)	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002
Total depth of CPT (m)	7.95	7.95
Minimum depth of analysis (m)	0	0
Maximum depth of analysis (m)	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A
Surcharge load (kPa)	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280730	CPT104	0.0	0.0	0.0
TTGD 280730	CPT104	0.0	10.0	2.6
TTGD 280731	CPT105	0.0	0.0	0.0
TTGD 280731	CPT105	0.0	10.0	2.6

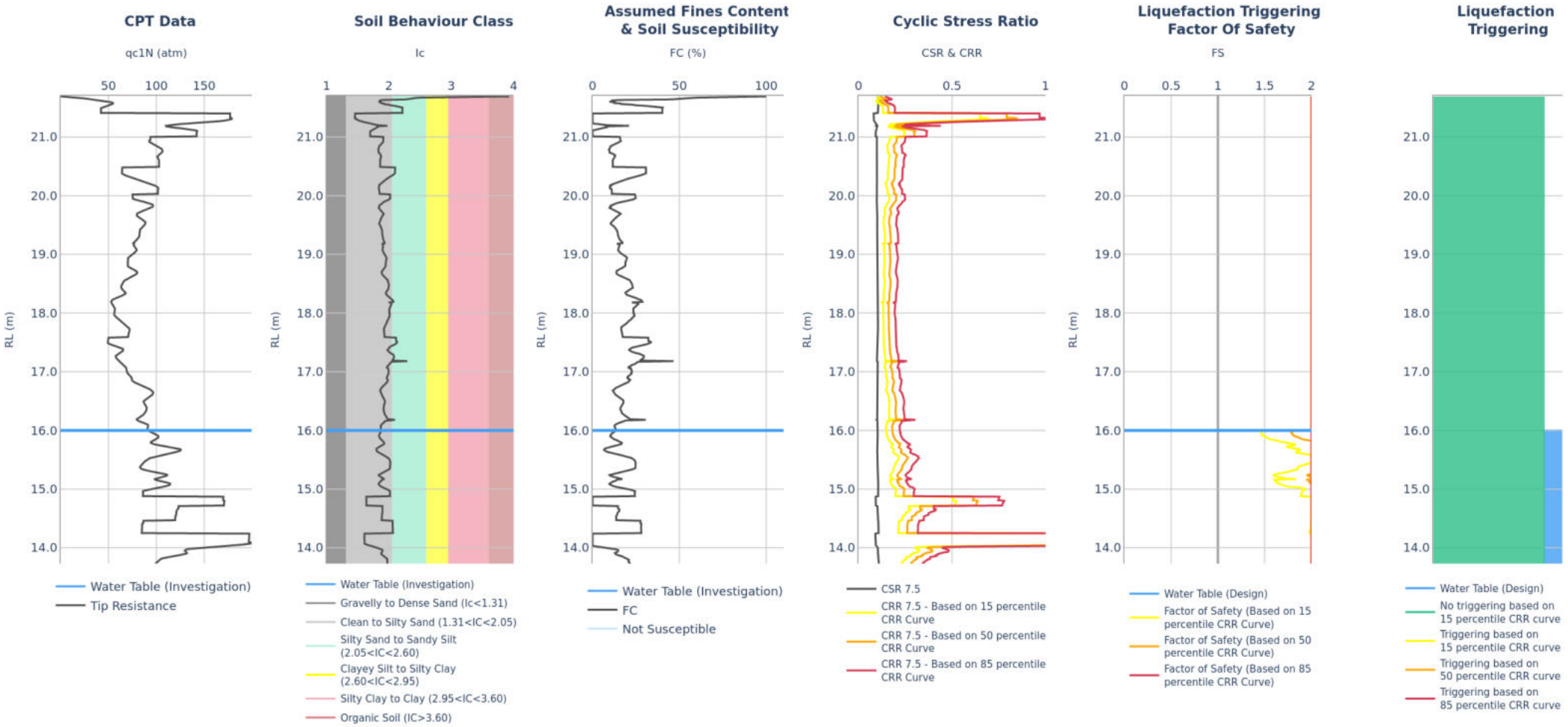
Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280730	CPT104	0.0	10.0	0.0 CFC
TTGD 280731	CPT105	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280730	CPT104	0.0	0.0001	18.0
TTGD 280730	CPT104	0.0001	8.12	18.0
TTGD 280731	CPT105	0.0	0.0001	18.0
TTGD 280731	CPT105	0.0001	8.12	18.0

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT111	CPT_TT280737	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

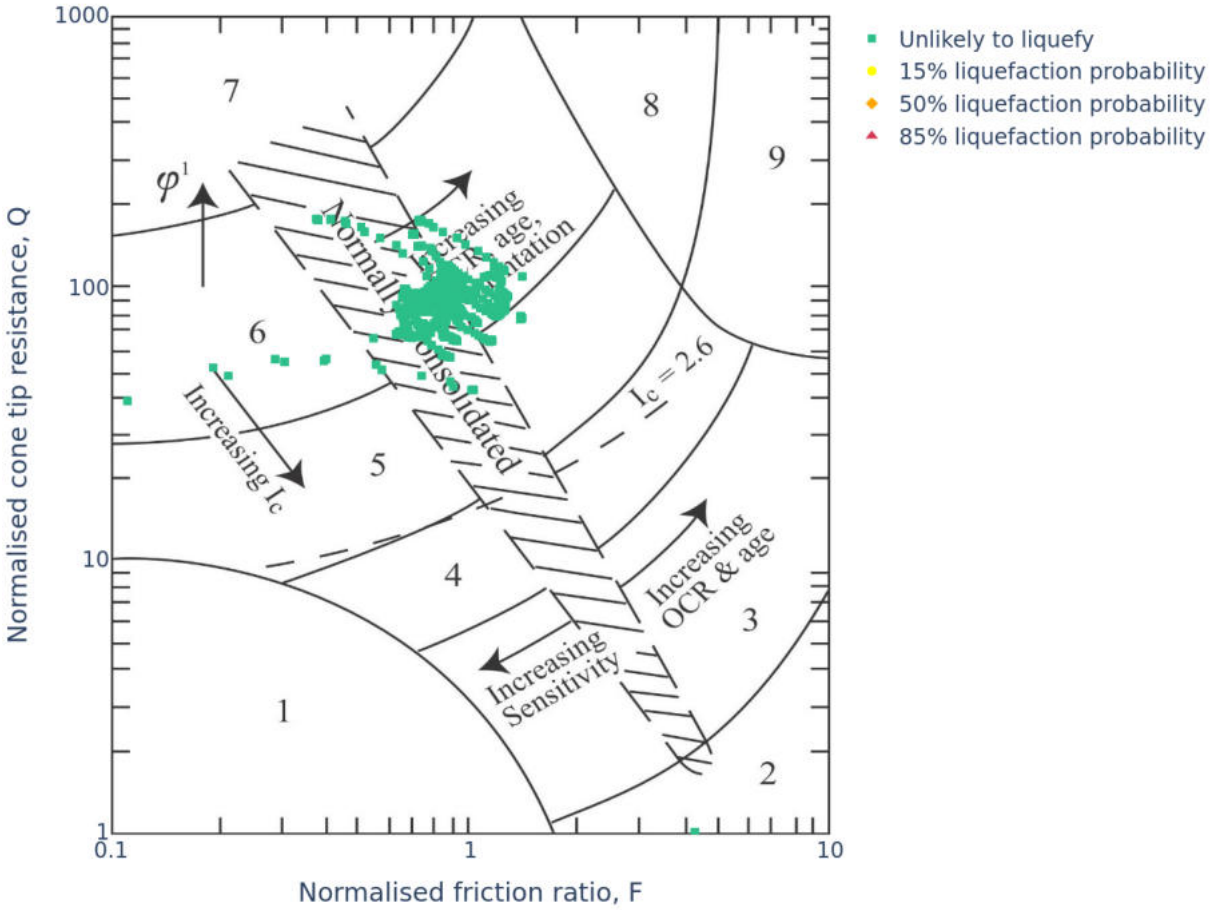
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	0	0.0	0	0	8.0	0
50%	0	0.0	0	0	8.0	0
85%	0	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT111 to CPT 115 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 1/19*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

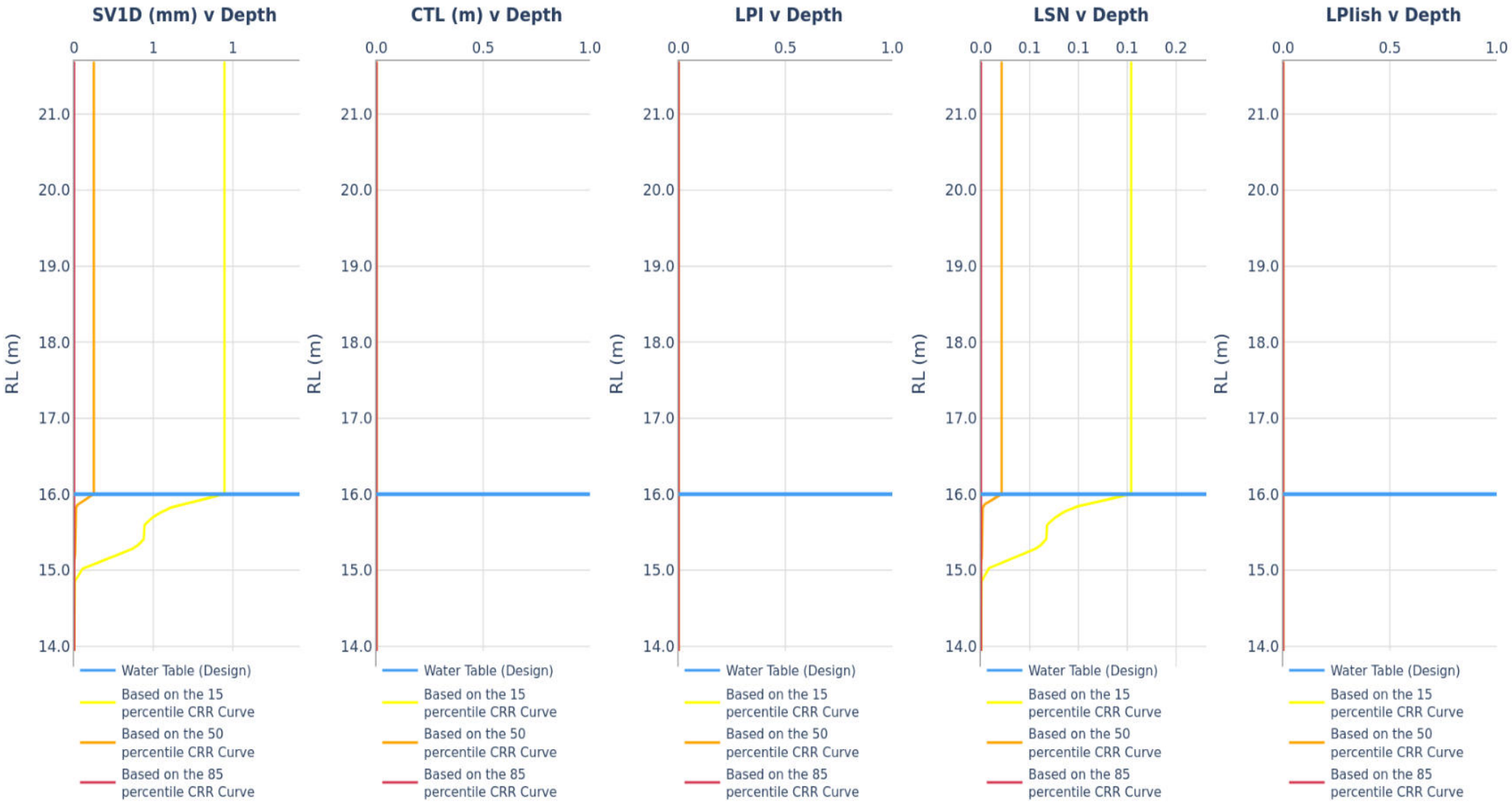


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

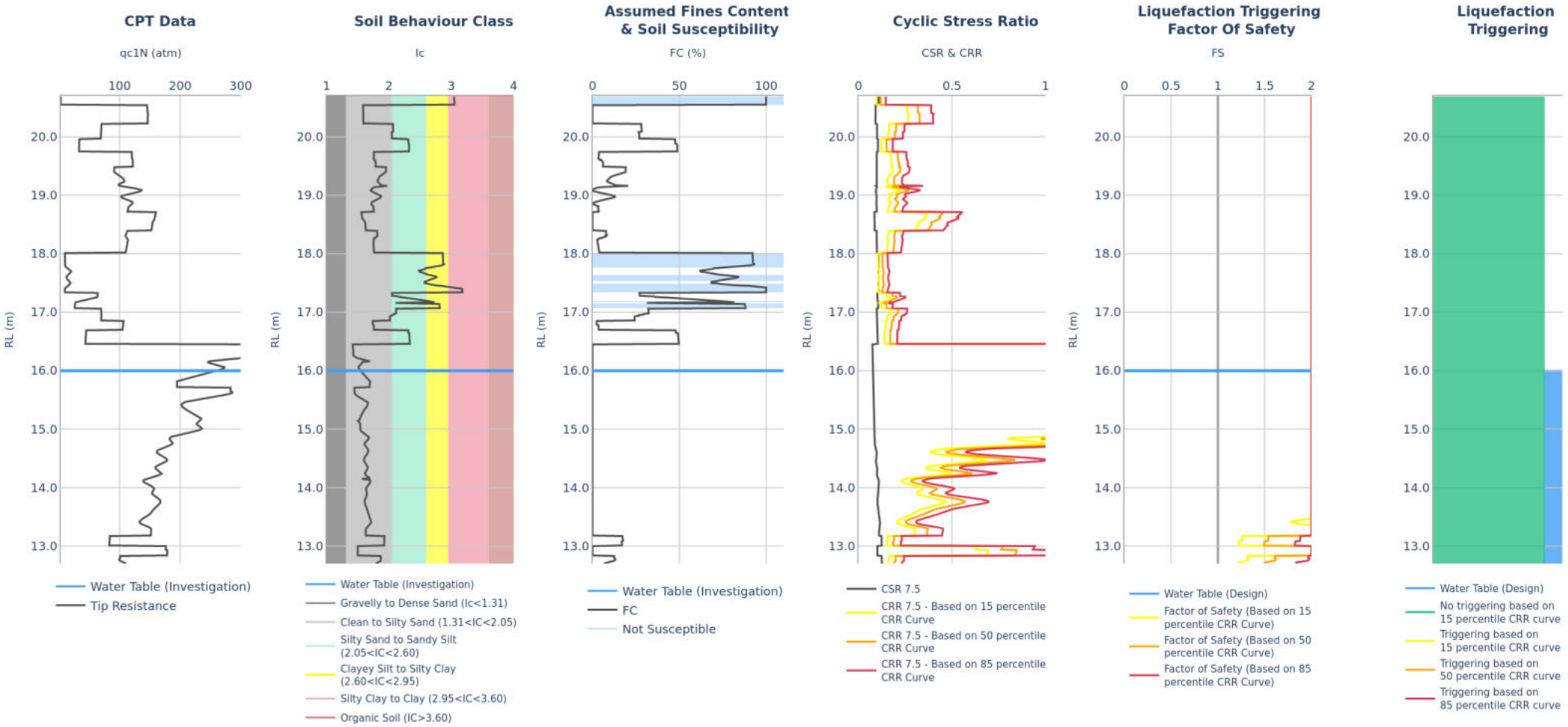
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT111	CPT_TT280737	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT112	CPT_TT280738	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

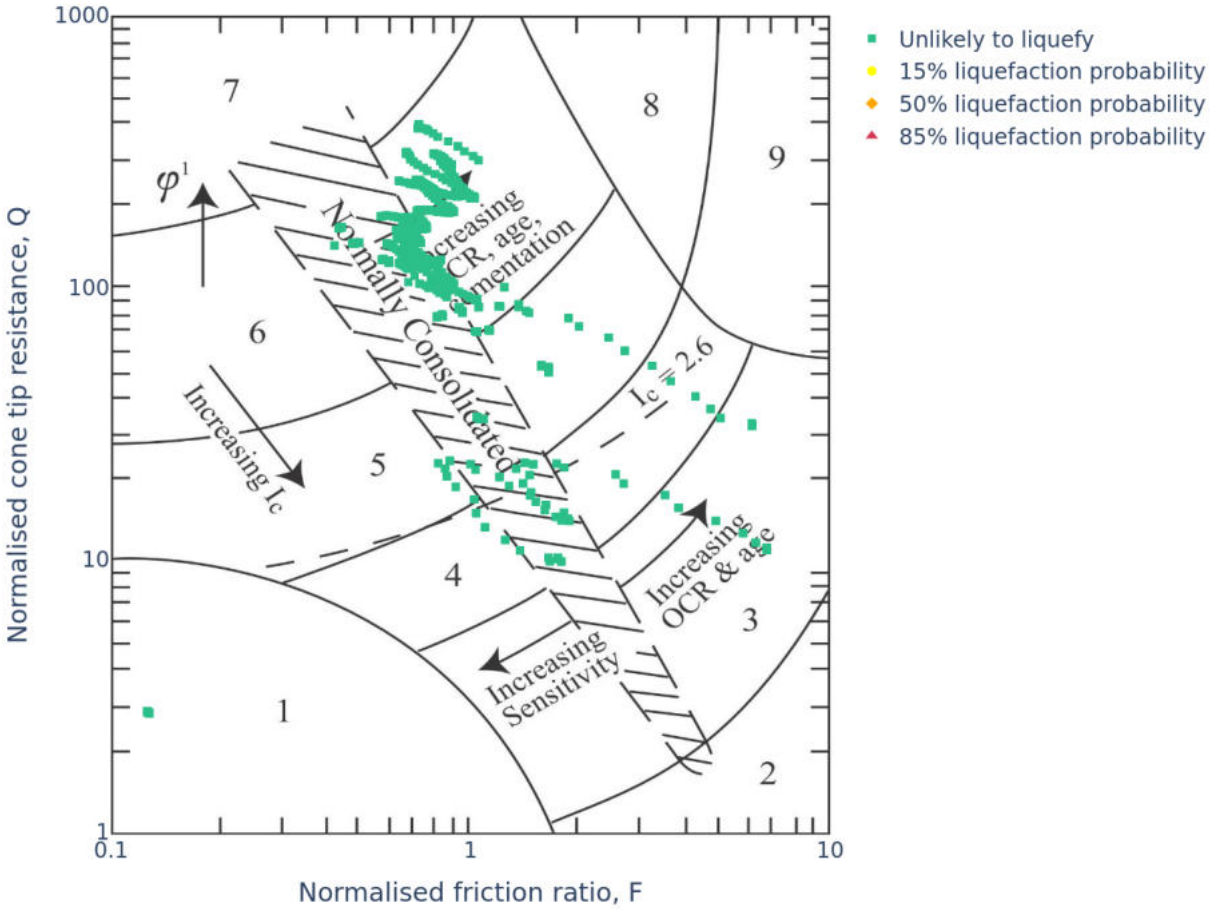
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	1	0.0	0	0	8.0	0
50%	0	0.0	0	0	8.0	0
85%	0	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

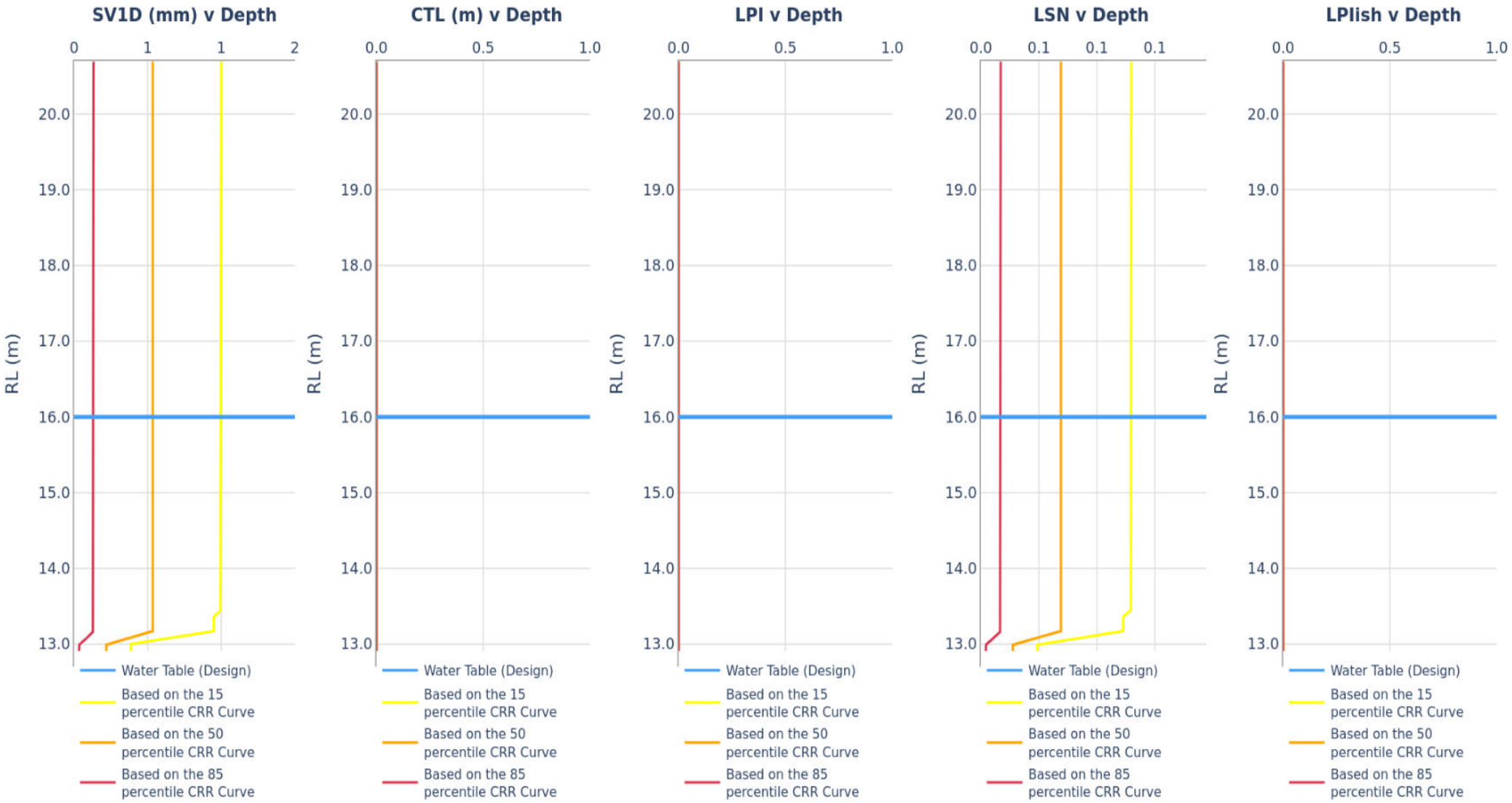


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

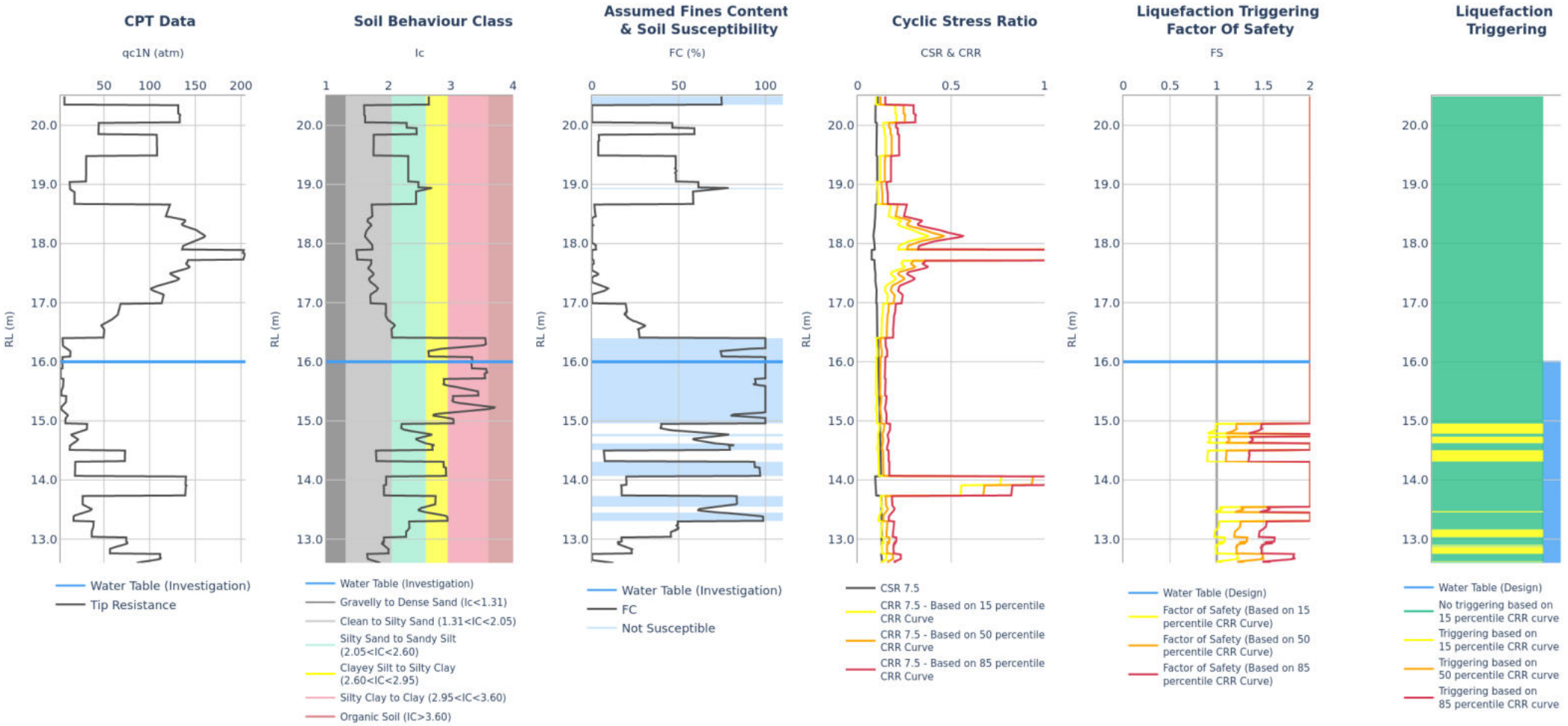
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT112	CPT_TT280738	08/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT113	CPT_TT280739	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

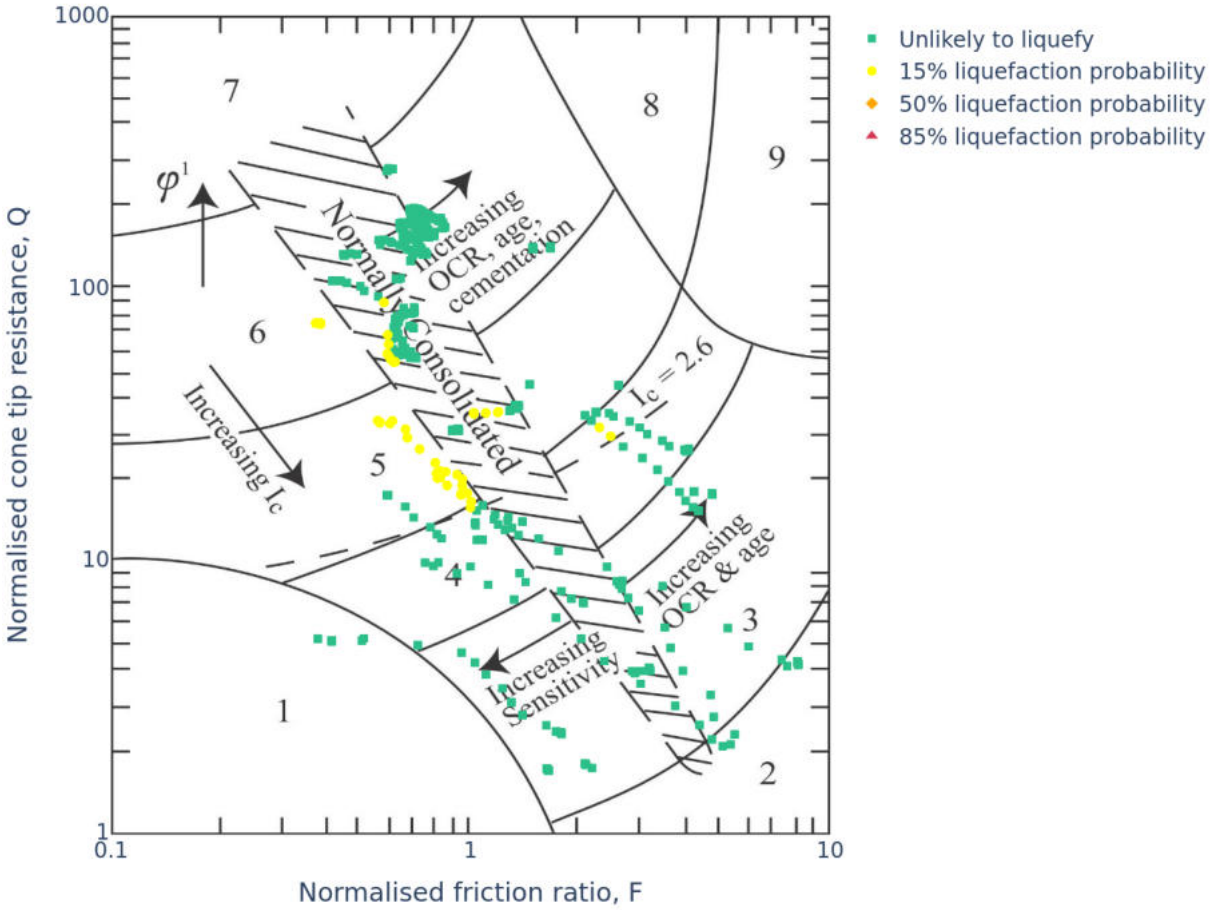
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	16	0.8	0	2	5.6	0
50%	5	0.0	0	0	7.9	0
85%	2	0.0	0	0	7.9	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

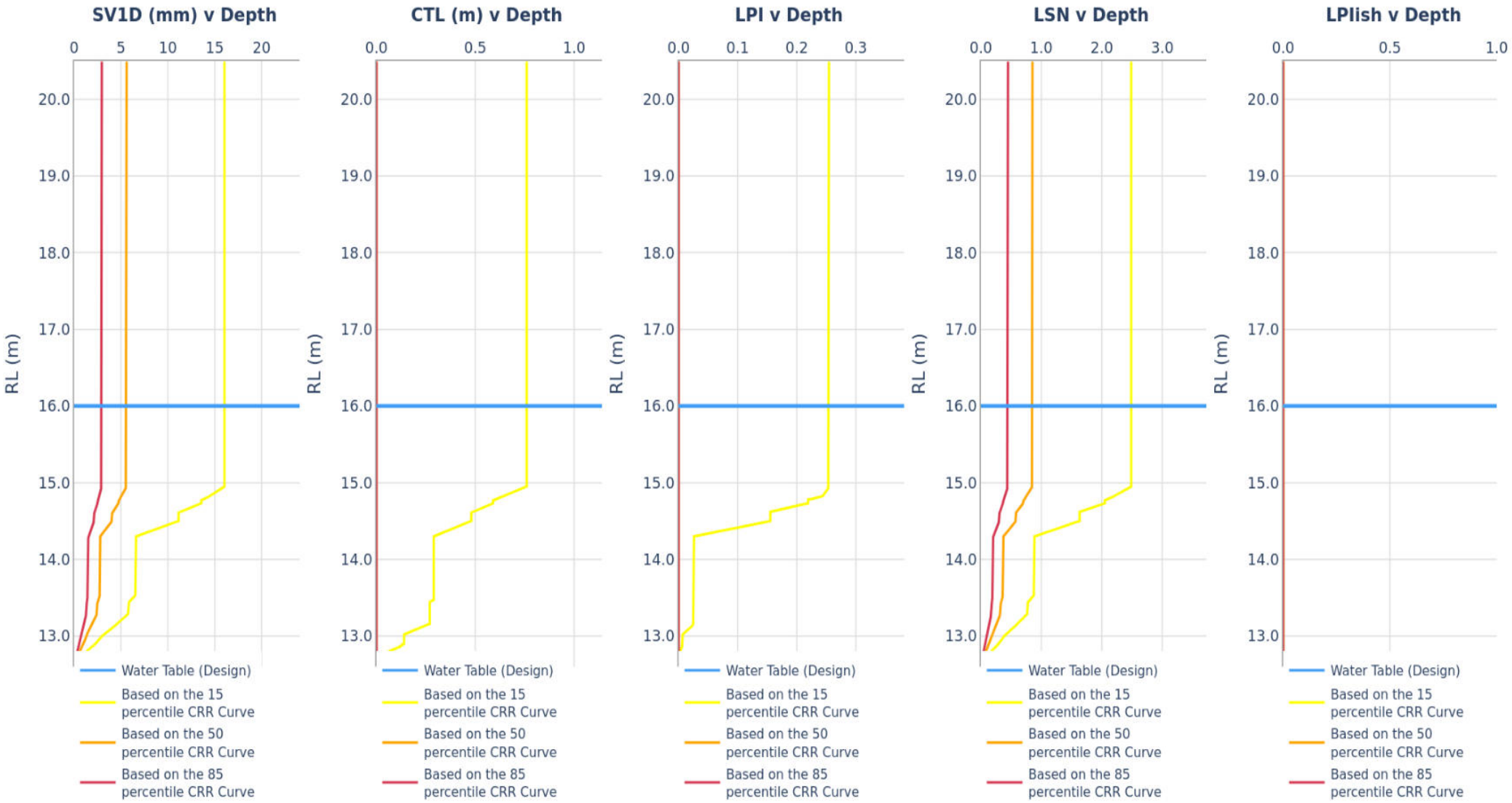


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

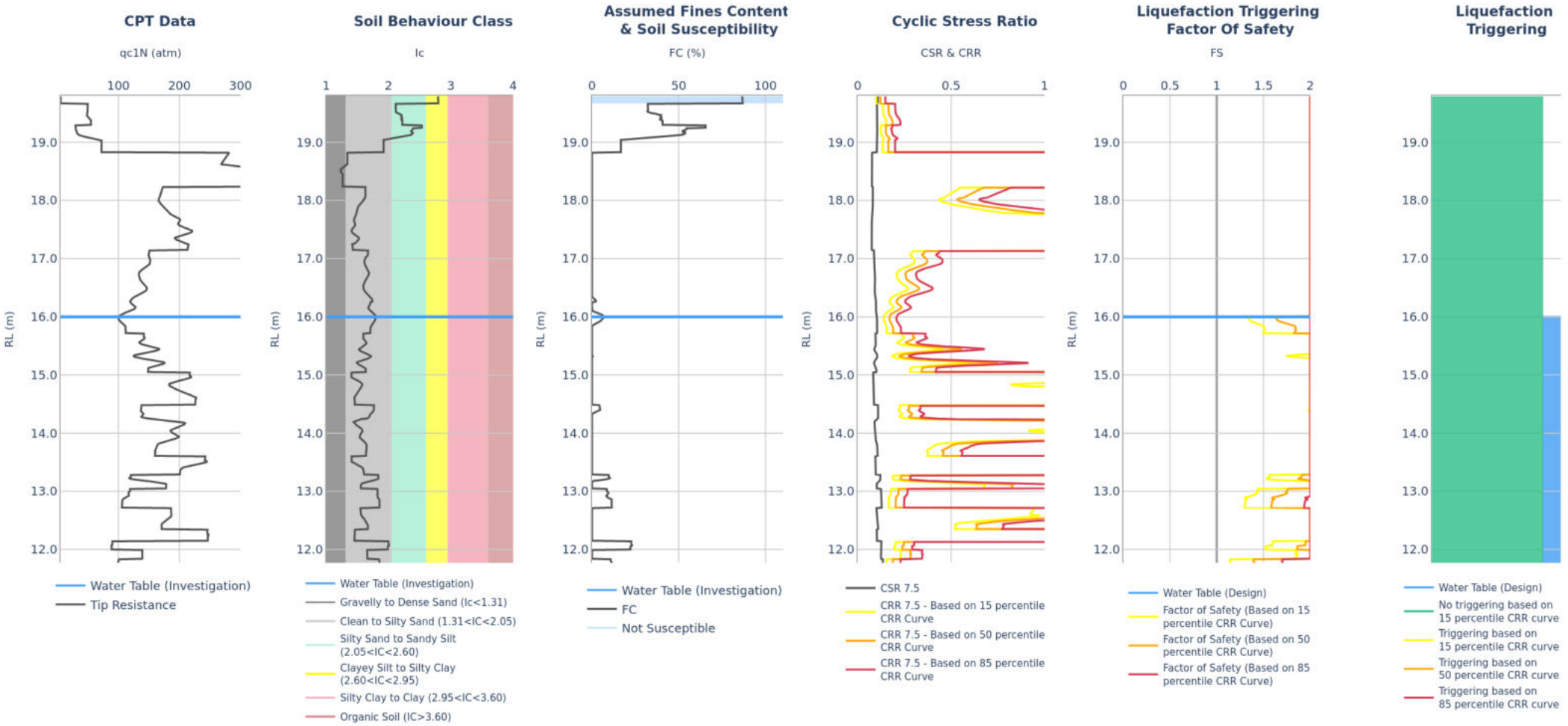
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT113	CPT_TT280739	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT114	CPT_TT280740	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

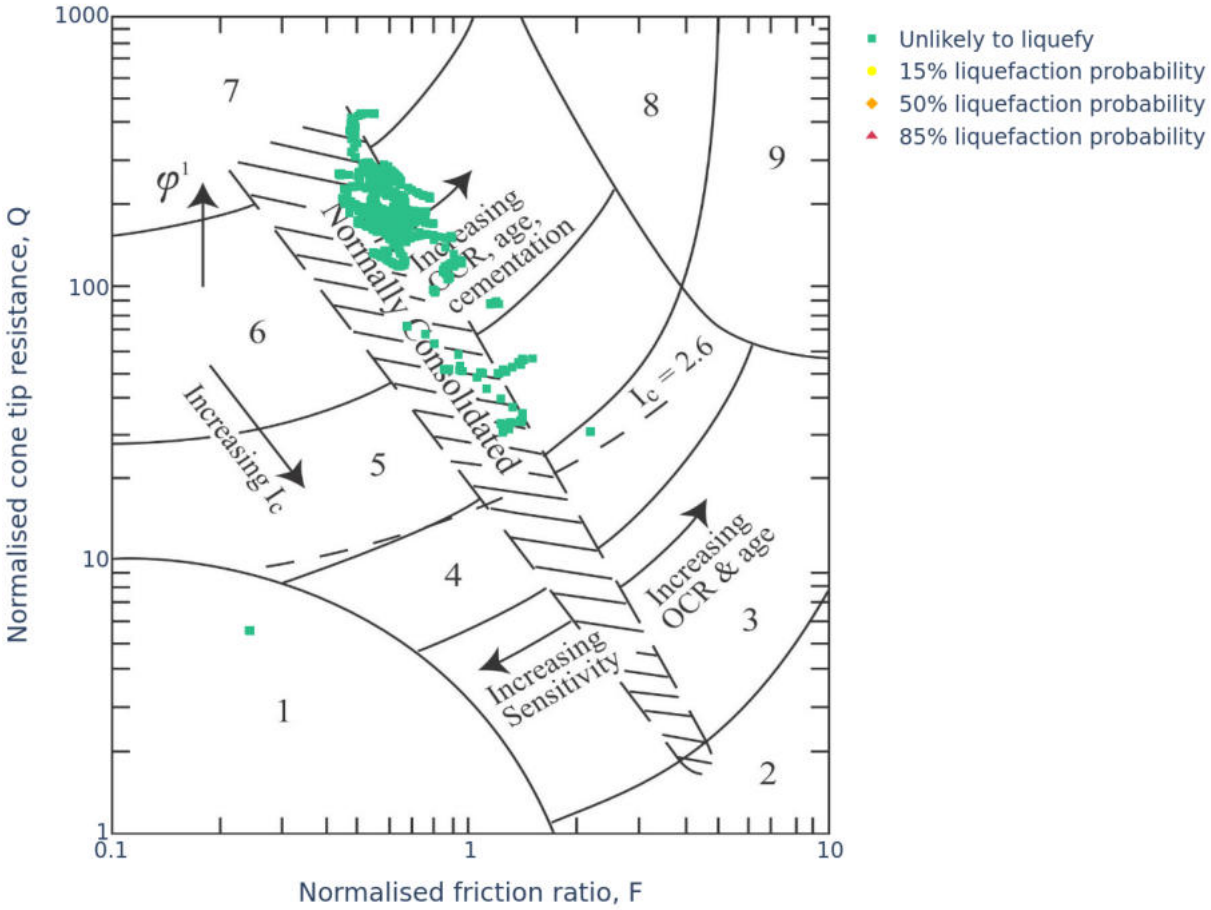
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	2	0.0	0	0	8.0	0
50%	0	0.0	0	0	8.0	0
85%	0	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

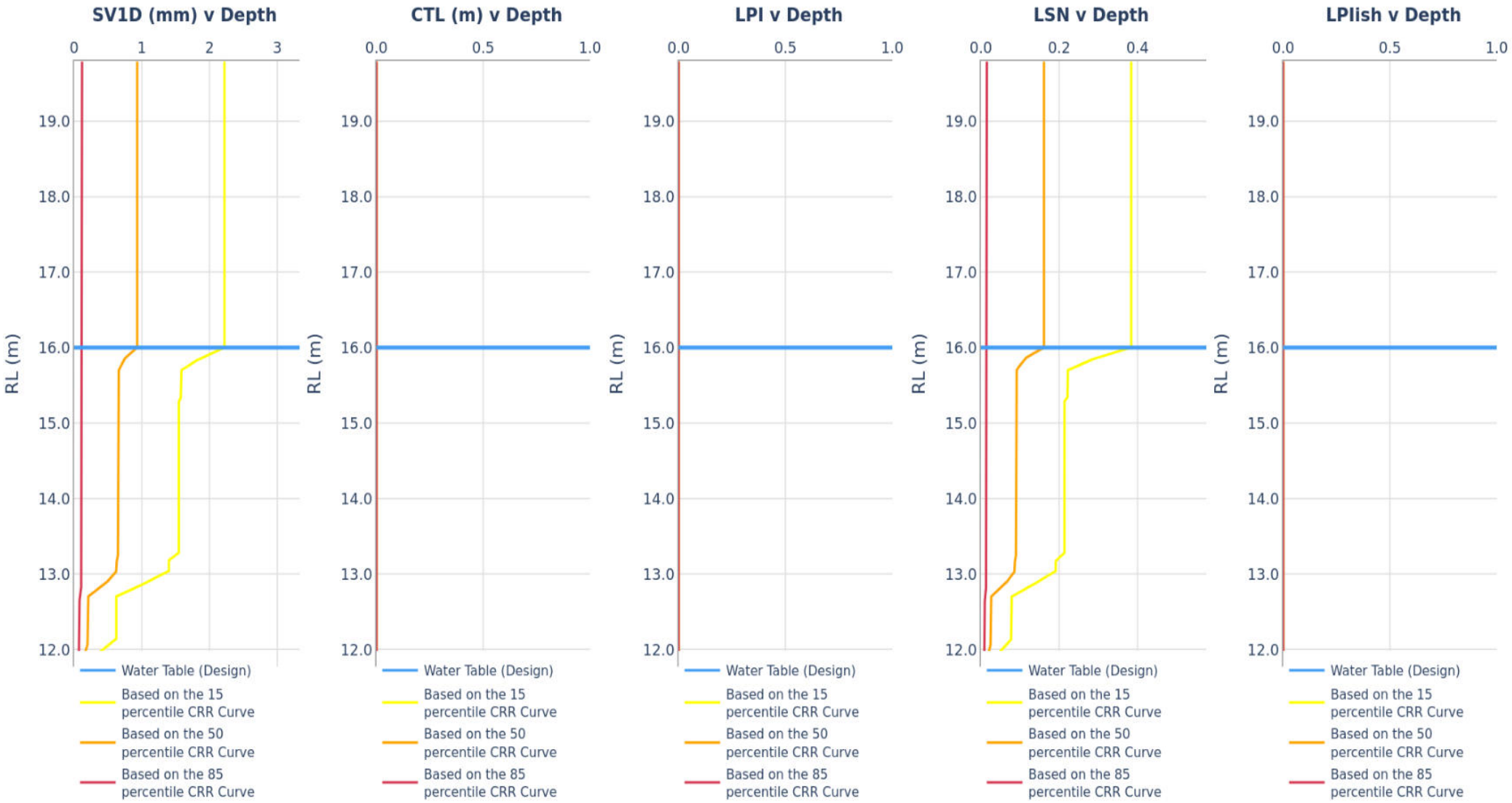


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

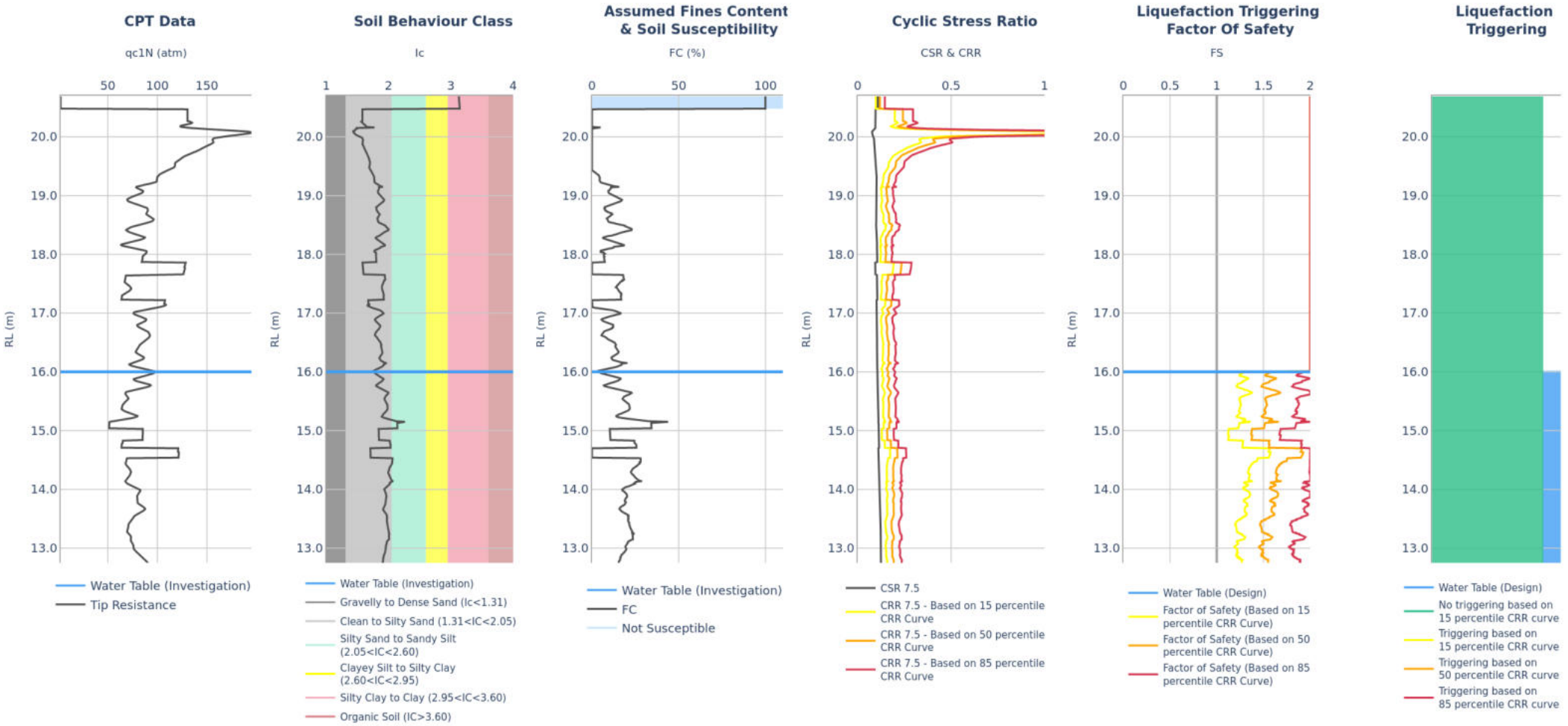
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT114	CPT_TT280740	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT115	CPT_TT280741	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

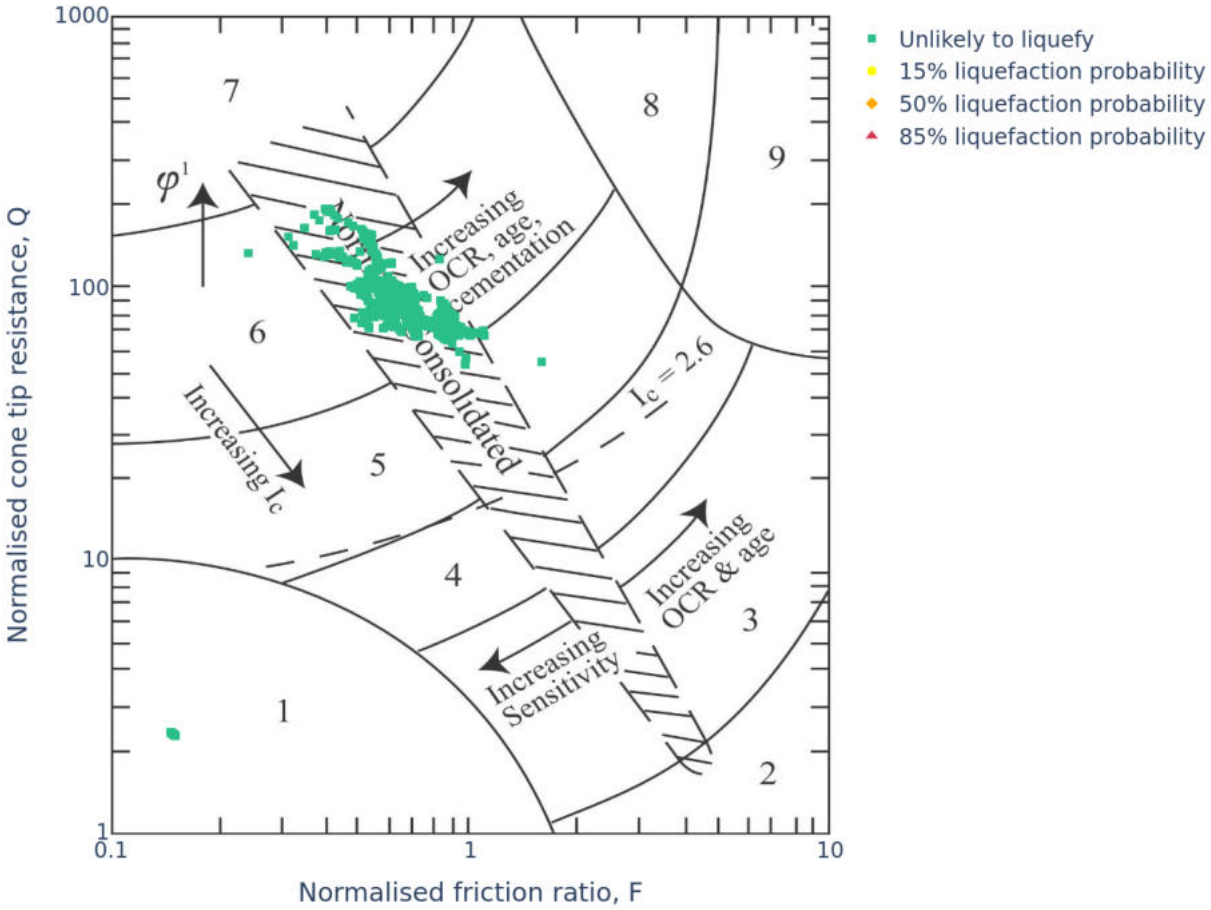
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	10	0.0	0	1	8.0	0
50%	5	0.0	0	0	8.0	0
85%	1	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

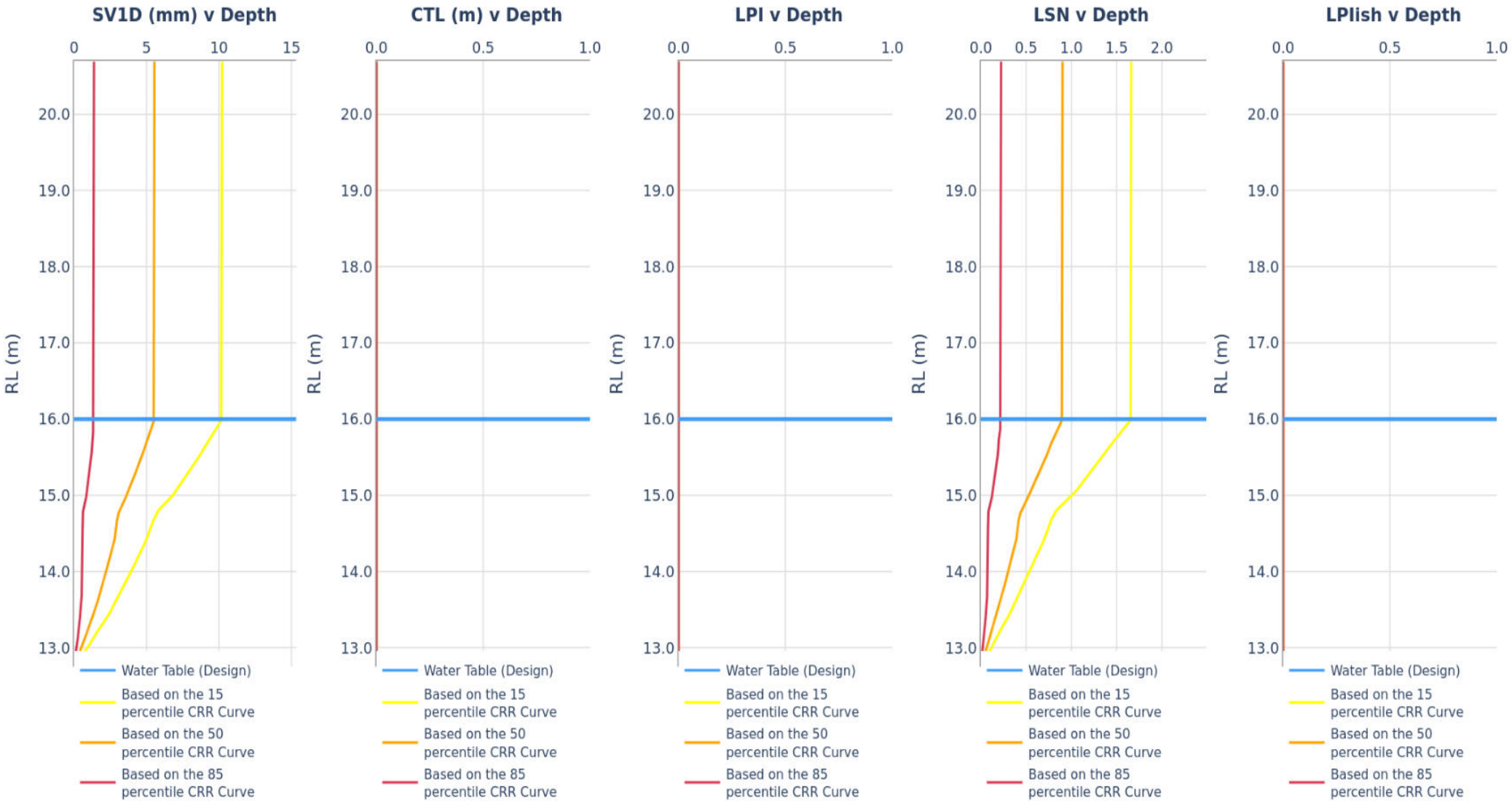


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

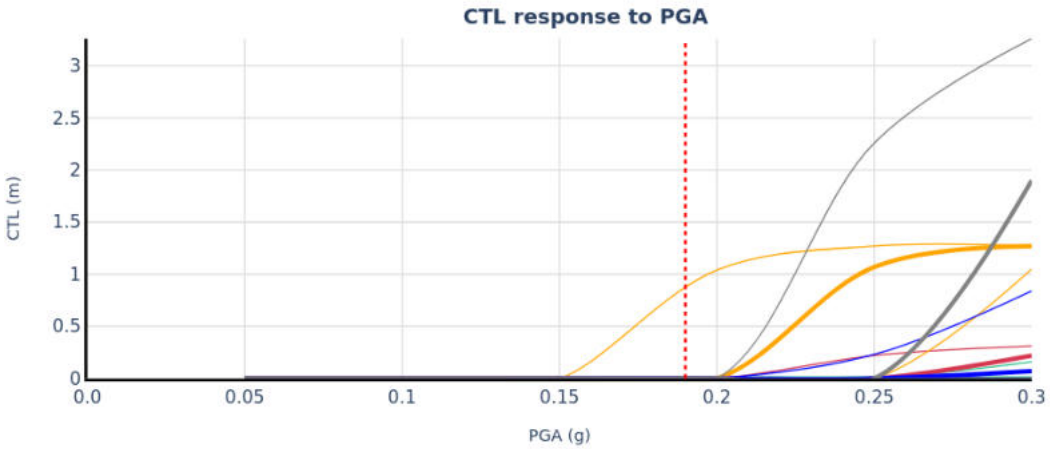
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

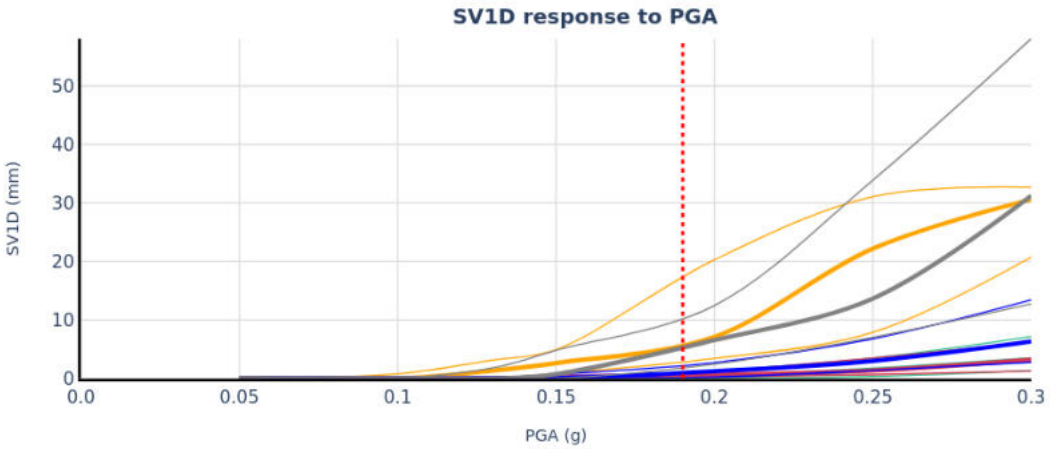


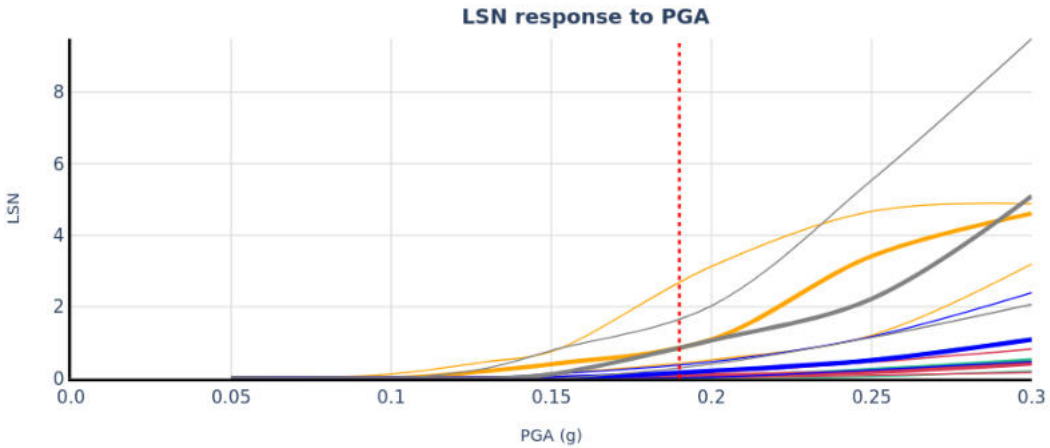
Input

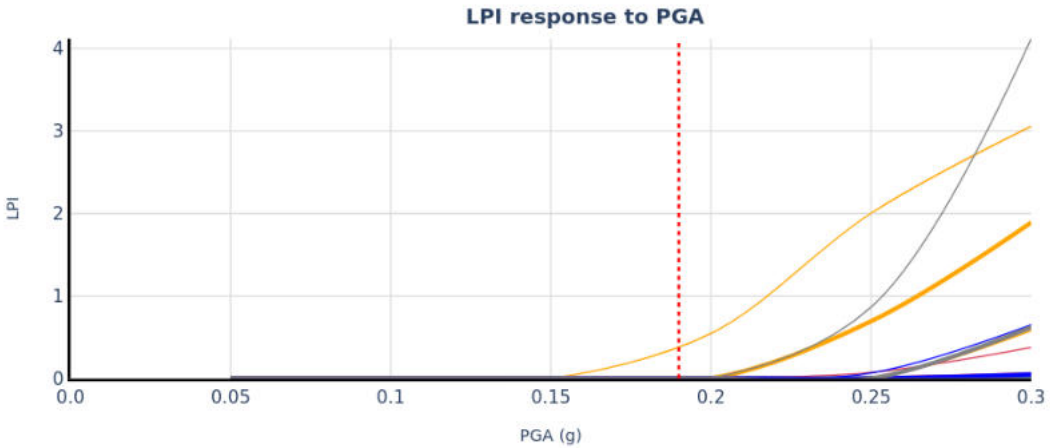
Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT115	CPT_TT280741	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT







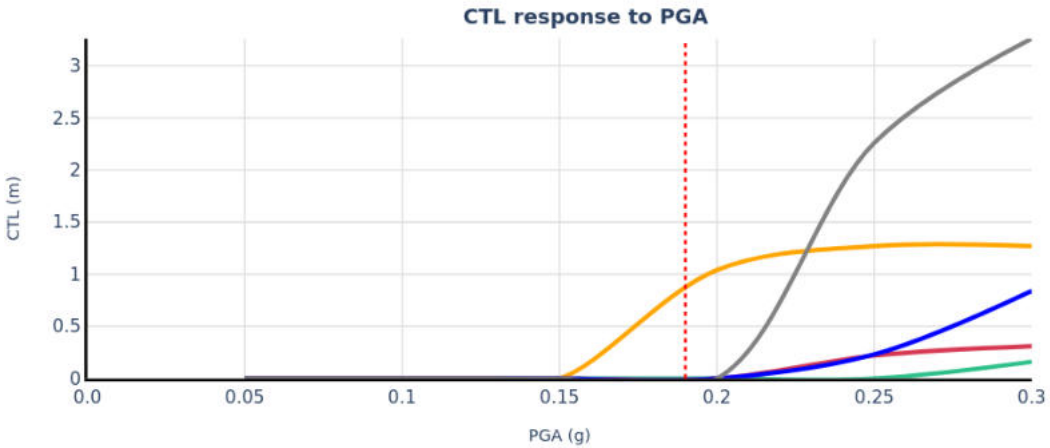


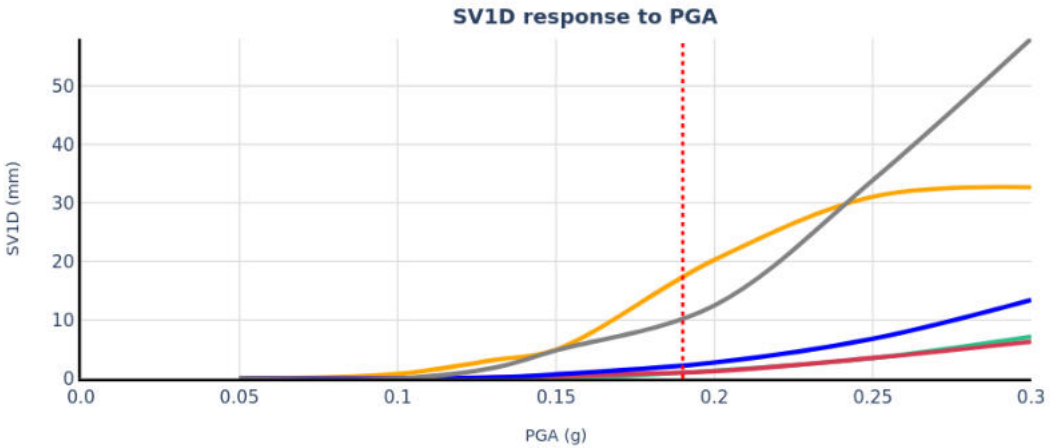
Input

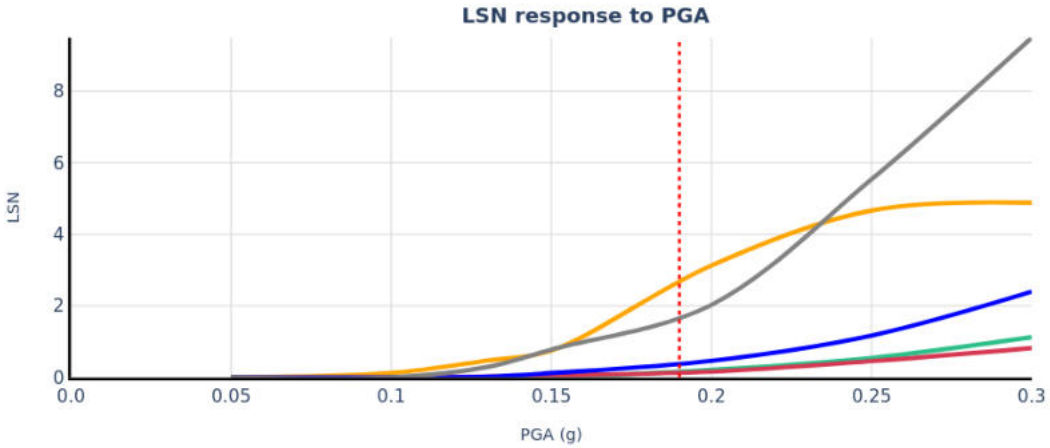
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT111	CPT_TT280737	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT112	CPT_TT280738	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT113	CPT_TT280739	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT114	CPT_TT280740	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT115	CPT_TT280741	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

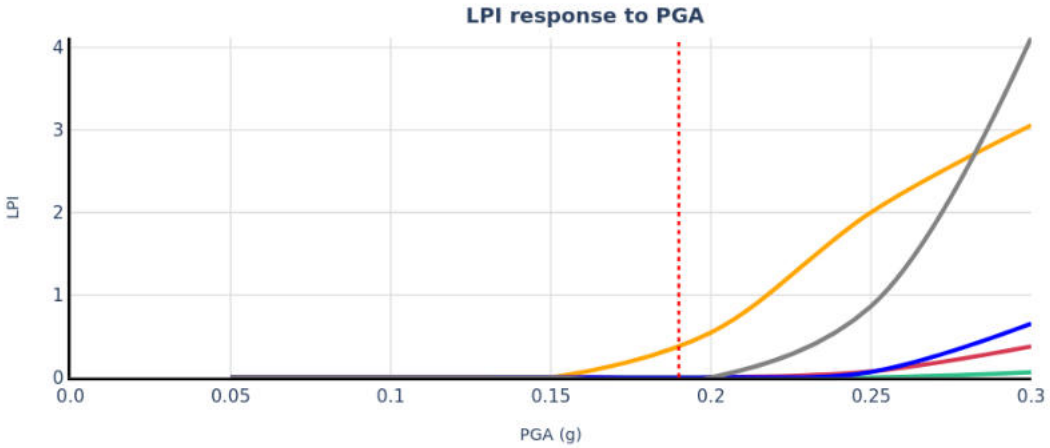
Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT BASED ON 15 PERCENTILE CRR CURVE









Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT111	CPT_TT280737	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT112	CPT_TT280738	08/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT113	CPT_TT280739	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT114	CPT_TT280740	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT115	CPT_TT280741	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280737	TTGD 280738	TTGD 280739
CPT Name	CPT111	CPT112	CPT113
Run Description	CPT111	CPT112	CPT113
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	5.7	4.7	4.5
Depth to groundwater for design (m)	5.7	4.7	4.5
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	7.97	8.0	7.9
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	10	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280737	CPT111	0.0	0.0	0.0
TTGD 280737	CPT111	0.0	10.0	2.6
TTGD 280738	CPT112	0.0	0.0	0.0
TTGD 280738	CPT112	0.0	10.0	2.6
TTGD 280739	CPT113	0.0	0.0	0.0
TTGD 280739	CPT113	0.0	10.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280737	CPT111	0.0	10.0	0.0 CFC
TTGD 280738	CPT112	0.0	10.0	0.0 CFC
TTGD 280739	CPT113	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280737	CPT111	0.0	0.0001	18.0
TTGD 280737	CPT111	0.0001	8.12	18.0
TTGD 280738	CPT112	0.0	0.0001	18.0
TTGD 280738	CPT112	0.0001	8.12	18.0
TTGD 280739	CPT113	0.0	0.0001	18.0
TTGD 280739	CPT113	0.0001	8.12	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280740	TTGD 280741
CPT Name	CPT114	CPT115
Run Description	CPT114	CPT115
EQ PGA (g)	0.19	0.19
EQ Magnitude	6.5	6.5
Depth to groundwater at time of Investigation (m)	3.8	4.7
Depth to groundwater for design (m)	3.8	4.7
Pre-drill depth (m)	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002
Total depth of CPT (m)	8.03	7.95
Minimum depth of analysis (m)	0	0
Maximum depth of analysis (m)	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A
Surcharge load (kPa)	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280740	CPT114	0.0	0.0	0.0
TTGD 280740	CPT114	0.0	10.0	2.6
TTGD 280741	CPT115	0.0	0.0	0.0
TTGD 280741	CPT115	0.0	10.0	2.6

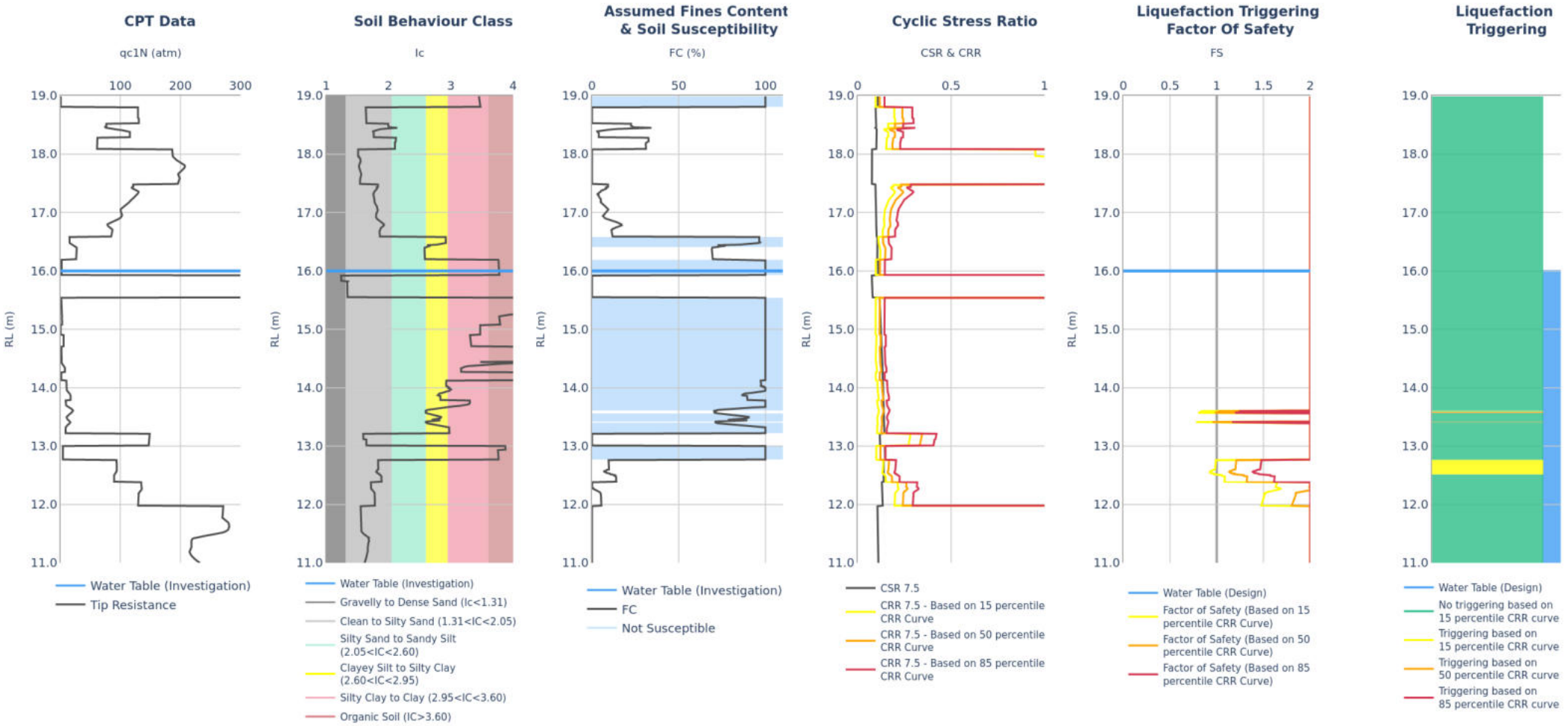
Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280740	CPT114	0.0	10.0	0.0 CFC
TTGD 280741	CPT115	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280740	CPT114	0.0	0.0001	18.0
TTGD 280740	CPT114	0.0001	8.12	18.0
TTGD 280741	CPT115	0.0	0.0001	18.0
TTGD 280741	CPT115	0.0001	8.12	18.0

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT116	CPT_TT280742	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

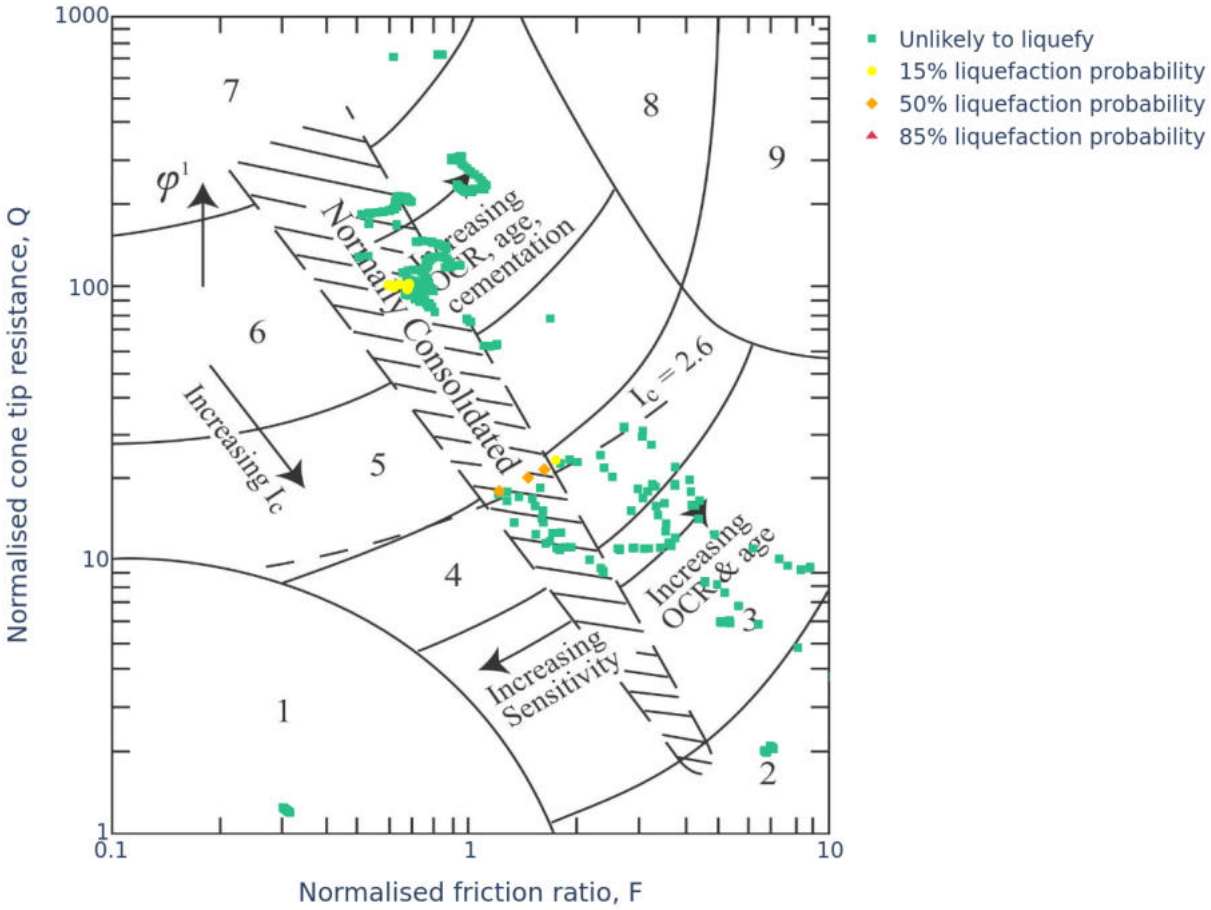
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	5	0.3	0	0	6.3	0
50%	2	0.0	0	0	8.0	0
85%	0	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT116 to CPT 120 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 1/16*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

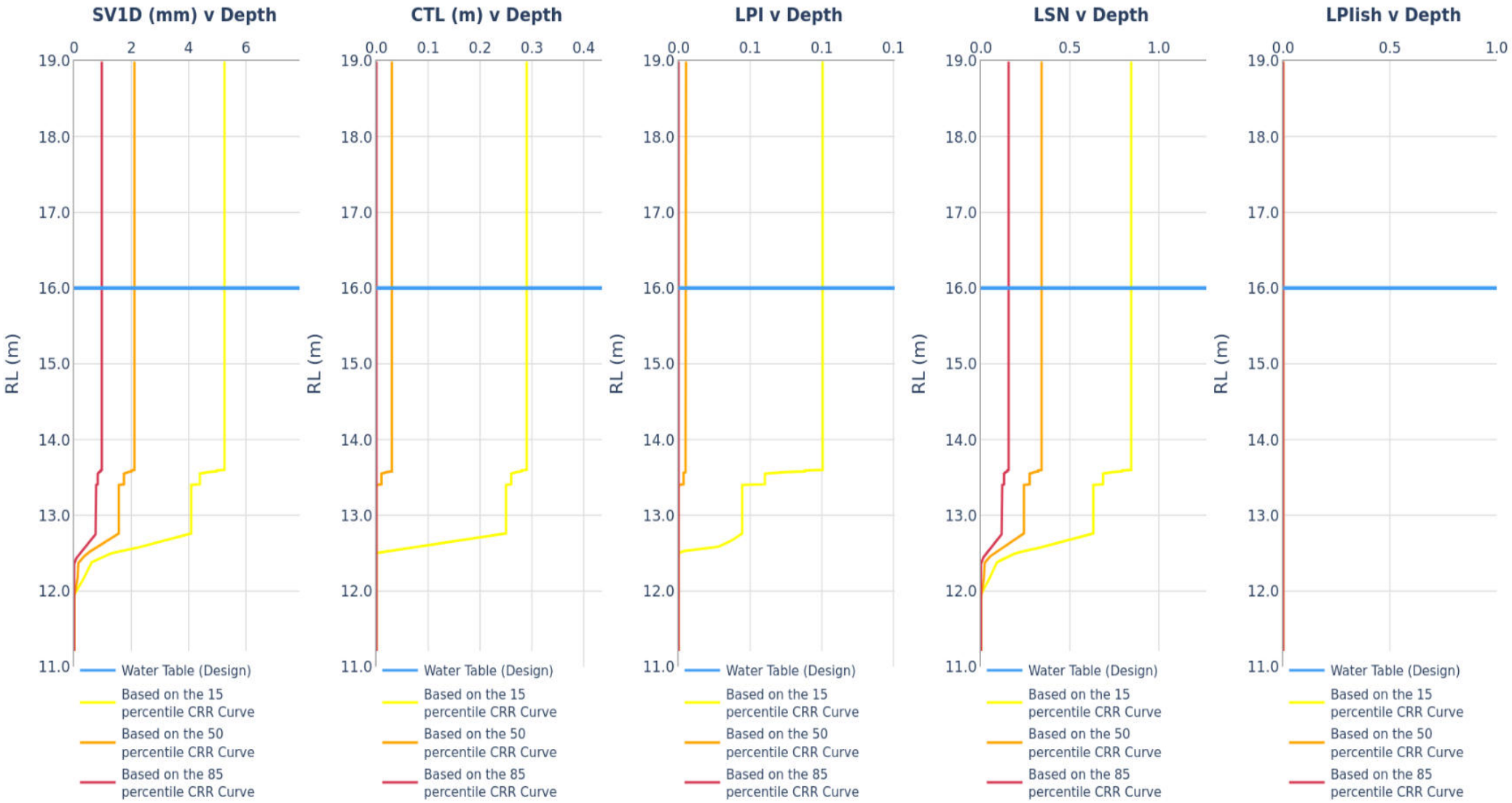


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

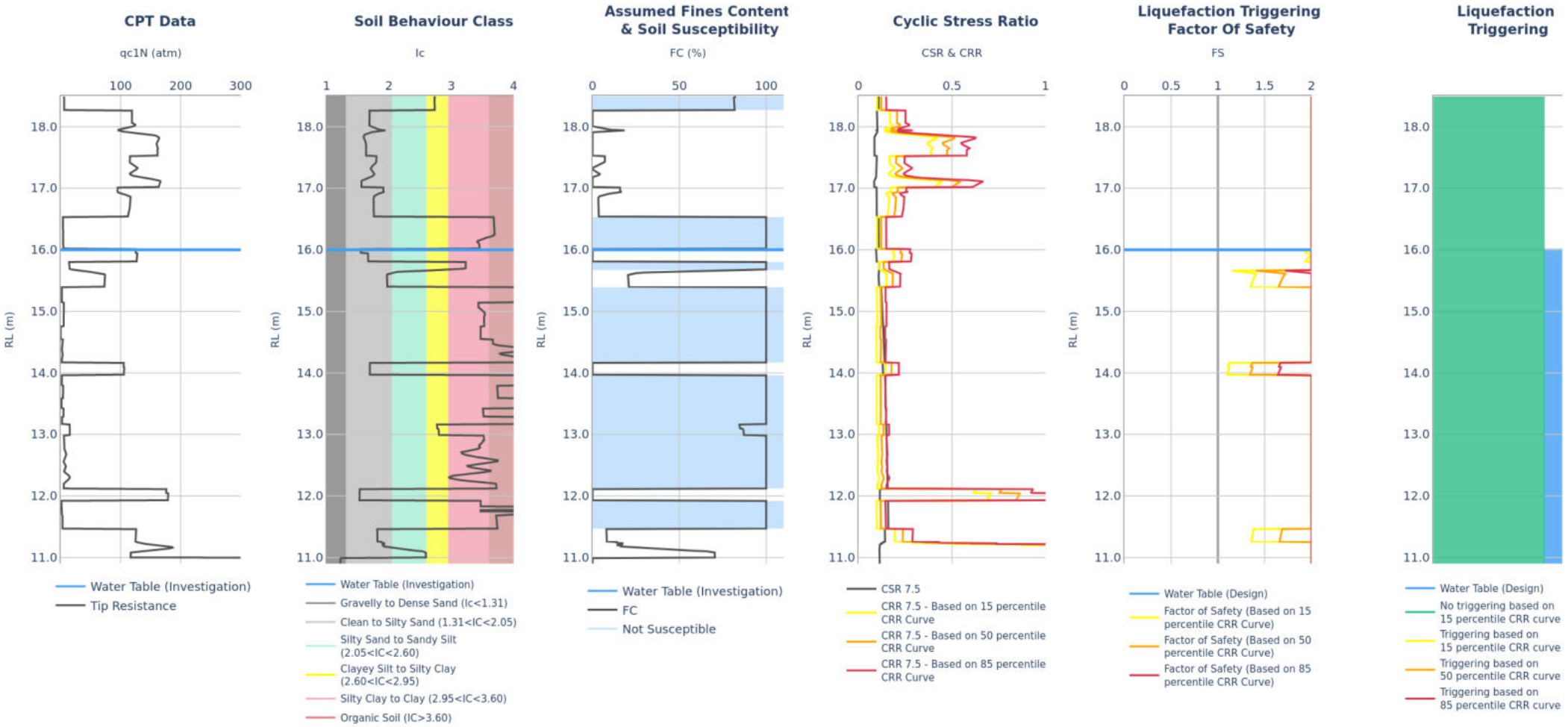
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT116	CPT_TT280742	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT117	CPT_TT280743	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

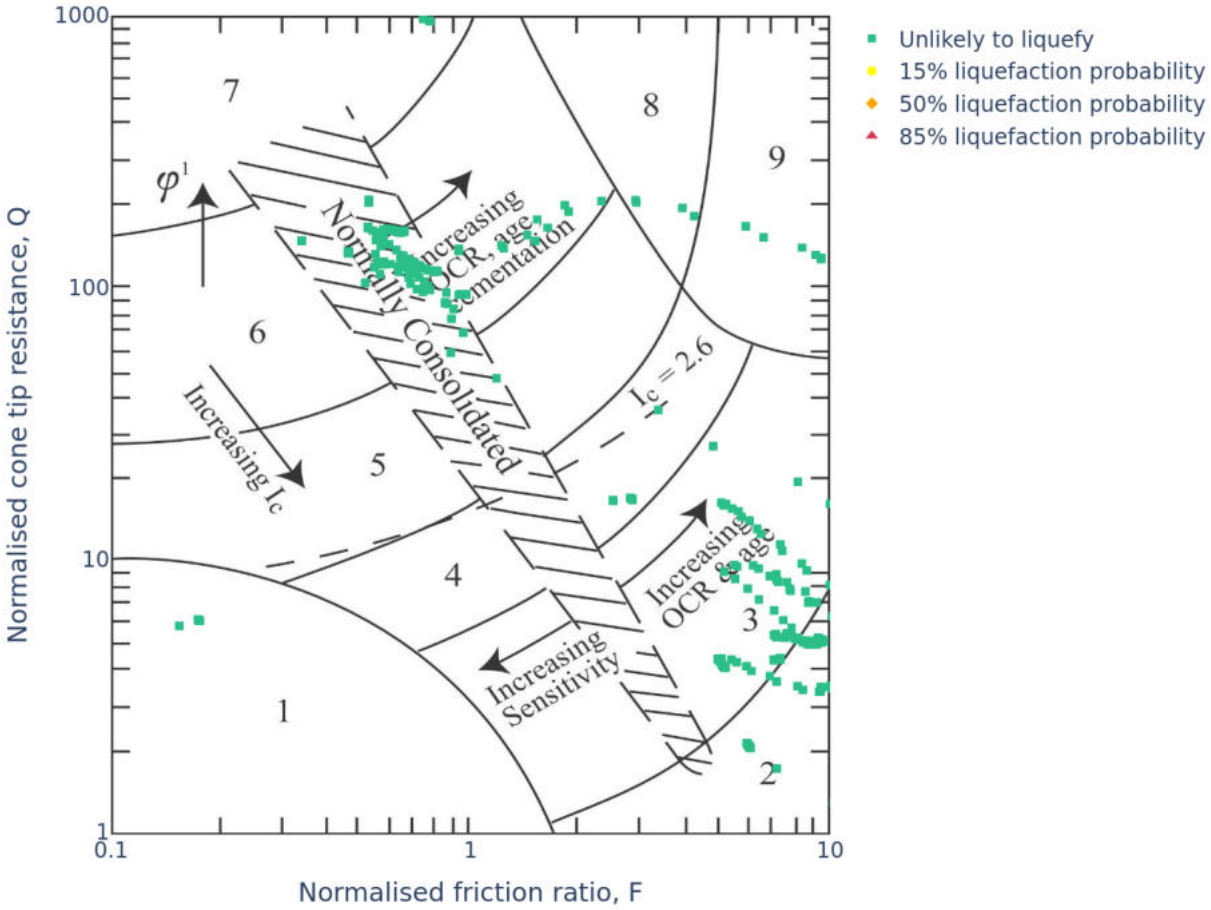
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	2	0.0	0	0	7.6	0
50%	1	0.0	0	0	7.6	0
85%	0	0.0	0	0	7.6	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

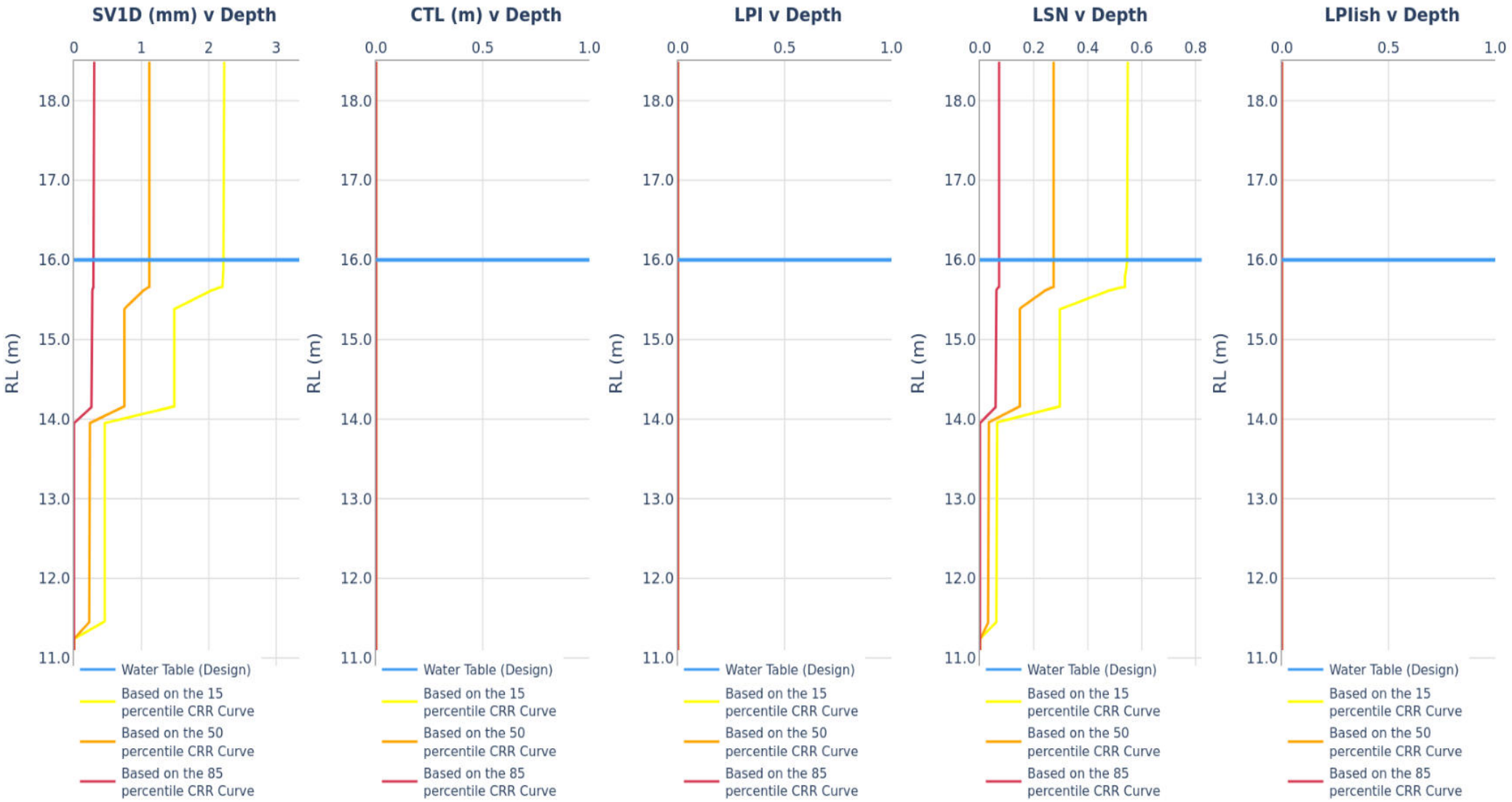


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

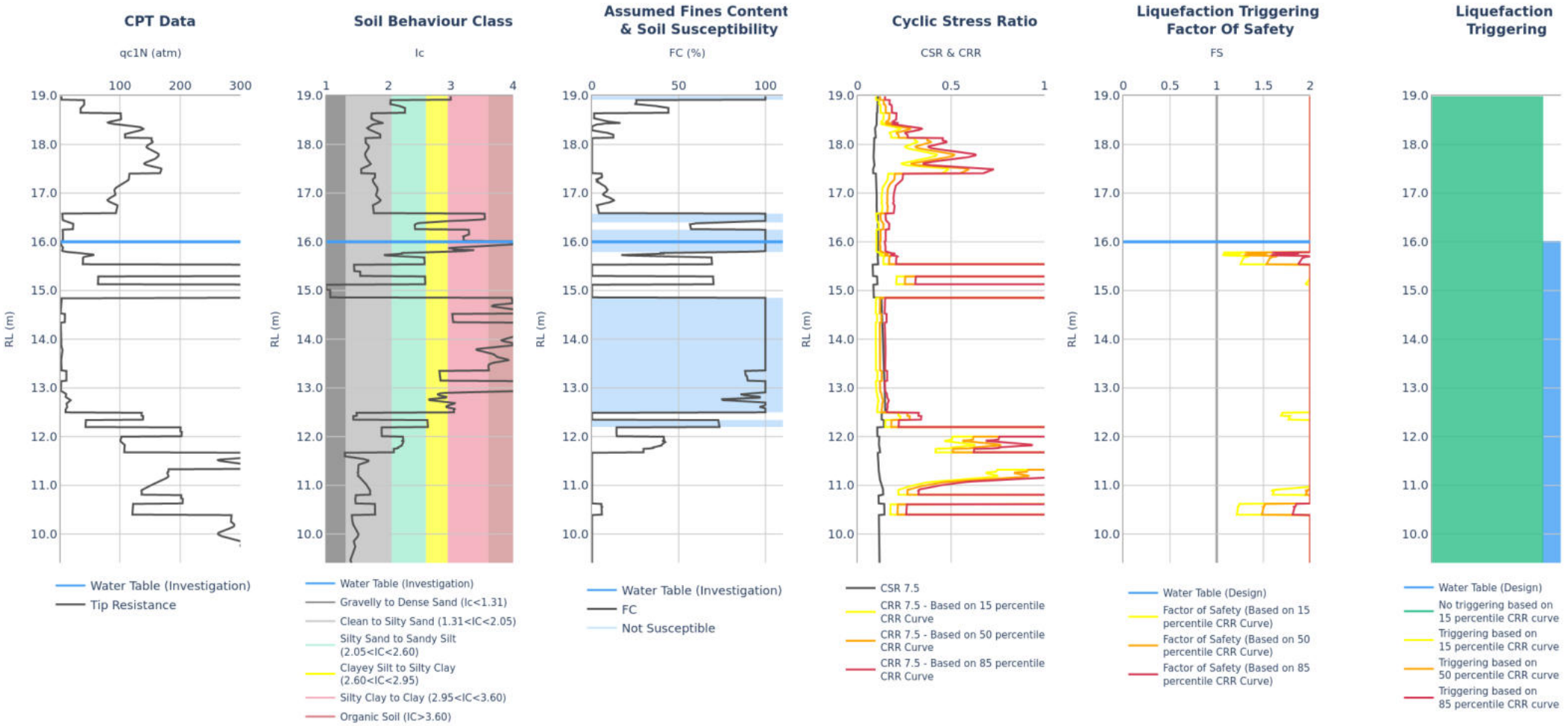
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT117	CPT_TT280743	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT118	CPT_TT280744	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

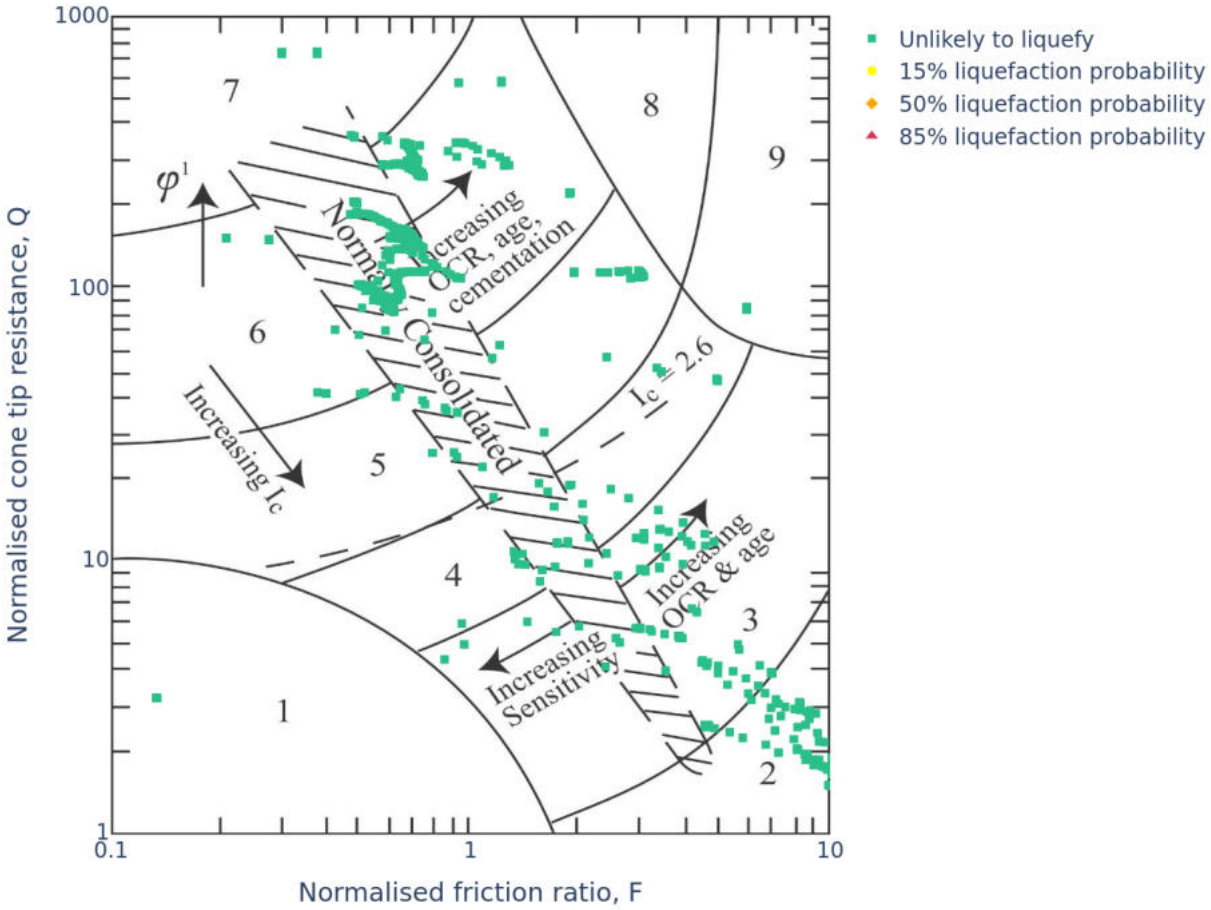
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	2	0.0	0	0	9.6	0
50%	0	0.0	0	0	9.6	0
85%	0	0.0	0	0	9.6	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

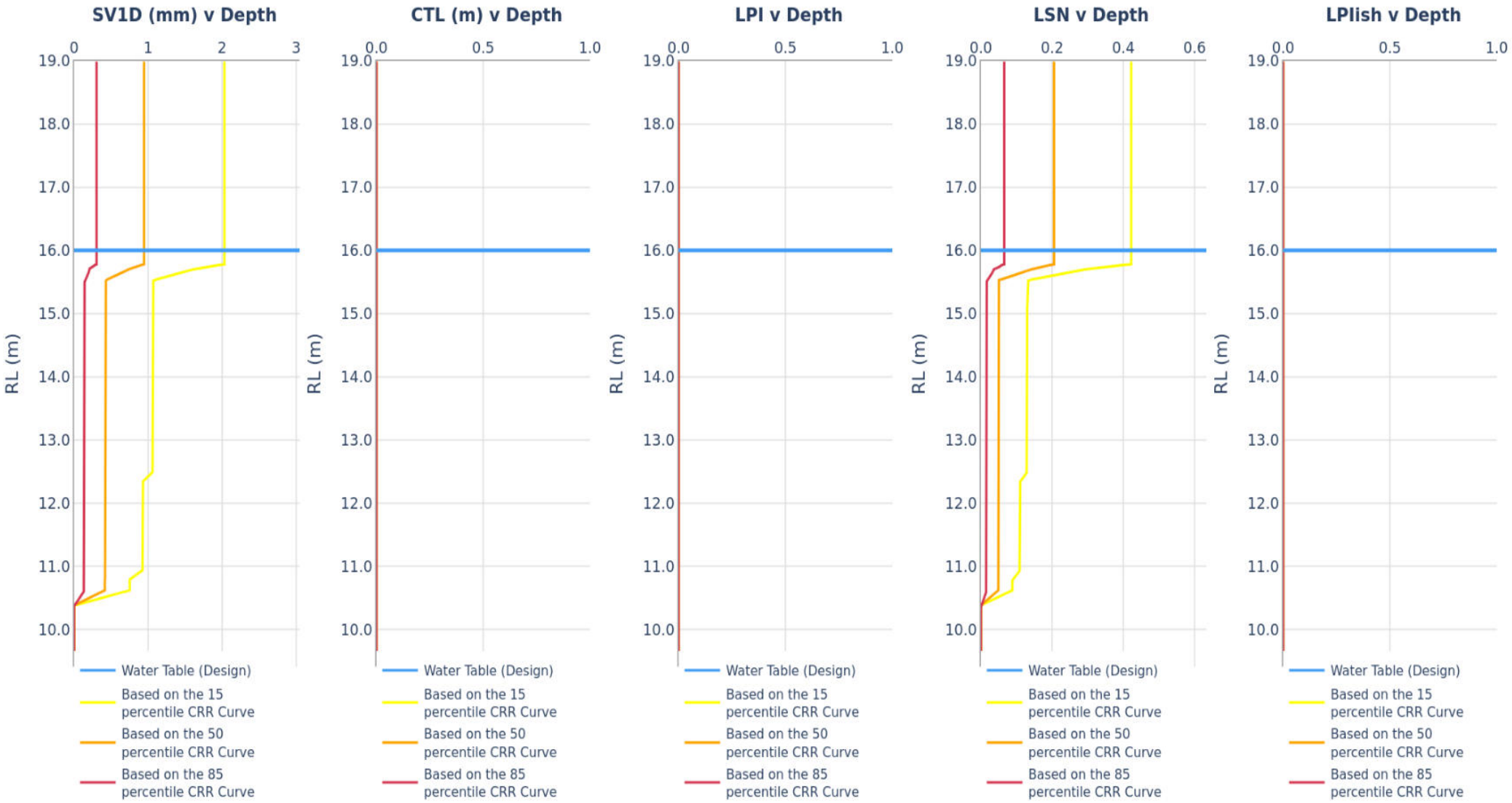


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

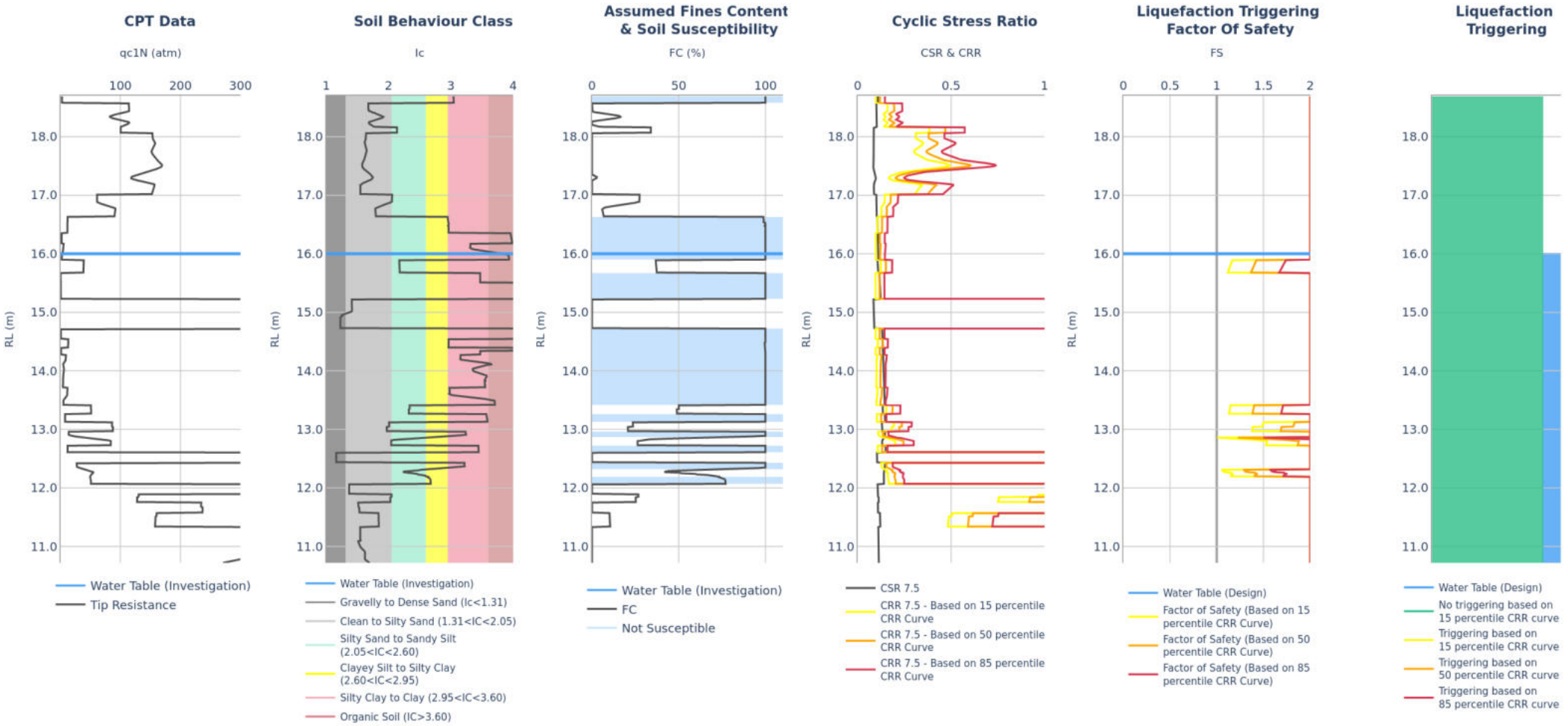
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT118	CPT_TT280744	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT120	CPT_TT280745	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

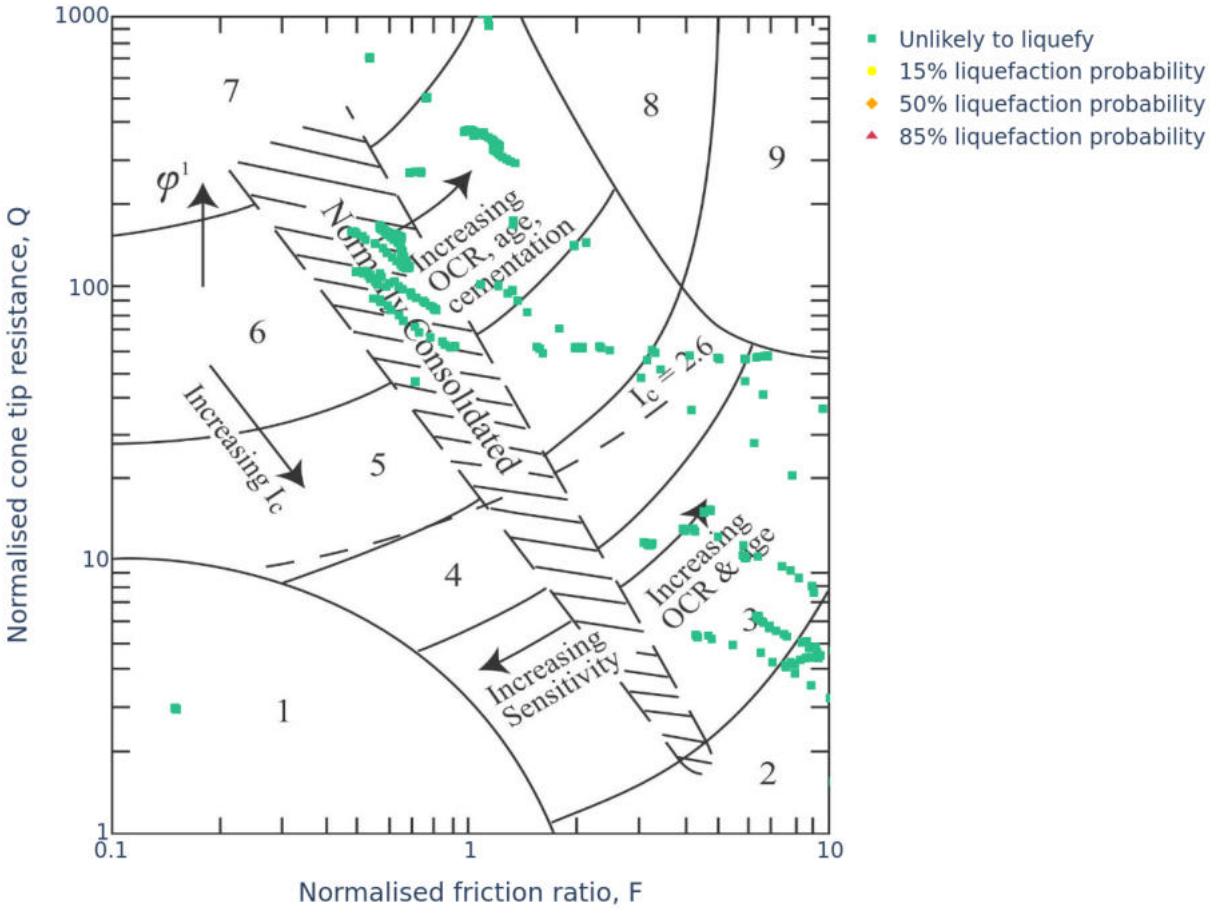
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	3	0.0	0	0	8.0	0
50%	1	0.0	0	0	8.0	0
85%	0	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT



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2. Organic soils - peats
3. Clays - silty clay to clay
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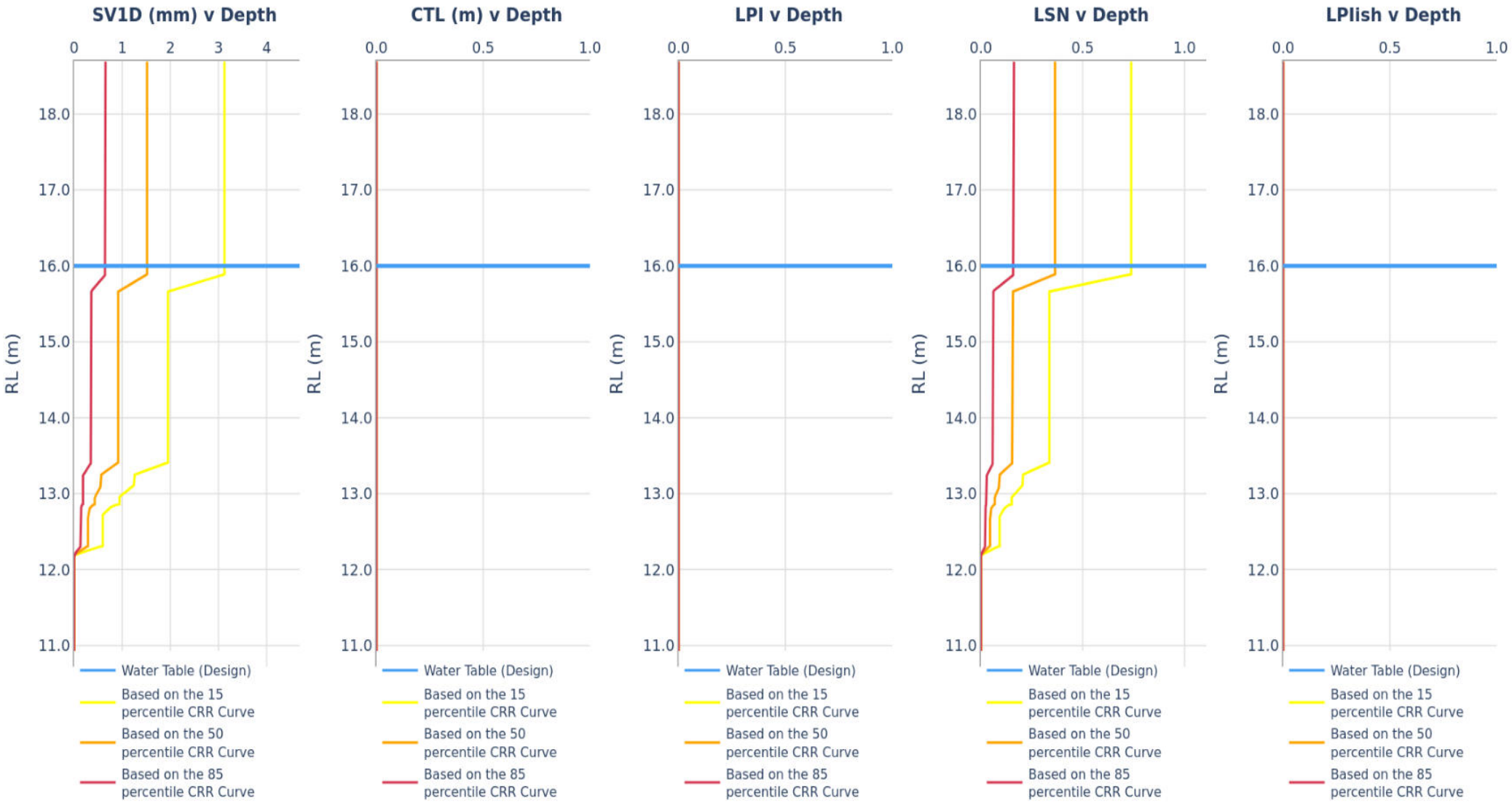
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

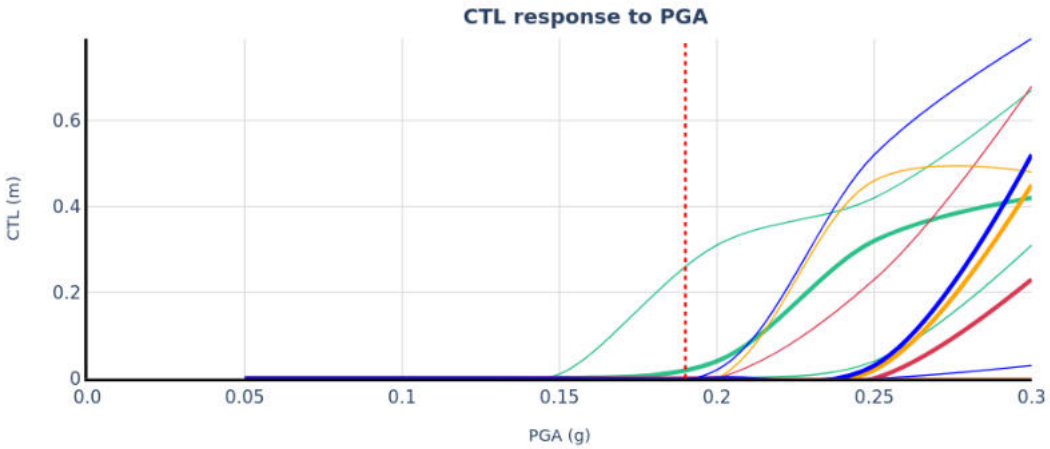
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

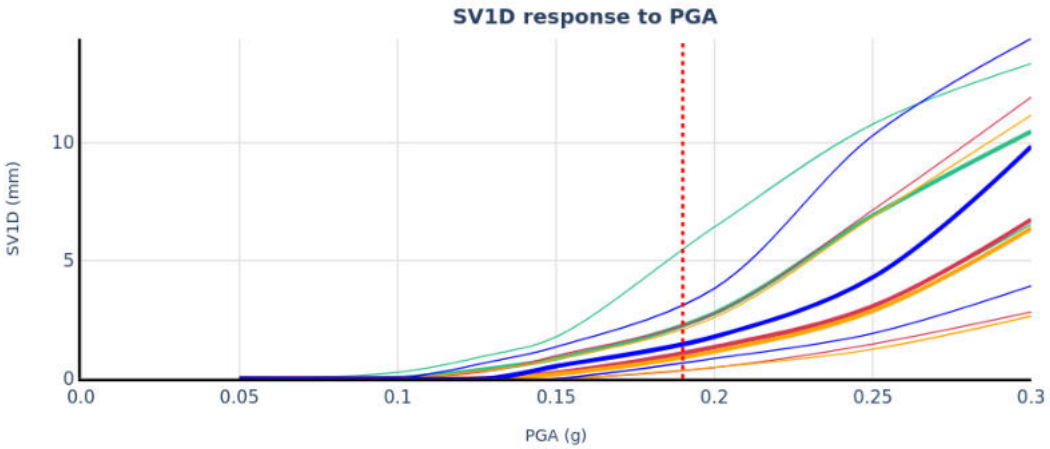


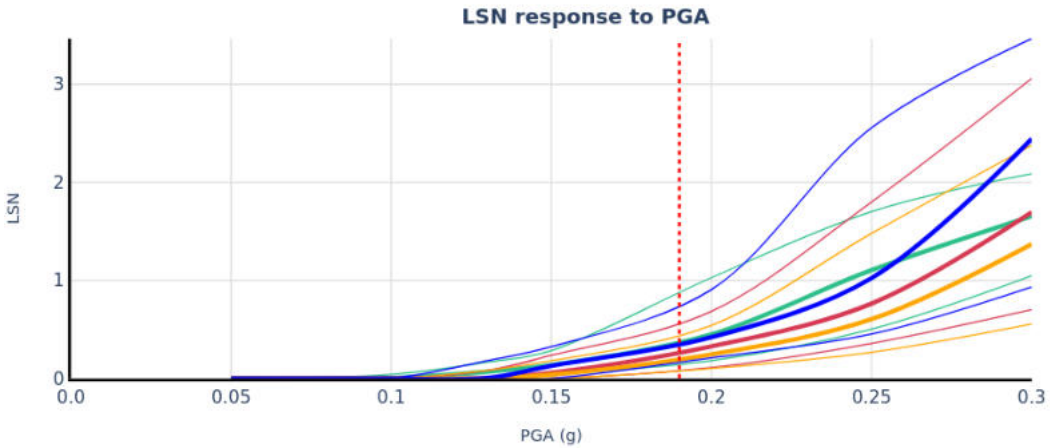
Input

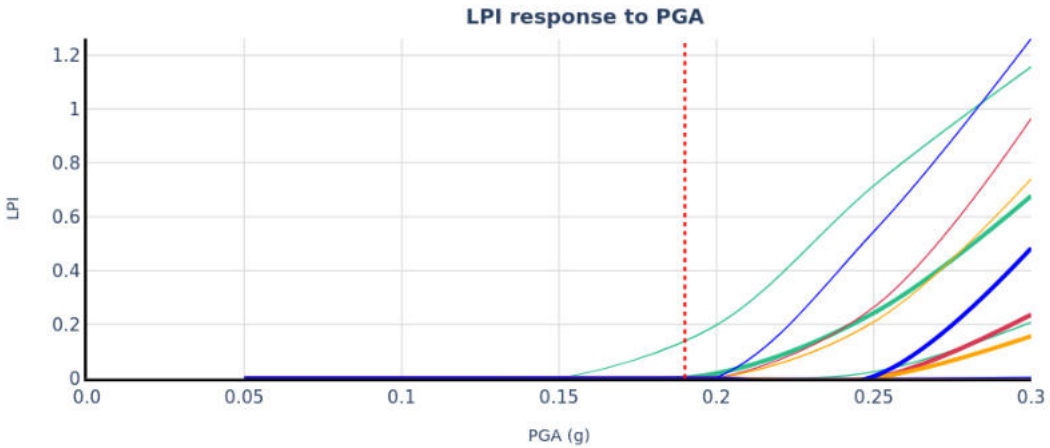
Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT120	CPT_TT280745	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT







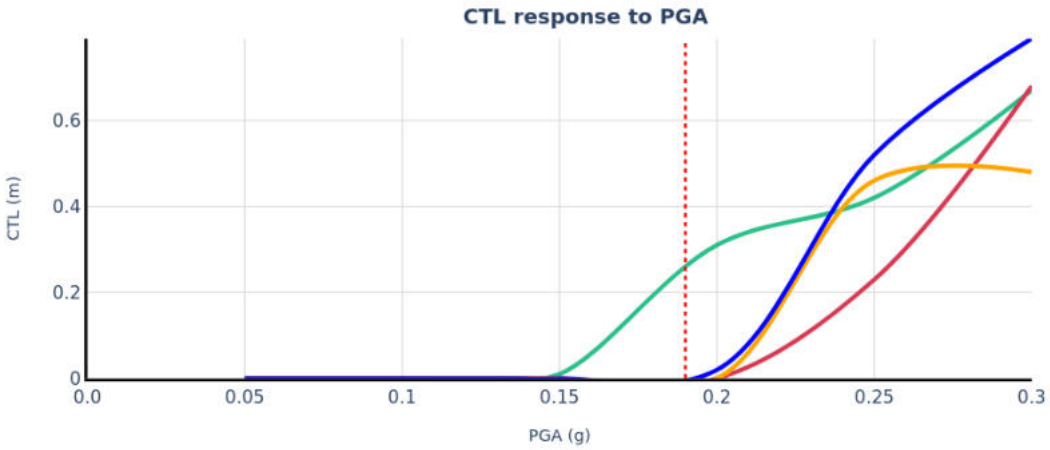


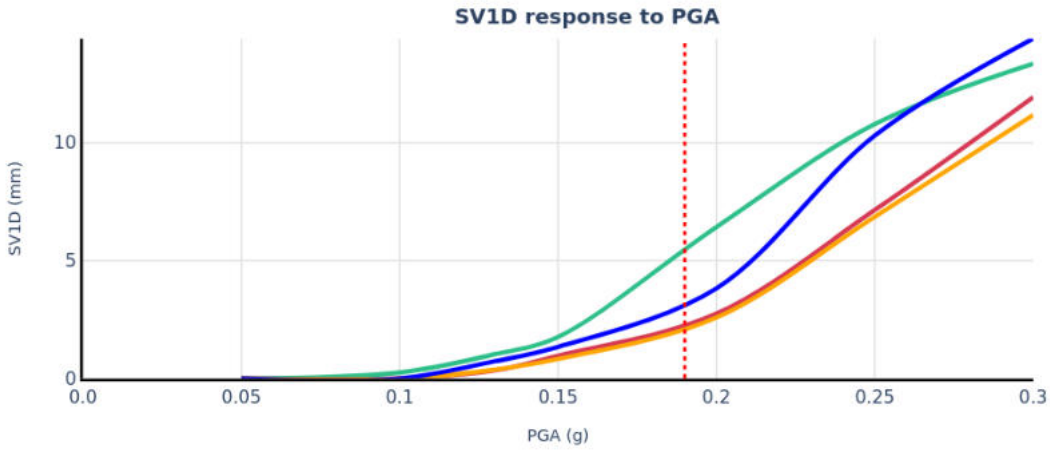
Input

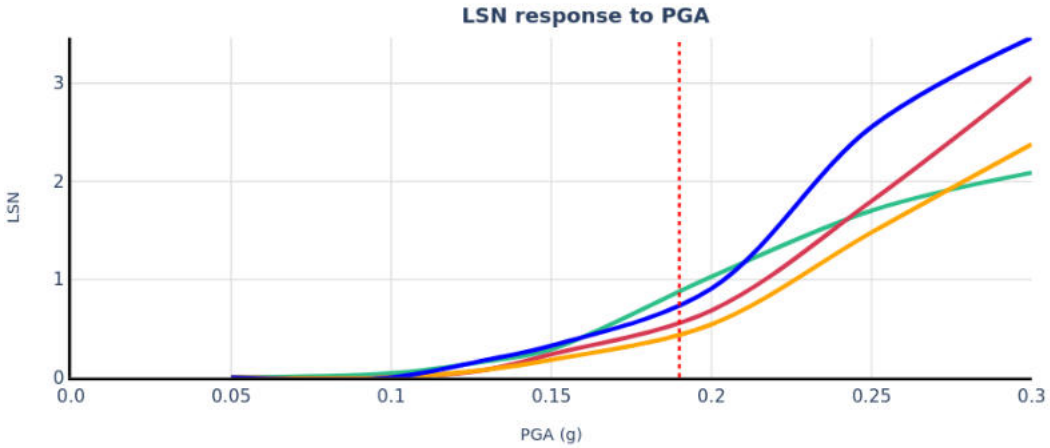
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT116	CPT_TT280742	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT117	CPT_TT280743	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT118	CPT_TT280744	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT120	CPT_TT280745	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

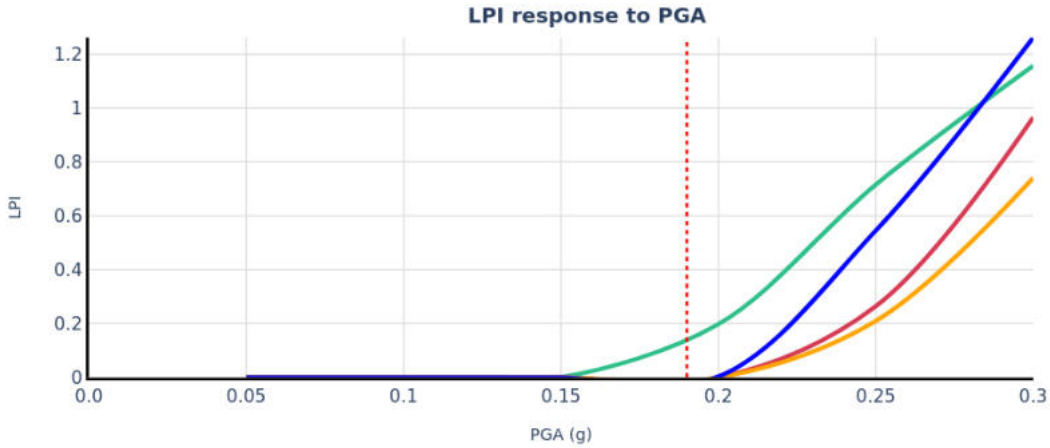
Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT BASED ON 15 PERCENTILE CRR CURVE









Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT116	CPT_TT280742	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT117	CPT_TT280743	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT118	CPT_TT280744	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT120	CPT_TT280745	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280742	TTGD 280743	TTGD 280744
CPT Name	CPT116	CPT117	CPT118
Run Description	CPT116	CPT117	CPT118
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	3.0	2.5	3.0
Depth to groundwater for design (m)	3.0	2.5	3.0
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	8.0	7.6	9.59
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	10	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280742	CPT116	0.0	0.0	0.0
TTGD 280742	CPT116	0.0	10.0	2.6
TTGD 280743	CPT117	0.0	0.0	0.0
TTGD 280743	CPT117	0.0	10.0	2.6
TTGD 280744	CPT118	0.0	0.0	0.0
TTGD 280744	CPT118	0.0	10.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280742	CPT116	0.0	10.0	0.0 CFC
TTGD 280743	CPT117	0.0	10.0	0.0 CFC
TTGD 280744	CPT118	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280742	CPT116	0.0	0.0001	18.0
TTGD 280742	CPT116	0.0001	8.12	18.0
TTGD 280743	CPT117	0.0	0.0001	18.0
TTGD 280743	CPT117	0.0001	8.12	18.0
TTGD 280744	CPT118	0.0	0.0001	18.0
TTGD 280744	CPT118	0.0001	9.59	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280745
CPT Name	CPT120
Run Description	CPT120
EQ PGA (g)	0.19
EQ Magnitude	6.5
Depth to groundwater at time of Investigation (m)	2.7
Depth to groundwater for design (m)	2.7
Pre-drill depth (m)	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)
Settlement method	ZRB-2002
Total depth of CPT (m)	7.98
Minimum depth of analysis (m)	0
Maximum depth of analysis (m)	10
Inverse filtering applied?	Yes (10 cm^2)
Cut/Fill Height	N/A
Surcharge load (kPa)	N/A
Fill unit weight (kN/m^3)	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280745	CPT120	0.0	0.0	0.0
TTGD 280745	CPT120	0.0	10.0	2.6

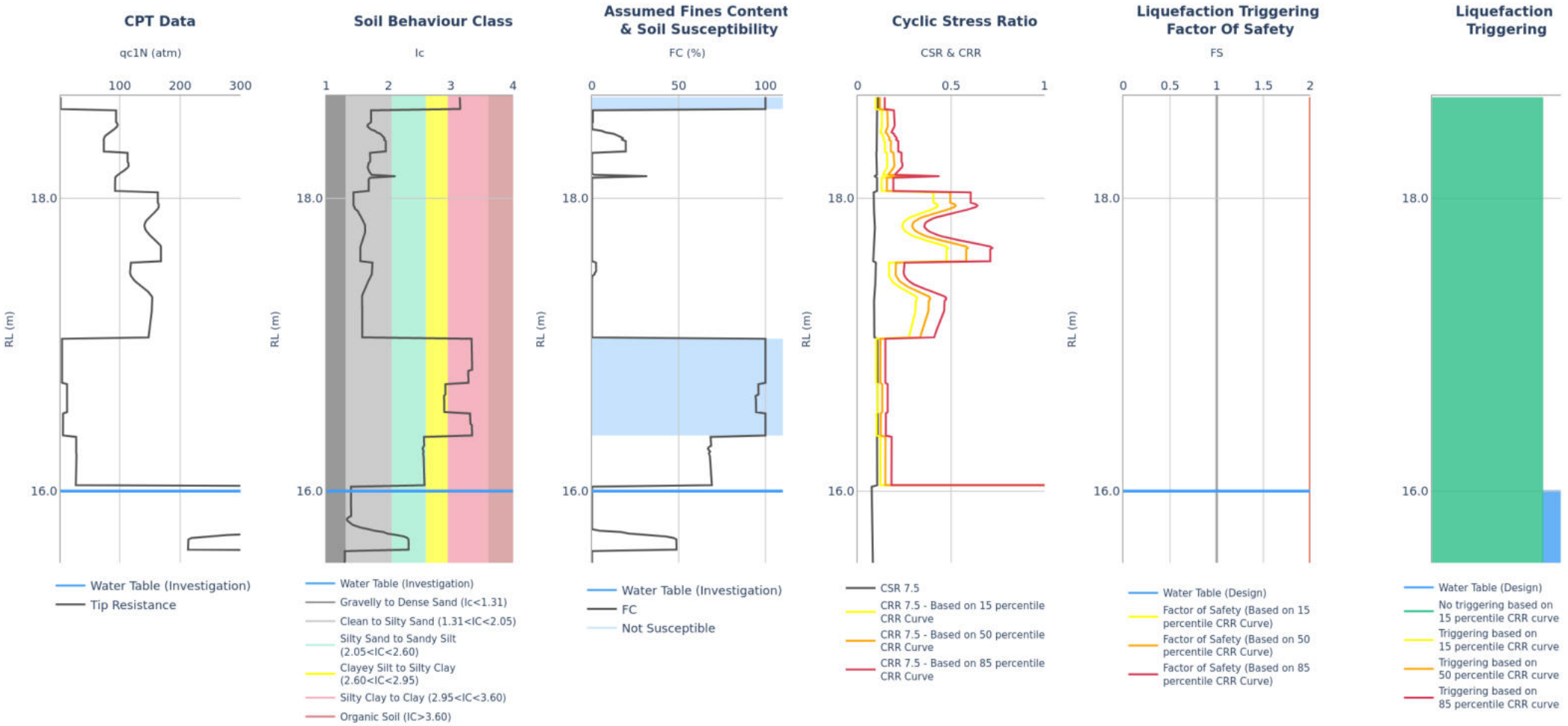
Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280745	CPT120	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280745	CPT120	0.0	0.0001	18.0
TTGD 280745	CPT120	0.0001	8.12	18.0

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT121	CPT_TT280746	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

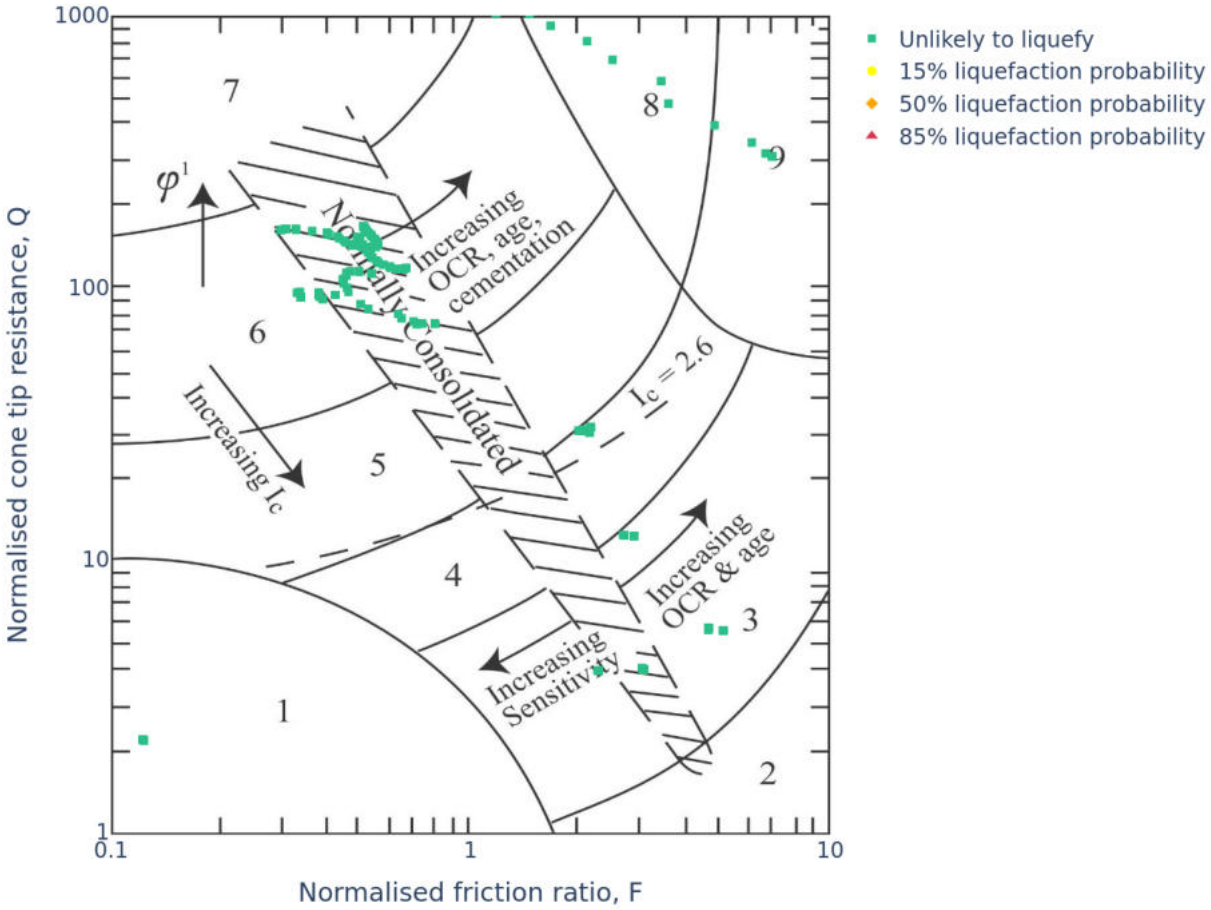
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	0	0.0	0	0	3.2	0
50%	0	0.0	0	0	3.2	0
85%	0	0.0	0	0	3.2	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT121 to CPT125 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 1/19*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

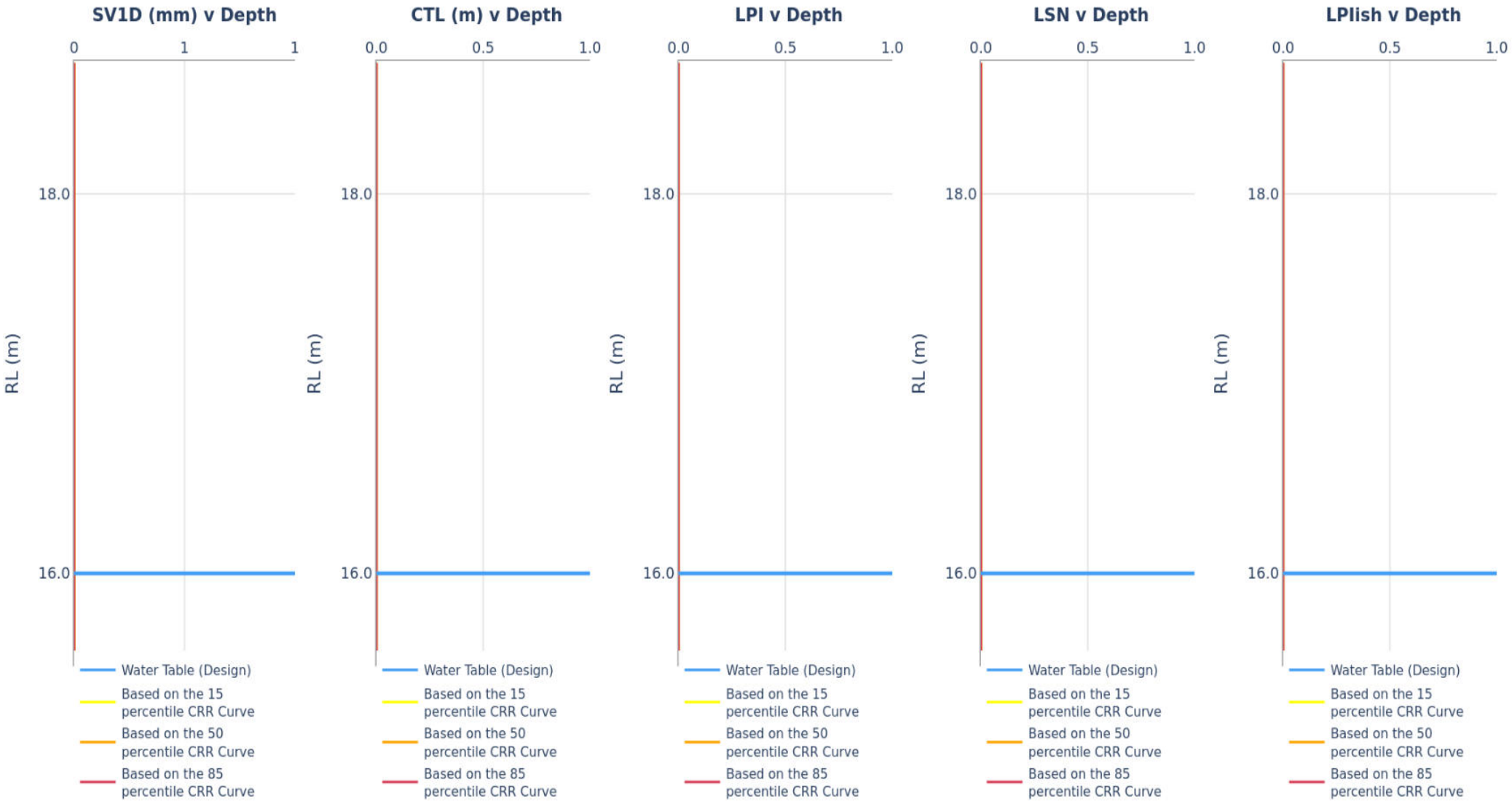


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

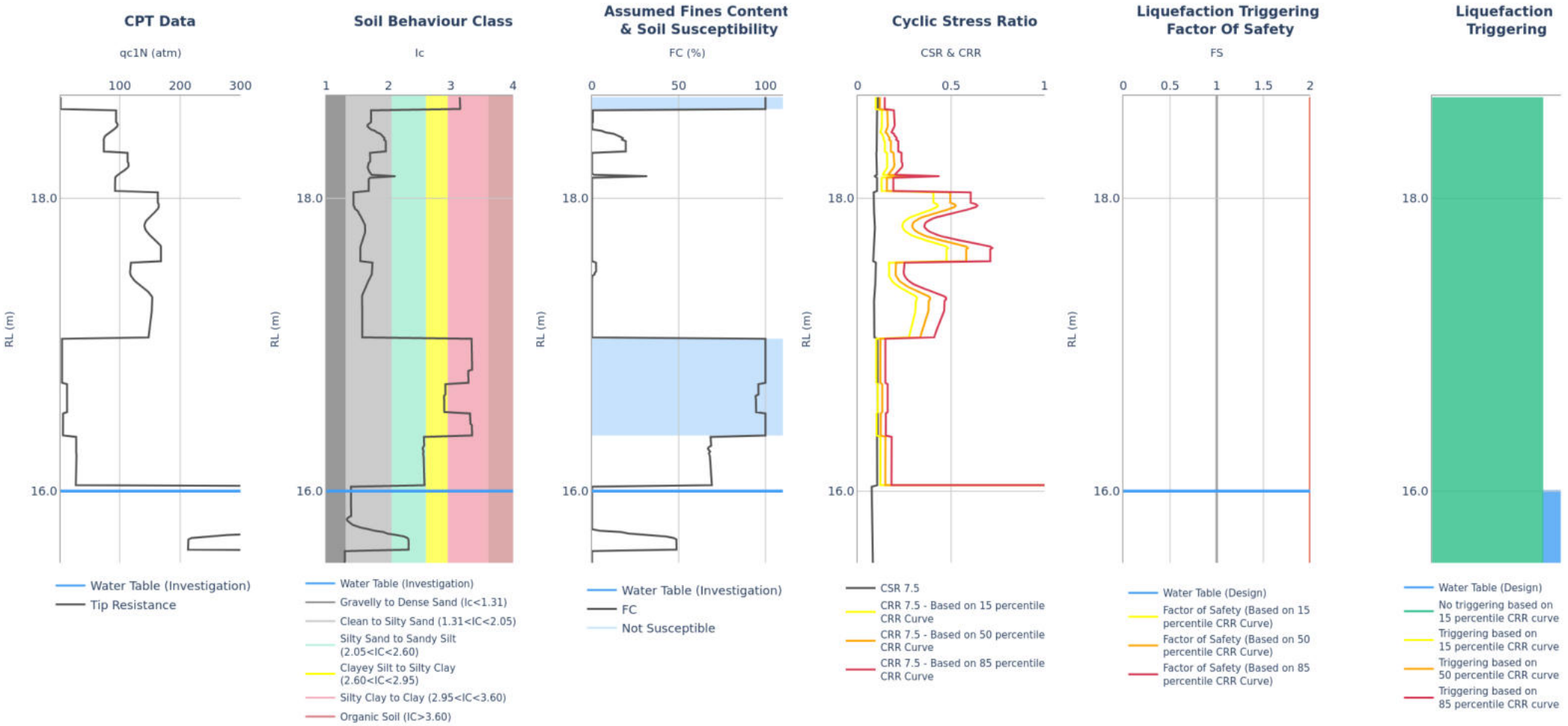
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT121	CPT_TT280746	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT122	CPT_TT280747	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

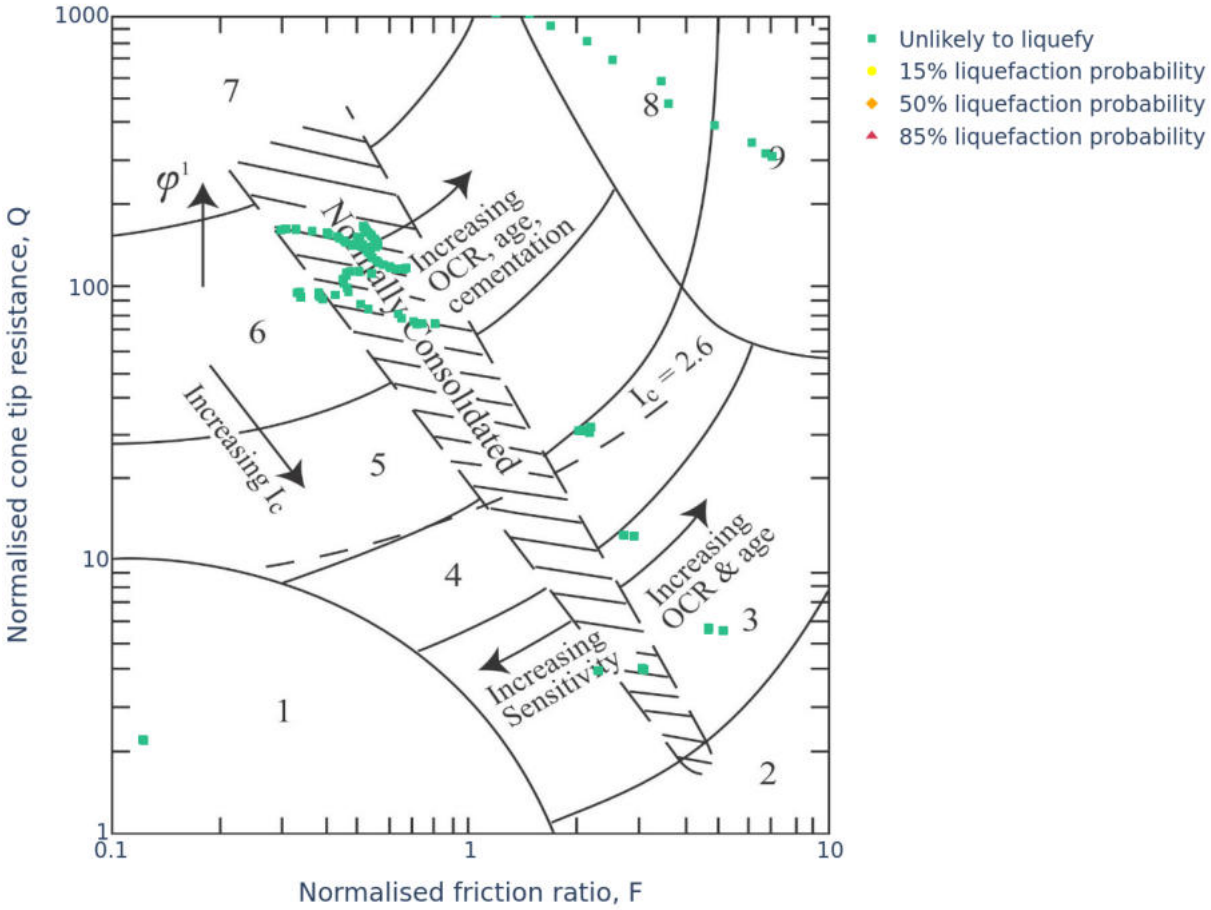
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	0	0.0	0	0	3.2	0
50%	0	0.0	0	0	3.2	0
85%	0	0.0	0	0	3.2	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT121 to CPT125 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 4/19*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

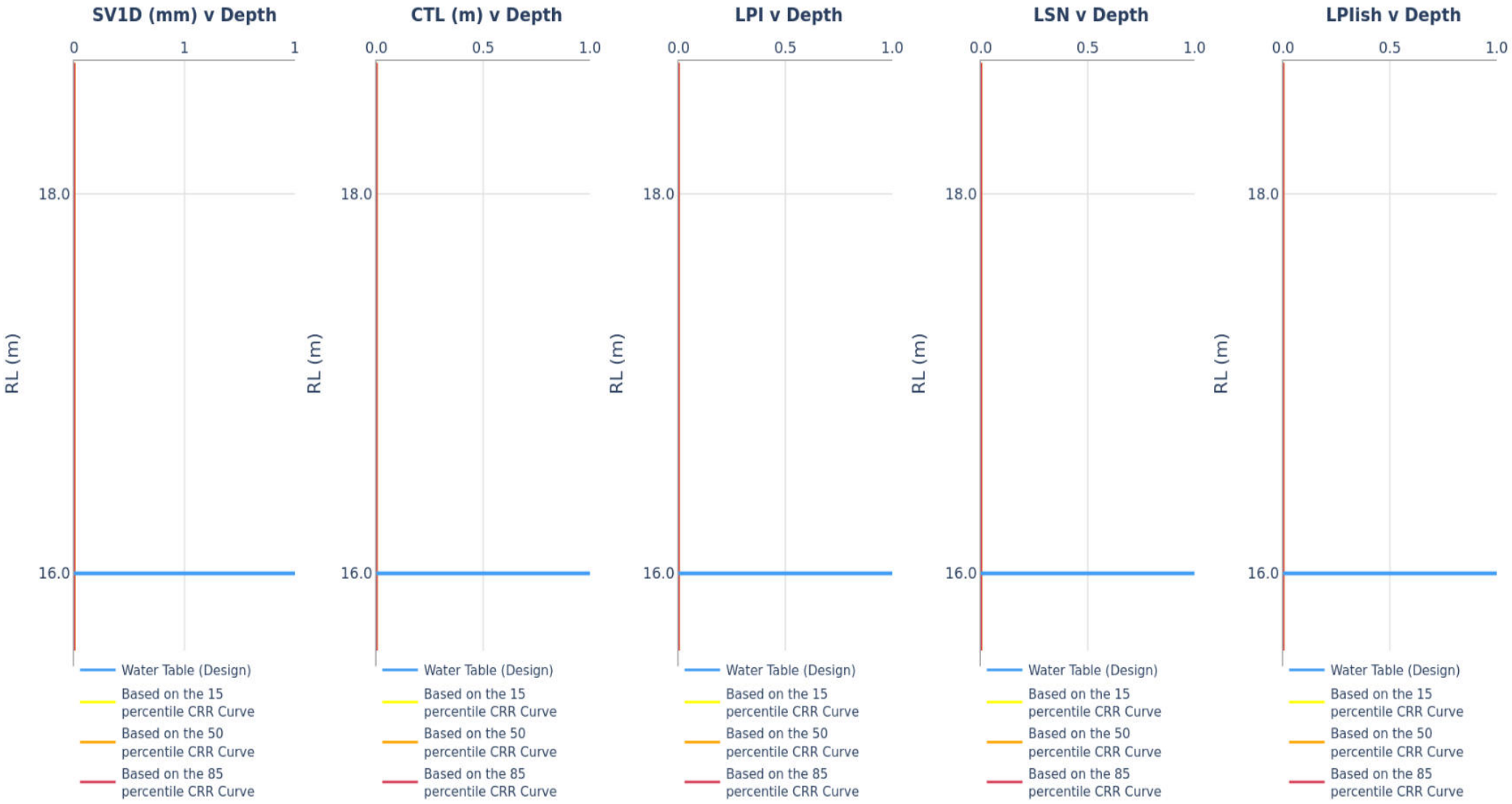


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

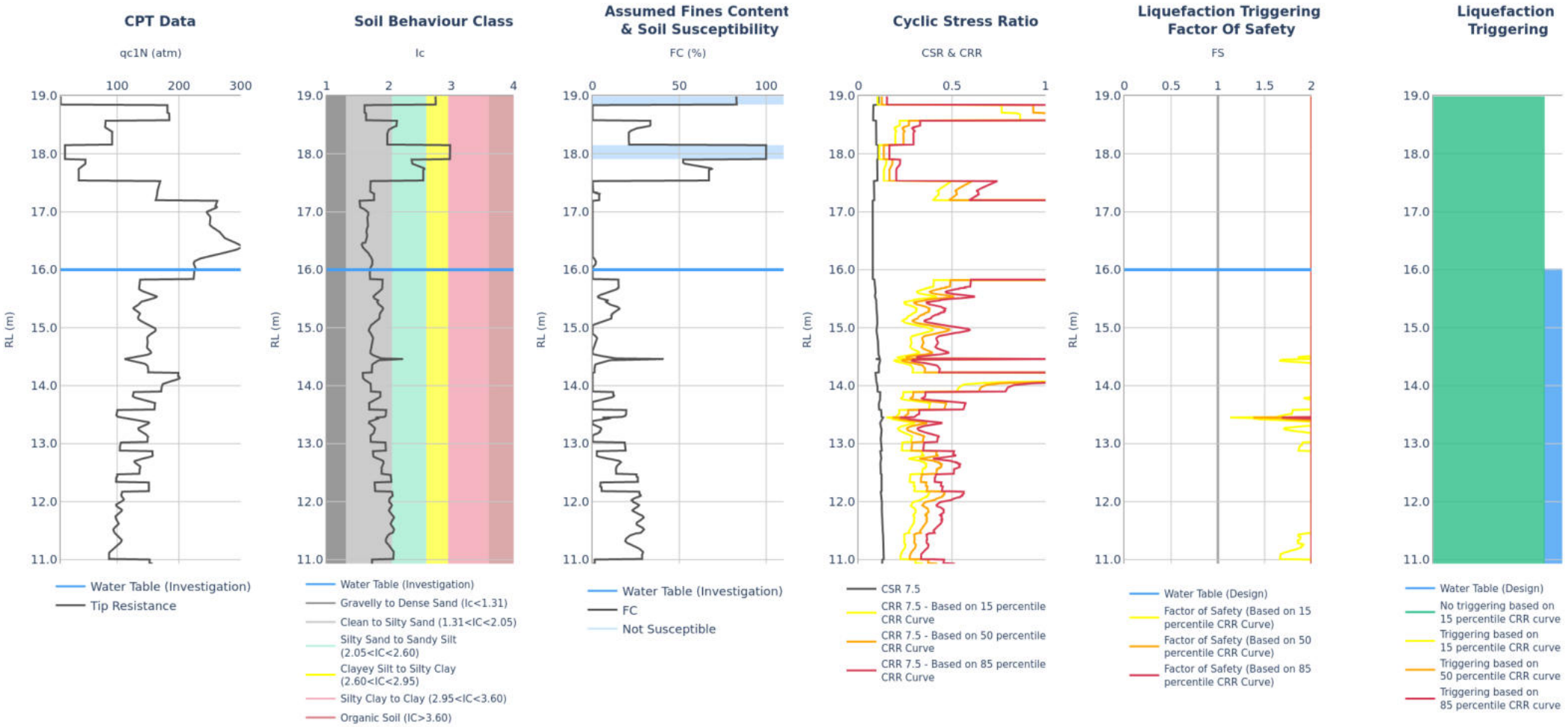
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT122	CPT_TT280747	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT123	CPT_TT280748	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

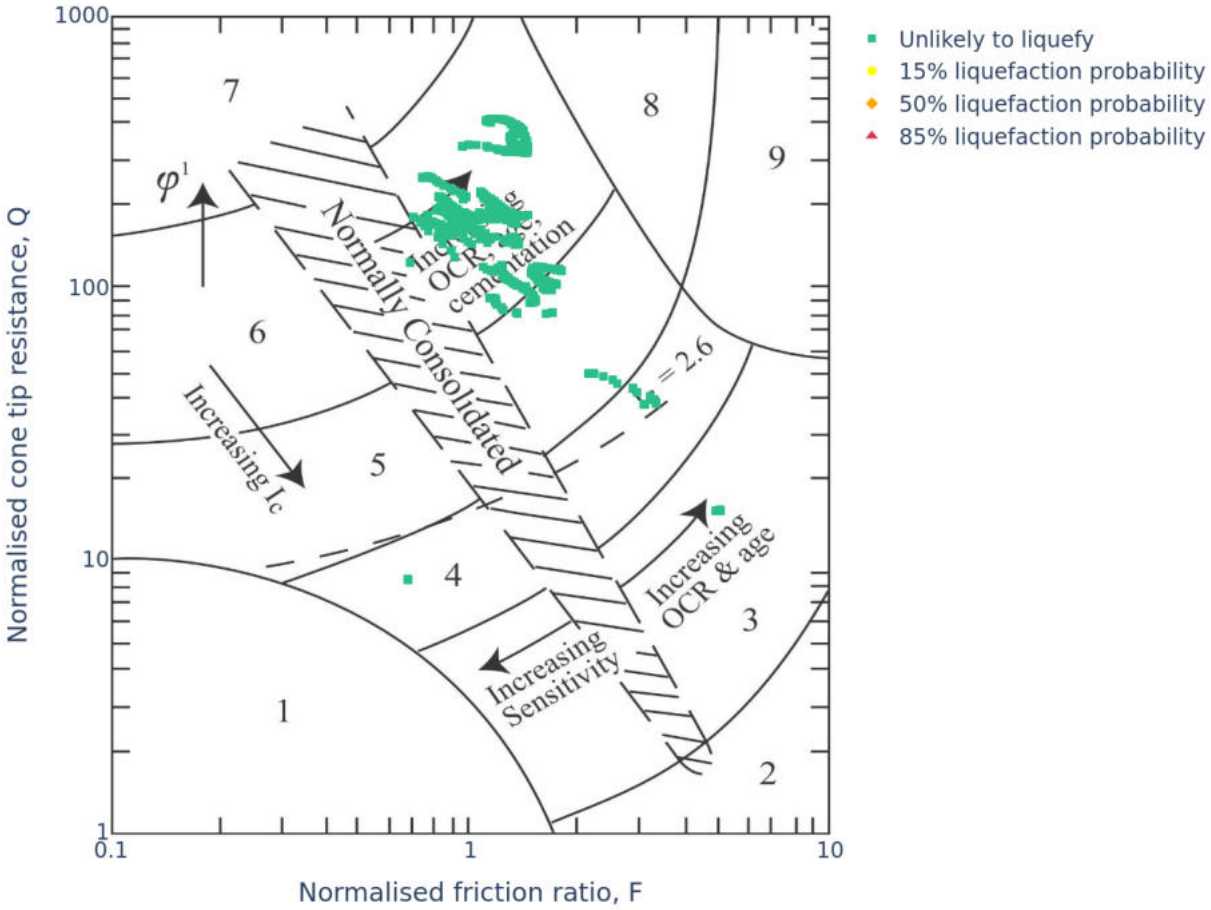
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	0	0.0	0	0	8.1	0
50%	0	0.0	0	0	8.1	0
85%	0	0.0	0	0	8.1	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

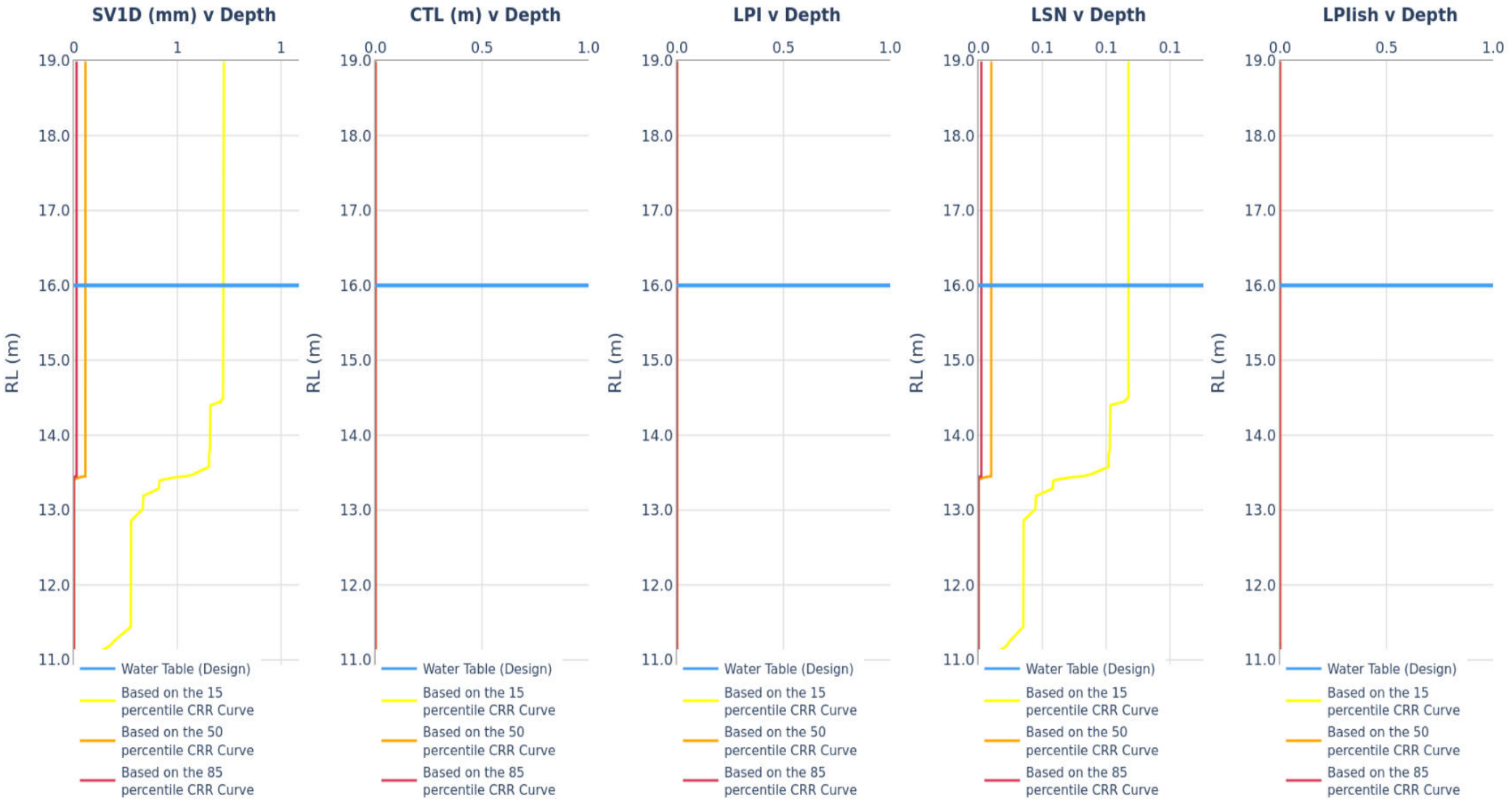


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

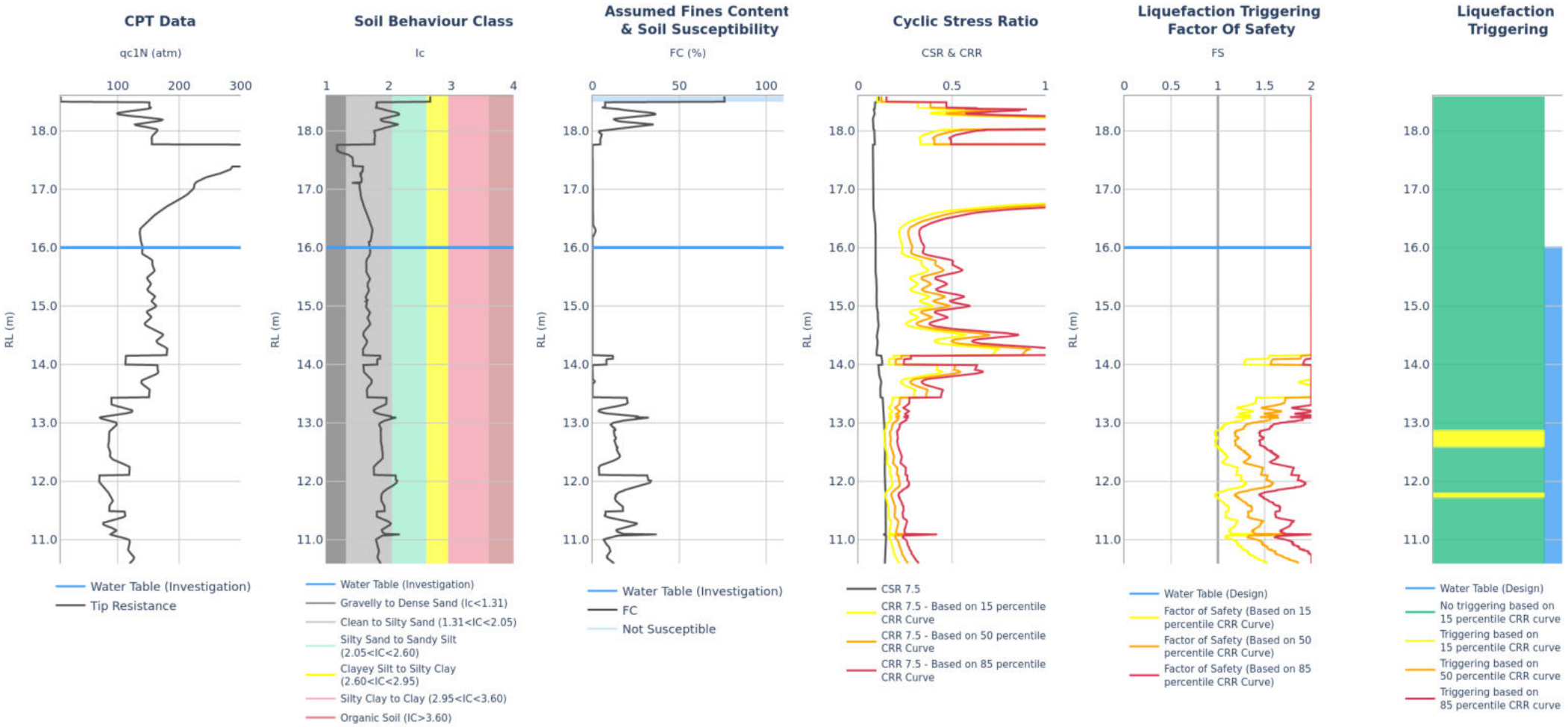
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT123	CPT_TT280748	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT124	CPT_TT280749	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

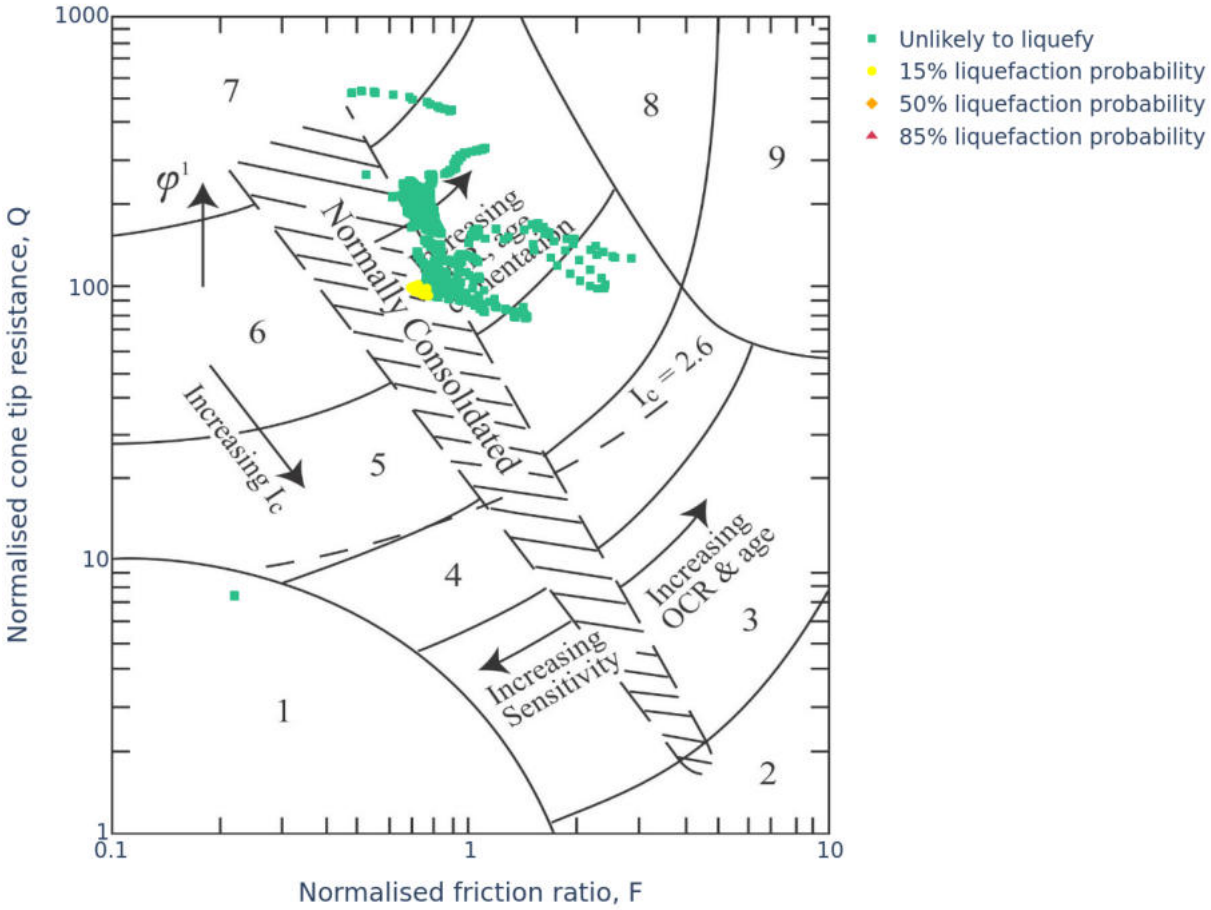
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	14	0.4	0	2	5.8	0
50%	6	0.0	0	1	8.0	0
85%	3	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT121 to CPT125 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 10/19*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

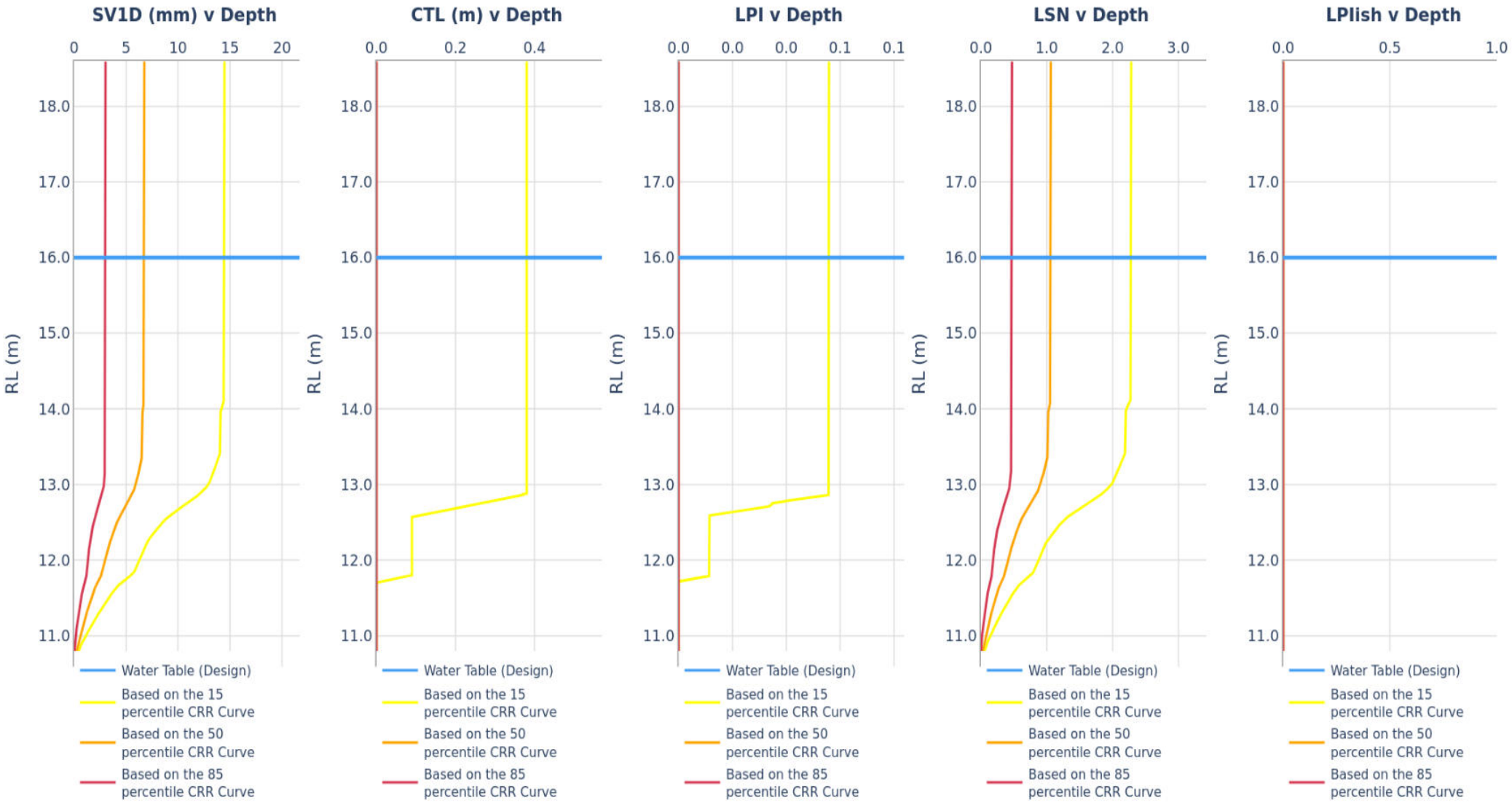


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

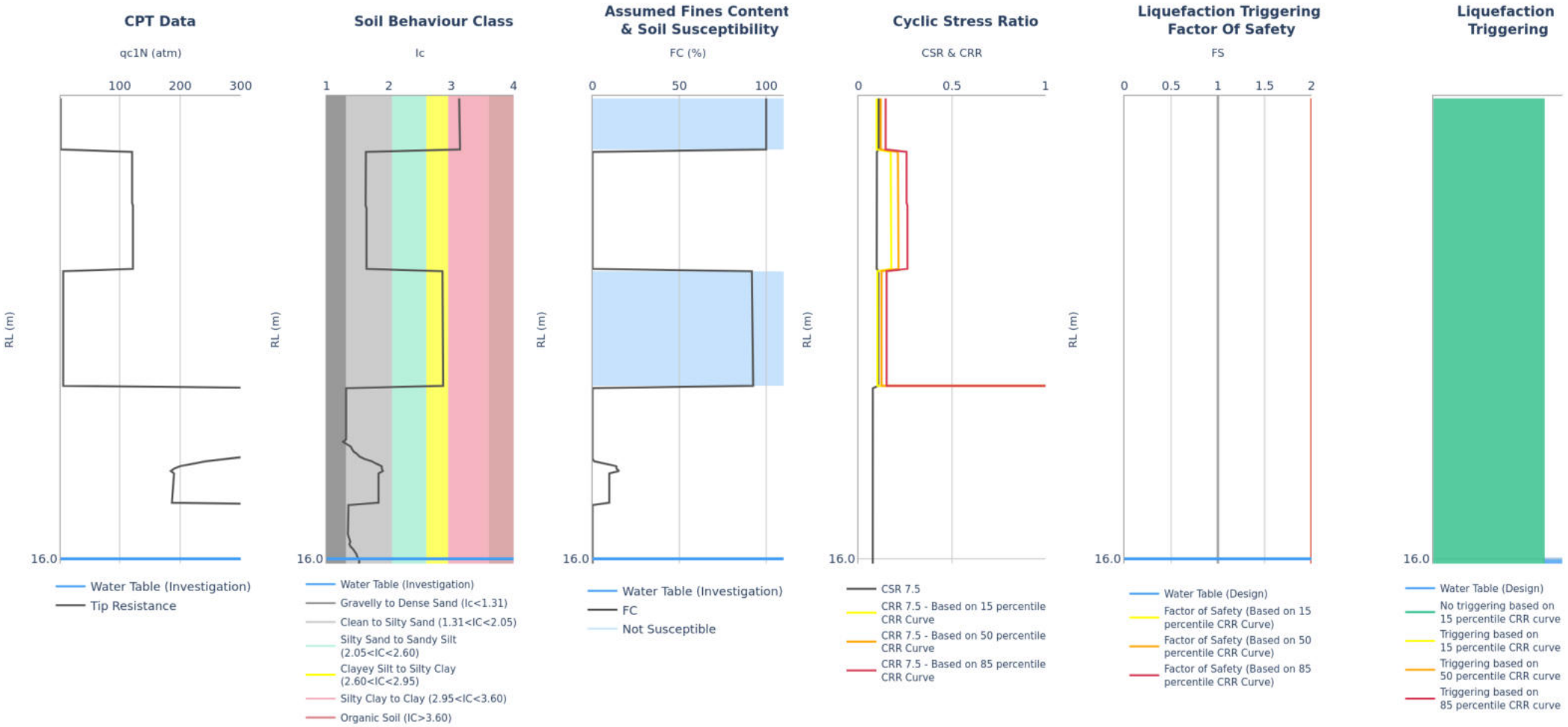
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT124	CPT_TT280749	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT125	CPT_TT280750	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

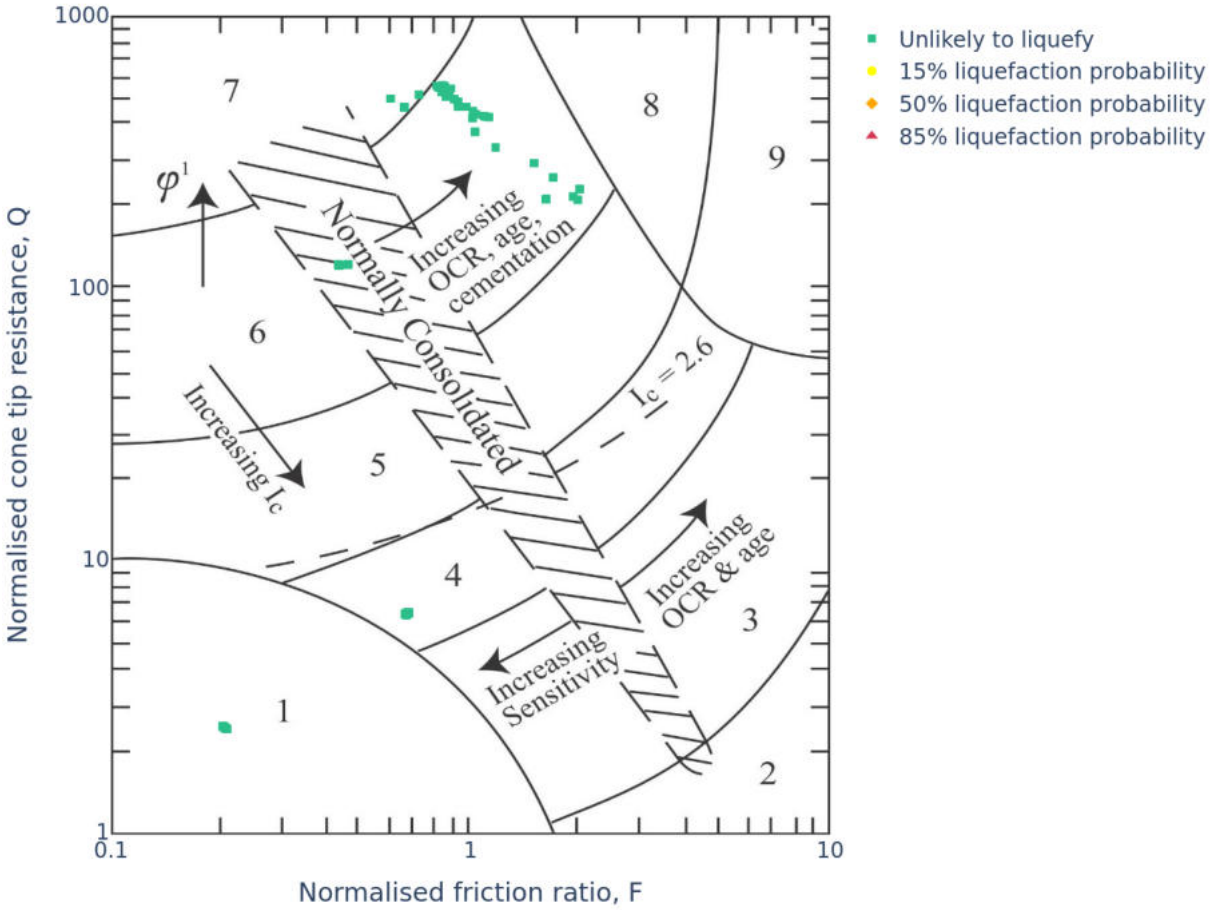
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	0	0.0	0	0	1.9	0
50%	0	0.0	0	0	1.9	0
85%	0	0.0	0	0	1.9	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT121 to CPT125 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 13/19*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

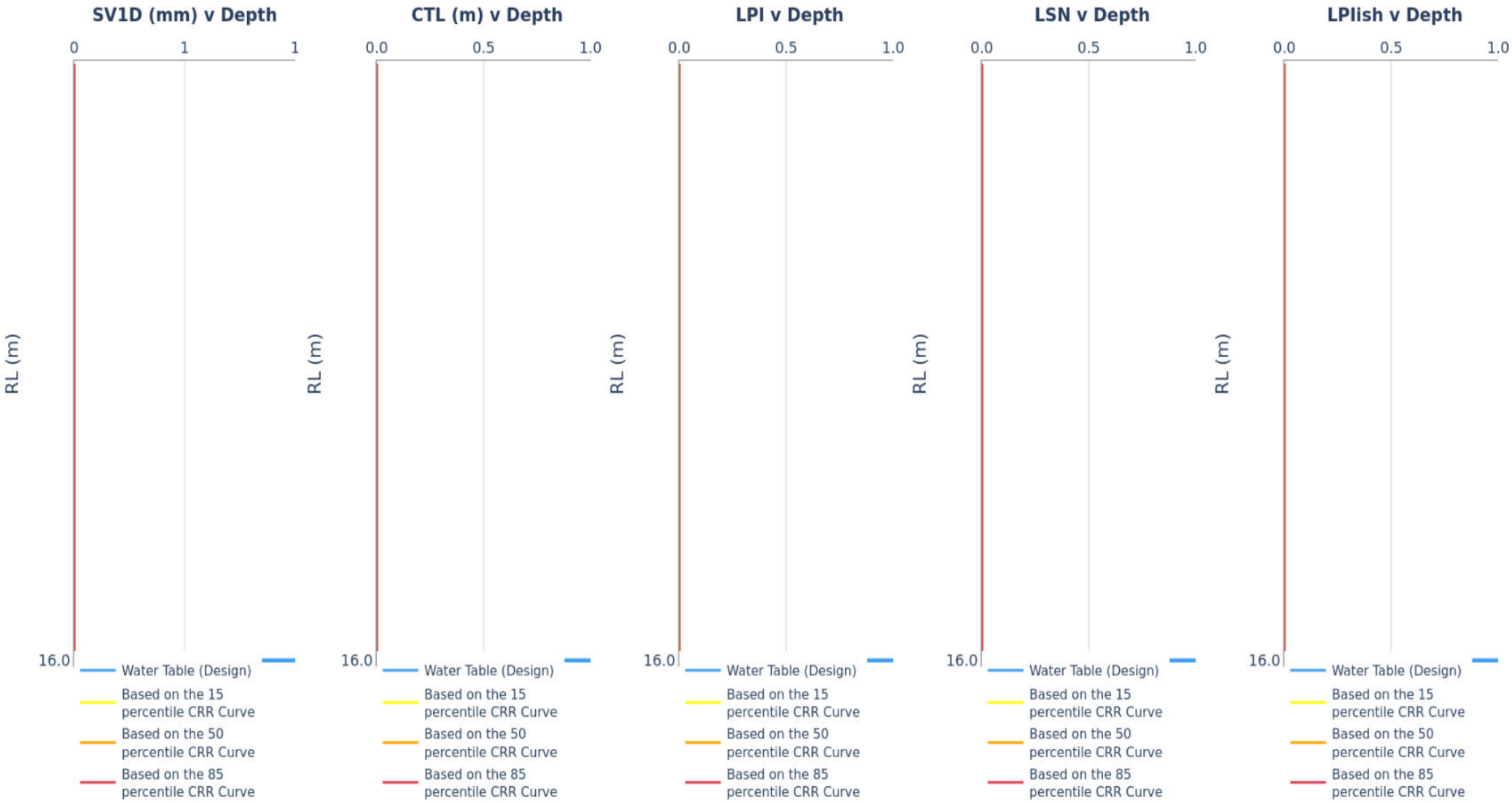


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

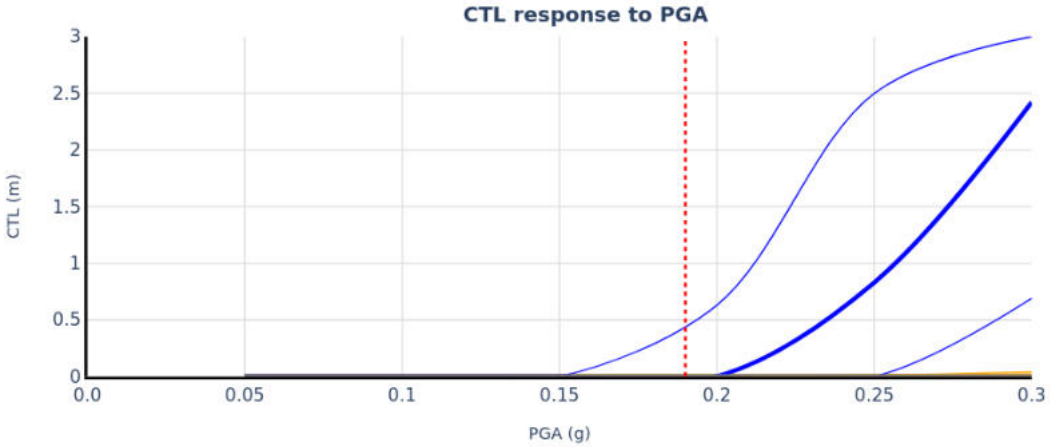
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

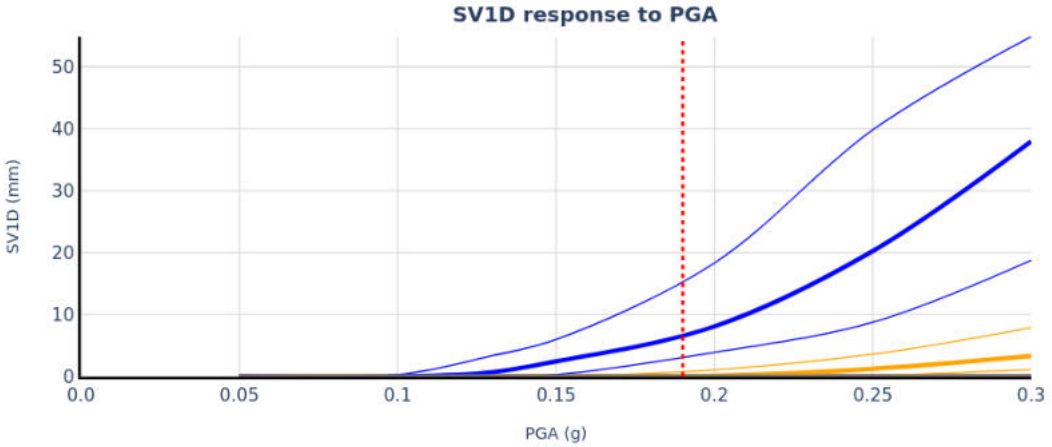


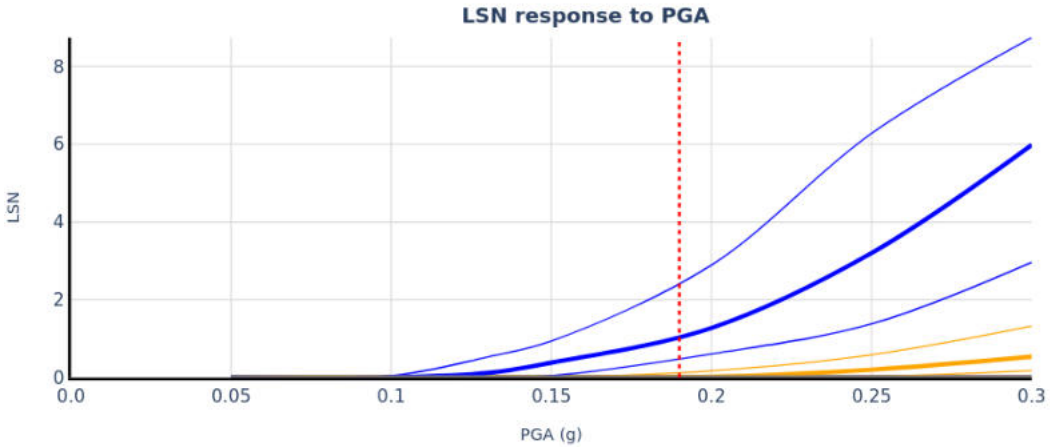
Input

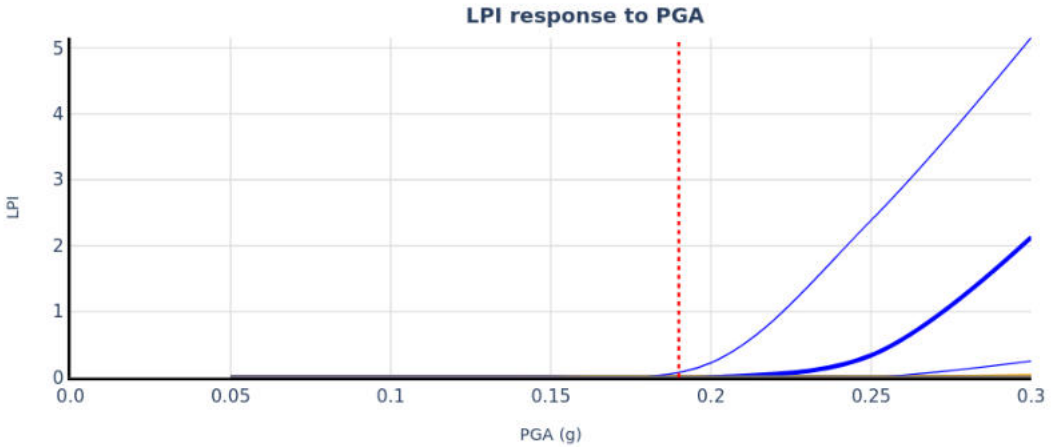
Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT125	CPT_TT280750	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT







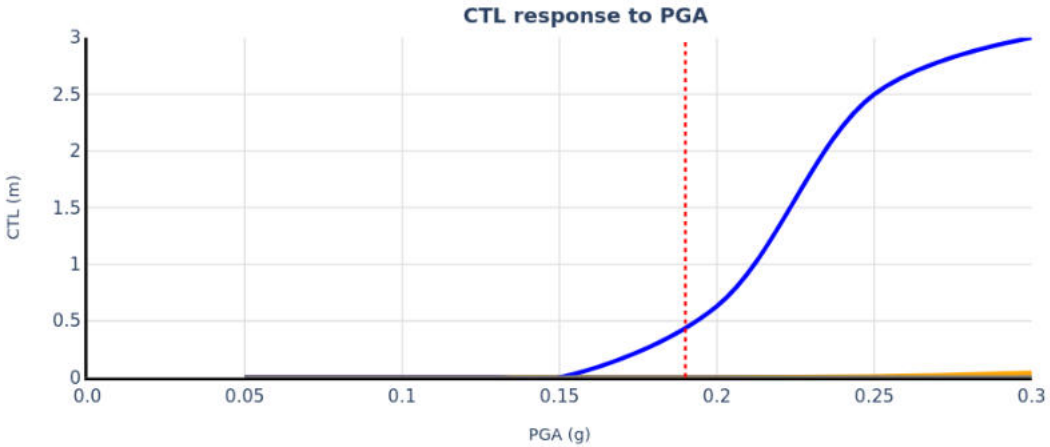


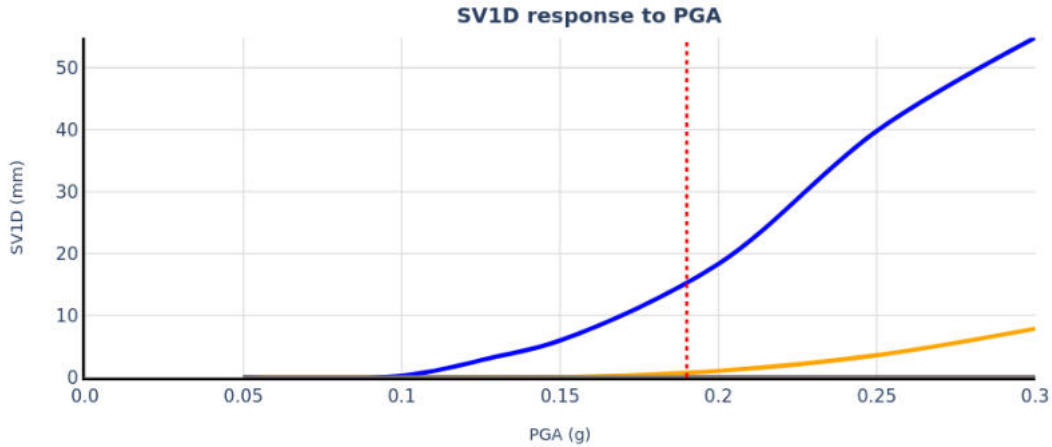
Input

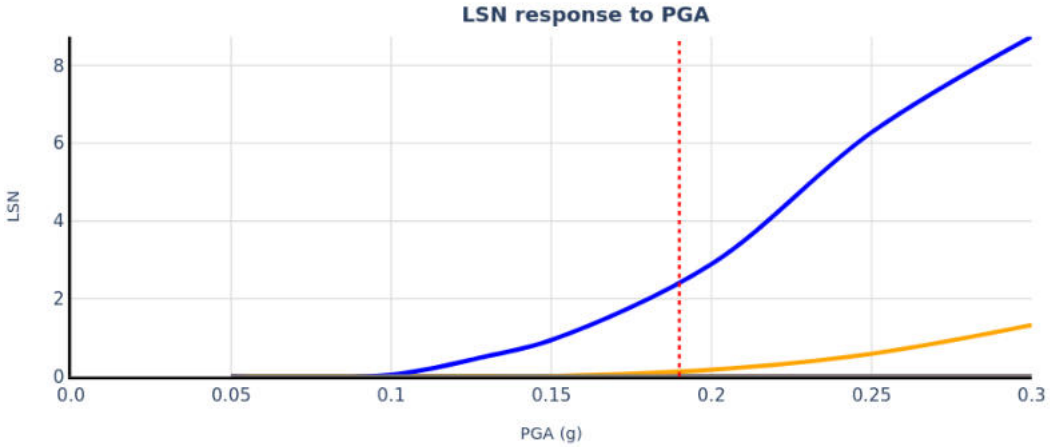
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT121	CPT_TT280746	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT122	CPT_TT280747	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT123	CPT_TT280748	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT124	CPT_TT280749	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT125	CPT_TT280750	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

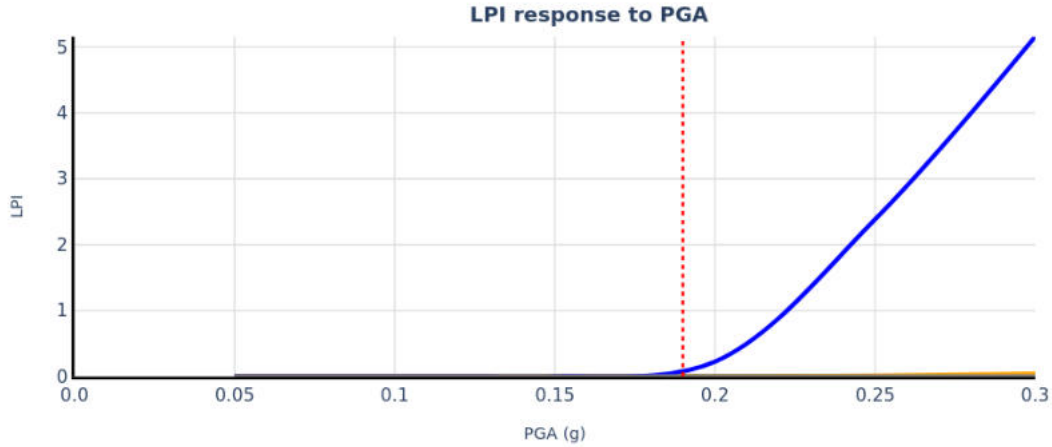
Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT BASED ON 15 PERCENTILE CRR CURVE









Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT121	CPT_TT280746	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT122	CPT_TT280747	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT123	CPT_TT280748	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT124	CPT_TT280749	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT125	CPT_TT280750	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280746	TTGD 280747	TTGD 280748
CPT Name	CPT121	CPT122	CPT123
Run Description	CPT121	CPT122	CPT123
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	2.7	2.7	3.0
Depth to groundwater for design (m)	2.7	2.7	3.0
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	3.19	3.19	8.07
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	10	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280746	CPT121	0.0	0.0	0.0
TTGD 280746	CPT121	0.0	10.0	2.6
TTGD 280747	CPT122	0.0	0.0	0.0
TTGD 280747	CPT122	0.0	10.0	2.6
TTGD 280748	CPT123	0.0	0.0	0.0
TTGD 280748	CPT123	0.0	10.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280746	CPT121	0.0	10.0	0.0 CFC
TTGD 280747	CPT122	0.0	10.0	0.0 CFC
TTGD 280748	CPT123	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280746	CPT121	0.0	0.0001	18.0
TTGD 280746	CPT121	0.0001	10.0	18.0
TTGD 280747	CPT122	0.0	0.0001	18.0
TTGD 280747	CPT122	0.0001	10.0	18.0
TTGD 280748	CPT123	0.0	0.0001	18.0
TTGD 280748	CPT123	0.0001	10.0	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280749	TTGD 280750
CPT Name	CPT124	CPT125
Run Description	CPT124	CPT125
EQ PGA (g)	0.19	0.19
EQ Magnitude	6.5	6.5
Depth to groundwater at time of Investigation (m)	2.6	1.9
Depth to groundwater for design (m)	2.6	1.9
Pre-drill depth (m)	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002
Total depth of CPT (m)	8.01	1.92
Minimum depth of analysis (m)	0	0
Maximum depth of analysis (m)	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A
Surcharge load (kPa)	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280749	CPT124	0.0	0.0	0.0
TTGD 280749	CPT124	0.0	10.0	2.6
TTGD 280750	CPT125	0.0	0.0	0.0
TTGD 280750	CPT125	0.0	10.0	2.6

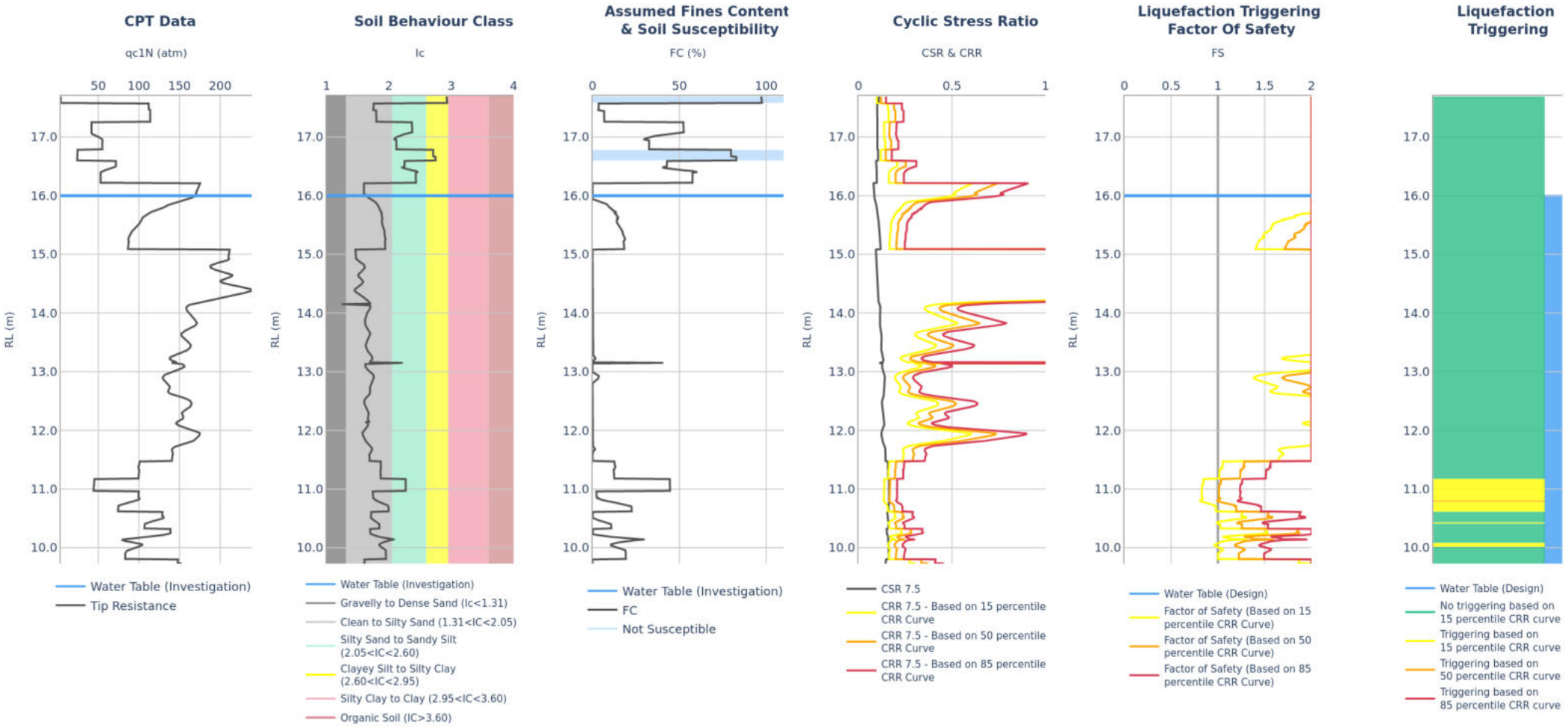
Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280749	CPT124	0.0	10.0	0.0 CFC
TTGD 280750	CPT125	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280749	CPT124	0.0	0.0001	18.0
TTGD 280749	CPT124	0.0001	10.0	18.0
TTGD 280750	CPT125	0.0	0.0001	18.0
TTGD 280750	CPT125	0.0001	10.0	18.0

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT126	CPT_TT280751	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

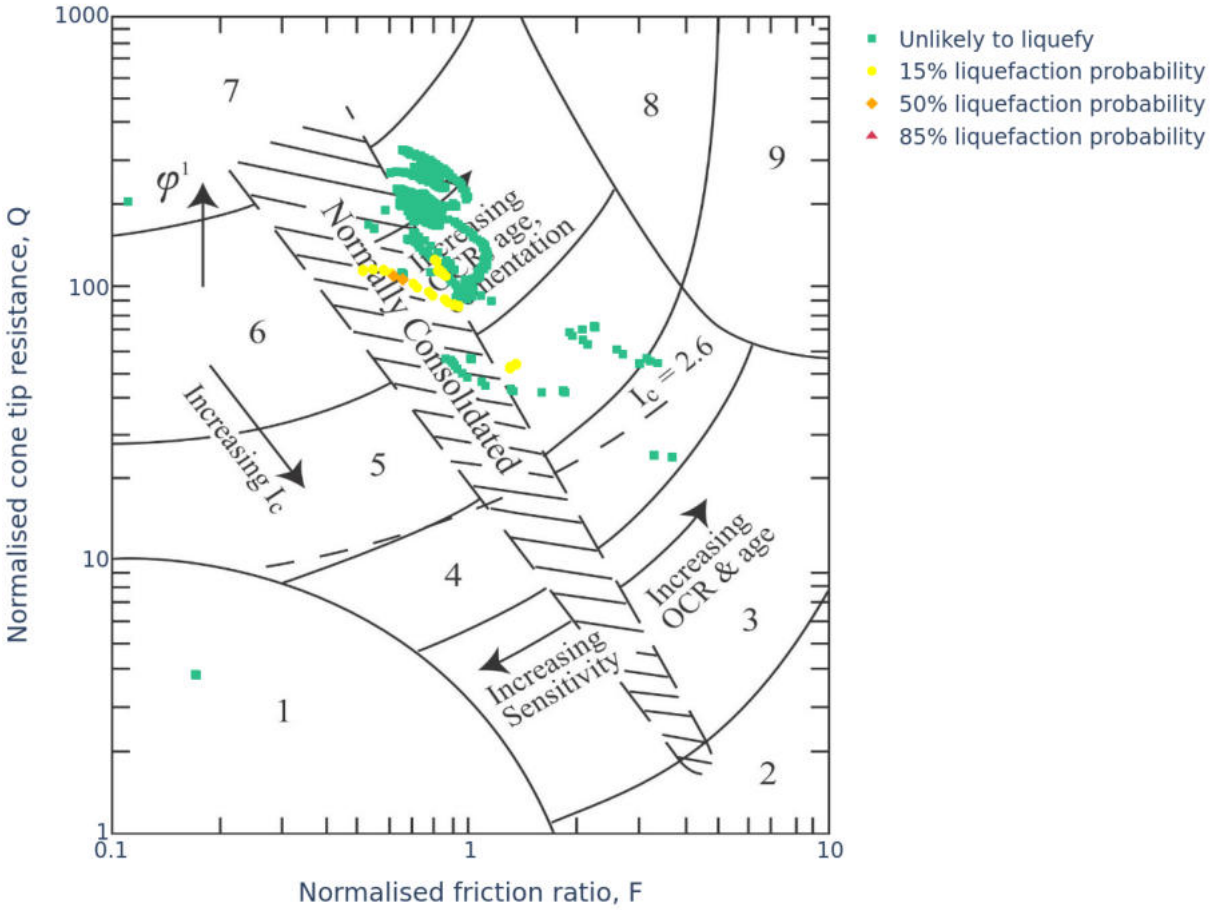
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	17	0.6	0	2	6.6	0
50%	7	0.0	0	1	8.0	0
85%	3	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT126 to CPT130A - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 1/22*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

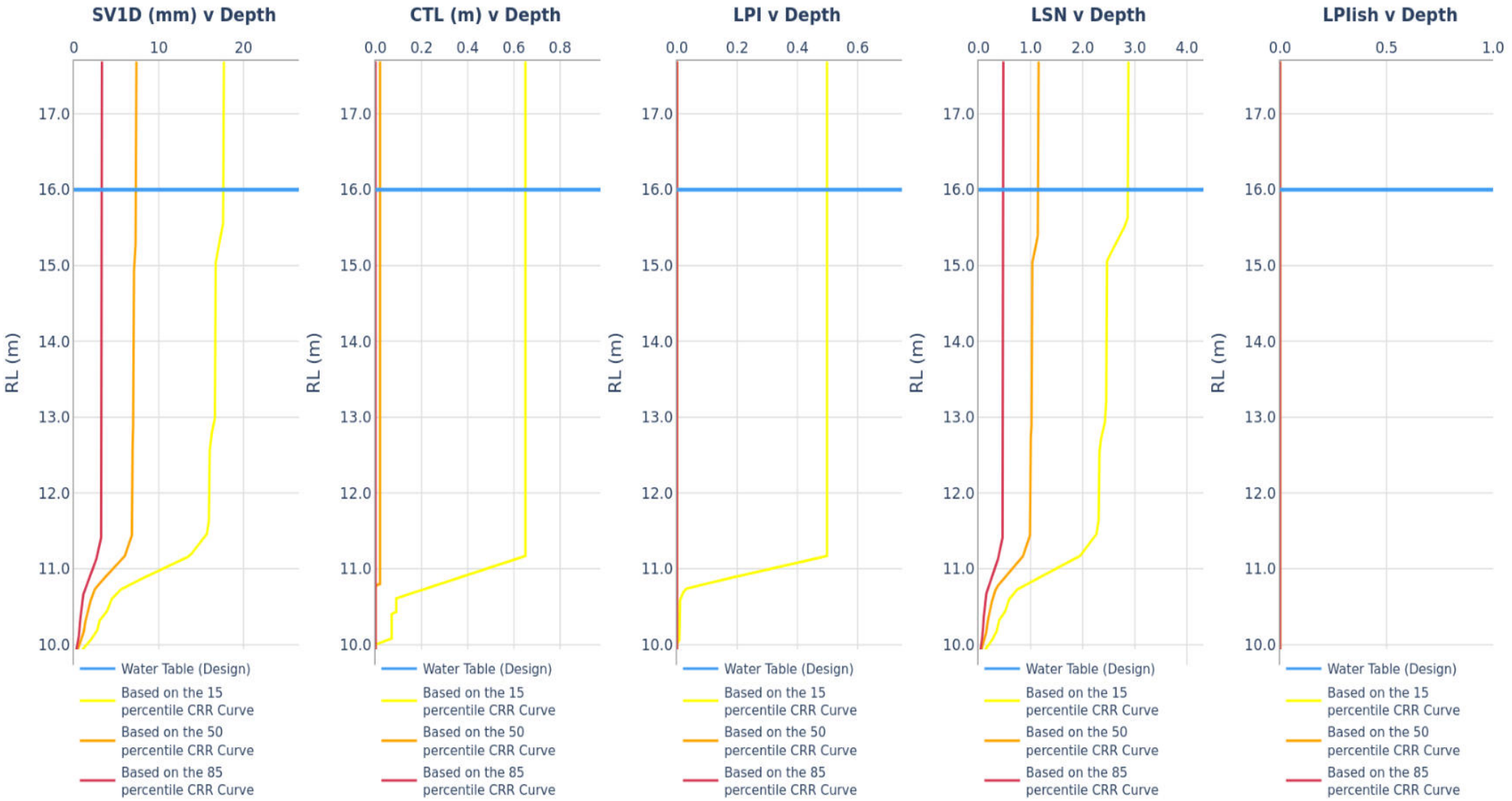


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

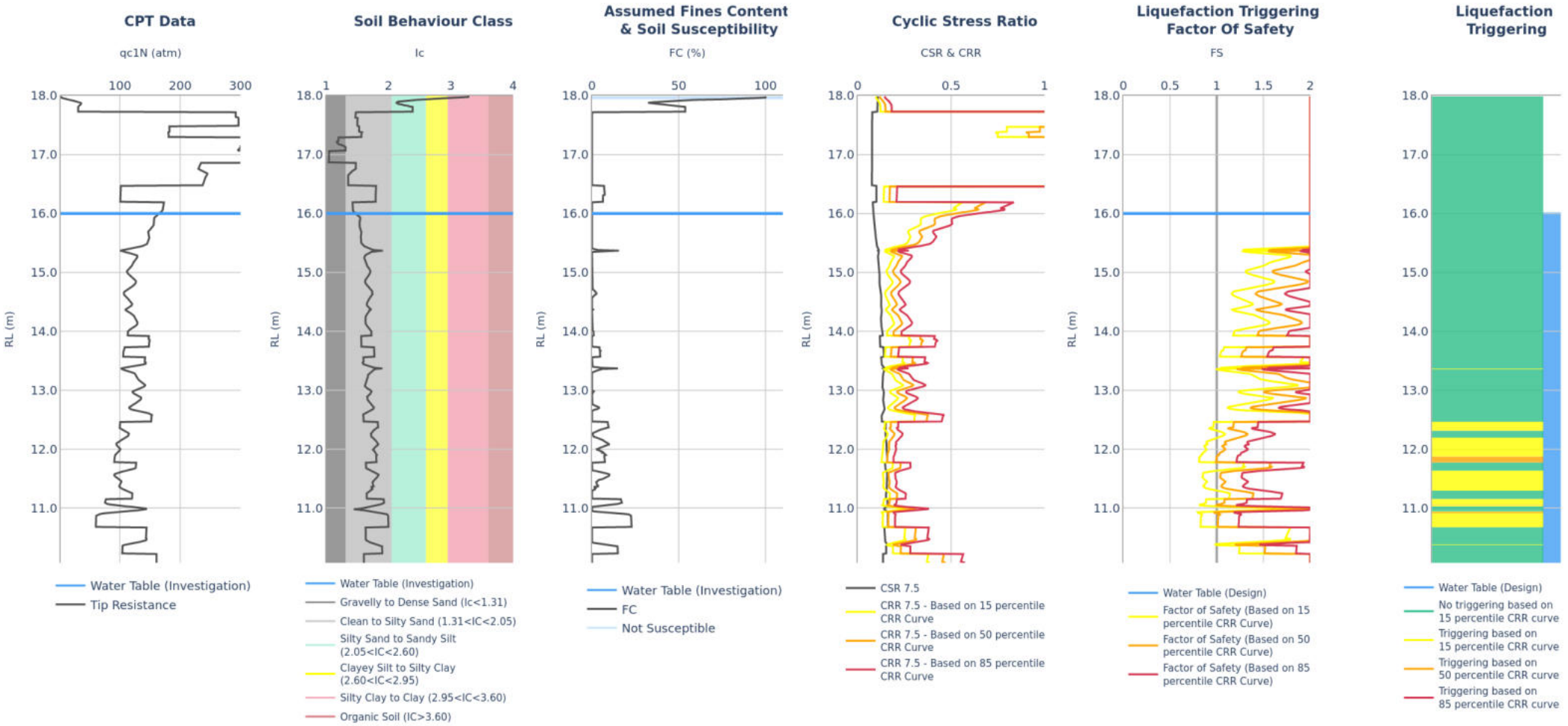
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT126	CPT_TT280751	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT127	CPT_TT280752	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

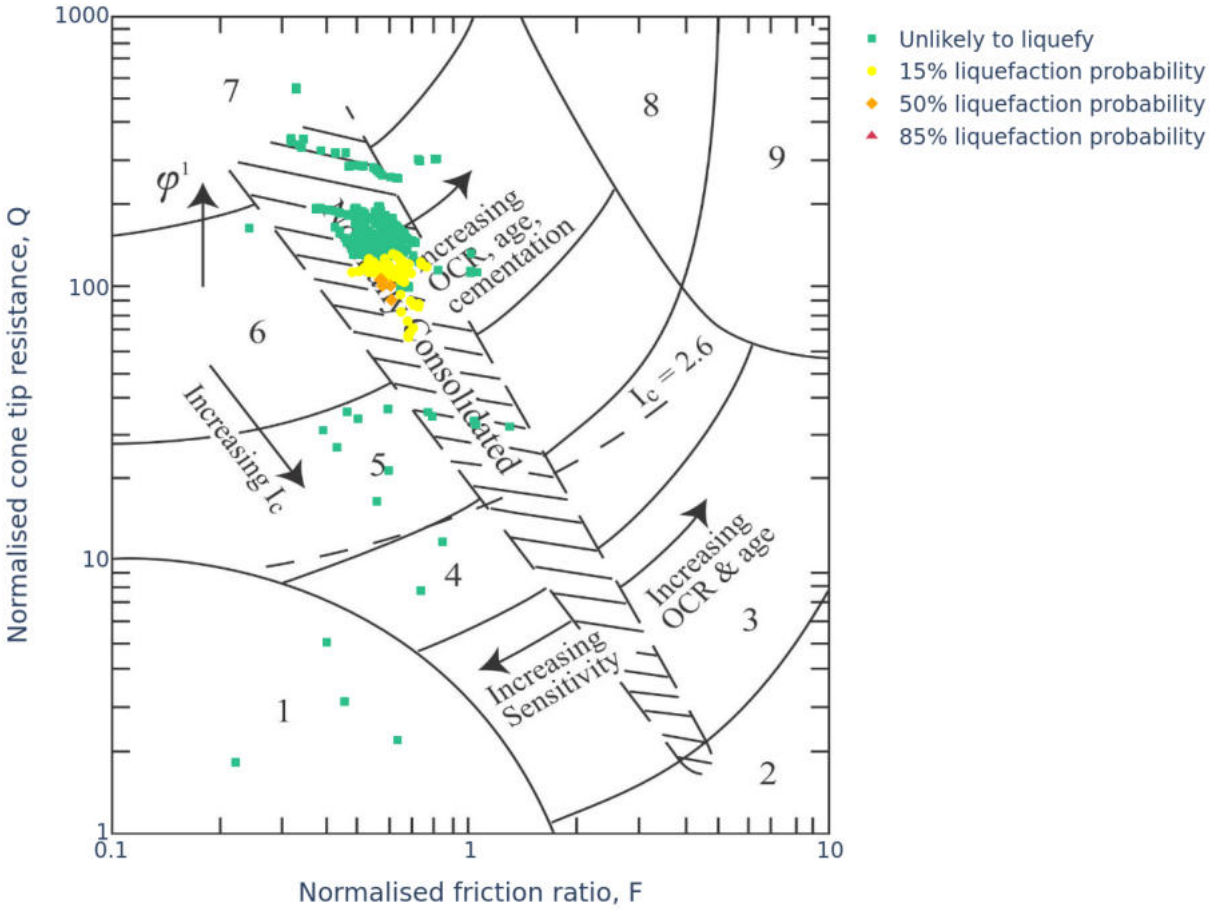
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	32	1.3	1	5	5.6	0
50%	13	0.1	0	2	6.2	0
85%	5	0.0	0	0	7.9	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT126 to CPT130A - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 4/22*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

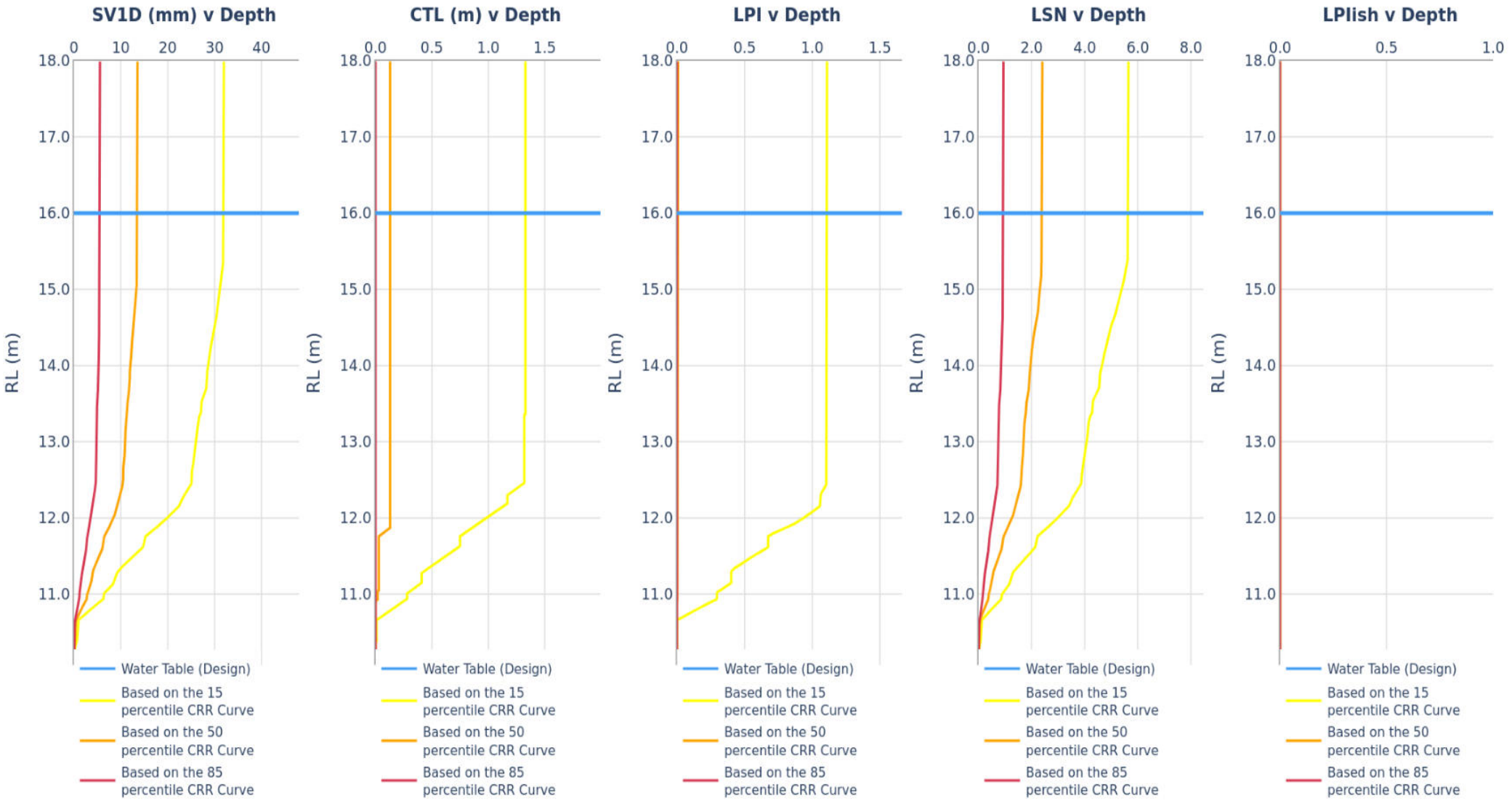


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

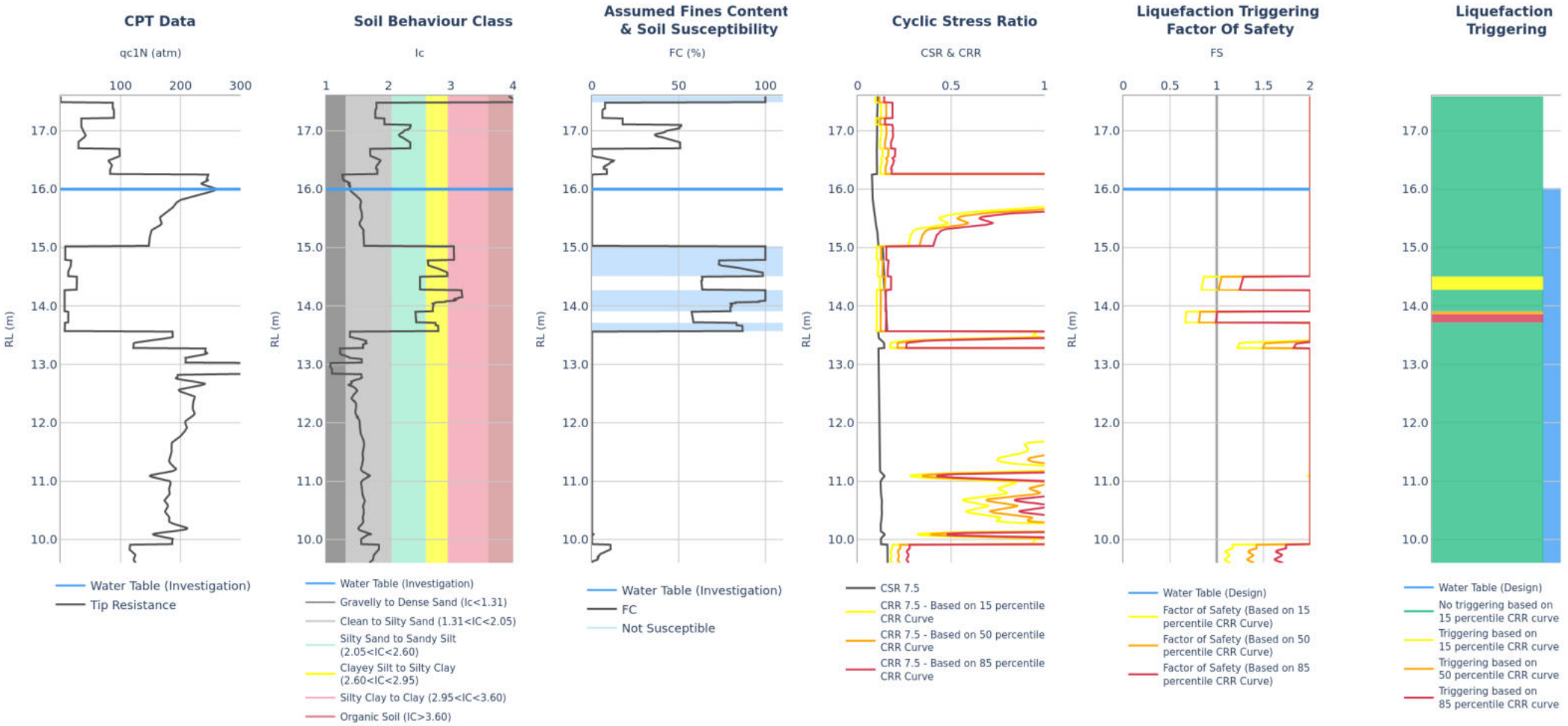
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT127	CPT_TT280752	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT128	CPT_TT280753	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

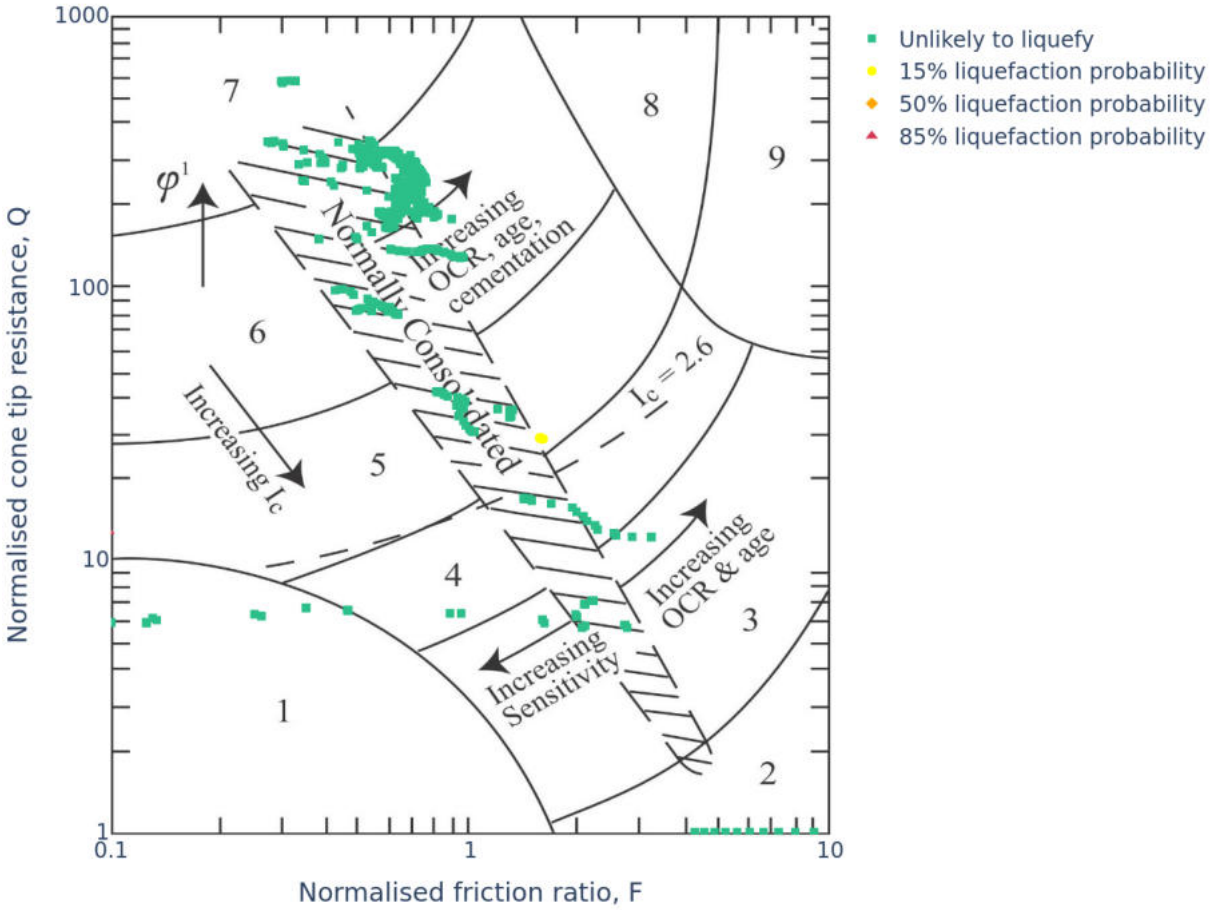
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	13	0.4	0	3	3.2	0
50%	9	0.2	0	2	3.8	0
85%	3	0.1	0	1	3.8	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

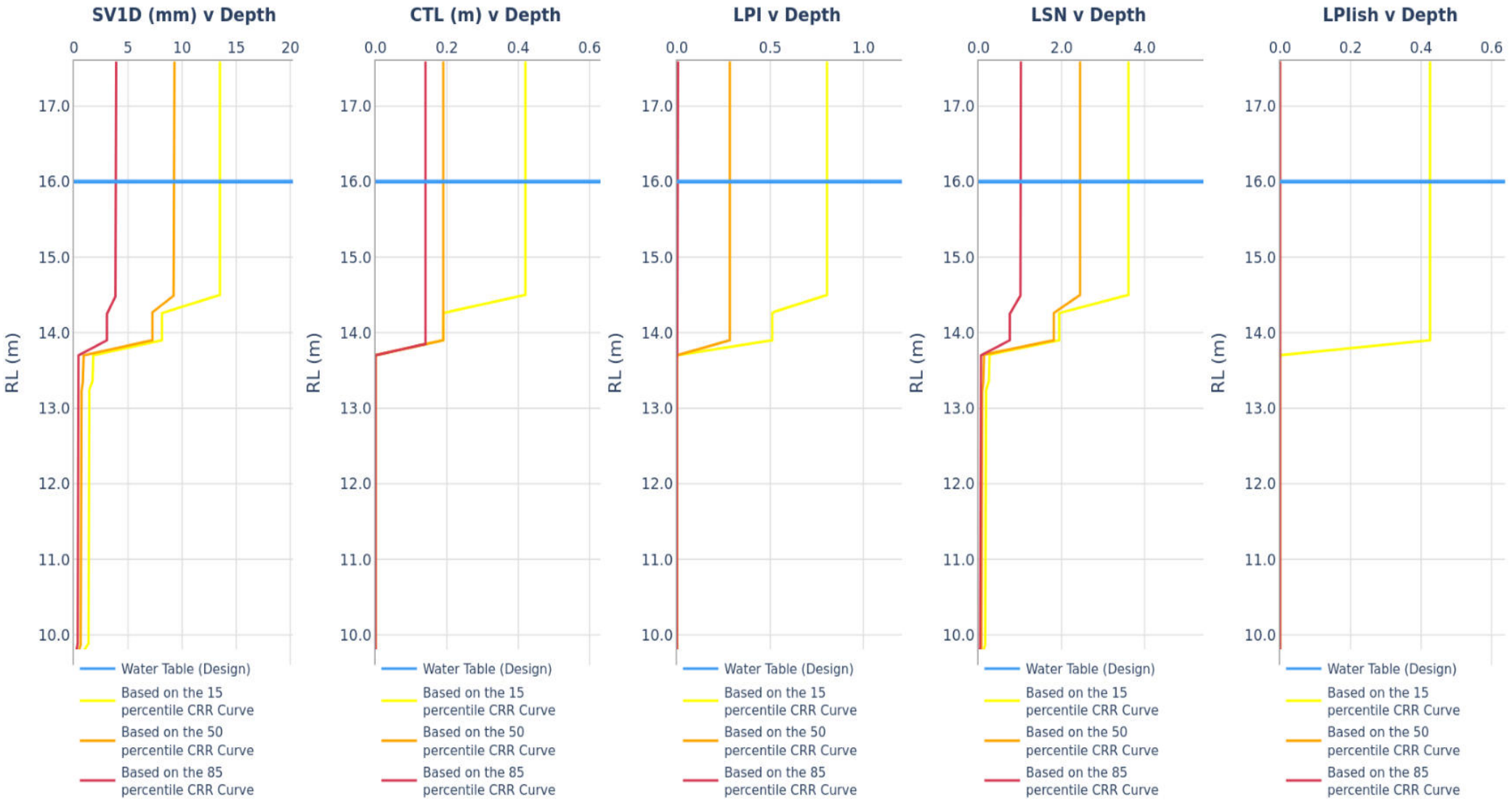


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

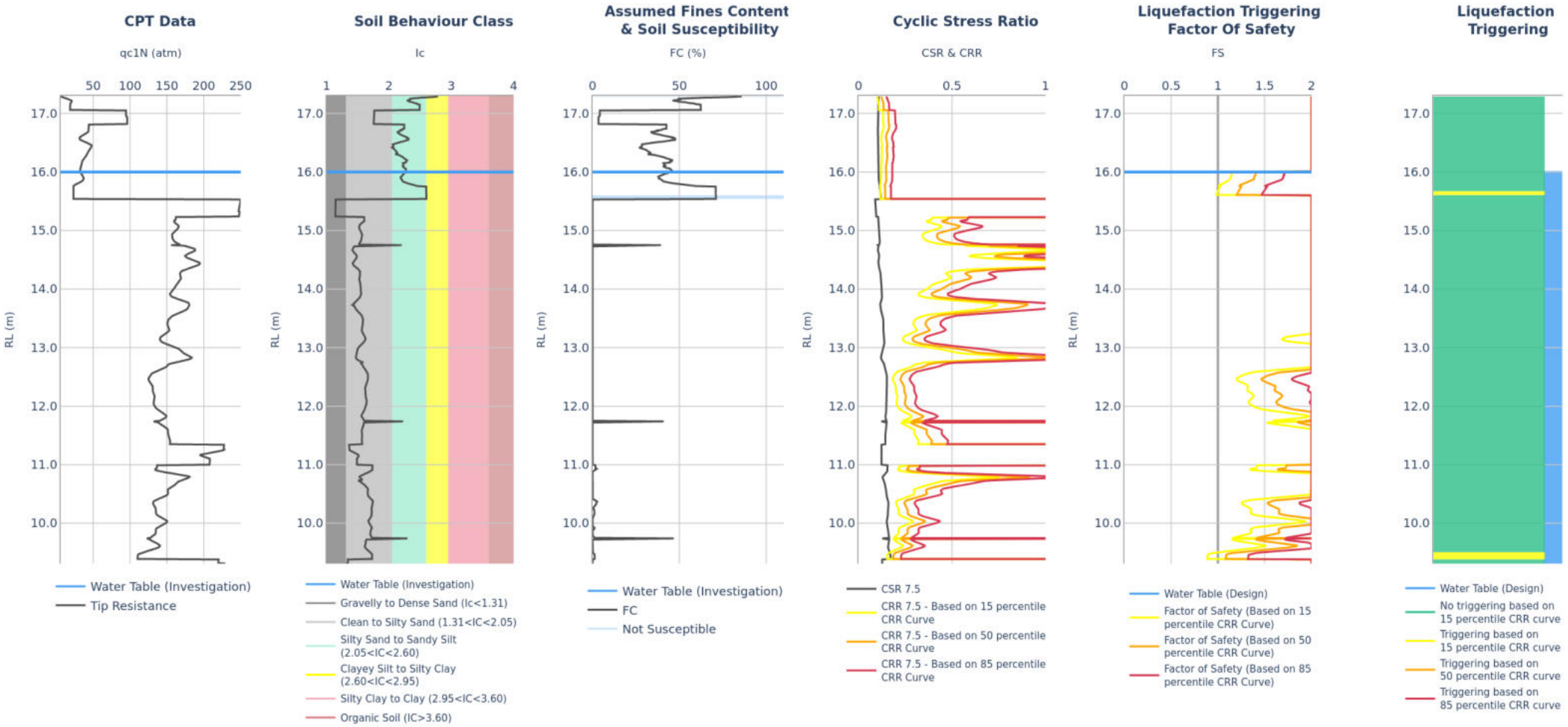
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT128	CPT_TT280753	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT129	CPT_TT280754	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

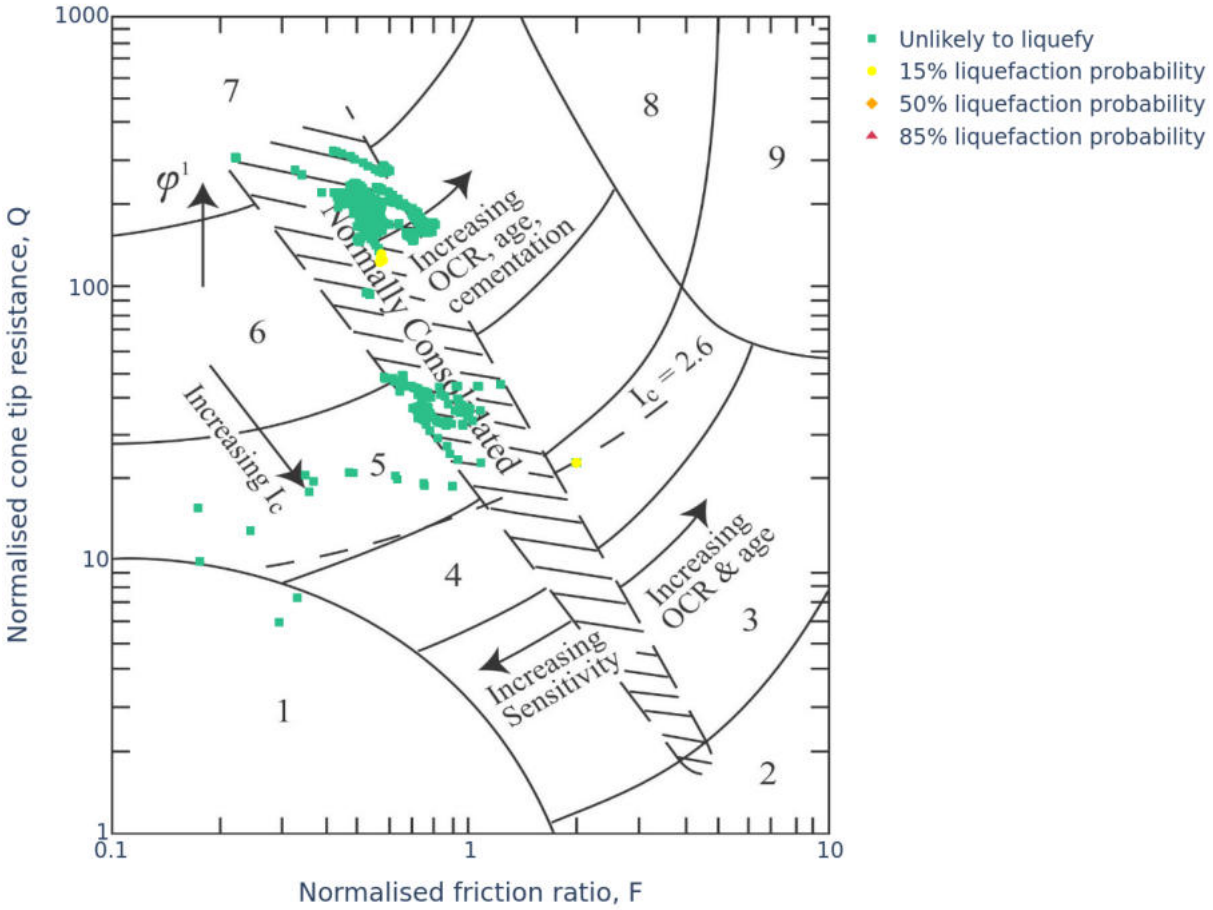
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	9	0.2	0	3	7.8	0
50%	4	0.0	0	1	8.0	0
85%	1	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT126 to CPT130A - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 10/22*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

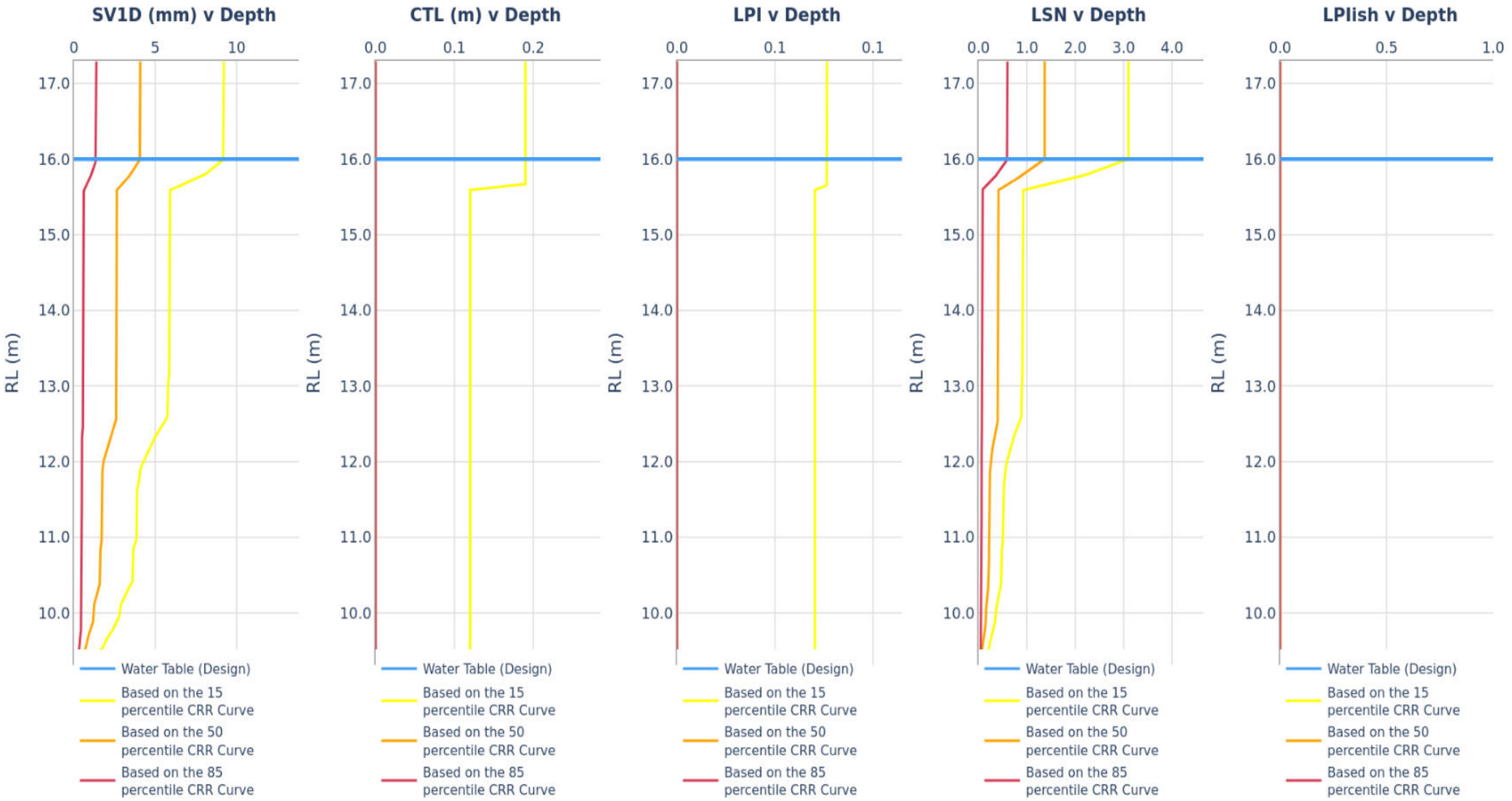


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

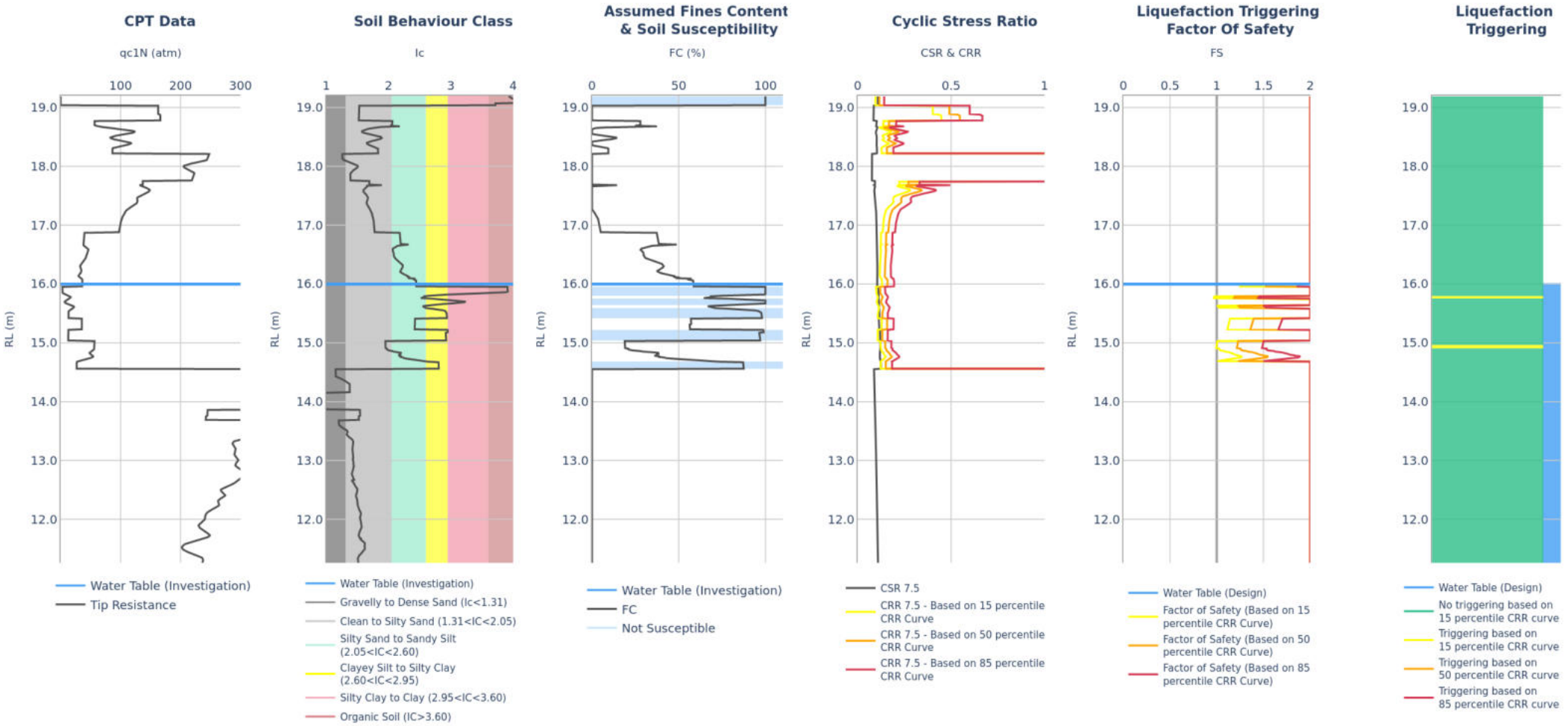
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT129	CPT_TT280754	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT130	CPT_TT280755	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

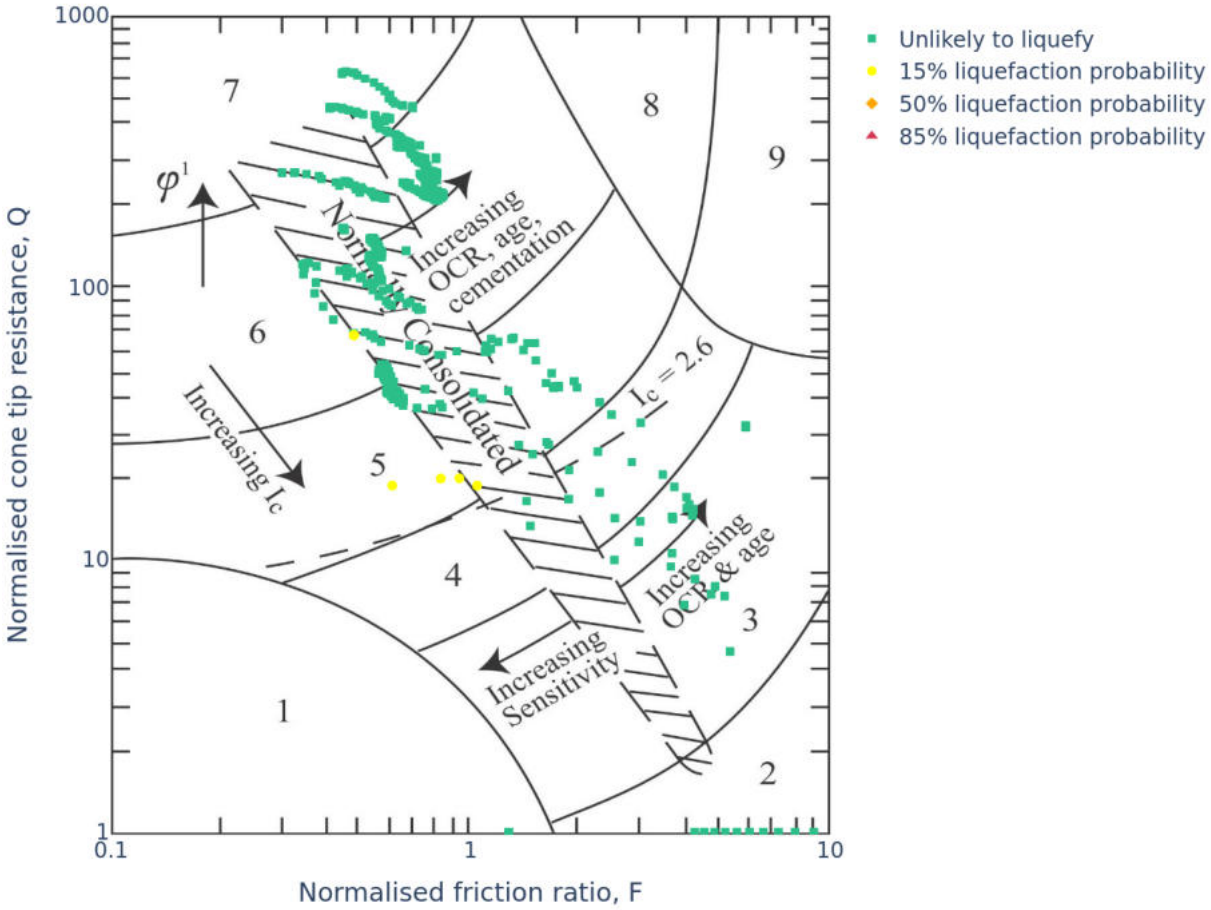
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	4	0.1	0	1	4.3	0
50%	2	0.0	0	0	7.9	0
85%	1	0.0	0	0	7.9	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT126 to CPT130A - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 13/22*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

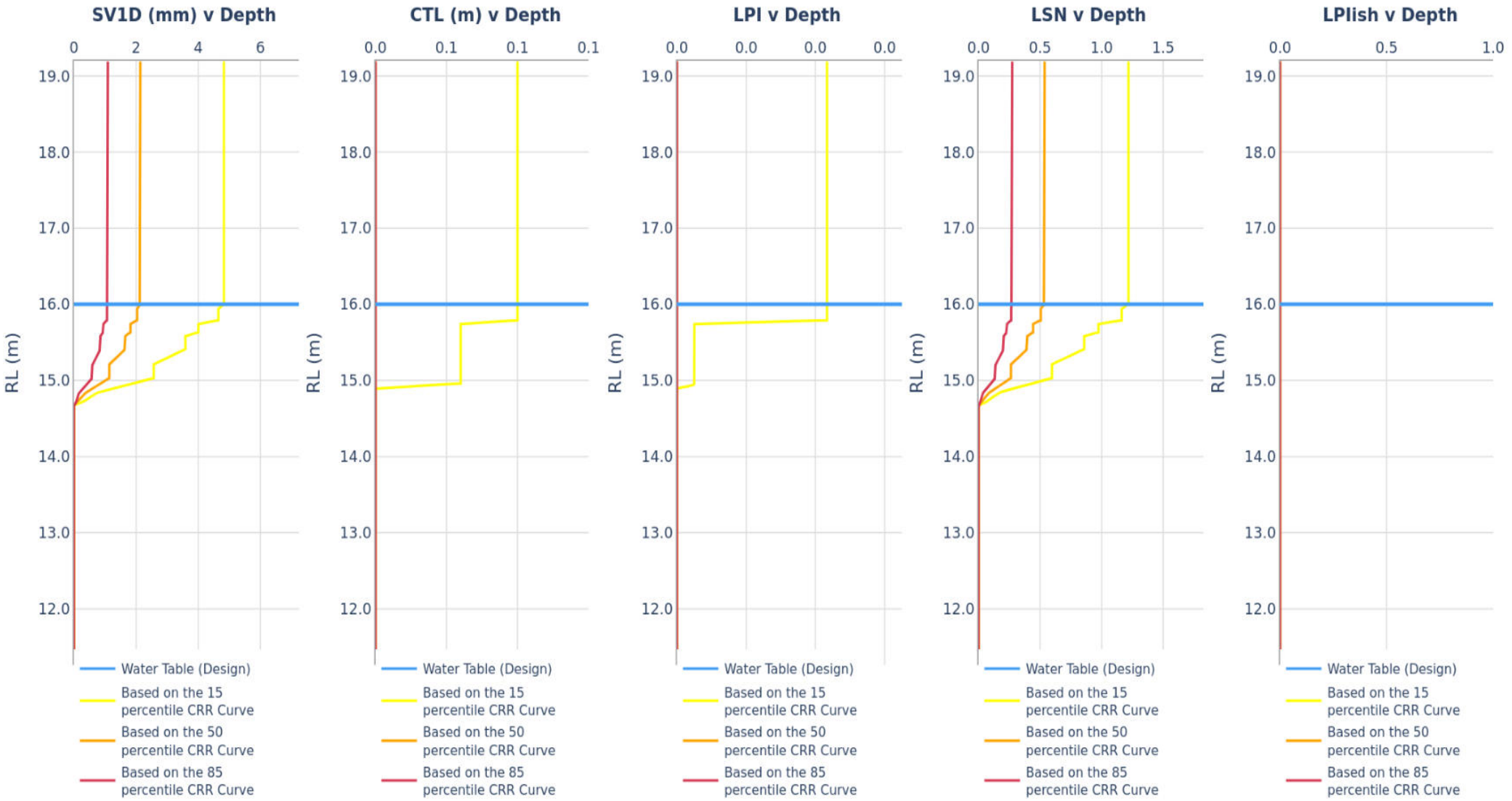


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

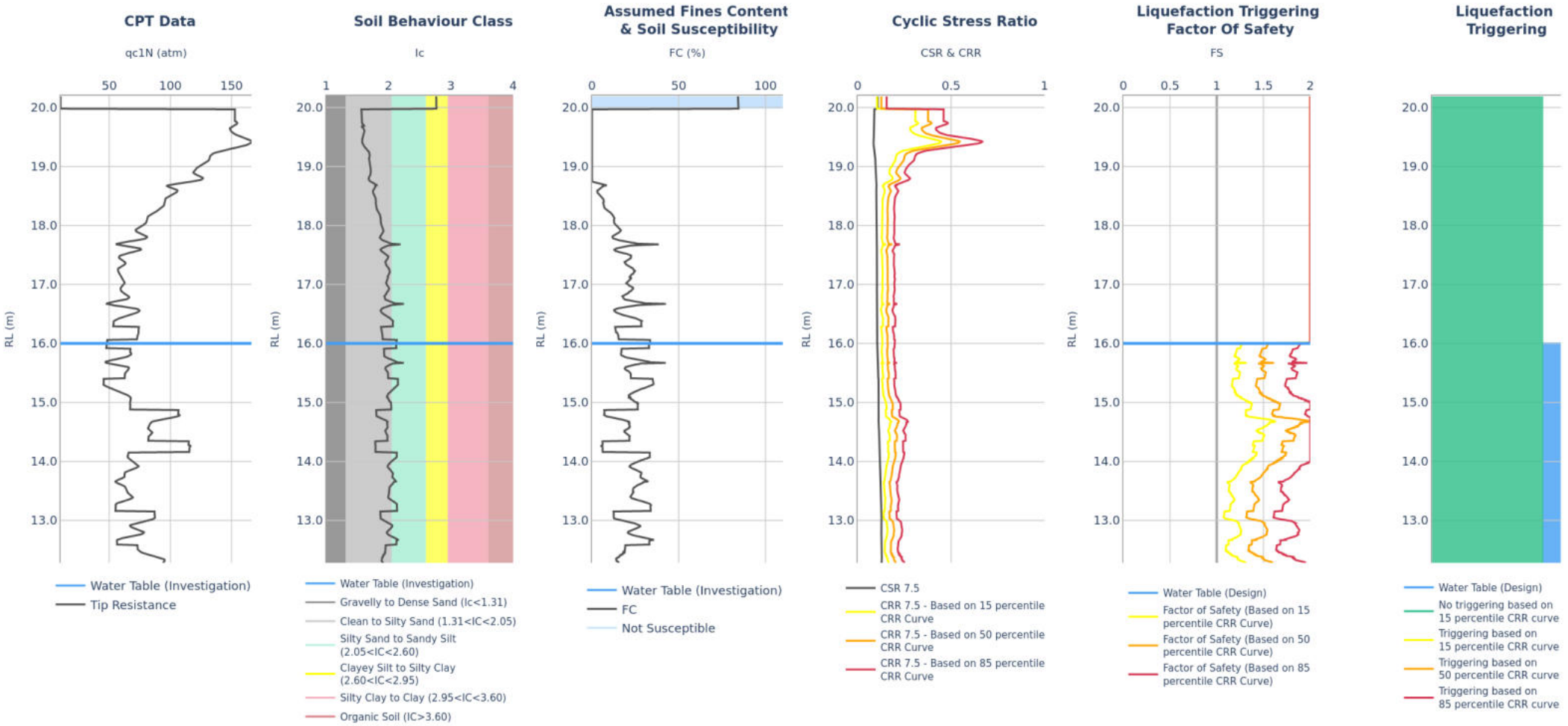
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT130	CPT_TT280755	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT130A	CPT_TT280756	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

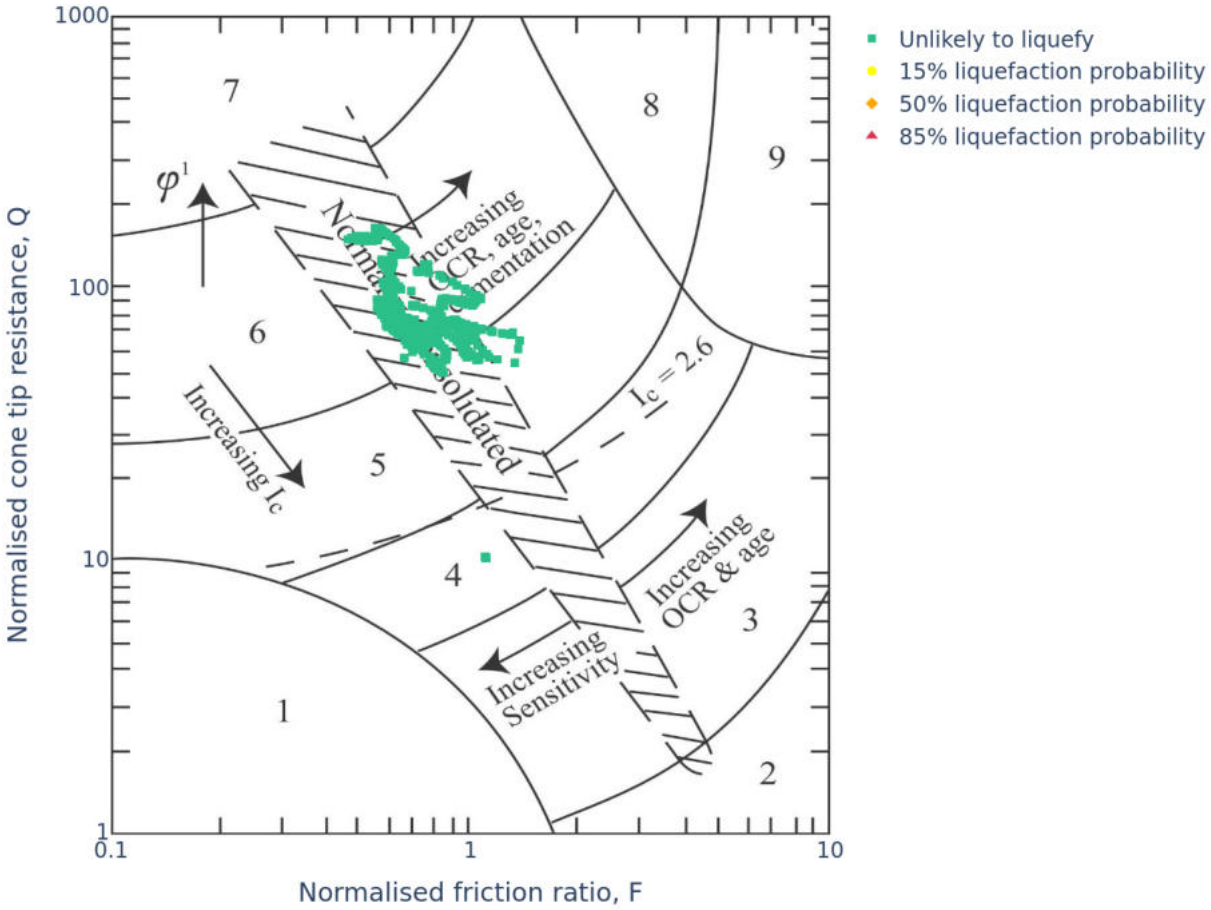
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	13	0.0	0	2	7.9	0
50%	6	0.0	0	1	7.9	0
85%	2	0.0	0	0	7.9	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT126 to CPT130A - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 16/22*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

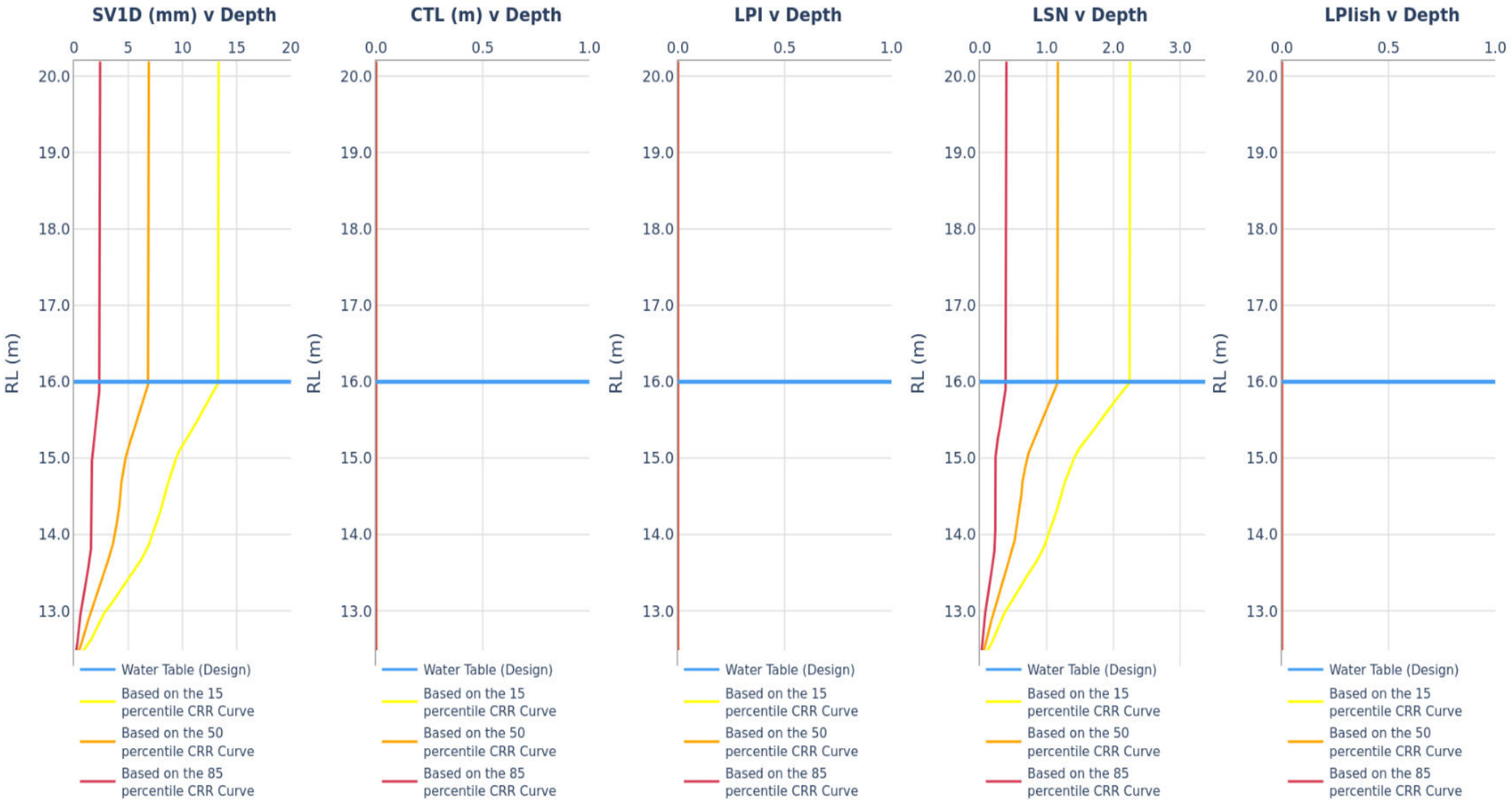


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

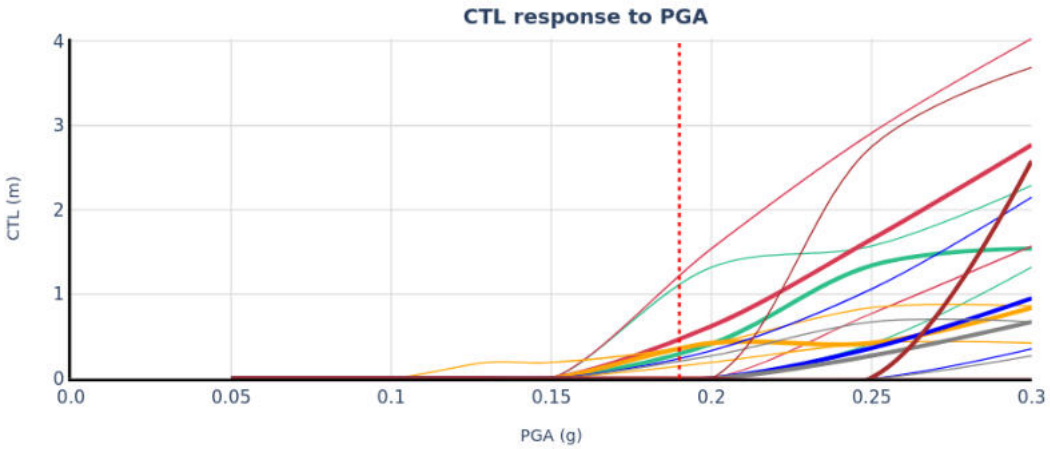
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

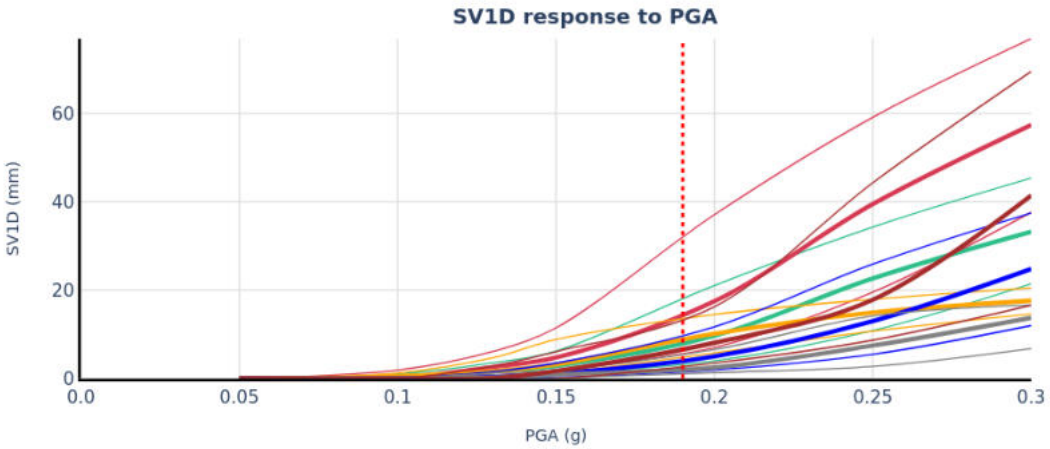


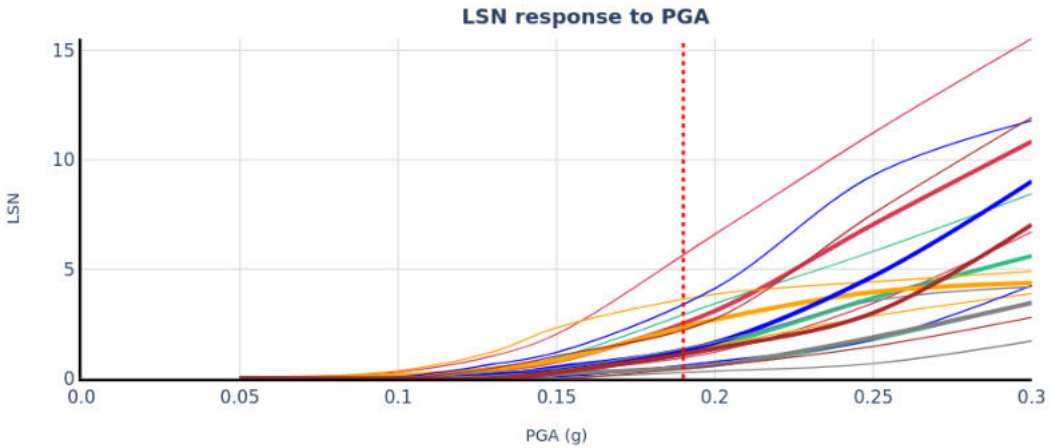
Input

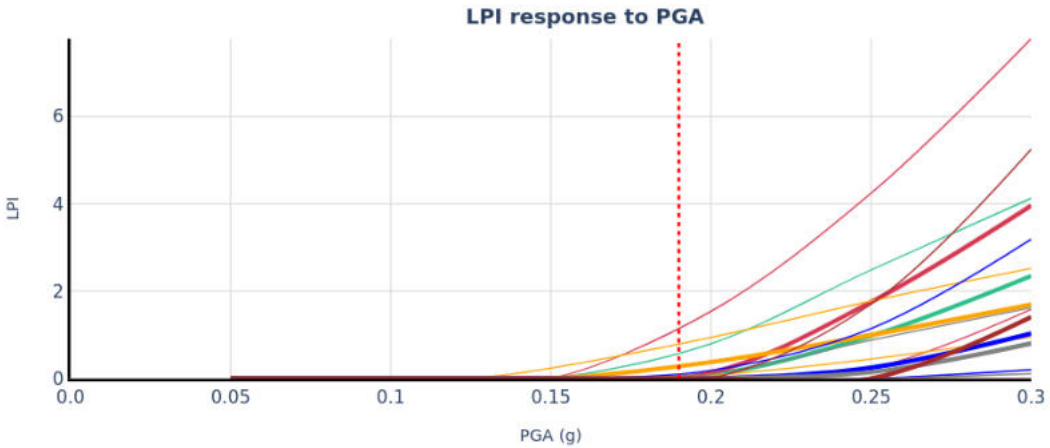
Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT130A	CPT_TT280756	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT







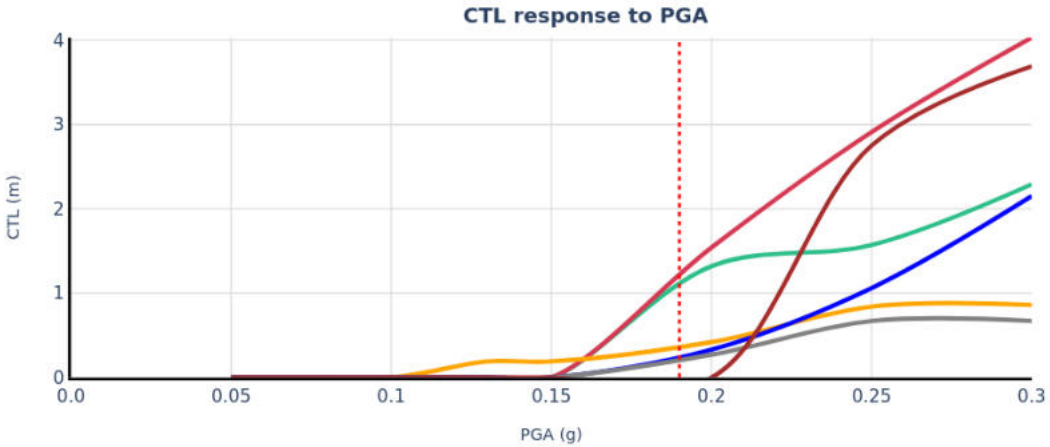


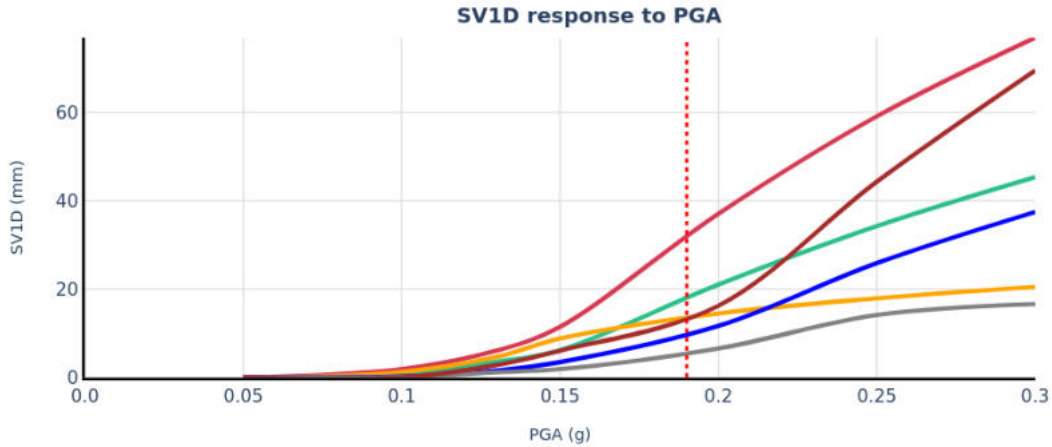
Input

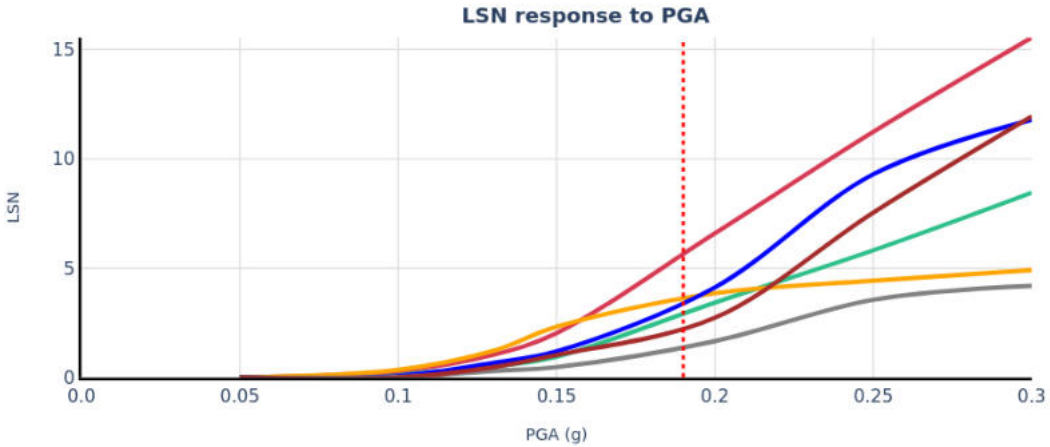
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT126	CPT_TT280751	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT127	CPT_TT280752	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT128	CPT_TT280753	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT129	CPT_TT280754	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT130	CPT_TT280755	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT130A	CPT_TT280756	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

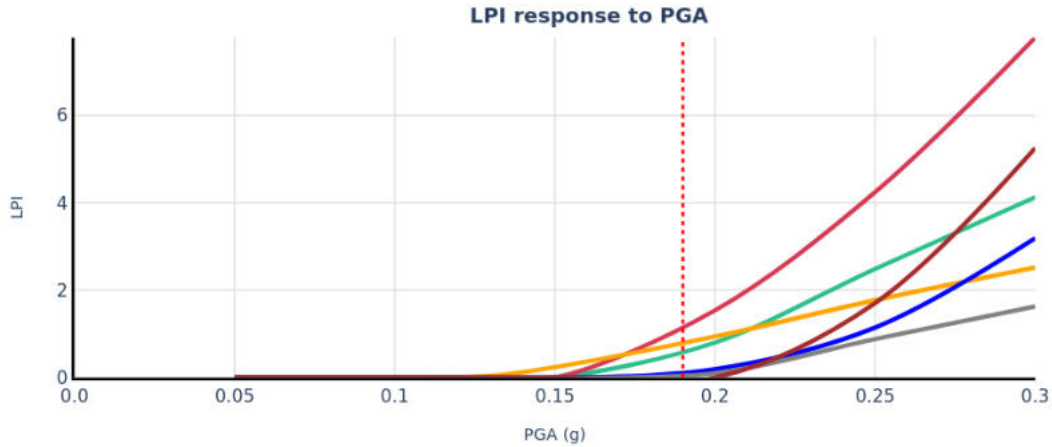
Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT BASED ON 15 PERCENTILE CRR CURVE









Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT126	CPT_TT280751	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT127	CPT_TT280752	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT128	CPT_TT280753	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT129	CPT_TT280754	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT130	CPT_TT280755	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT130A	CPT_TT280756	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280751	TTGD 280752	TTGD 280753
CPT Name	CPT126	CPT127	CPT128
Run Description	CPT126	CPT127	CPT128
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	1.7	2.0	1.6
Depth to groundwater for design (m)	1.7	2.0	1.6
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	7.97	7.93	8.0
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	10	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280751	CPT126	0.0	0.0	0.0
TTGD 280751	CPT126	0.0	10.0	2.6
TTGD 280752	CPT127	0.0	0.0	0.0
TTGD 280752	CPT127	0.0	10.0	2.6
TTGD 280753	CPT128	0.0	0.0	0.0
TTGD 280753	CPT128	0.0	10.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280751	CPT126	0.0	10.0	0.0 CFC
TTGD 280752	CPT127	0.0	10.0	0.0 CFC
TTGD 280753	CPT128	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280751	CPT126	0.0	0.0001	18.0
TTGD 280751	CPT126	0.0001	10.0	18.0
TTGD 280752	CPT127	0.0	0.0001	18.0
TTGD 280752	CPT127	0.0001	10.0	18.0
TTGD 280753	CPT128	0.0	0.0001	18.0
TTGD 280753	CPT128	0.0001	10.0	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280754	TTGD 280755	TTGD 280756
CPT Name	CPT129	CPT130	CPT130A
Run Description	CPT129	CPT130	CPT130A
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	1.3	3.2	4.2
Depth to groundwater for design (m)	1.3	3.2	4.2
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	7.99	7.94	7.92
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	10	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280754	CPT129	0.0	0.0	0.0
TTGD 280754	CPT129	0.0	10.0	2.6
TTGD 280755	CPT130	0.0	0.0	0.0
TTGD 280755	CPT130	0.0	10.0	2.6
TTGD 280756	CPT130A	0.0	0.0	0.0
TTGD 280756	CPT130A	0.0	10.0	2.6

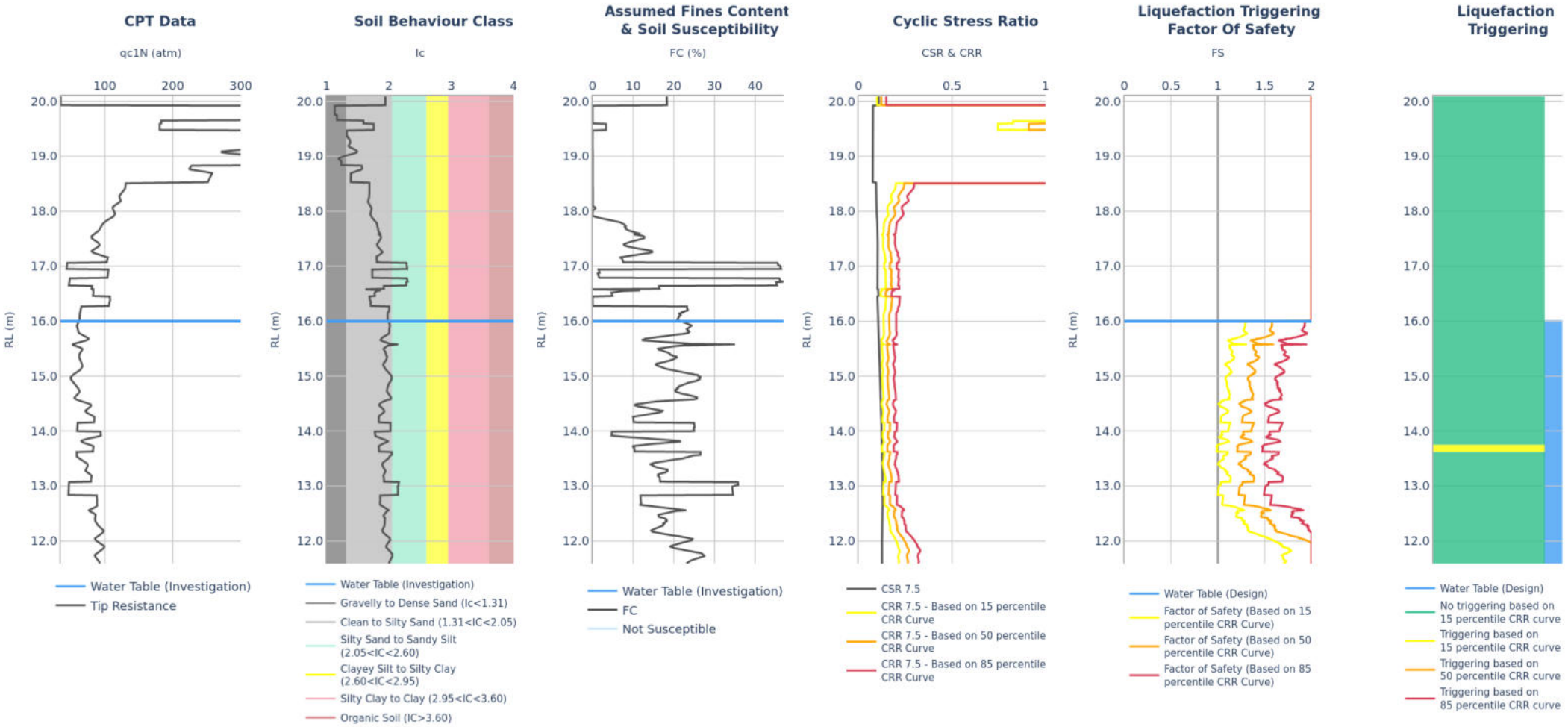
Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280754	CPT129	0.0	10.0	0.0 CFC
TTGD 280755	CPT130	0.0	10.0	0.0 CFC
TTGD 280756	CPT130A	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280754	CPT129	0.0	0.0001	18.0
TTGD 280754	CPT129	0.0001	10.0	18.0
TTGD 280755	CPT130	0.0	0.0001	18.0
TTGD 280755	CPT130	0.0001	10.0	18.0
TTGD 280756	CPT130A	0.0	0.0001	18.0
TTGD 280756	CPT130A	0.0001	10.0	18.0

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT131	CPT_TT280757	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

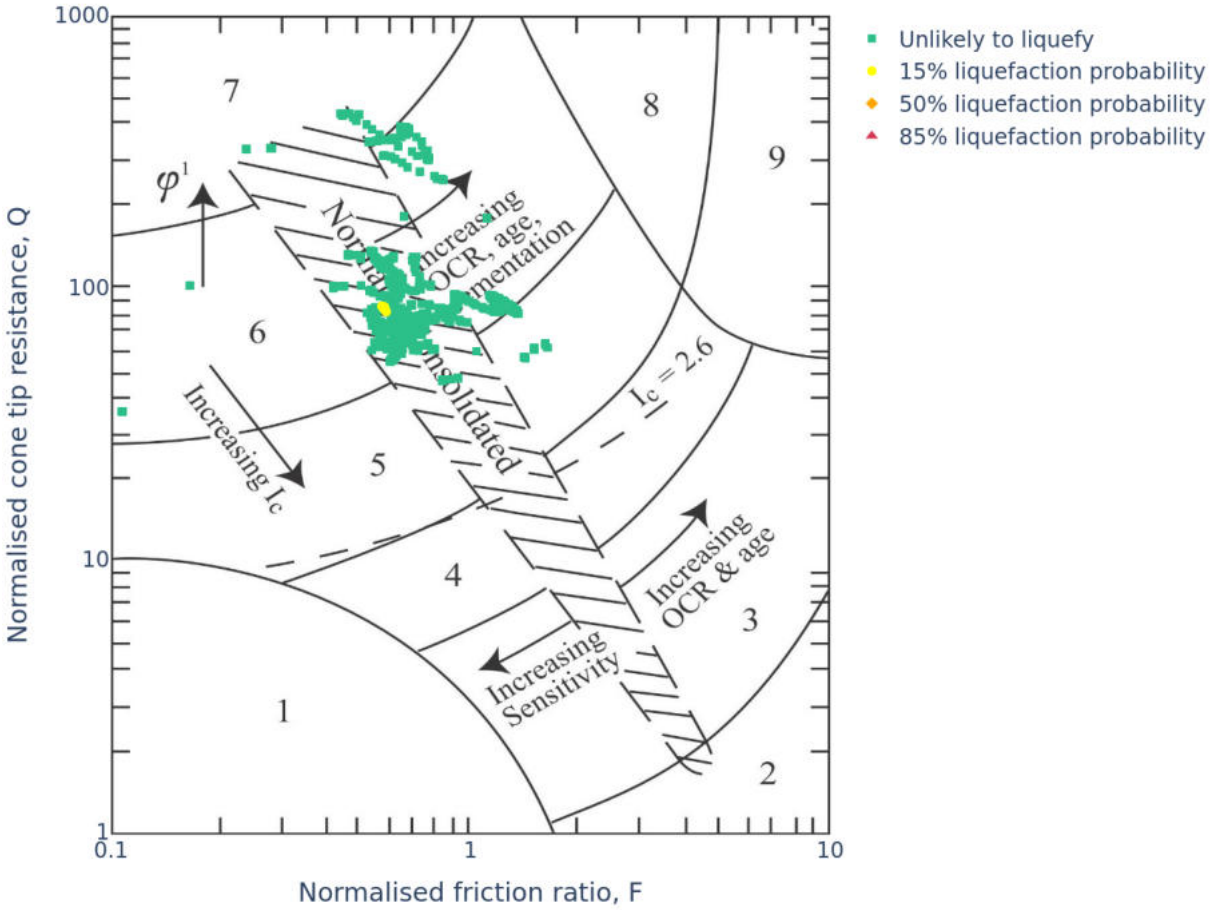
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	23	0.1	0	3	6.4	0
50%	10	0.0	0	1	8.5	0
85%	5	0.0	0	0	8.5	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT131 to CPT 134 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

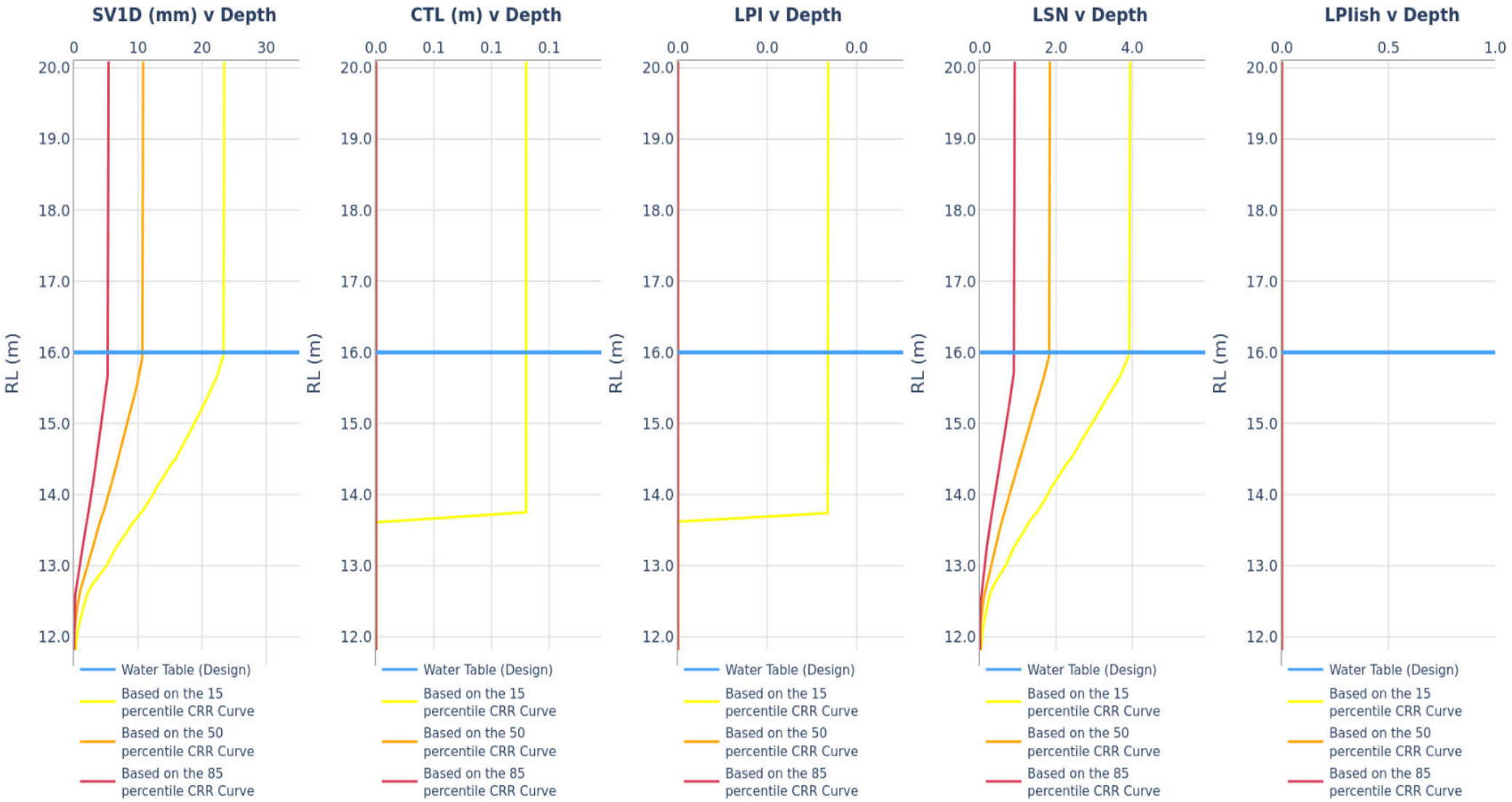


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

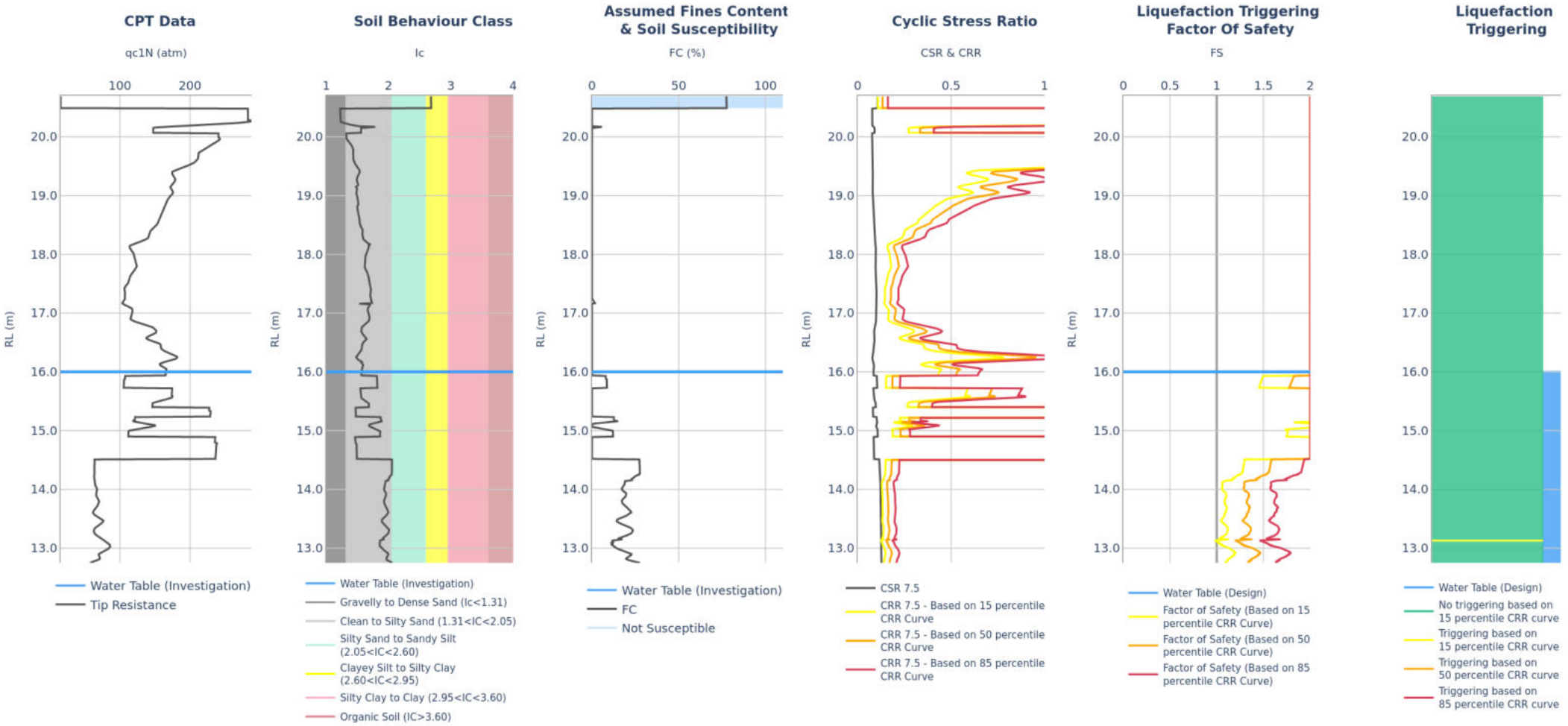
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT131	CPT_TT280757	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT132	CPT_TT280758	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

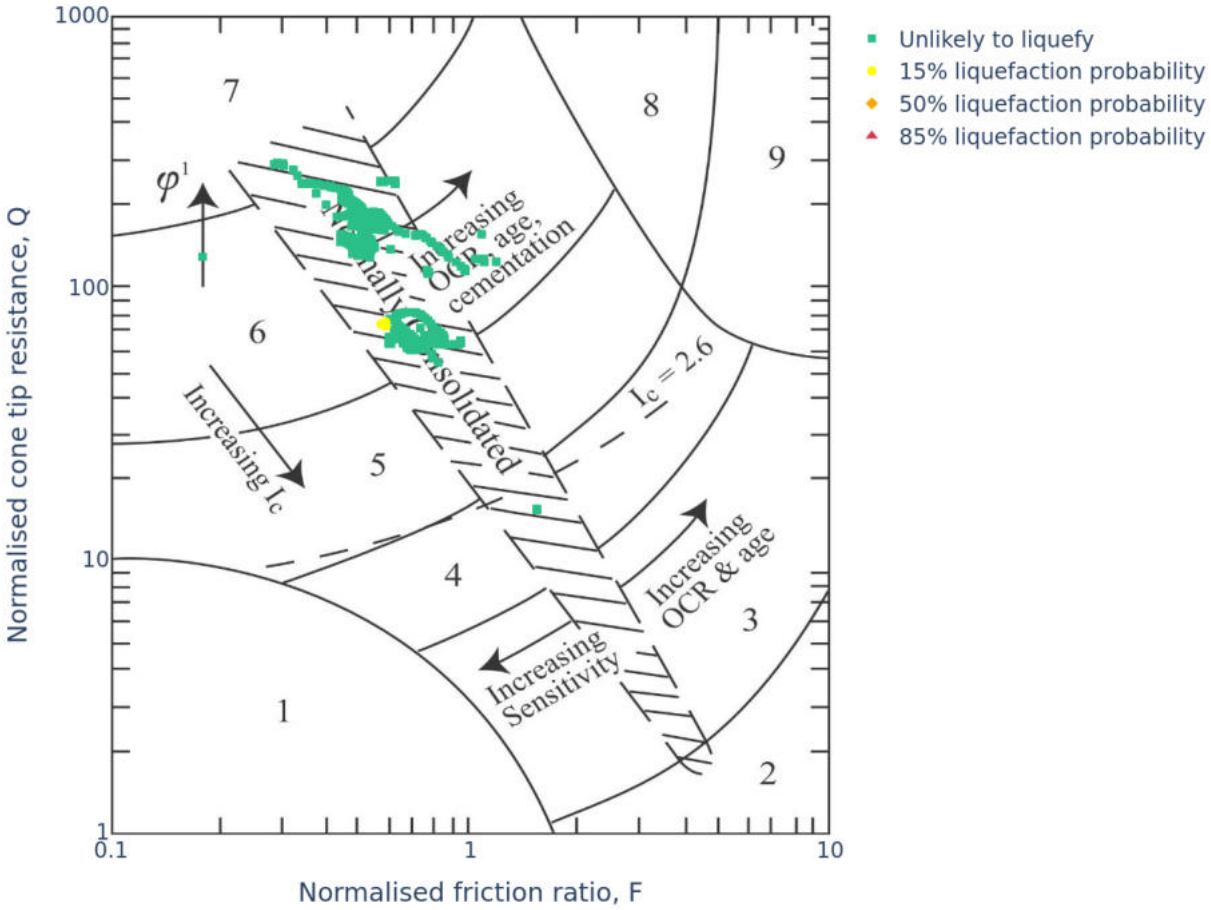
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	10	0.0	0	1	8.0	0
50%	4	0.0	0	0	8.0	0
85%	2	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT131 to CPT 134 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

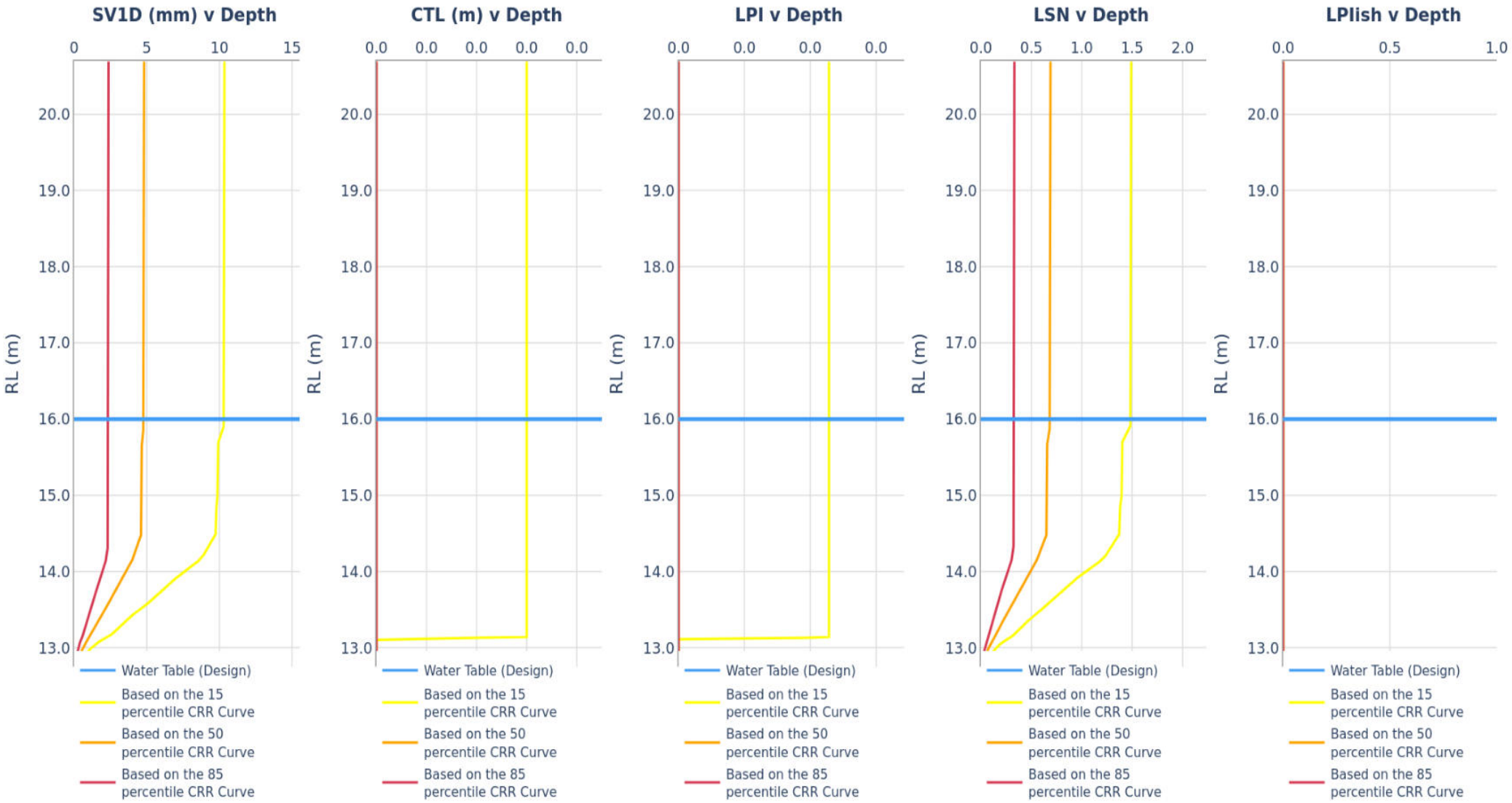


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

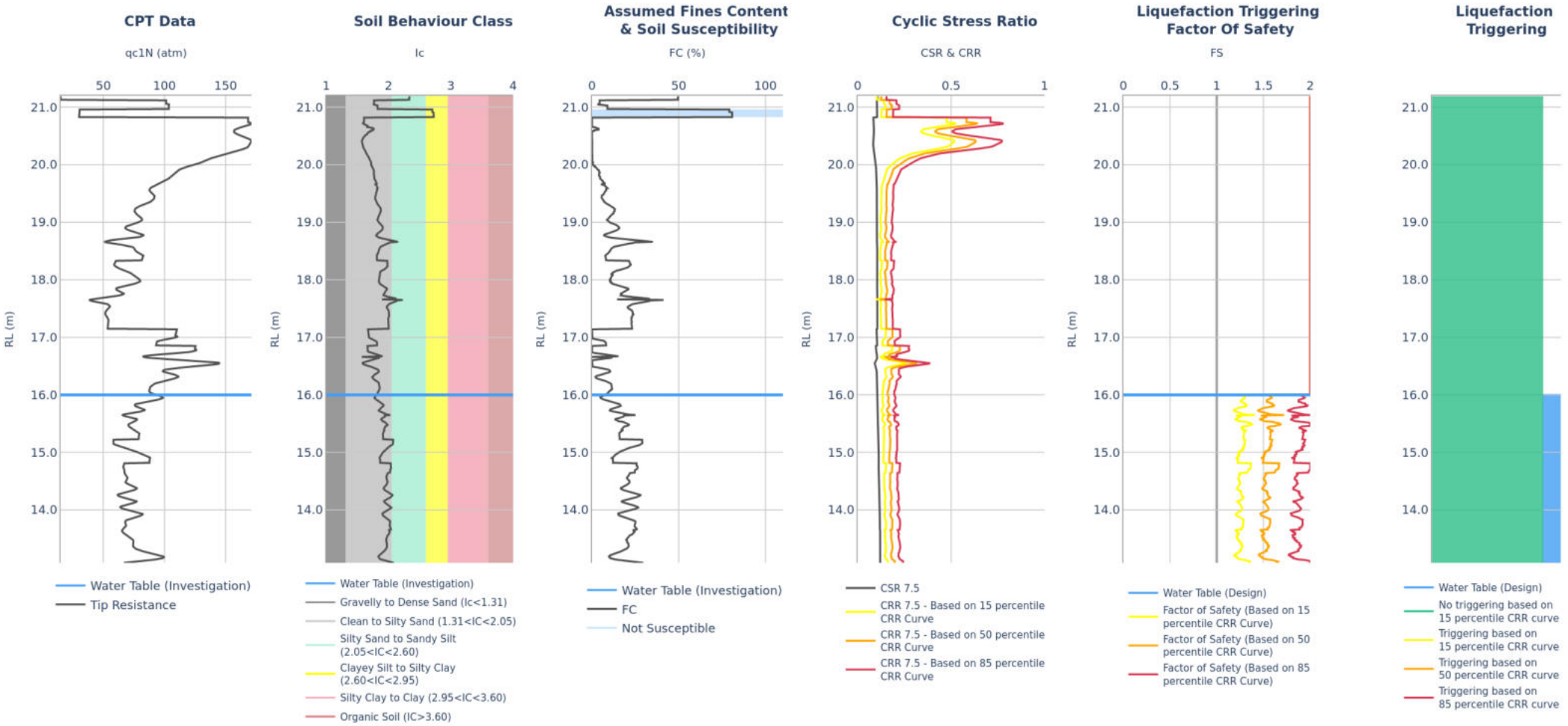
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT132	CPT_TT280758	10/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT133	CPT_TT280759	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

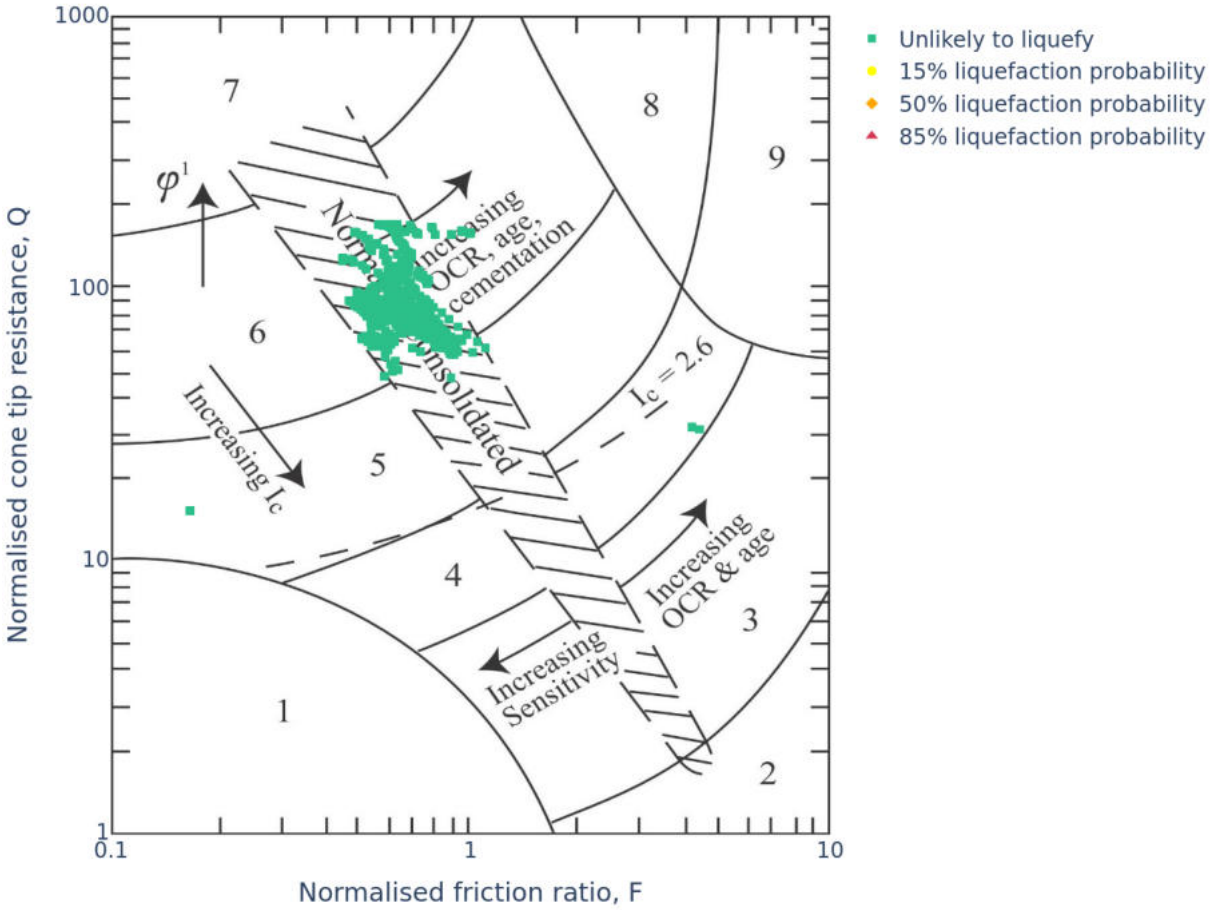
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	9	0.0	0	1	8.1	0
50%	5	0.0	0	0	8.1	0
85%	1	0.0	0	0	8.1	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

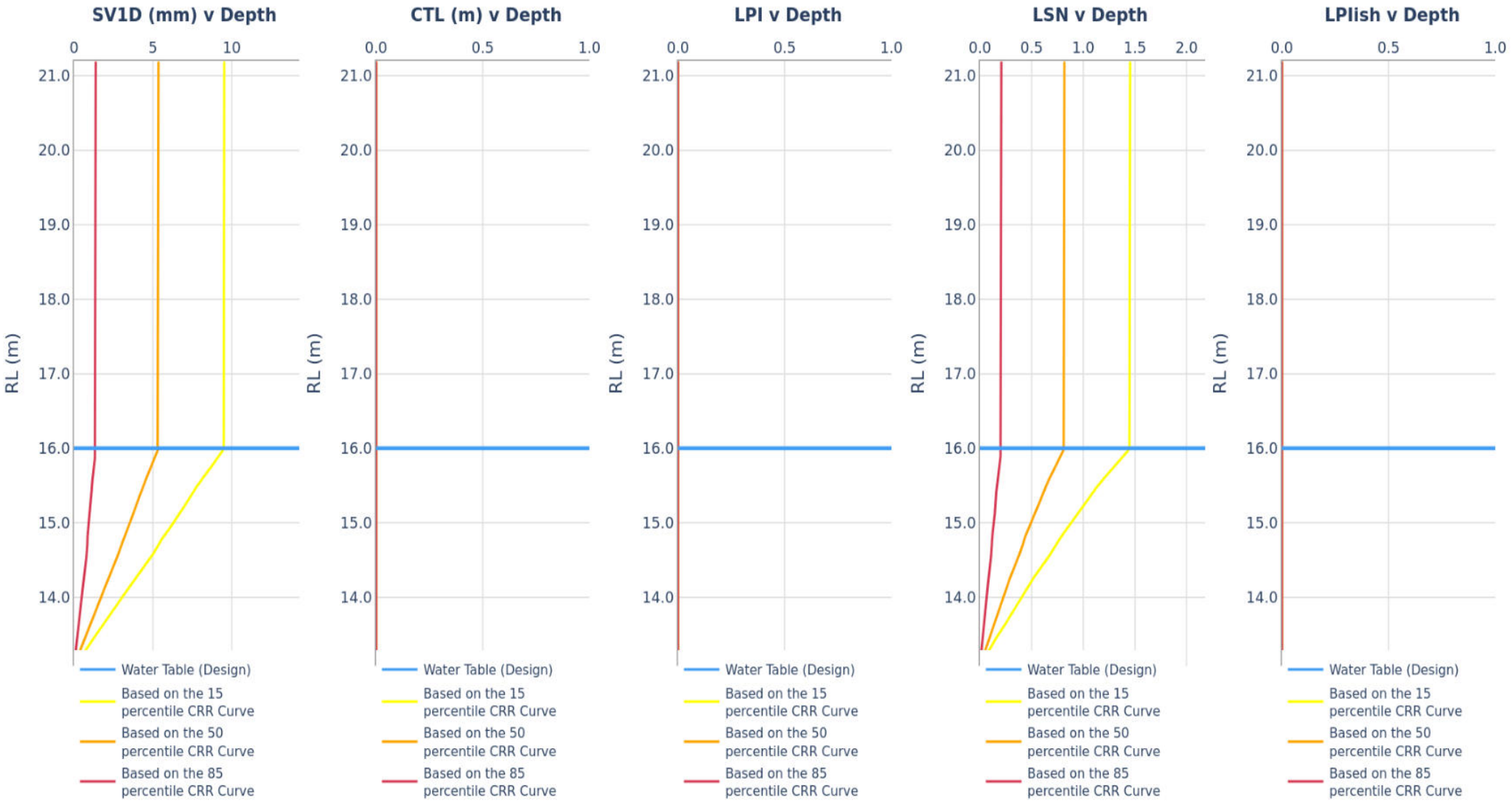


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

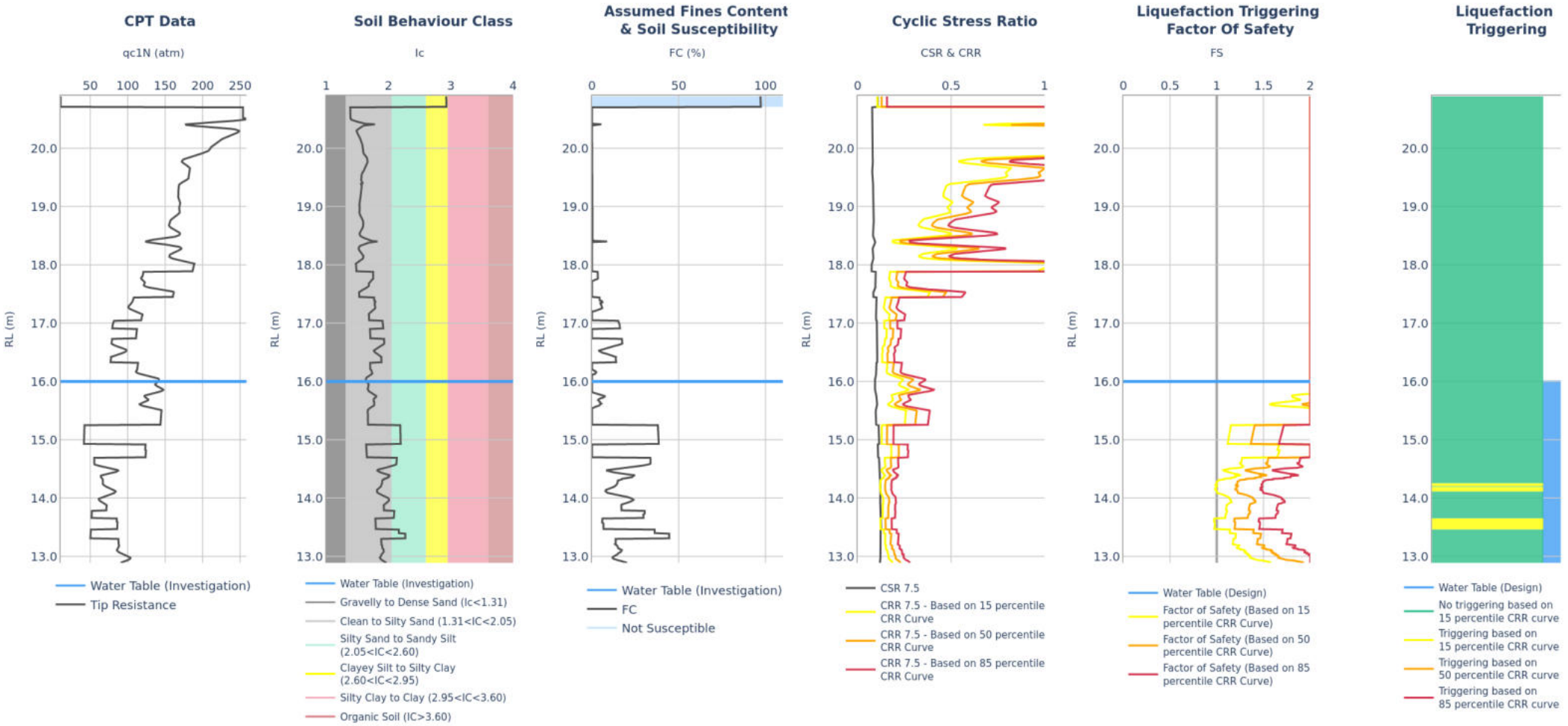
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT133	CPT_TT280759	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT134	CPT_TT280760	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

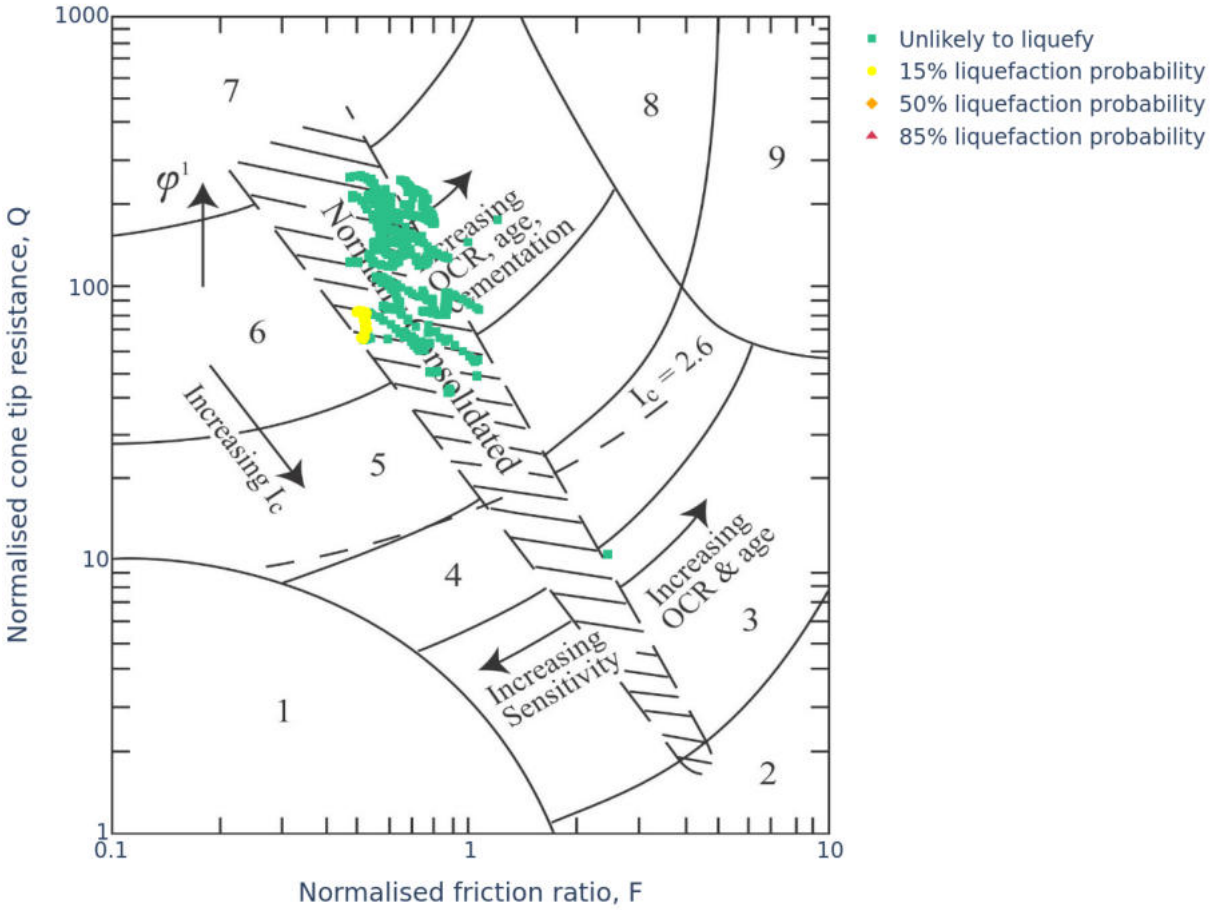
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	12	0.3	0	1	6.8	0
50%	5	0.0	0	0	8.0	0
85%	2	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT131 to CPT 134 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 10/16*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

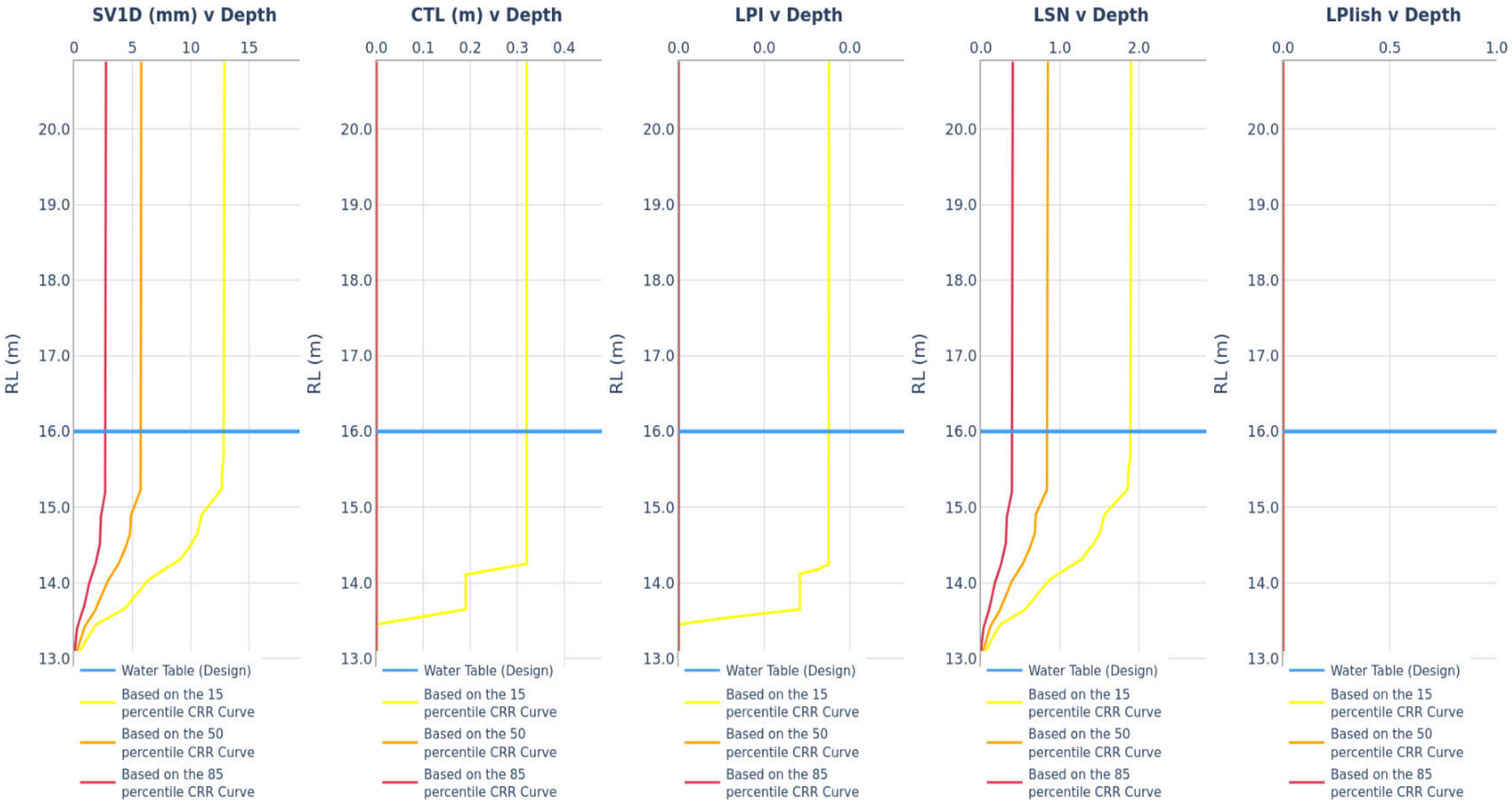


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

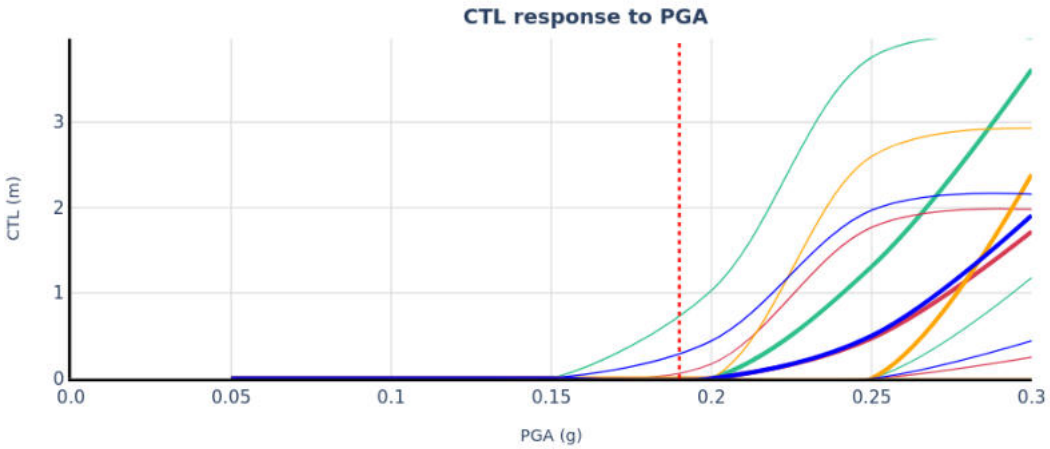
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

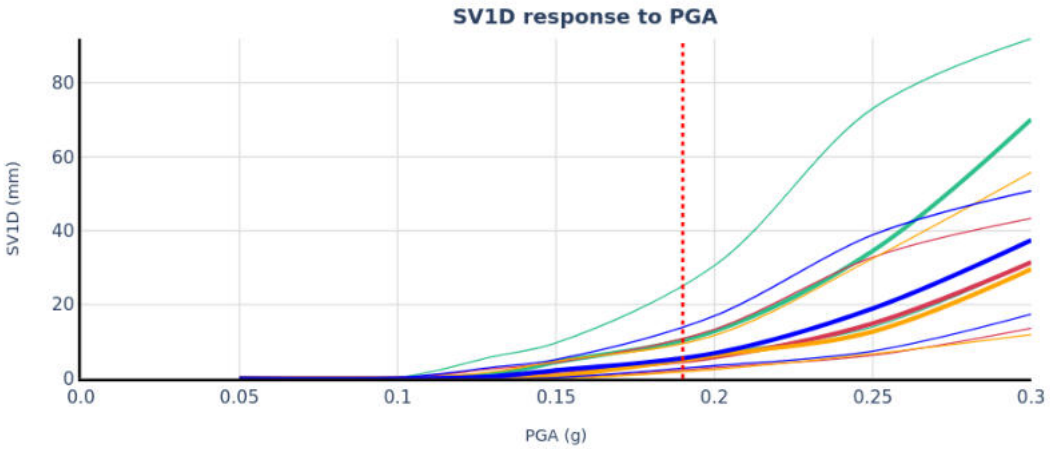


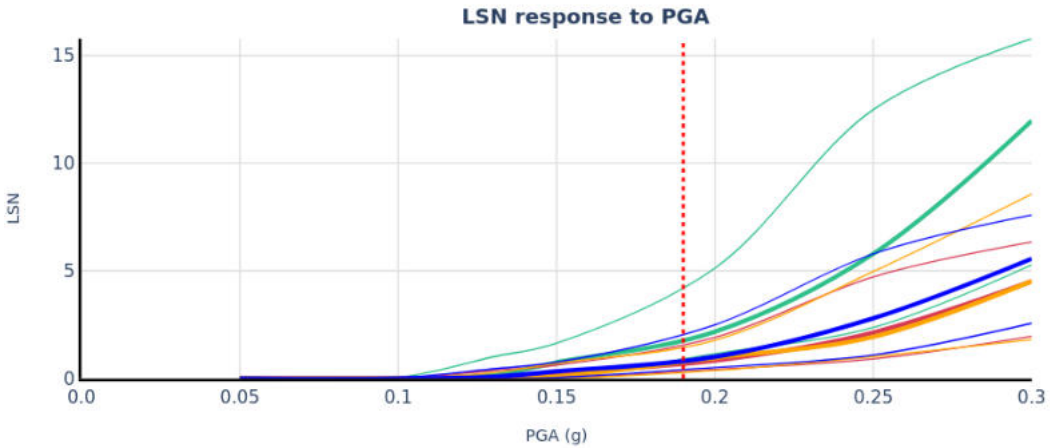
Input

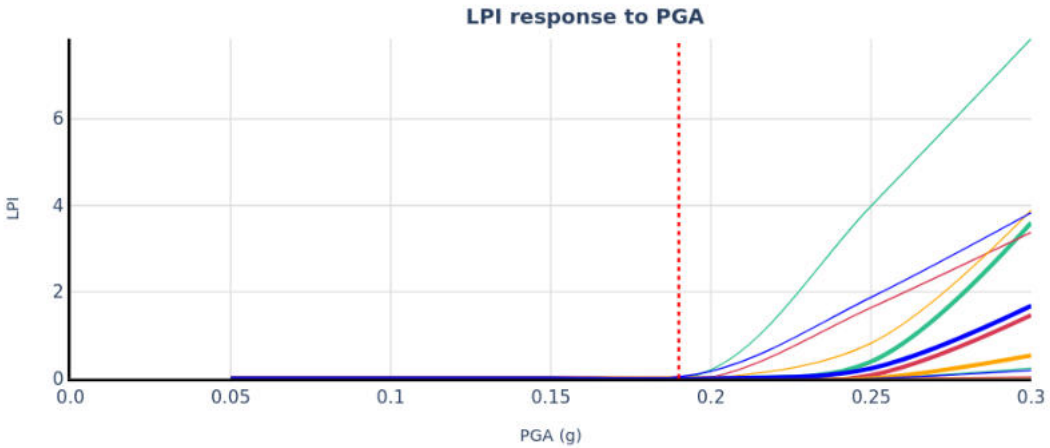
Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT134	CPT_TT280760	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT







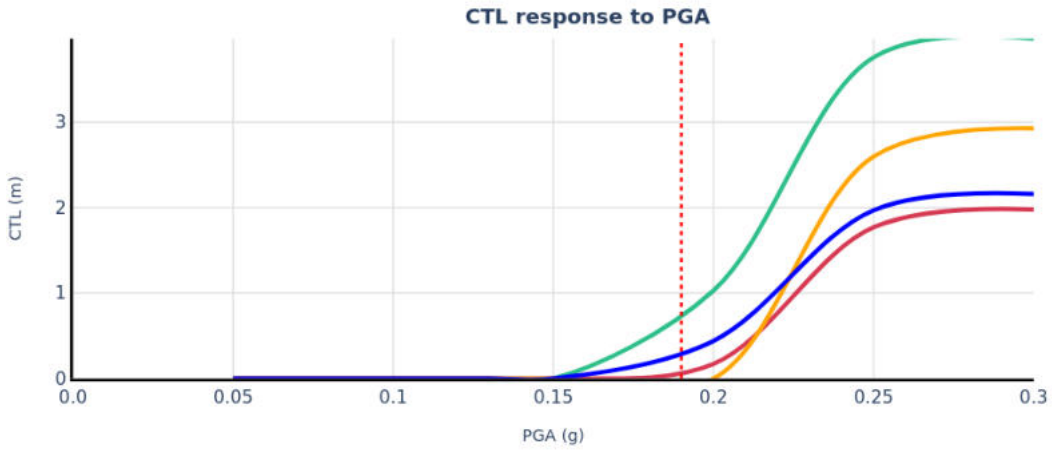


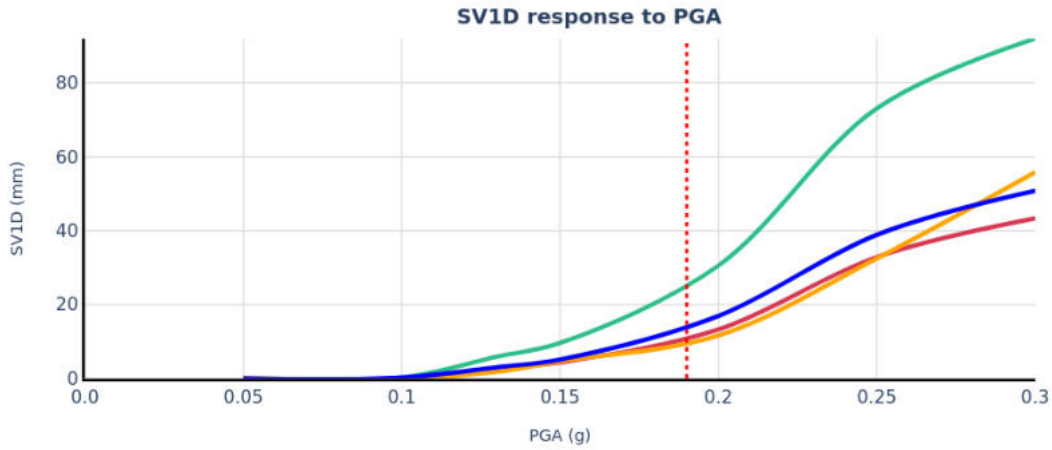
Input

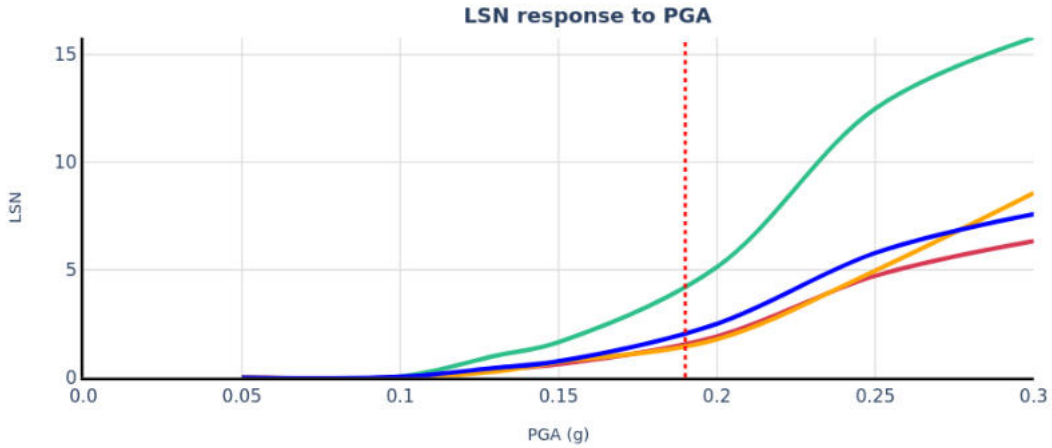
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT131	CPT_TT280757	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT132	CPT_TT280758	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT133	CPT_TT280759	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT134	CPT_TT280760	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

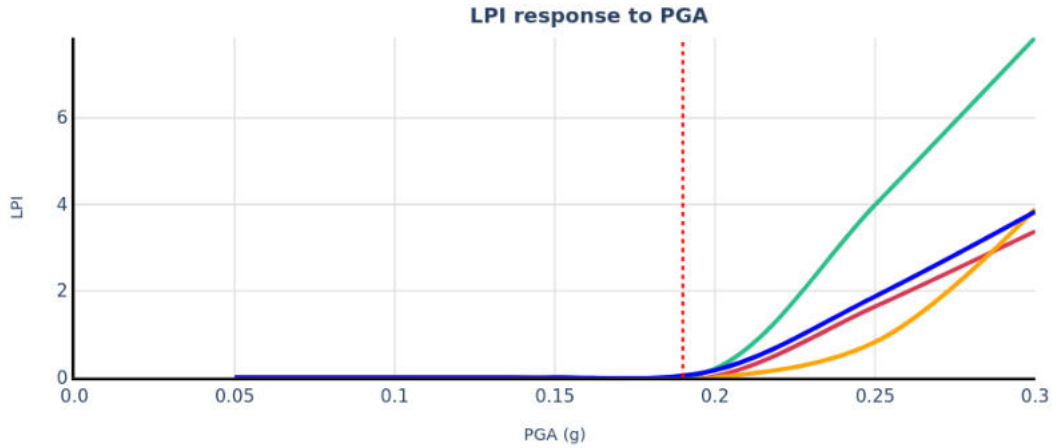
Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT BASED ON 15 PERCENTILE CRR CURVE









Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT131	CPT_TT280757	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT132	CPT_TT280758	10/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT133	CPT_TT280759	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT134	CPT_TT280760	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280757	TTGD 280758	TTGD 280759
CPT Name	CPT131	CPT132	CPT133
Run Description	CPT131	CPT132	CPT133
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	4.1	4.7	5.2
Depth to groundwater for design (m)	4.1	4.7	5.2
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	8.51	7.95	8.12
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	10	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280757	CPT131	0.0	0.0	0.0
TTGD 280757	CPT131	0.0	10.0	2.6
TTGD 280758	CPT132	0.0	0.0	0.0
TTGD 280758	CPT132	0.0	10.0	2.6
TTGD 280759	CPT133	0.0	0.0	0.0
TTGD 280759	CPT133	0.0	10.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280757	CPT131	0.0	10.0	0.0 CFC
TTGD 280758	CPT132	0.0	10.0	0.0 CFC
TTGD 280759	CPT133	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280757	CPT131	0.0	0.0001	18.0
TTGD 280757	CPT131	0.0001	10.0	18.0
TTGD 280758	CPT132	0.0	0.0001	18.0
TTGD 280758	CPT132	0.0001	10.0	18.0
TTGD 280759	CPT133	0.0	0.0001	18.0
TTGD 280759	CPT133	0.0001	10.0	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280760
CPT Name	CPT134
Run Description	CPT134
EQ PGA (g)	0.19
EQ Magnitude	6.5
Depth to groundwater at time of Investigation (m)	4.9
Depth to groundwater for design (m)	4.9
Pre-drill depth (m)	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)
Settlement method	ZRB-2002
Total depth of CPT (m)	8.01
Minimum depth of analysis (m)	0
Maximum depth of analysis (m)	10
Inverse filtering applied?	Yes (10 cm^2)
Cut/Fill Height	N/A
Surcharge load (kPa)	N/A
Fill unit weight (kN/m^3)	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280760	CPT134	0.0	0.0	0.0
TTGD 280760	CPT134	0.0	10.0	2.6

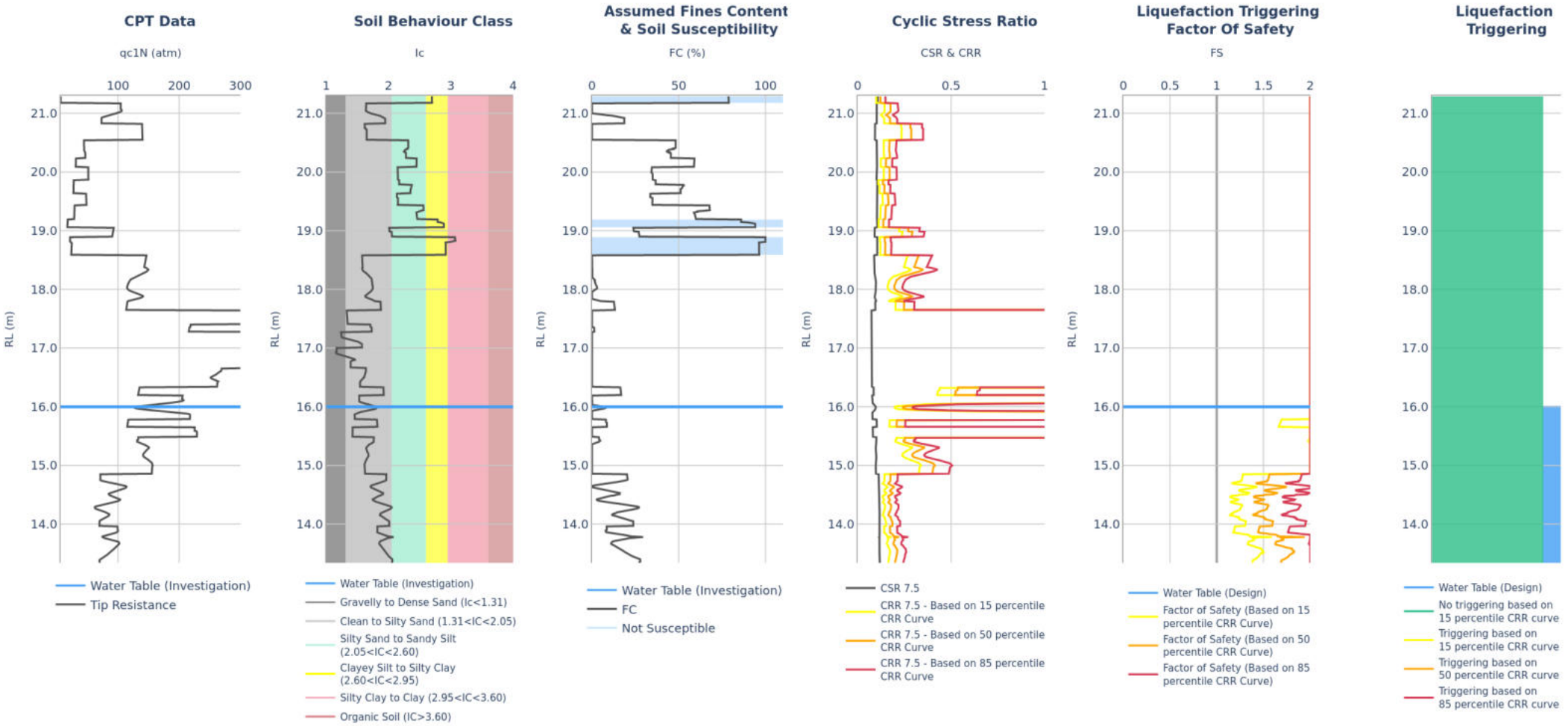
Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280760	CPT134	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280760	CPT134	0.0	0.0001	18.0
TTGD 280760	CPT134	0.0001	10.0	18.0

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT135	CPT_TT280761	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

Output

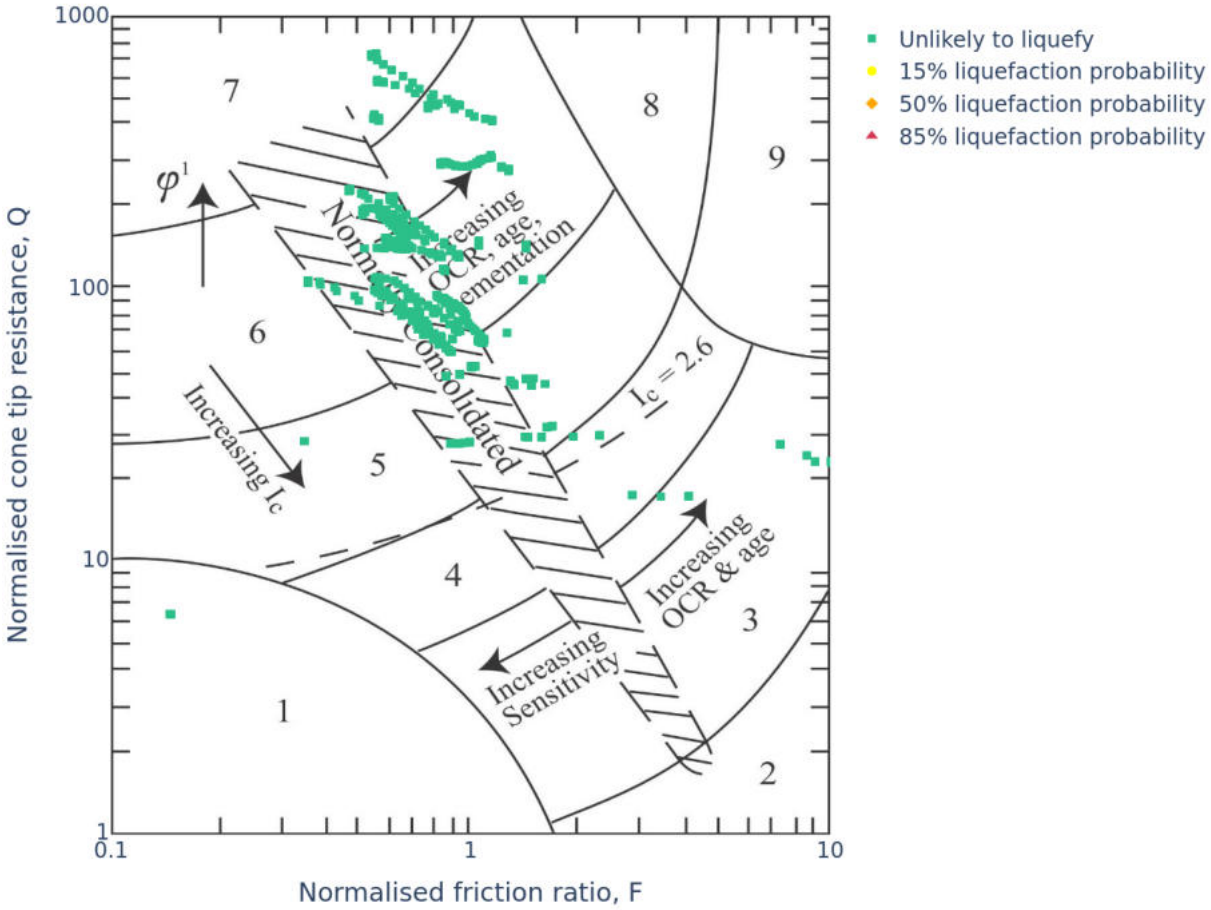
PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	4	0.0	0	0	8.0	0
50%	2	0.0	0	0	8.0	0
85%	0	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

Tonkin+Taylor	*CLIENT*	*Te Runanga o NgaiTakoto Custodian Trust*	*LOCATION*	*424 Sandhills Road*	*DATE: 29/01/2026*
	PROJECT	*Sandhills Road - Proposed Egg Farm*		*,Ahipara*	*ANALYSED: BJFR*
	TITLE	*CPT135 to CPT138 - ULS*	*JOB NUMBER*	*1099963*	
	COMMENT	*nan*			*Page 1/16*

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

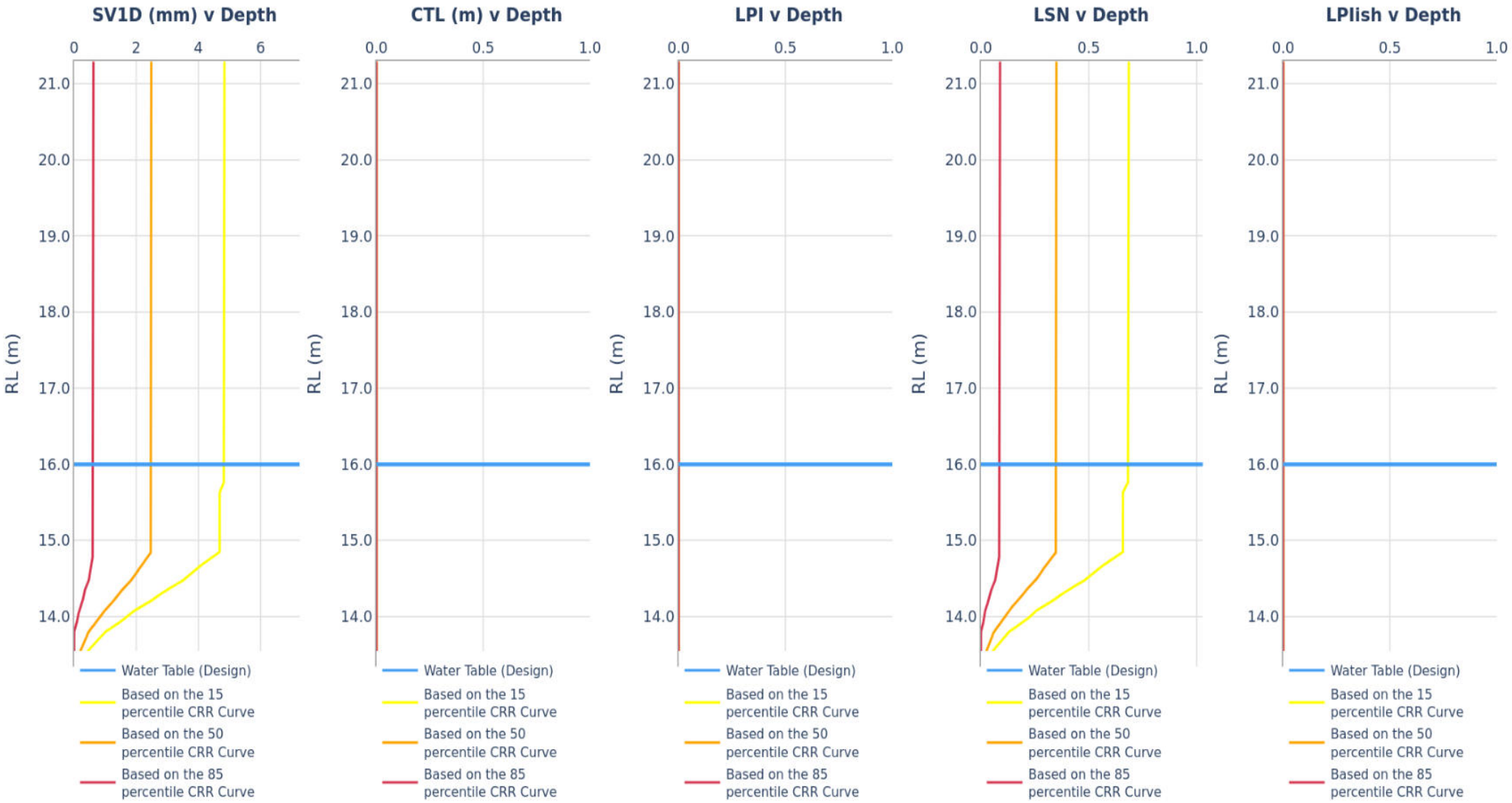


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

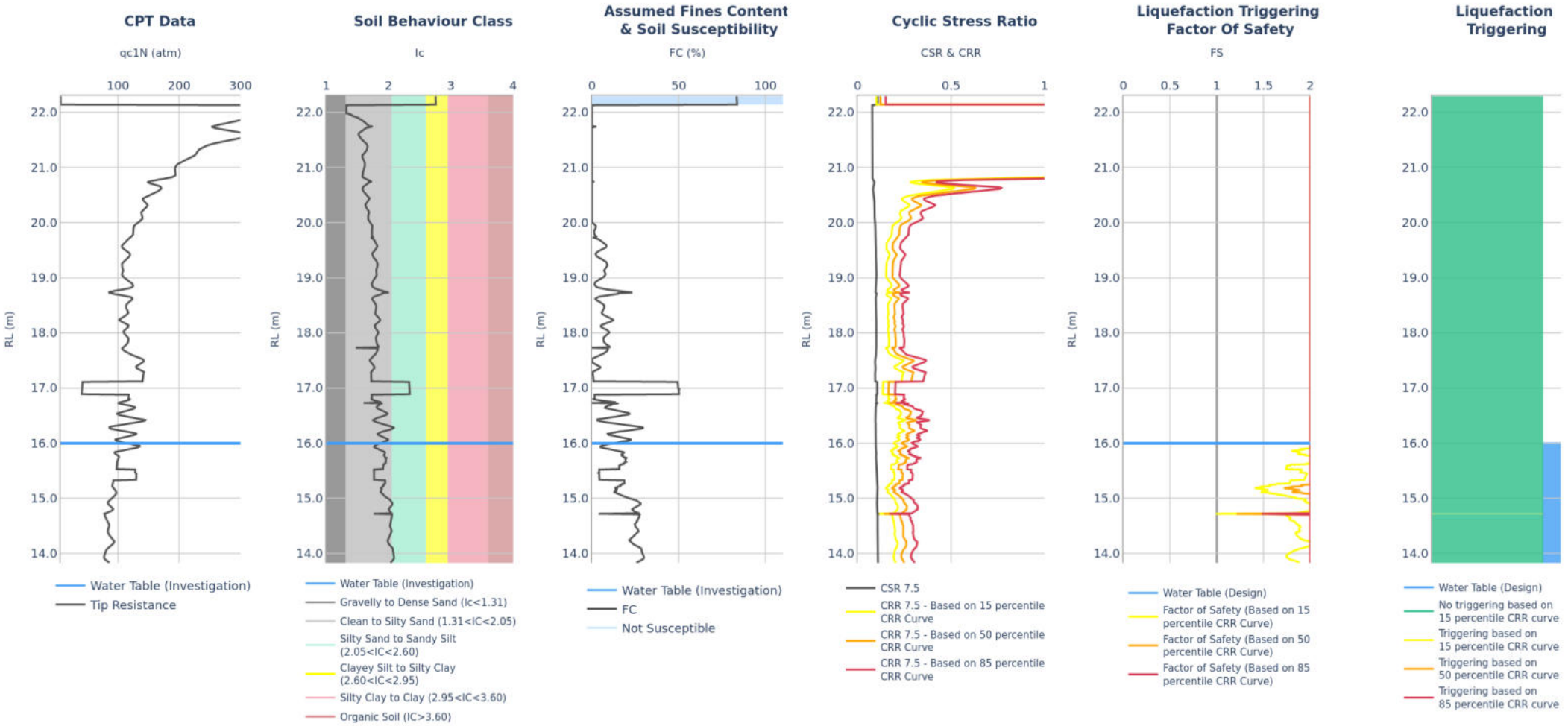
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT135	CPT_TT280761	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT136	CPT_TT280762	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

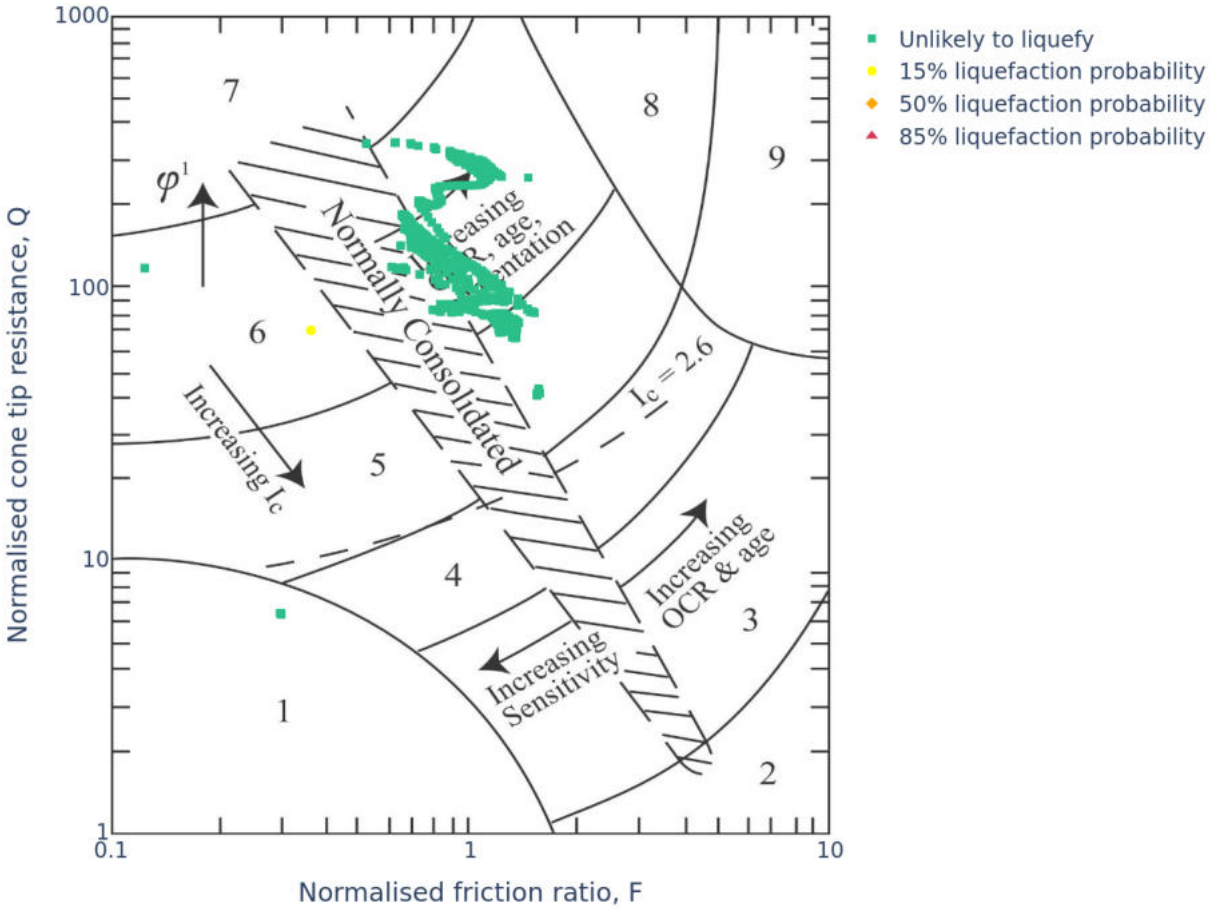
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	1	0.0	0	0	8.5	0
50%	0	0.0	0	0	8.5	0
85%	0	0.0	0	0	8.5	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

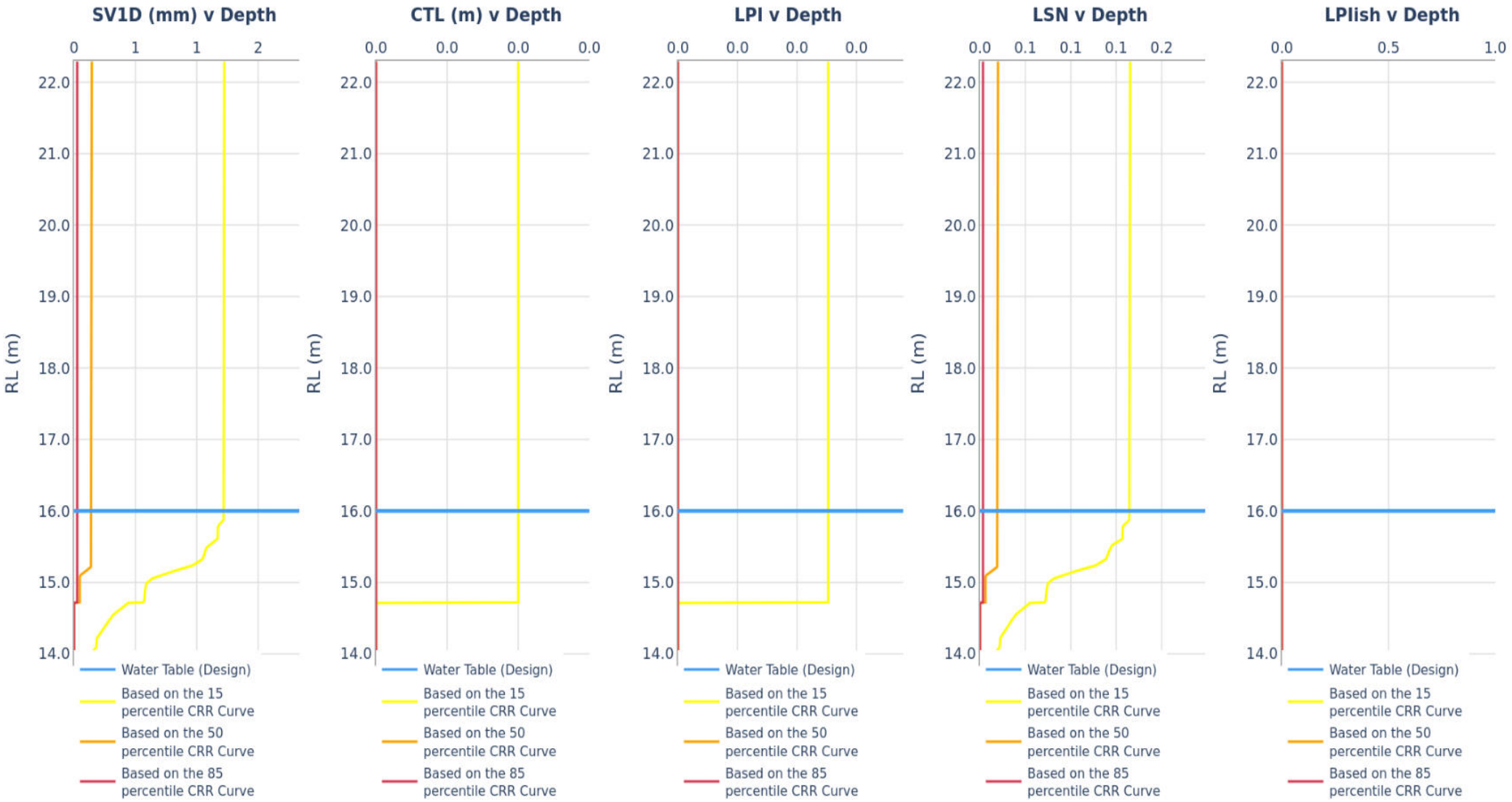


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

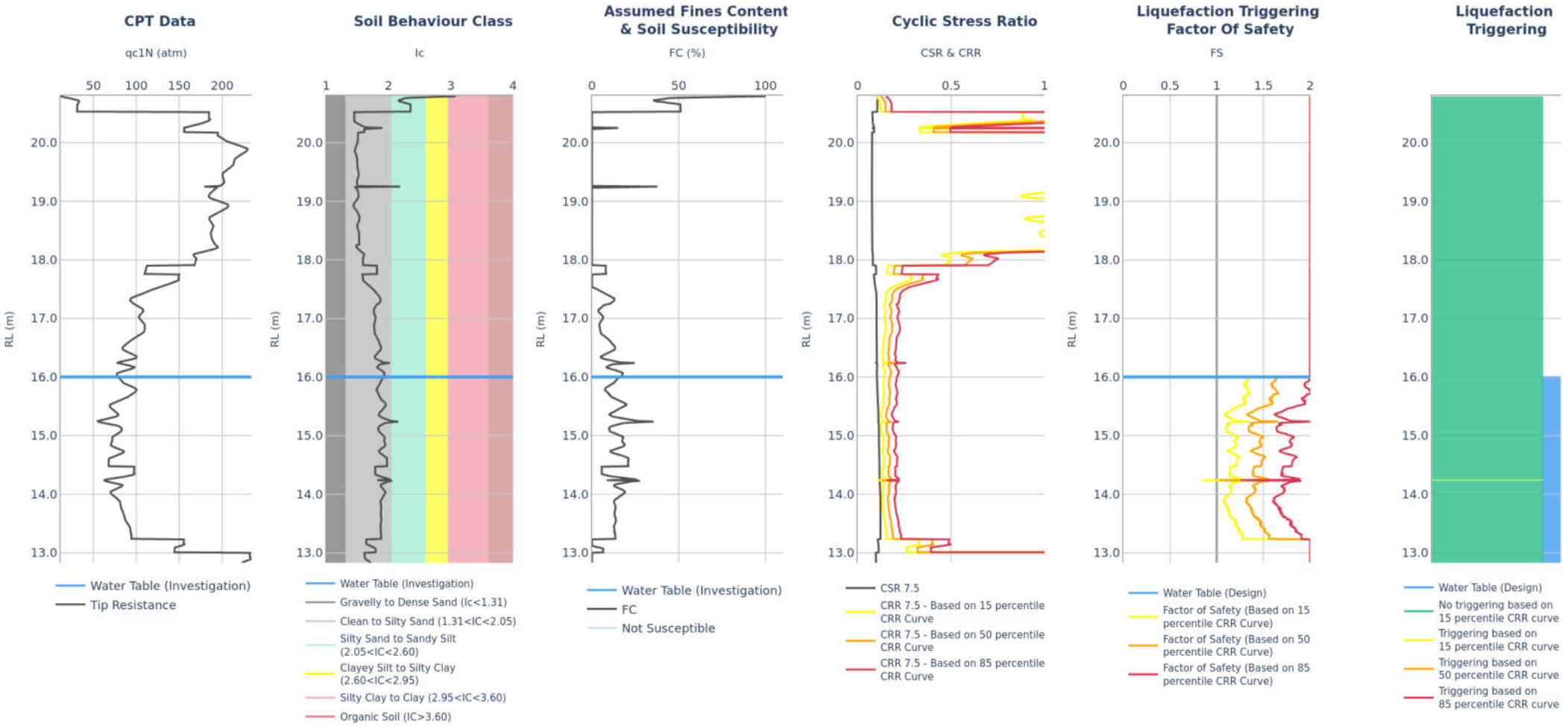
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT136	CPT_TT280762	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT137	CPT_TT280763	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

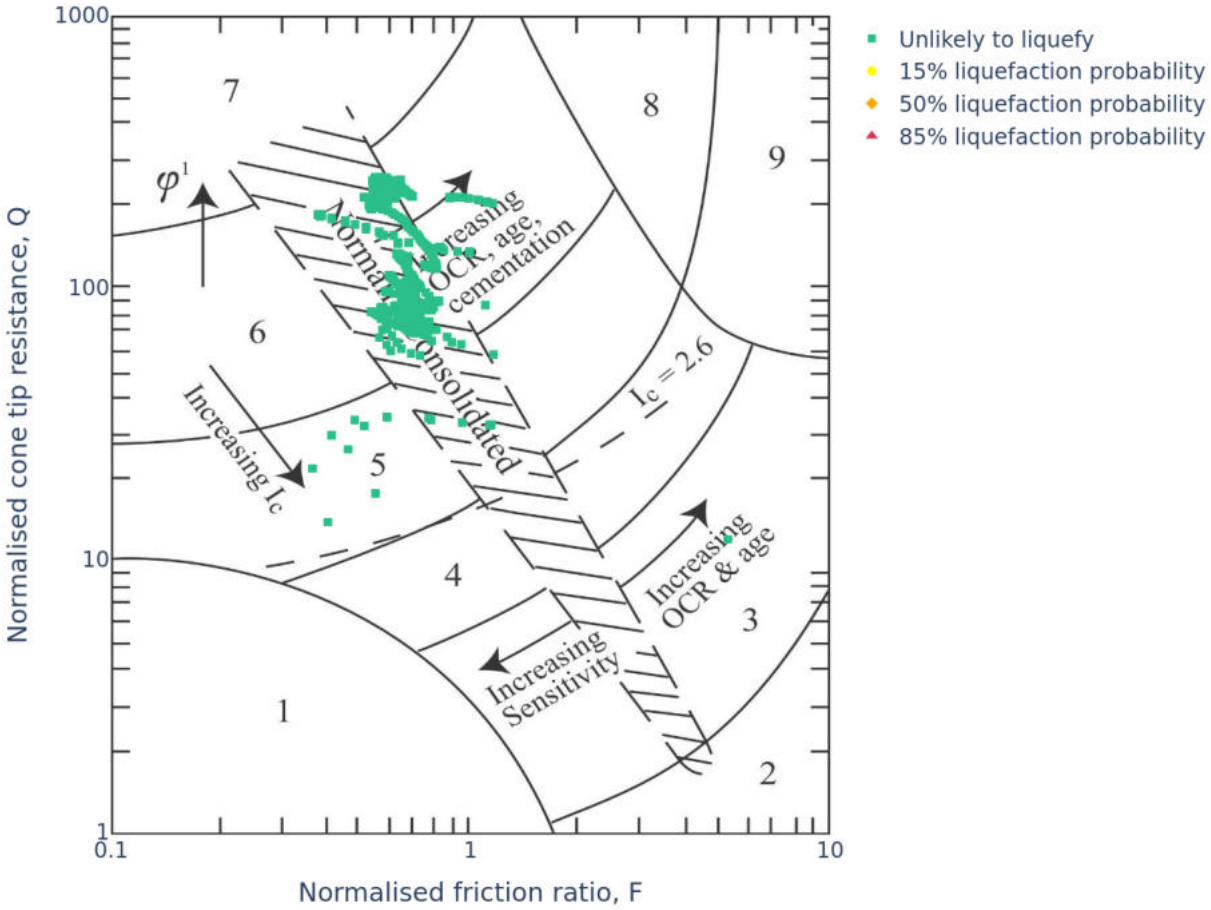
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	12	0.0	0	1	8.0	0
50%	6	0.0	0	1	8.0	0
85%	2	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

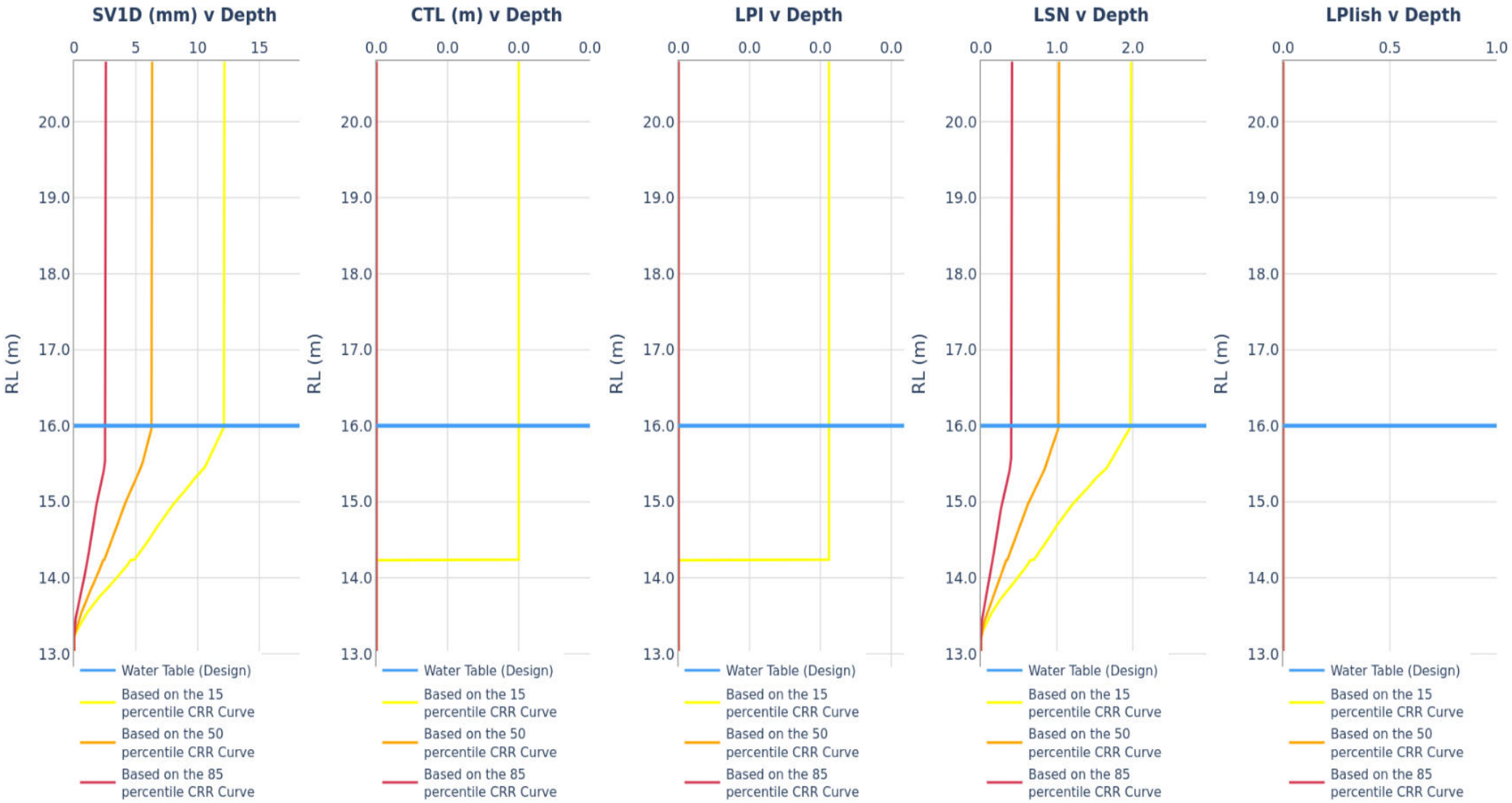


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

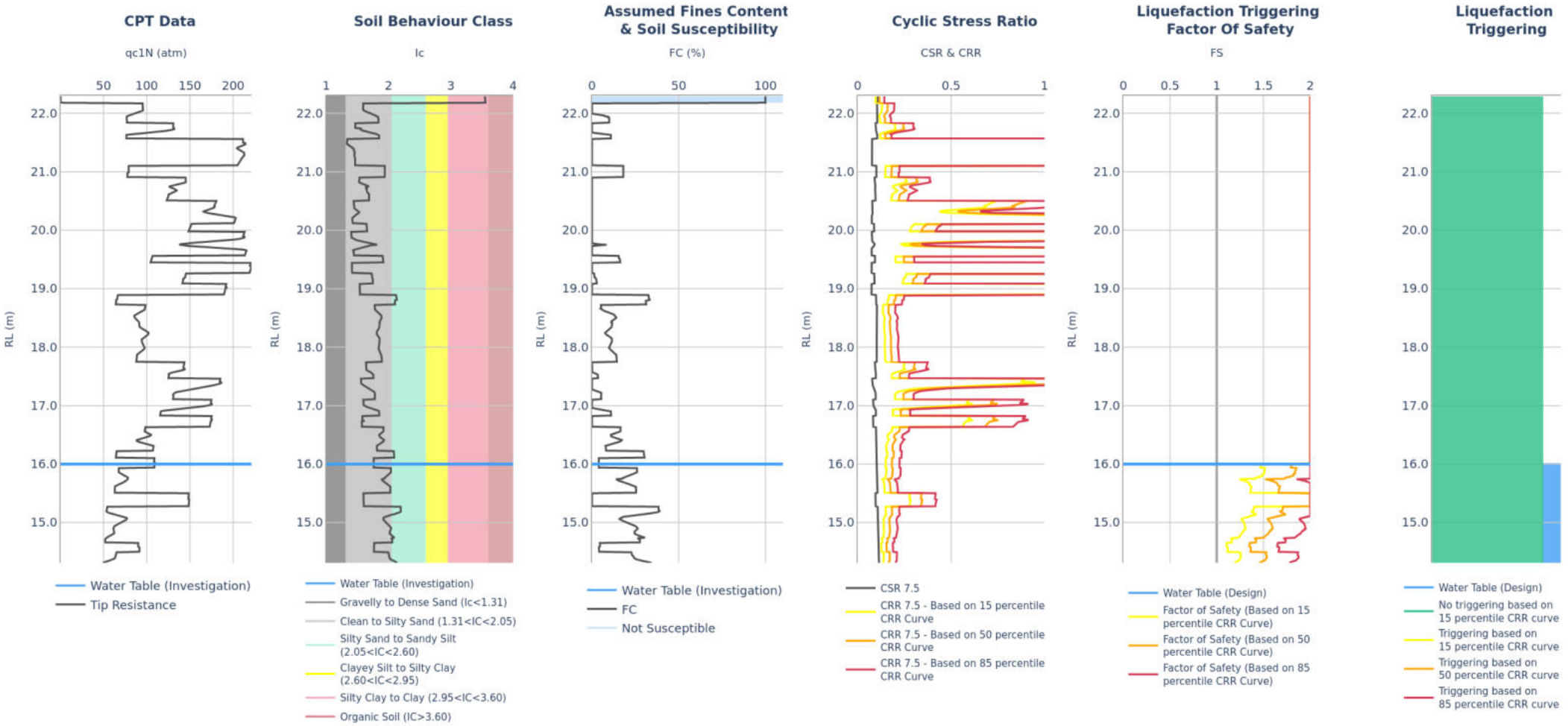
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT



Input

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT137	CPT_TT280763	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

CPT DATA AND LIQUEFACTION TRIGGERING ASSESSMENT



Input

Note: Inverse filter Qc/Fs data (10 cm²).

Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT138	CPT_TT280764	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

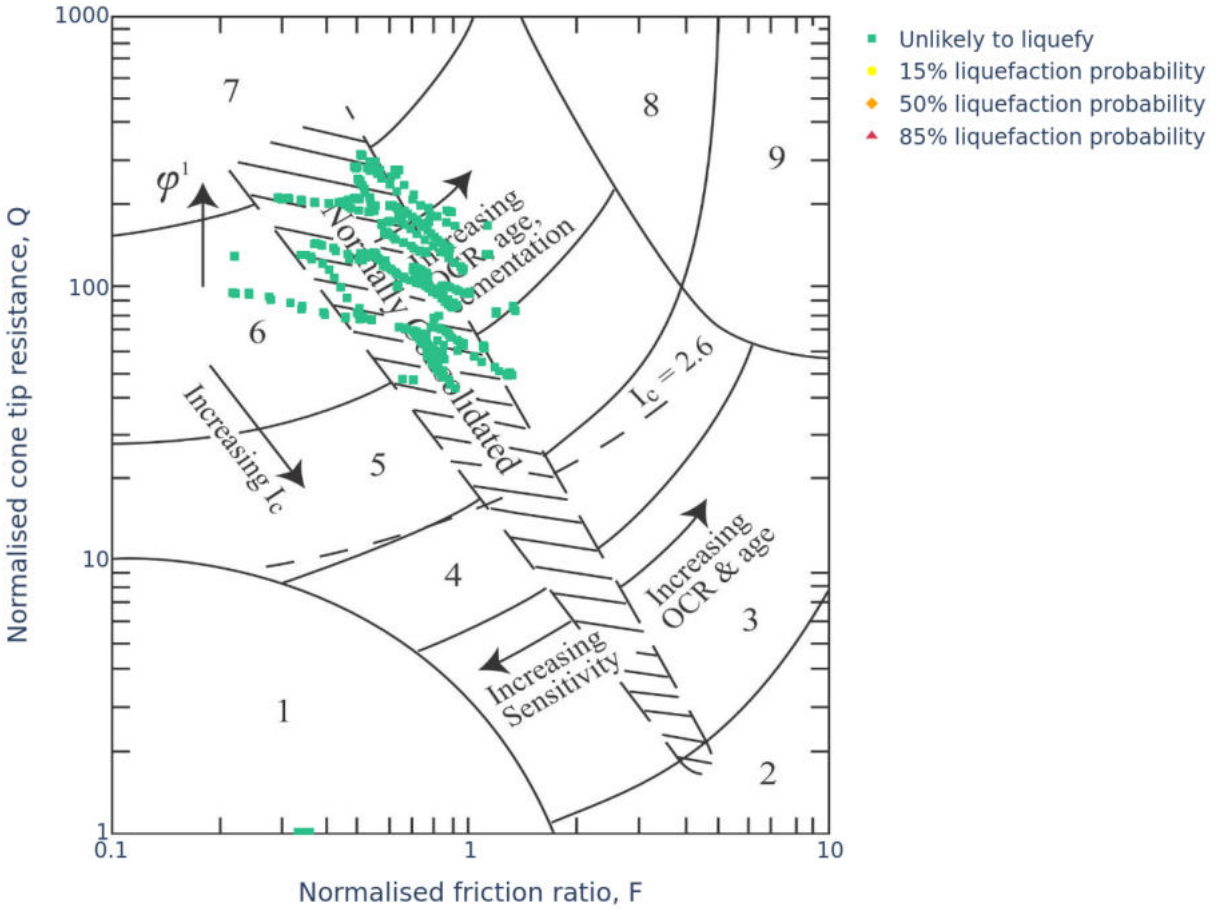
Output

PL	SV1D (mm)	CTL (m)	LPI	LSN	CT (m)	LPIish
15%	4	0.0	0	0	8.0	0
50%	2	0.0	0	0	8.0	0
85%	0	0.0	0	0	8.0	0

Reviewed by

CPT inversion	ABL
Groundwater	ABL
Stress	ABL
Susceptibility	ABL
Triggering	ABL
Consequence	ABL

SOIL BEHAVIOUR TYPE CLASSIFICATION ASSESSMENT

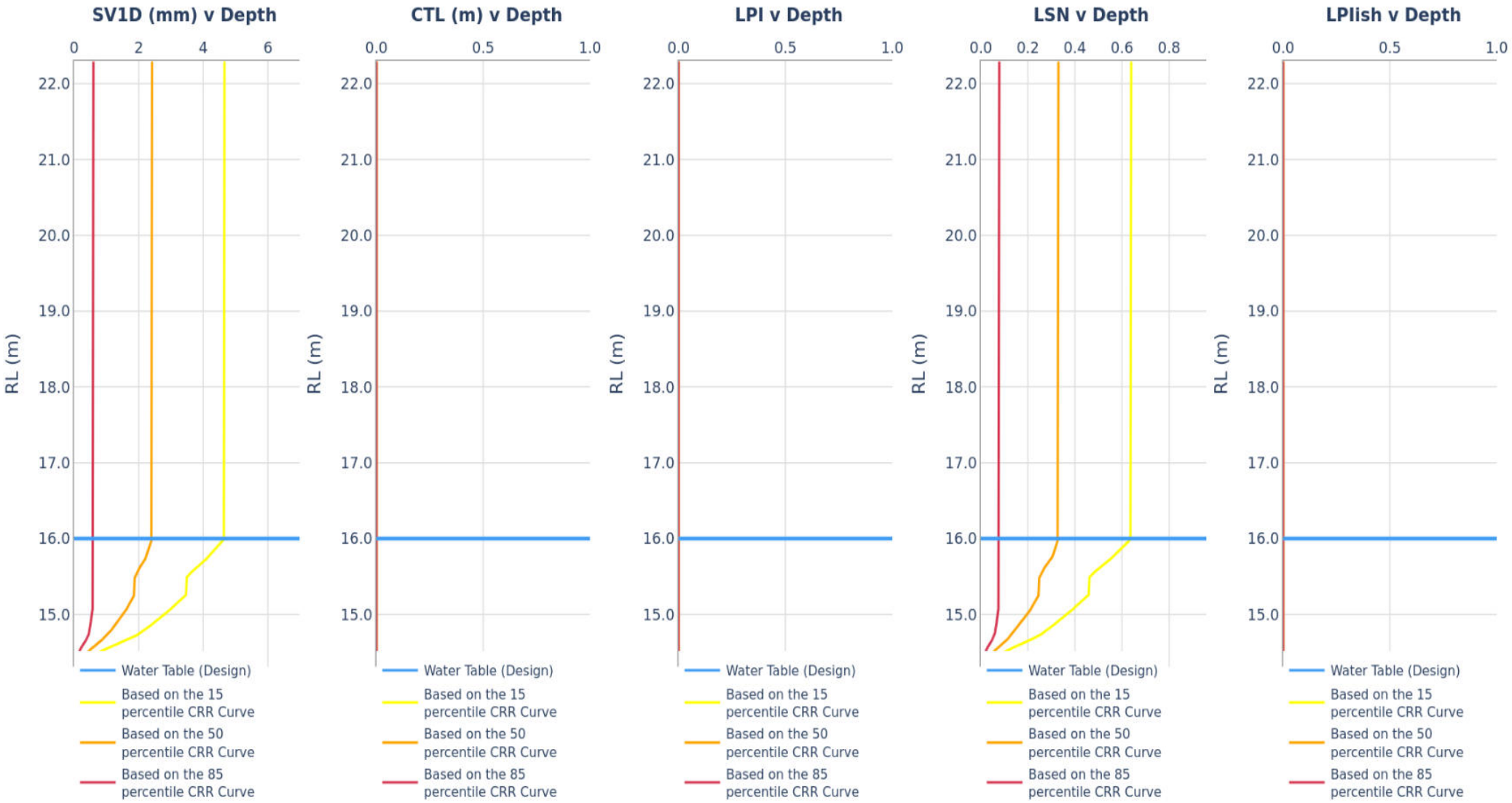


1. Sensitive, fine grained
2. Organic soils - peats
3. Clays - silty clay to clay
4. Silt mixtures - clayey silt to silty clay
5. Sand mixtures - silty sand to sandy silt
6. Sands - clean sand to silty sand
7. Gravelly sand to dense sand
8. Very stiff sand to clayey sand
9. Very stiff, fine grained *

*Heavily overconsolidated or cemented

CPT-based soil behavior type classification chart by Robertson (1990)

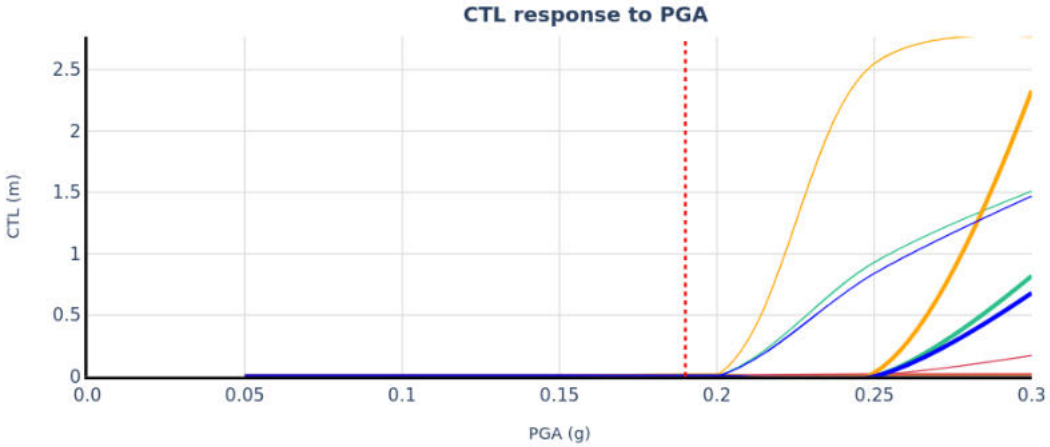
LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT

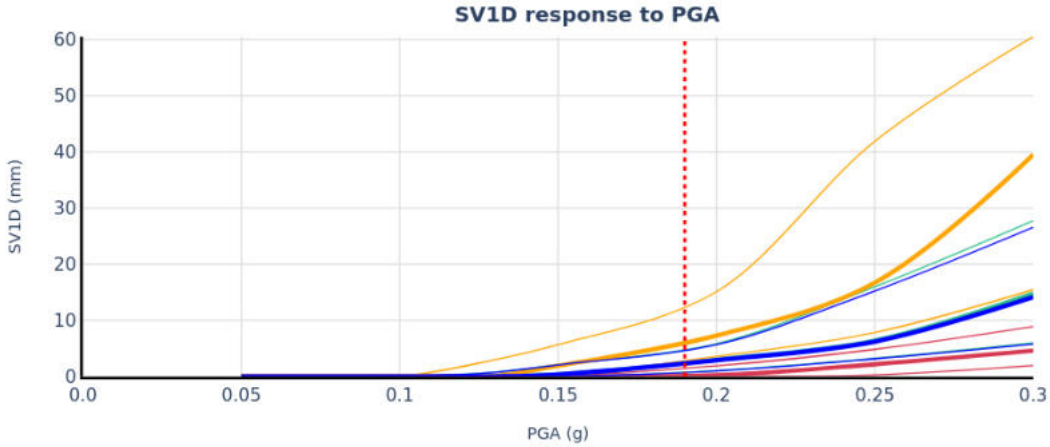


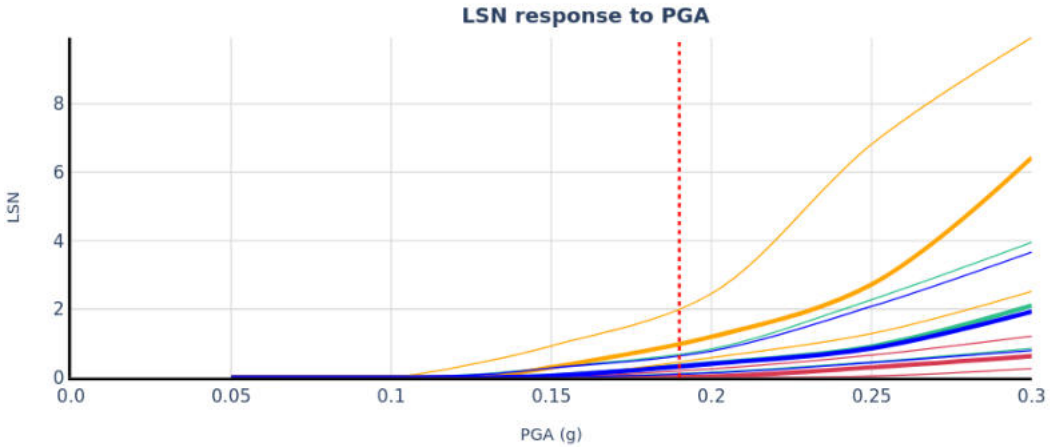
Input

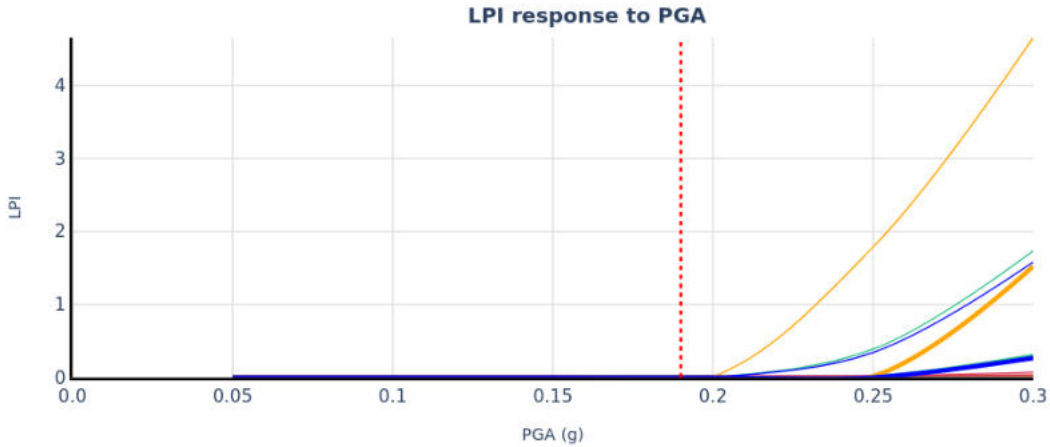
Run Description	NZGD ID	Investigation Date	Pre-drill depth (m)	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT138	CPT_TT280764	09/12/2025	0	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT







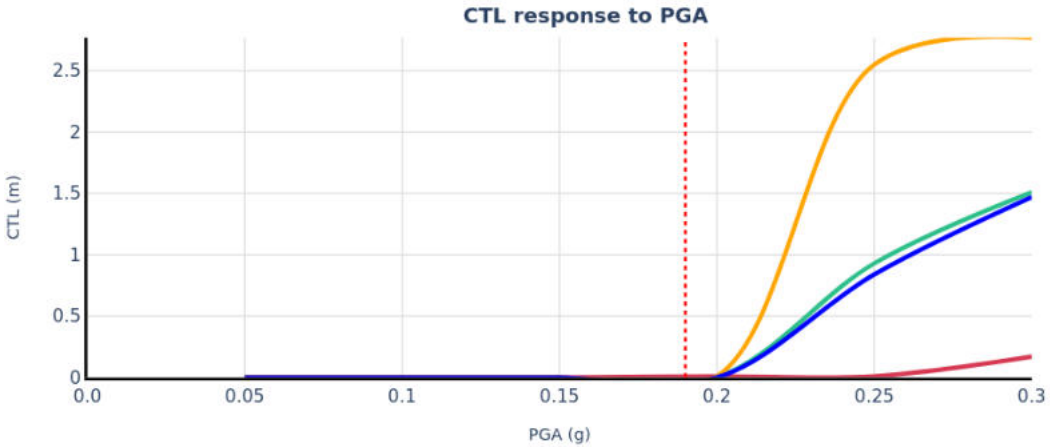


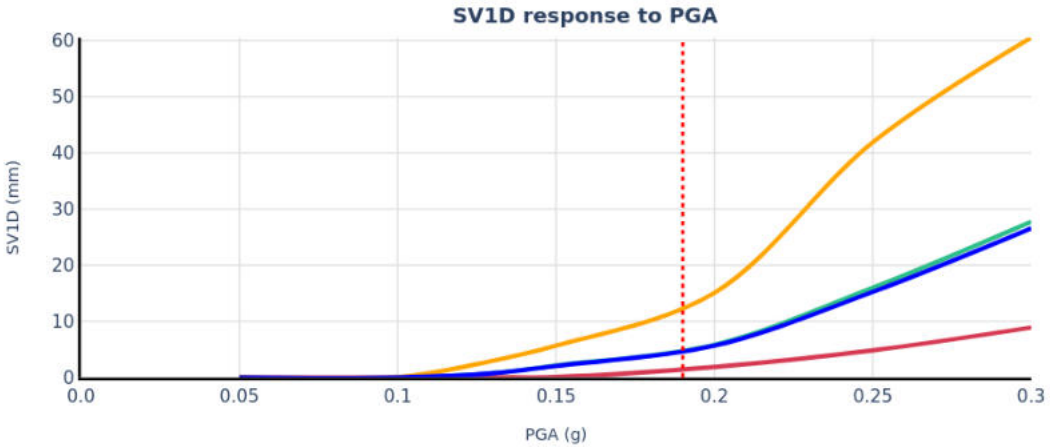
Input

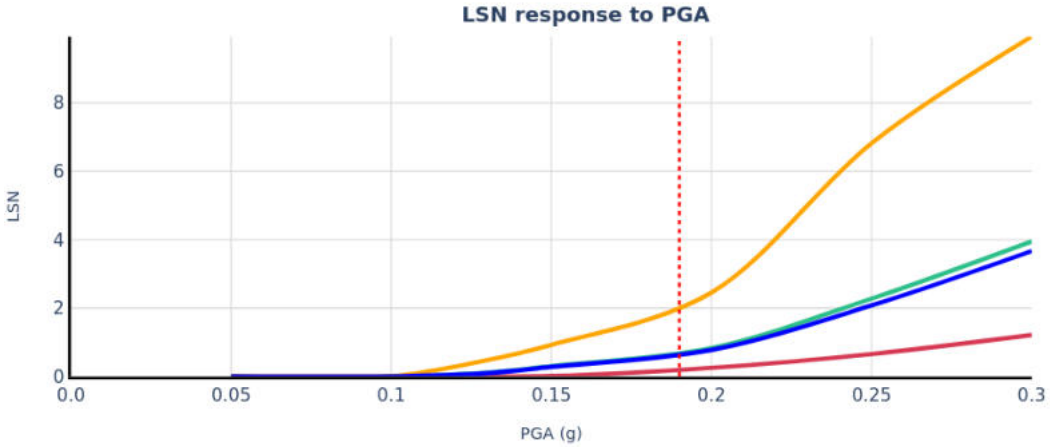
Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT135	CPT_TT280761	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT136	CPT_TT280762	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT137	CPT_TT280763	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT138	CPT_TT280764	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

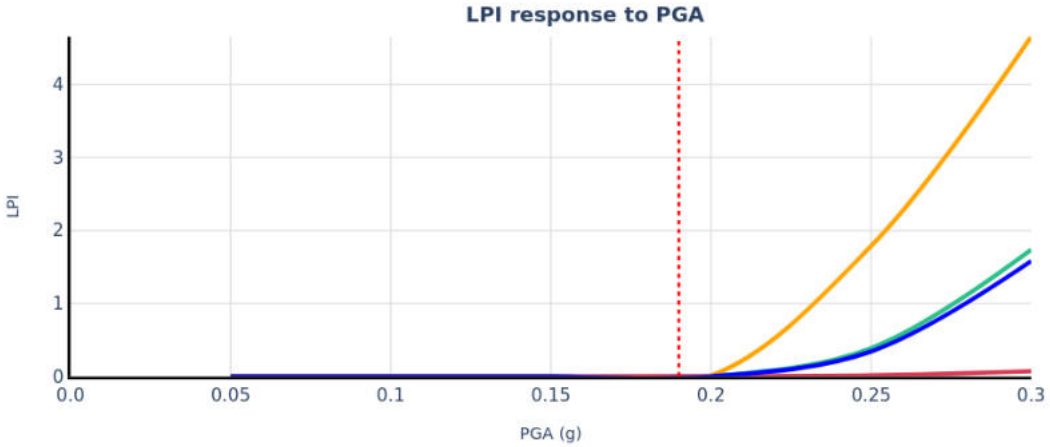
Thicker lines based on 50 percentile CRR curve and the thinner lines beneath and above the thicker lines are based on 85 and 15 percentile CRR curve, respectively.

PGA SENSITIVITY ASSESSMENT OF LIQUEFACTION CONSEQUENCE AND GROUND DAMAGE INDICATORS ASSESSMENT BASED ON 15 PERCENTILE CRR CURVE









Input

Run Description	NZGD ID	Investigation Date	EQ Magnitude	EQ PGA (g)	Trigger Method	Settlement Method	Surcharge/Cut/Fill	Surcharge (kPa)	Cut/Fill Height (m)
CPT135	CPT_TT280761	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT136	CPT_TT280762	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT137	CPT_TT280763	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A
CPT138	CPT_TT280764	09/12/2025	6.5	0.19	BI-2014	ZRB-2002	None	N/A	N/A

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280761	TTGD 280762	TTGD 280763
CPT Name	CPT135	CPT136	CPT137
Run Description	CPT135	CPT136	CPT137
EQ PGA (g)	0.19	0.19	0.19
EQ Magnitude	6.5	6.5	6.5
Depth to groundwater at time of Investigation (m)	5.3	6.3	4.8
Depth to groundwater for design (m)	5.3	6.3	4.8
Pre-drill depth (m)	0	0	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)	Boulanger & Idriss (2014)
Settlement method	ZRB-2002	ZRB-2002	ZRB-2002
Total depth of CPT (m)	7.96	8.47	7.97
Minimum depth of analysis (m)	0	0	0
Maximum depth of analysis (m)	10	10	10
Inverse filtering applied?	Yes (10 cm^2)	Yes (10 cm^2)	Yes (10 cm^2)
Cut/Fill Height	N/A	N/A	N/A
Surcharge load (kPa)	N/A	N/A	N/A
Fill unit weight (kN/m^3)	N/A	N/A	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280761	CPT135	0.0	0.0	0.0
TTGD 280761	CPT135	0.0	10.0	2.6
TTGD 280762	CPT136	0.0	0.0	0.0
TTGD 280762	CPT136	0.0	10.0	2.6
TTGD 280763	CPT137	0.0	0.0	0.0
TTGD 280763	CPT137	0.0	10.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280761	CPT135	0.0	10.0	0.0 CFC
TTGD 280762	CPT136	0.0	10.0	0.0 CFC
TTGD 280763	CPT137	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280761	CPT135	0.0	0.0001	18.0
TTGD 280761	CPT135	0.0001	10.0	18.0
TTGD 280762	CPT136	0.0	0.0001	18.0
TTGD 280762	CPT136	0.0001	10.0	18.0
TTGD 280763	CPT137	0.0	0.0001	18.0
TTGD 280763	CPT137	0.0001	10.0	18.0

SUMMARY OF INPUT PARAMETERS FOR LIQUEFACTION ASSESSMENT

Table 1 Summary of inputs for liquefaction analysis

NZGD ID	TTGD 280764
CPT Name	CPT138
Run Description	CPT138
EQ PGA (g)	0.19
EQ Magnitude	6.5
Depth to groundwater at time of Investigation (m)	6.3
Depth to groundwater for design (m)	6.3
Pre-drill depth (m)	0
Assumed predrill tip resistance and skin friction (MPa)	qc= 2 & Fs= 0.01
Trigger method	Boulanger & Idriss (2014)
Settlement method	ZRB-2002
Total depth of CPT (m)	7.99
Minimum depth of analysis (m)	0
Maximum depth of analysis (m)	10
Inverse filtering applied?	Yes (10 cm^2)
Cut/Fill Height	N/A
Surcharge load (kPa)	N/A
Fill unit weight (kN/m^3)	N/A

Table 2 Summary of Ic inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Ic
TTGD 280764	CPT138	0.0	0.0	0.0
TTGD 280764	CPT138	0.0	10.0	2.6

Table 3 Summary of Fc inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Fc
TTGD 280764	CPT138	0.0	10.0	0.0 CFC

Table 4 Summary of soil density inputs for liquefaction analysis

ID	Run description	From (m)	To (m)	Unit Weight (kN/m^3)
TTGD 280764	CPT138	0.0	0.0001	18.0
TTGD 280764	CPT138	0.0001	10.0	18.0

Appendix E Inferred Settlement Risk Heat Map

LEGEND

- 2018 - 2020 Northland LiDAR 1m Contours
- Revised layout 251112
- 2025 Chesters Drone Survey Contours
- CPTs with inferred soft cohesive and/or peat material
- CPTs with no soft cohesive material or peat inferred
- High Settlement Risk
- Moderate Settlement Risk

ANNOTATIONS LEGEND

Black text = CPT ID

Blue text = Approximate depth to soft cohesive / peat material

Red text = Inferred thickness of soft cohesive / peat material

CPT101
2.2 mbgl
1.0 m thick

CPT102

CPT103
3.0 mbgl
1.5 m thick

CPT104
3.0 mbgl
0.5 m thick

CPT105

CPT106

CPT107

CPT108
2.5 mbgl
1.0 m thick

CPT4
2.5 mbgl
0.5 m thick

CPT3
4.0 mbgl
2.0 m thick

CPT112
2.5 mbgl
1.0 m thick

CPT1

CPT109

CPT110

CPT111

CPT2

CPT113
4.0 mbgl
3.5 m thick

CPT116
2.5 mbgl
4.0 m thick

CPT7
2.0 mbgl
5.0 m thick

CPT6
2.5 mbgl
4.0 m thick

CPT5

CPT122
1.5 mbgl
1.0 m thick

CPT13
3.0 mbgl
2.5 m thick

CPT121
2.0 mbgl
1.5 m thick

CPT114

CPT115

CPT8

CPT120
2.0 mbgl
4.5 m thick

CPT118
2.5 mbgl
4.0 m thick

CPT131

CPT117
2.0 mbgl
5.0 m thick

CPT130
3.0 mbgl
1.5 m thick

CPT130A

CPT9
1.5 mbgl
0.5 m thick

CPT132

CPT10

CPT12

CPT124

CPT123
1.0 mbgl
0.5 m thick

CPT133

CPT125
1.0 mbgl
0.5 m thick

CPT134

CPT126

CPT127

CPT11

CPT136

CPT128
2.5 mbgl
1.5 m thick

CPT135

CPT129

CPT138

CPT137

A3 SCALE 1:1,750
0 20 40 60 80 100 m

NOTES:

1. Stage 1 CPTs follow a numerical naming convention 'CPT1, CPT2, CPT3...'
2. Stage 2 CPTs follow a numerical naming convention 'CPT101, CPT102, CPT103...'
3. CPT119 was omitted from the investigation schedule due to time constraints.
4. Ground model is based on observations and interpretation between discrete testing locations. The continuity of ground is likely to vary from that presented on this drawing.
5. This information is to support the concept design stage and should not be relied upon for detailed design or construction.
6. Additional investigations and testing will be required prior to detailed design to confirm the presence or absence of compressible soils, and to test the strength and compressibility properties.
7. No differentiation has been made between peat and very soft or soft clay. This will need refining at the subsequent design stage.
8. For this stage of the project, the settlement risk has been based on thickness of soft cohesive / peat material inferred with the CPT investigations - further settlement assessment will be required at detailed design.
9. The settlement risk presented is based on a first principles qualitative assessment of likely settlement primarily considering the ground conditions inferred from CPT investigations but also the pre-earthworks ground contours - no calculations or settlement analysis considering applied loading have been undertaken.
10. Areas that are not zoned as moderate or high risk do not imply that no settlement will occur - these areas are inferred as lower settlement risk.

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NOTES:
See notes box on map.

REV	DESCRIPTION	GIS	CHK	DATE
0	First version	POLL		

LOCATION PLAN

PROJECT No.	1099963.0000	
DESIGNED	POLL	JAN.26
DRAWN	POLL	JAN.26
CHECKED		
APPROVED		DATE

CLIENT TE RŪNANGA Ō NGĀITAKOTO
PROJECT FREE RANGE EGG FARM
TITLE INFERRED SETTLEMENT RISK HEAT MAP
SCALE (A3) 1:1,750 FIG No. FIGURE 1 REV 0

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284 and 458 Sandhills Road, Awanui

Ecological Impact Assessment

Prepared for: Te Rūnanga o NgāiTakoto

February 2026

DOCUMENT CONTROL AND REVISION HISTORY

Document title	284 and 458 Sandhills Road, Awanui
	Ecological Impact Assessment
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Date	3 February 2026
Document number	10387-002-1

Version	Issue date	Document number
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	Mark Delaney, MSc.(Hons.), MEIANZ
	Director & Lead Ecologist

Reference: Viridis 2026. 284 and 458 Sandhills Road, Awanui Ecological Impact Assessment. A report prepared for Te Rūnanga o NgāiTakoto by Viridis Limited. February 2026.

Cover photo: Wetland C to the south of the proposed development area, facing south-west (source: Viridis 2025).

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1 INTRODUCTION

Te Rūnanga o NgāiTakoto engaged Viridis Limited (Viridis) to undertake an ecological impact assessment (EcIA) for the proposed development of 284 and 458 Sandhills Road, Awanui ('the site', Figure 1). The 730.9 ha area is zoned as 'Rural Production' under the Operative Far North District Plan 2009 (FNDP).

The application seeks to construct a free-range chicken farm, which will involve the construction of four new hen laying sheds with a pack house, a dwelling, a shed, a manure bunker, and associated accessways and stormwater and wastewater infrastructure (Figure 2).

This report has been prepared to support a resource consent application and discusses the ecological effects of the proposal. Due to the site's large size, a project zone of influence ('ZOI') has been identified which highlights the proposed location of the development and the surrounding ecological features. Figure 1 shows the location of the 54-hectare ZOI in relation to the wider site boundaries (Figure 1).

Where appropriate, recommendations have been provided to aid in the avoidance, minimisation and remediation of adverse effects that could arise as a result of the proposed works. The assessment has been informed by relevant regulations, including the National Policy Statement for Freshwater Management 2020 (NPS-FM), the National Environmental Standards for Freshwater 2020 (NES-F) and the National Policy Statement for Indigenous Biodiversity 2023 (NPS-IB).

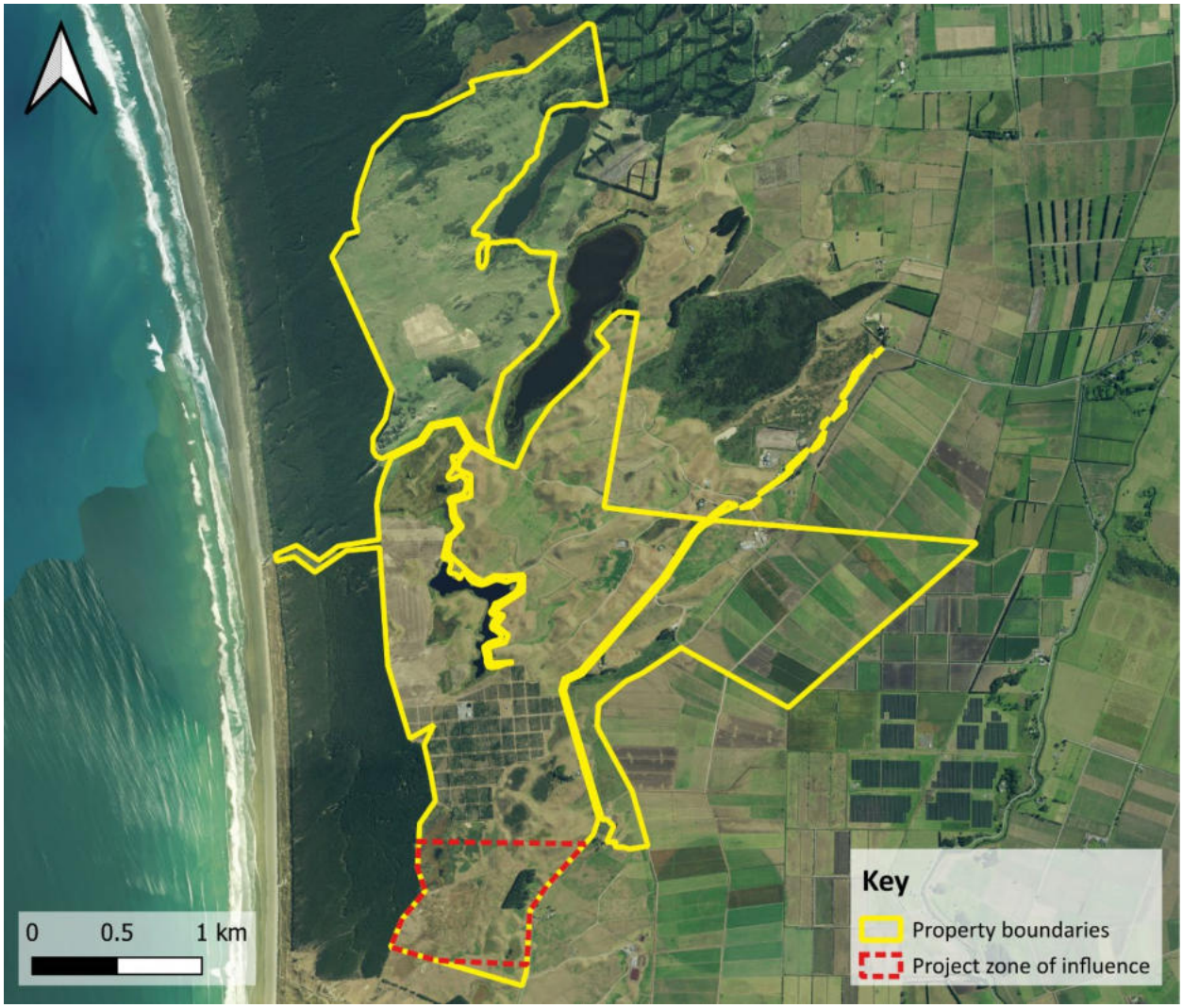

Figure 1. Map showing an overview of the property boundaries and the project 'zone of influence'.

Figure 2. Site context plan showing proposed layout for free range chicken farm, four laying sheds and packhouse and associated accessways and structures (reproduced from Neo Architecture Studio Limited. Scale = 1:1500.

2 METHODOLOGY

2.1 Overview

A site assessment was undertaken on 7 August 2025 by suitably qualified and experienced ecologists. During this visit, freshwater and terrestrial features within the ZOI were identified and mapped, and the quality of associated fauna habitat was visually assessed in accordance with the methodology outlined in Sections 2.2 through 2.3.

A desktop assessment was also undertaken, including a review of current and historical aerial imagery to identify changes in vegetation cover and surface water extent over time. Relevant district and regional planning maps were reviewed, including any available biodiversity overlays, mapped and predicted watercourses, and site topography information.

2.2 Terrestrial Ecology

Vegetation within the ZOI was assessed during the site visit, with the botanical value of both exotic and indigenous vegetation recorded. The quality, extent, and connectivity of vegetation were considered. Terrestrial fauna habitat was assessed qualitatively, informed by the site visit and a review of relevant databases, including the Department of Conservation's ARDs, Bioweb, eBird, and iNaturalist. This assessment considered potential habitat for indigenous lizards, birds, and bats.

Opportunistic observations of avifauna were recorded during the site visit, and the conservation status of species was determined in accordance with Robertson et al. (2021). The ecological values of terrestrial features was determined using the methodology prescribed in the Environment Institute of Australia and New Zealand (EIANZ) guidelines (Section 2.4).

2.3 Freshwater Ecology

2.3.1 Watercourses

During the site assessment, the presence and extent of streams (if any) were noted and the quality of any freshwater habitat was visually assessed. All watercourses within the ZOI were classified as per the NRP definitions to determine ephemeral, intermittent or permanent status. Freshwater habitat was assessed, noting ecological aspects such as channel modification, hydrological heterogeneity, riparian vegetation extent, substrate type and any fish or macroinvertebrate habitat observed. Riparian and catchment information was also reviewed and the NIWA New Zealand Freshwater Fish Database (NZFFD) was examined for fish species potentially present within the site.

2.3.2 Natural inland wetlands

Where appropriate, potential wetland areas were assessed in accordance with wetland delineation protocols (MfE 2022a, Clarkson 2014) to determine if a putative wetland area met the regulatory definition of a 'natural inland wetland' under the NPS-FM. Potential wetland areas were assessed based on the prevalence of certain vegetation species and their indicator status ratings, as defined in Clarkson et. al. (2021):

- Obligate wetland (OBL) vegetation, which almost always is a hydrophyte (a plant which only grows in wet environments), rarely found in uplands (non-wetland areas).
- Facultative wetland (FACW) vegetation, which usually is a hydrophyte but can occasionally be found in uplands.

- Facultative (FAC) vegetation, which is commonly either a hydrophyte or non-hydrophyte.
- Facultative upland (FACU) vegetation, which is occasionally a hydrophyte but is usually found in uplands.
- Upland (UPL) vegetation, which is rarely a hydrophyte and is almost always found in uplands.

Where the dominance or prevalence tests showed unclear results, hydric soils and hydrology tests were undertaken in accordance with methodology outlined in MfE (2022) and Clarkson (2014).

Wetland assessments also included identifying native and exotic vegetation species, examining the structural tiers within wetland areas, and assessing the quality and abundance of aquatic habitats. Signs of wetland degradation such as pugging and grazing from stock access, structures such as culverts impeding hydrological function, and weed infestation were also noted.

The ecological values of freshwater features were determined in accordance with the methodology prescribed in the EIANZ guidelines (Section 2.4).

2.4 Ecological Impact Assessment

The ecological values of the site, relating to species, communities and systems, were determined in general accordance with the EIANZ Ecological Impact Assessment guidelines (EcIAG) for use in New Zealand (Roper-Lindsay et al. 2018). This report also identifies statutory guidelines and regulation with respect to ecology (such as watercourses, wetlands, high value vegetation and habitats) where relevant to the proposed development. Using this framework, the EcIAG describes a simple ranking system to assign value to species as well as other matters of ecological importance such as species assemblages and levels of organisation. The overall ecological value is then determined on a scale from '*Negligible*' to '*Very High*'.

Criteria for describing the magnitude of effects are given in Chapter 6 of the EcIAG. The level of effect can then be determined through combining the value of the ecological feature/attribute with the score or rating for magnitude of effect to create a criterion for describing level of effects (Table 1). A moderate level of effect requires careful assessment and analysis of the individual case. For moderate levels of effects or above, measures need to be introduced to avoid through design, or appropriate mitigation needs to be addressed (Roper-Lindsay et al. 2018).

Table 1. Criteria for describing the level of effects (from Roper-Lindsay et al. 2018).

Magnitude of Effect	**Ecological Value**				
	Very High	**High**	**Moderate**	**Low**	**Negligible**
Very High	*Very High*	*Very High*	*High*	*Moderate*	Low
High	*Very High*	*Very High*	*Moderate*	Low	Very Low
Moderate	*High*	*High*	*Moderate*	Low	Very Low
Low	*Moderate*	Low	Low	Very Low	Very Low
Negligible	Low	Very Low	Very Low	Very Low	Very Low
Positive	Net Gain	Net Gain	Net Gain	Net Gain	Net Gain

Notes: Where text is italicised, it indicates 'significant effects' where mitigation is required.

3 SITE ASSESSMENT

3.1 Historical Context

The site is situated in the Aupouri Ecological District of the Northland Region. Historically (pre-human), the Ahipara and wider Aupouri Ecological District landscape was likely a mosaic of indigenous coastal and lowland ecosystems. Upland areas and more fertile soils likely supported kauri (*Agathis australis*), podocarp, broadleaved forests (WF11, Singers et al. 2017, Singers 2018), with coastal broadleaf and riparian forests in sheltered gullies. Poorer sandy soils and podzols likely supported gumland shrubland and dune forest (WF5) and coastal dune plant communities. In lower-lying areas between dunes and near tidal harbours, a network of freshwater wetlands, dune lakes and marshes existed, dominated by raupō (*Typha orientalis*), sedges and other wetland plants, grading seawards into saltmarsh and mangrove communities in the estuaries. Much of the native cover has since been modified by clearance in this district for drainage and agriculture. Remaining wetlands and forest remnants now represent fragmented examples of ecosystems that were once widespread across the Aupouri Ecological District.

A review of historical aerial imagery indicates that the site, and much of the surrounding landscape, was cleared well over 60 years ago for agricultural purposes (Figure 3).

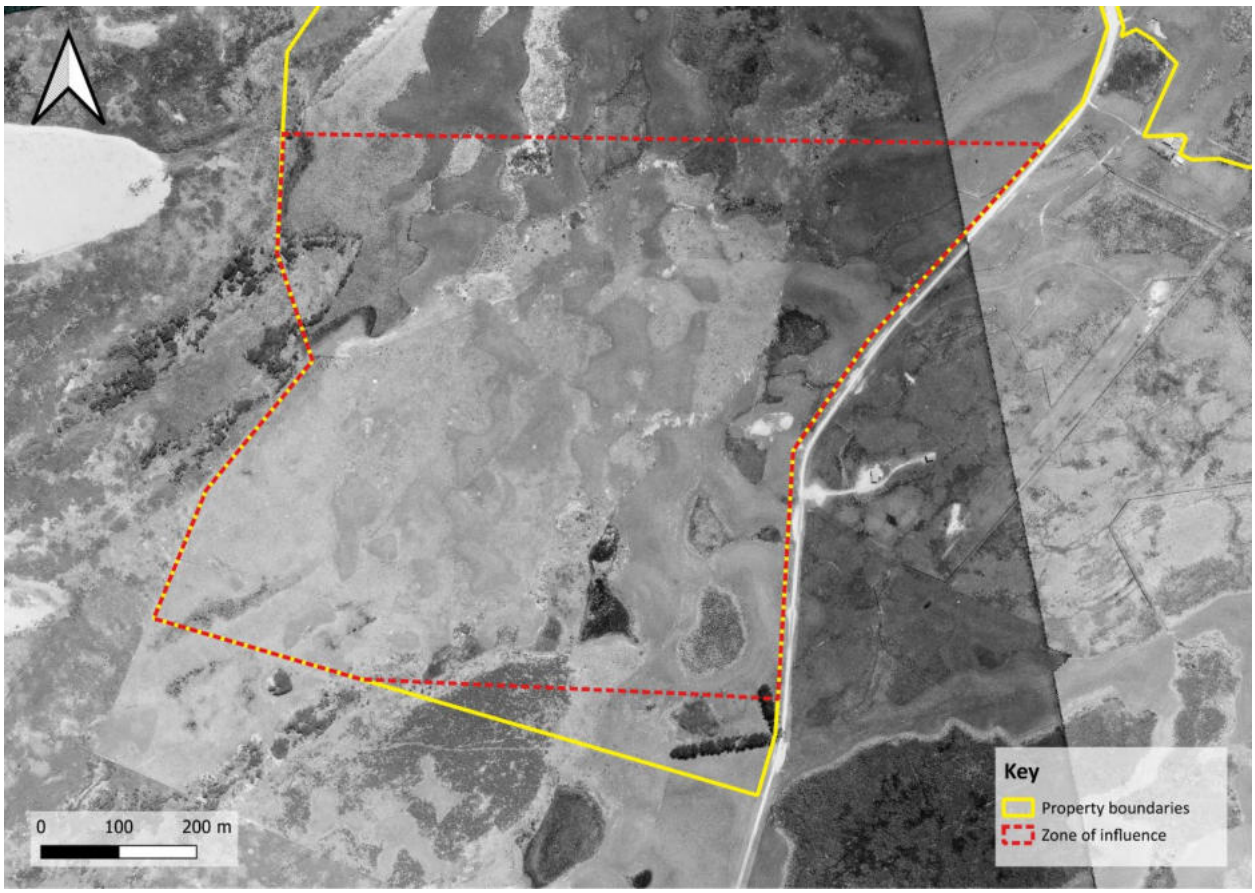

Figure 3. Historical aerial imagery of the ZOI within the site, dated 1962 (source: Retrolens).

3.2 Existing Site Context

The site is currently used for agricultural and horticultural purposes, and a series of natural wetlands are present. Within the ZOI, a portion of the land has recently been utilised for potato cultivation. As a result, the terrestrial environment within the ZOI can be characterised by modified pastoral and cropped land with limited indigenous vegetation cover outside of natural wetland areas.

The ZOI is located in close proximity to the coast, with Ninety Mile Beach approximately 500 m to the west. The settlement of Kaitaia is located approximately 6 km to the southeast of the site.

The surrounding wider environment comprises a mosaic of land uses, including productive agricultural and horticultural land, extensive pine plantation forestry along the west coast, and areas of indigenous wetland vegetation. These wetland systems represent comparatively high ecological value habitats within an otherwise modified landscape and are likely to provide important ecological functions, including providing habitat for indigenous fauna and contributing to ecological connectivity within the wider landscape.

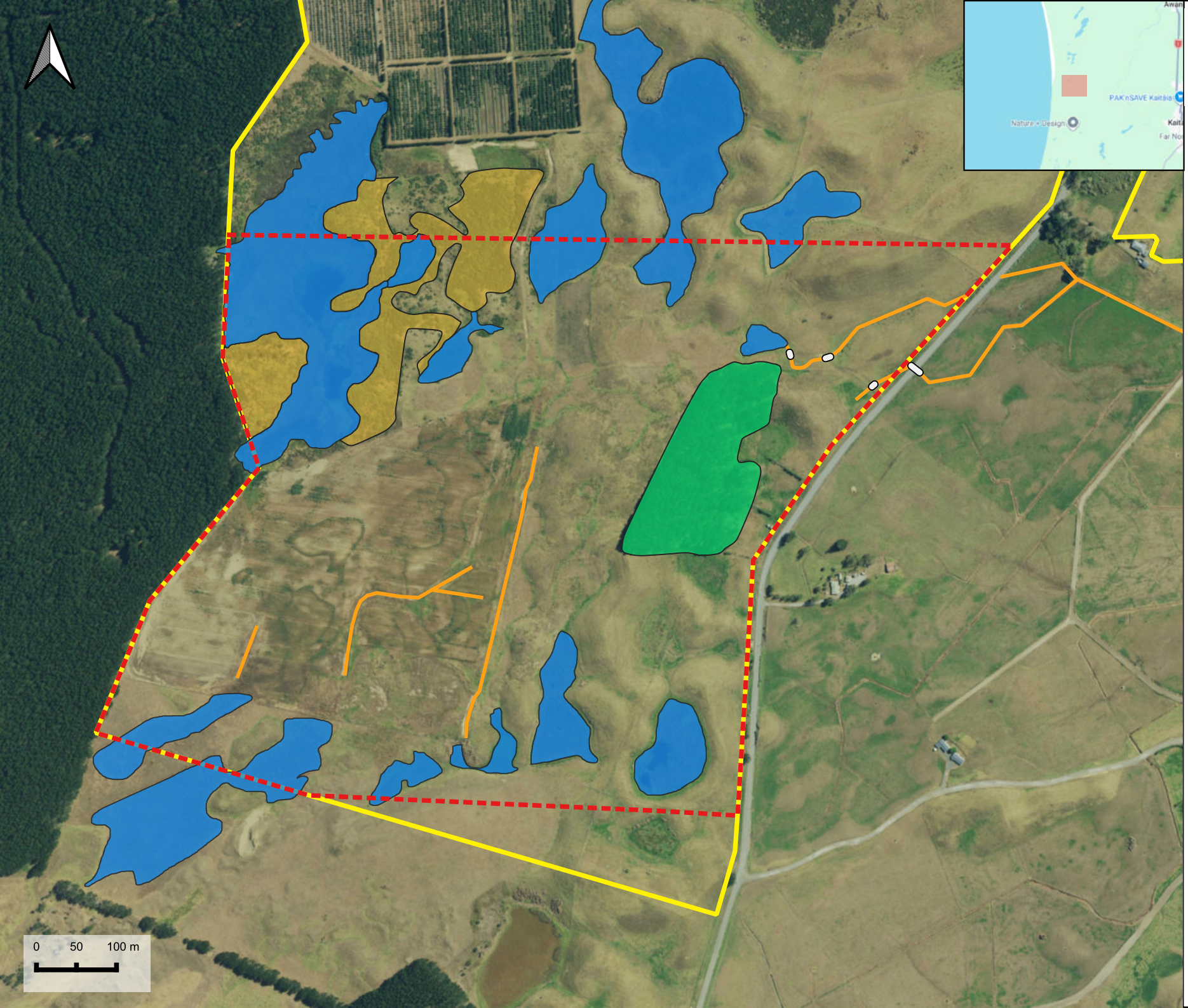

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Figure 4 - Map showing ecological features within the ZOI

Legend

- Property boundaries
- Zone of influence

Vegetation

- Pine Stand
- Exotic Scrub

Freshwater features

- Artificial
- Culvert
- Natural wetlands

SOURCES

LINZ 2023-2025

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SCALE **1:6,000** **@ A4**

PROJECT NO.	10387
DRAWN BY:	B.P / T.Y
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3.3 Terrestrial Vegetation

The terrestrial vegetation within the ZOI was highly modified and reflected its current and historical use for agricultural and horticultural production. At the time of the August 2025 site visit, the majority of the ZOI comprised cropped land and pasture, with vegetation largely consisting of short exotic pasture grasses (Figure 5) and ruderal species typical of intensively managed farmland. Exotic scrub vegetation consisting largely of listed pest plants (as per the Northland Regional Pest and Marine Pathway Management Plan 2017-2027), namely gorse (*Ulex europaeus*) and woolly nightshade (*Solanum mauritianum*) buffered wetlands within the northwest of the ZOI (Figure 4 & Figure 6). Indigenous vascular plant species were absent or very limited within these areas.

A small area of pine plantation forestry (approx. 0.25 ha) was also present within the ZOI (Figure 4 & Figure 7a). This area was characterised by an even-aged stand of mature pine (*Pinus* sp.) with a sparse understorey, limited structural diversity, and low indigenous species representation (Figure 7b). No areas of indigenous forest, shrubland or significant terrestrial vegetation were identified within the ZOI.

Overall, terrestrial vegetation within the ZOI was of **low** botanical value due to its highly modified nature, dominance of exotic species, and limited structural complexity.

a) **b)**

Figure 5. Examples of areas used for agricultural and horticultural land uses within the site, including a) grazed pasture and b) an area that had been used for potato crops.

Figure 6. Examples of exotic-dominated scrub consisting of gorse and woolly nightshade around wetlands.

a)

b)

Figure 7. a) View of the small mature pine block within the east of the ZOI and b) photo showing the lack of developed understorey within the pine block.

3.4 Terrestrial Fauna Habitat

3.4.1 Avifauna (birds)

Terrestrial bird habitat within the ZOI is limited by the predominance of cropped land, pasture, and plantation forestry, which provide minimal structural complexity and limited nesting or roosting opportunities for indigenous bird species. As a result, the ZOI is expected to be used primarily by common, adaptable species associated with modified rural environments. Birds observed utilising the wetland habitat within the ZOI are addressed separately in Section 2.3.2.

Opportunistic observations during the August 2025 site visit recorded a range of common indigenous and introduced bird species utilising terrestrial areas of the site. These included Australasian harrier/kāhu (*Circus approximans*), paradise shelduck/pūtangitangi (*Tadorna variegata*), white-faced heron/matuku moana (*Egretta novaehollandiae*), kingfisher/kōtare (*Todiramphus sanctus*), welcome swallow/warou (*Hirundo neoxena*), skylark (*Alaudala cheleensis*), spur-winged plover (*Vanellus miles*), mallard (*Anas platyrhynchos*), yellowhammer (*Emberiza citrinella*), Indian myna (*Acridotheres tristis*), and peafowl (*Pavo cristatus*).

These species are typical of open farmland, wet pasture margins and highly modified environments, and their presence reflects opportunistic foraging or movement through the site rather than reliance on the ZOI for breeding habitat. While occasional transient use by indigenous bird species is expected, the site does not provide significant or high-quality terrestrial bird habitat. The ecological value of the ZOI for terrestrial birds was considered to be **low**.

3.4.2 Herpetofauna (lizards)

Habitat suitable for indigenous lizards is largely absent from the ZOI. Cropped land and regularly managed pasture provide limited shelter, basking opportunities, or food resources, and the isolated pine plantation is characterised by a sparse understorey and limited ground cover. Features typically associated with lizard habitat, such as rock outcrops, dense indigenous vegetation, coarse woody debris, or unmanaged rank grassland, were absent within the ZOI.

A review of the Department of Conservation (DOC) Bioweb database indicates that shore skink/moko-pāpaka (*Oligosoma smithi*; At Risk – Declining) and Northland green gecko/moko kākāriki (*Naultinus grayii*; At Risk – Declining) have been recorded within 10 km of the site.

Exotic scrub-dominated vegetation connected to an extensive pine plantation to the west of the site, and a shore skink record was made within this pine area approximately 4.6 km to the northwest of the ZOI. However, this observation was from 1963 and no further records have been recorded in the database from this area. The exotic scrub may provide limited habitat connectivity and marginal shelter opportunities for indigenous skinks. However, given the highly modified nature of the ZOI and the lack of suitable habitat features, the presence of resident indigenous lizard populations within the ZOI is considered unlikely.

Plague skink (*Lampropholis delicata*; introduced and naturalised) is expected to be present given its abundance in northern New Zealand and the modified nature of the site.

Overall, the ecological value of the ZOI for indigenous lizards was conservatively assessed as **low**, reflecting the absence of high-quality habitat within the ZOI but the presence of limited connectivity to adjacent vegetation and wetlands in the wider landscape.

3.4.3 Chiroptera (bats)

The ZOI was dominated by cropped land, pasture, and plantation forestry, and lacked habitat features typically associated with bat foraging or roosting. No indigenous forest, riparian corridors, or sheltered gullies that would provide suitable bat habitat were identified within the ZOI. A mature pine plantation was present towards the east; however, it is structurally uniform and generally provides low-quality habitat for bats compared with indigenous forest.

A review of available records indicates that long-tailed bat/pekapeka-tou-roa (*Chalinolobus tuberculatus*; Threatened – Nationally Critical) has been recorded approximately 14 km to the north and south of the site, with records dating from 2000, 2001, and 2007 (DOC database records as of 20 May 2025). No more recent records of long-tailed bats are known from the surrounding area. A small population of northern lesser short-tailed bats/pekapeka-tou-poto (*Mystacina tuberculata aupourica;* Threatened – Nationally Vulnerable) is located approximately 40 km away in the Puketi Forest, but this species is not known outside of this forest on the mainland.

While the presence of potential bat roost features cannot be entirely ruled out within the pine plantation on site, the absence of recent records, the highly modified nature of the surrounding landscape, and the lack of suitable foraging and terrestrial connectivity features suggest that regular use of the ZOI by bats is unlikely.

Overall, ecological value of the ZOI for indigenous bats is conservatively assessed as **low**. The ZOI is not considered to provide significant habitat for indigenous bats, and bat activity within the ZOI, if present, is expected to be infrequent and transient.

3.5 Watercourses

No natural watercourses were identified within the ZOI. However, several artificial drainage channels were present, primarily within the eastern and central portions of the ZOI.

The drains in the east appear to form part of a wider agricultural drainage network extending beyond the site boundary onto the eastern side of Sandhills Road (Figure 4 & Figure 8). Review of historical aerial imagery from 1962 (Figure 3) indicates that these drainage features have been present for several decades and have likely been artificially constructed and subsequently straightened, deepened, and widened to facilitate agricultural and horticultural land use.

At the time of the August 2025 site visit, the drains were either dry or contained standing water clogged with exotic macrophytes, indicating that they were likely ephemeral or intermittently flowing and dependent on rainfall events. The drains exhibited low habitat complexity, with uniform channel forms and limited variation in depth or substrate.

Vegetation within and adjacent to the drains was sparse and consisted primarily of scattered rushes and exotic grasses, reflecting ongoing grazing and land management. While this vegetation may provide limited marginal habitat, the drains were not considered to provide suitable habitat for indigenous freshwater fish or significant aquatic macroinvertebrate communities. Any ecological use is likely limited to occasional opportunistic foraging by common bird species.

Overall, the artificial drainage channels within the ZOI were assessed as having low freshwater ecological value, reflecting their artificial origin, modified form, limited connectivity, and low habitat complexity.

Figure 8. Examples of artificial watercourses within the ZOI.

3.6 Natural Inland Wetlands

3.6.1 Wetland characteristics

A total of 13 wetlands have been identified and mapped within the ZOI (Wetlands A-M, Figure 9). These wetlands represent the key ecological features of the site and are characteristic of peat bog systems associated with the Aupouri Ecological District.

All wetlands were considered ‘natural inland wetlands’ as per the NPS-FM definitions. Each wetland was delineated based on the clear dominance of more than 50% FACW/OBL species coverage and/or clear

primary hydrological indicators such as standing water. Wetland extent was delineated based on the site's topography and a clear change in vegetation community from hydrophytic to upland. The majority of these wetlands had been mapped by Northland Regional Council (NRC) and have been refined on site by Viridis ecologists as per Figure 9.

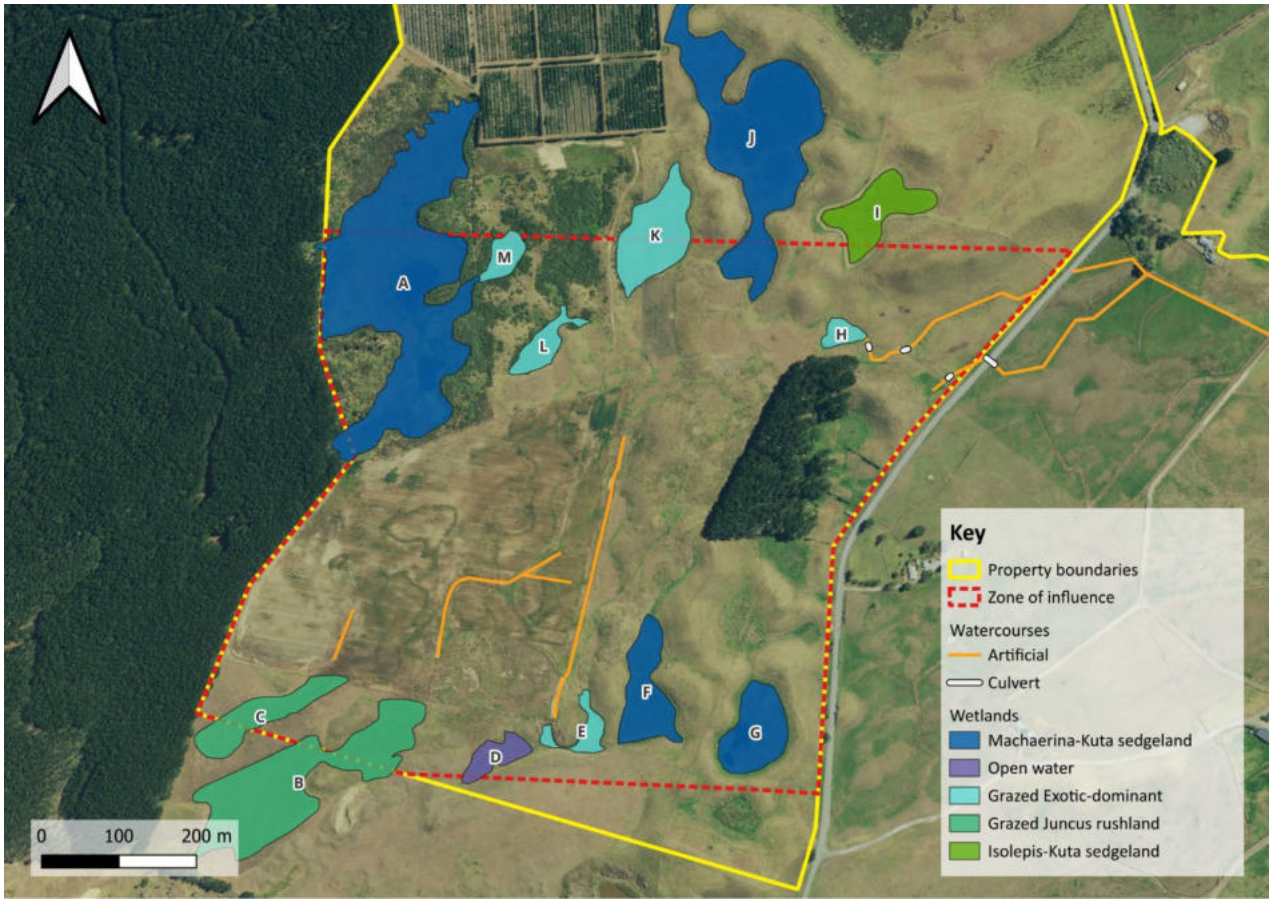

Figure 9. Map showing the key wetland types and existing artificial watercourses identified within the ZOI.

The wetlands occur within interdune flats formed by Pleistocene consolidated parabolic dunes and are consistent with peat bogs ponded by dune system, as per the 'Natural Areas of the Aupouri Ecological District' reported as a part of the Protected Natural Areas Programme ('PNAP', Conning & Holland 2003) and 'A Directory of Wetlands in New Zealand: Northland Conservatory' (Cromarty & Scott 1996). These wetland types typically receive water primarily from rainfall and are characterised by low nutrient status and high ecological sensitivity.

The PNAP identifies the series of peat bog wetlands in the north of the ZOI (Survey No. N04/017, surveyed September 1995), which recorded the presence of threatened fauna including black mudfish/ngāpua (*Neochanna diversus*; At Risk – Declining), and identified the wider environment as supporting habitat for wetland birds such as Australasian bittern/matuku hūrepo (*Botaurus poiciloptilus*; Threatened – Nationally Critical) and potentially crakes (*Zapornia* spp.; At Risk – Declining) (Dunn et al. 2017; O'Donnell et al. 2023). While these species were not observed during the current site visit, the wetlands within the ZOI provide habitat that is consistent with those described in the PNAP and may support similar ecological values. A pair of dabchicks/weweia (*Poliocephalus rufopectus*; At Risk – Nationally Increasing) and a black shag/kawau tūī (*Phalacrocorax carbo*; At Risk – Relict) were observed utilising the open water habitat present within Wetland A.

The key characteristics of each wetland are summarised in Appendix A and photos showing the general wetland environments are provided in Figure 10-Figure 13. Wetlands A-M varied in size and vegetation composition, but collectively form a network of seasonally wet peatland habitats within a highly modified agricultural landscape.

Several wetlands were dominated by indigenous sedgeland communities, particularly Machaerina–kuta (*Eleocharis sphacelata*) and Isolepis–kuta sedgelands, which are characteristic of bog systems in Northland. Other wetlands have been modified by grazing and are dominated by rushland or exotic species; however, their hydrology, landform setting, and soil conditions indicate that they remain natural wetlands rather than artificial features. Wetlands A, M and part of L had a vegetated buffer comprised of exotic scrub, while the remaining wetlands had no significant buffer vegetation and these areas consisted of managed pasture only.

a) **b)**

Figure 10. a) Machaerina-kuta sedgeland in Wetland J, and b) open water habitat in Wetland D.

a) **b)**

Figure 11. a) Machaerina-kuta sedgeland in a) Wetland F, and b) Wetland G.

a) b)

Figure 12. a) Overview of Wetland A southwest showing Machaerina-kuta sedgeland, open water and exotic scrub buffer vegetation, and b) view of Wetland A facing north showing areas of open water amongst Machaerina-kuta sedgeland.

a) b)

Figure 13. Examples of grazed wetlands (Wetlands C & M) dominated by Juncus rushes.

3.6.2 Assessment of significance under the Northland Regional Plan

The significance of wetlands within the ZOI has been assessed against the criteria set out in Appendix 5 of the Northland Regional Policy Statement (NRPS). This assessment considers representativeness, rarity and distinctiveness, diversity and pattern, and ecological context.

Representativeness (Criterion 1)

The wetlands within the ZOI comprise natural peat bog systems formed within interdune flats associated with Pleistocene consolidated parabolic dunes. These wetlands are representative of bog and bog-derived wetland ecosystems that historically occurred across the Aupouri Ecological District, and which remain characteristic of the Aupouri Peninsula.

Several wetlands within the ZOI are dominated by indigenous sedgeland vegetation, including Machaerina-kuta and Isolepis-kuta communities. These vegetation types are typical of bog systems and are representative of the natural diversity of wetland ecosystems within the relevant ecological classification and scale. The combination of landform, peat soils, hydrology, and indigenous vegetation present within these wetlands represents a good example of their type.

Accordingly, all wetlands in the ZOI meet Criterion 1(a) and 1(b) of Appendix 5.

Rarity and distinctiveness (Criterion 2)

Peat bog wetlands are a naturally uncommon wetland type within Northland and are particularly restricted in extent outside the Aupouri and Te Paki dune systems. Under Appendix 5, natural bogs exceeding 0.2 ha in area meet the significance criteria.

Based on field assessment and mapping, multiple wetlands within the ZOI are classified as bogs or bog-derived peat wetlands and exceed the 0.2 ha threshold, including Wetlands A, F, G, I, and J. These wetlands therefore meet Criterion 2(a)(iii)(d).

In addition, peat bog wetlands of the Aupouri Peninsula are recognised in the PNAP as supporting threatened and at-risk indigenous fauna, including black mudfish and wetland bird species such as Australasian bittern, within the wider landscape. While these species were not observed during the site visit, the wetlands within the ZOI provide habitat consistent with those supporting such taxa elsewhere on the peninsula. This supports consideration under Criterion 2(b).

Diversity and pattern (Criterion 3)

The wetlands within the ZOI comprise a mosaic of wetland types and conditions, including intact indigenous sedgeland bogs, rush-dominated wetlands, open water areas, and more modified wetland margins. This variation reflects differences in hydrology, grazing pressure, and nutrient status, and contributes to ecological pattern and diversity at the site scale.

Collectively, the wetlands form a wetland complex that exhibits variation in vegetation composition and structure, rather than isolated individual features. This contributes to ecological diversity and reflects natural gradients typical of interdunal wetland systems, consistent with Criterion 3(a) and 3(b).

Ecological context (Criterion 4)

The wetlands within the ZOI occur within a landscape that is otherwise highly modified by agriculture and horticulture. As such, they represent important indigenous habitat remnants and contribute to ecological connectivity and buffering within the wider environment.

These wetlands play an important hydrological and ecological role, including water storage, maintenance of wetland hydrology, and provision of habitat for wetland-dependent indigenous flora and fauna. Their position within interdunal flats and proximity to other wetland systems on the Aupouri Peninsula further enhances their ecological context, consistent with Criterion 4(a) and 4(b).

Summary of wetland significance

Based on the assessment against Appendix 5, the wetlands within the ZOI meet multiple significance criteria, in particular those relating to representativeness, rarity and distinctiveness, and ecological context. Several wetlands exceed the area thresholds for bogs under Criterion 2(a), and collectively the wetlands form a high-value wetland complex within a modified landscape.

Despite varying condition, this complex of wetlands retain important ecological functions, including water storage, maintenance of wetland hydrology, and provision of habitat for indigenous flora and fauna. Their occurrence within a landscape otherwise dominated by cropping and pasture further elevates their ecological importance.

Accordingly, the wetlands within the ZOI are assessed as significant wetlands for the purposes of the NRPS and the NRP and are considered to be of high ecological value.

4 ASSESSMENT OF ECOLOGICAL EFFECTS

4.1 Proposal

The proposal seeks consent to establish and operate a free-range chicken farm. The development will involve the construction of four new hen laying sheds, a pack house, a dwelling, a shed, a manure bunker, and associated accessways, stormwater, and wastewater infrastructure. To facilitate these works, bulk earthworks and new water discharges are proposed.

The assessment of ecological effects considers both the direct and indirect effects of the proposal on terrestrial, freshwater, and wetland ecological values within and adjacent to the site. While terrestrial ecological values within the ZOI are generally low due to the modified nature of the site, several natural wetlands of high ecological value are present and represent the key ecological constraint. Accordingly, this assessment focuses on potential effects on these wetlands and associated receiving environments.

Figure 14 presents the footprint of these activities in relation to the identified wetlands in and around the site.

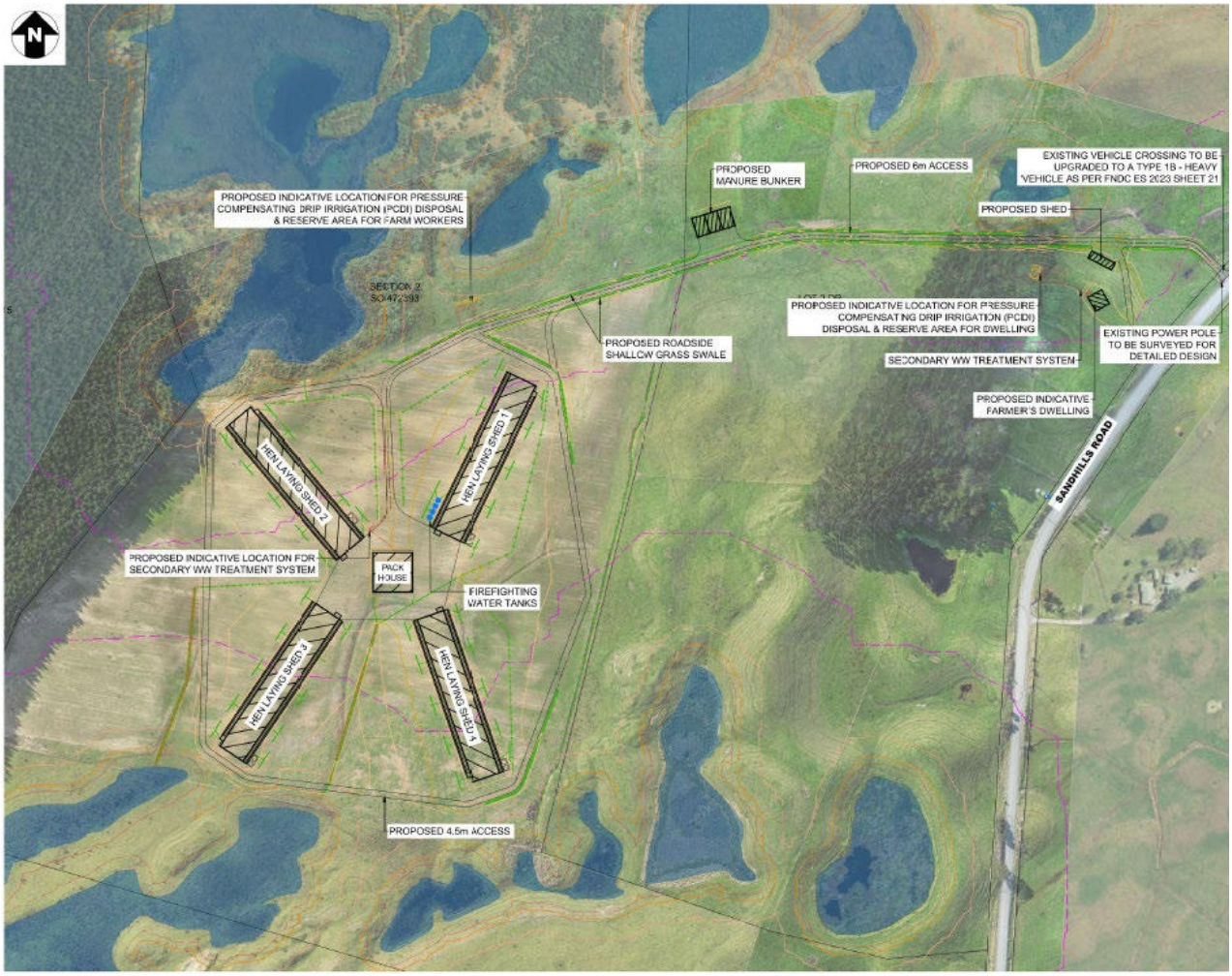

Figure 14. Proposed site plan, reproduced from Chester (2026, drawing C110), shown in relation to the identified wetlands.

4.2 Terrestrial Ecology

4.2.1 Effects of vegetation removal

Vegetation removal associated with the proposal is predominantly limited to areas of pasture and land currently used for agricultural and horticultural cropping. The removal of pasture and crop vegetation does not constitute vegetation clearance under the NRP and does not require consent, as these areas do not comprise indigenous vegetation or natural habitat.

In addition, a small number of exotic pine trees will be removed from the edge of an existing pine plantation to facilitate development. These trees form part of an even-aged plantation with a sparse understorey and limited structural diversity.

The removal of these pine trees will result in a minor loss of low-quality exotic vegetation and may temporarily displace common and adaptable bird species that utilise the plantation for opportunistic roosting or foraging. However, given the exotic nature of the vegetation, its limited habitat value, and the availability of similar habitat within the adjacent plantation, effects on terrestrial fauna are expected to be **low** and temporary.

Importantly, no vegetation removal is proposed within 10 m of any identified natural wetland. All indigenous wetland vegetation will be retained, and the development layout avoids direct effects on significant wetland vegetation.

4.3 Freshwater Ecology

4.3.1 Effects of earthworks

Bulk earthworks are proposed across a 10.27 ha area within the site to facilitate the development (Chester Consultants Limited (Chester) 2026). Proposed earthworks include the formation of building platforms, accessways, and installation of stormwater and wastewater infrastructure. No earthworks will occur within 10 m of natural inland wetlands.

Erosion and sedimentation

Elevated levels of suspended sediment can have detrimental effects on freshwater environments including reducing light penetration, smothering food and interstitial spaces, and clogging fish and invertebrate gills. However, aquatic organisms are adapted to periods of elevated sediment in the water, as they intermittently experience this during times of high river/stream flow.

It is expected earthworks and vegetation removal will generate the release of fine sediment. If not carefully managed, this could enter and detrimentally effect the freshwater environment. Erosion and sediment control (ESC) measures will be implemented on site line with Auckland Council's GD05 guidelines and an indicative ESC plan has been prepared by Chester (2026, plan 210). Erosion and sediment control measures have been proposed for the site, which may include a stabilised construction entrance, silt/super silt fencing, clean/dirty water diversion bunds decanting earth bunds and progressive site stabilisation.

The magnitude of effect of fine sediment release on freshwater environments is considered to be moderate, mitigated to **low** providing ESC measures are implemented.

4.3.2 Effects on wetland catchments and hydrology

The proposed development will result in changes to site hydrology associated with the introduction of impervious surfaces and minor site regrading.

The stormwater design has been developed by Chester (2026) to maintain existing catchment patterns and, where practicable, ensure that runoff continues to discharge to the same receiving wetlands as under existing conditions. Catchment redistribution resulting from site formation works represents a negligible proportion of the total contributing catchment areas for the receiving wetlands and is not expected to materially alter catchment hydrology.

Under the proposed design, surface runoff will be directed through filter strips and a vegetated swale network prior to discharge to the receiving environment (Chester 2026, plan C420). Roof runoff from proposed buildings will be discharged to in-ground dispersal trenches upstream of the swale network, promoting infiltration and groundwater recharge and reducing the volume and velocity of surface runoff entering the wetlands.

New impervious surfaces will be introduced for the proposed sheds, packhouse, and dwelling. A small area of impervious surface (approximately 55 m^2) is proposed within 30 m of Wetland A to facilitate the construction of Hen Laying Shed 2 (Chester 2026, plan C111). The proposed accessway will be gravelled to reduce the extent of impervious surfaces across the ZOI and specifically within 30 m of wetlands. This encroachment represents a very small proportion of the overall development footprint and the contributing wetland catchment. Runoff from this area will be managed via the proposed stormwater treatment and dispersal measures prior to reaching the wetland, such that potential effects on wetland hydrology are minimised and consistent with the intent of the FNDP setback provisions.

Stormwater modelling indicates a net increase in runoff volume of approximately 143 m^3 to Wetland A and 350 m^3 to Wetland B for the modelled design event (Chester 2026, plan 410). These increases are primarily attributable to the introduction of additional impervious surfaces, with only a very minor contribution from catchment redistribution. Given the large size of the contributing catchments and the natural capacity of these wetlands to accommodate fluctuations in inflows, these increases are expected to result in low adverse hydrological effects.

The proposed design avoids any reduction in runoff volumes to the wetlands during frequent storm events. Maintaining, or marginally increasing, runoff inputs is important for the ongoing health of bog wetlands, which are seasonally wetland therefore sensitive to drying and changes in water balance. In this context, the marginal increase in runoff volumes is consistent with the natural hydrological function of the wetlands and is not expected to result in adverse ecological effects.

Additional mitigation measures, including shallow grass swales and erosion and scour protection at discharge points where required, will further reduce potential effects by slowing flows, promoting infiltration, moderating water temperature, and improving water quality prior to discharge. Culverts discharging to the wetlands will incorporate appropriate outlet protection to avoid localised erosion or disturbance of wetland margins.

Overall, the proposed stormwater management measures are expected to maintain wetland hydrology and catchment processes and avoid significant changes to water levels, flow patterns, or ecological function. With the proposed mitigation in place, effects on the hydrology of the identified wetlands, particularly Wetlands A and B, are assessed as **low**.

4.3.3 Effects of wastewater and manure management on wetlands

Manure management

All chicken manure will be collected and transported off site for disposal. A temporary manure storage bunker is proposed in the north of the ZOI to manage manure prior to removal from the site. The bunker

is proposed to be fully concreted with a sealed base and walls, and will be covered by a shed structure. This design will prevent contact between manure and underlying soils and groundwater, and will avoid the generation of leachate entering the surrounding environment.

Given the sealed nature of the bunker, the temporary storage of manure is not expected to result in any discharge of contaminants to soil, groundwater, surface water, or adjacent wetlands. Accordingly, no adverse ecological effects on natural wetlands or other ecological values are anticipated as a result of manure storage and handling.

Wastewater treatment and disposal

Domestic wastewater generated by staff facilities and the proposed dwelling will be treated and disposed of on site. The wastewater system has been designed by Chester in accordance with AS/NZS 1547:2012.

The proposed wastewater disposal area contains by soils identified predominantly as 'sandy loams', which are well-drained and suitable for wastewater disposal (Chester 2026). Secondary treated wastewater will be disposed of to land via a pressure compensating drip irrigation (PCDI) system within Category 2 equivalent soils.

The wastewater system has been designed such that no component of the treatment or disposal system proposed to be located within 30 m of any river, lake, wetland, or the coastal marine area**.** This setback provides a sufficient buffer to protect wetland hydrology and water quality and is consistent with the intent of relevant FNDP provisions.

Based on the wastewater design and soil assessment, no surface ponding or runoff of wastewater is anticipated, and no adverse effects on groundwater or surface water quality are expected. As wastewater disposal occurs via subsurface drip irrigation, the risk of contaminants reaching adjacent wetlands is considered very low.

To summarise, the proposed wastewater and manure management systems have been specifically designed to avoid discharges to land or water that could affect nearby natural wetlands. Key measures include the off-site disposal of manure, sealed temporary manure storage, subsurface disposal of treated wastewater, suitable soil conditions, and setbacks from wetlands.

Thus, the proposal is not expected to result in changes to wetland hydrology, water quality, or ecological function. Effects on natural wetlands and other ecological values arising from wastewater and manure management are therefore assessed as **low.**

4.4 Operational Management and Disturbance

Operational activities associated with the proposed free-range chicken farm, including routine vehicle movements and human activity, are not expected to result in more than minor disturbance to ecological values, given the modified nature of the site and the surrounding landscape, which is currently used for horticultural and agricultural activities. To further minimise potential effects on adjacent natural wetlands and any indigenous fauna, it is recommended that external lighting be designed and positioned to avoid unnecessary light spill into wetland areas, particularly during night-time hours.

Chickens will be fenced in and their access to natural wetlands and their immediate margins will be prevented, thereby avoiding trampling, nutrient inputs, and damage/disturbance to wetland vegetation. With fencing in place, and the adoption of good practice lighting design, operational disturbance effects on ecological values are expected to remain **low**.

4.5 Enhancement Opportunities

The proposed development has been designed to avoid direct effects on the adjacent high-value natural wetlands, and the assessment of ecological effects concludes that overall ecological effects are low. On this basis, wetland enhancement is not required to mitigate adverse ecological effects associated with the proposal.

Notwithstanding this, there are opportunities to undertake targeted ecological enhancement to further support the long-term protection and resilience of the wetlands.

The establishment of 10 m wide native wetland buffer plantings is recommended in locations where earthworks or infrastructure are situated within 30 m of identified wetland edges. This would involve planting within the portion of the buffer zone adjacent to the development in the vicinity of Wetlands A-C and H. This targeted approach focuses enhancement efforts where additional buffering would provide the greatest ecological benefit. Such planting would assist in enhancing the condition of wetland margins that are currently dominated by pasture or pest plant species, improve filtration of runoff, and provide additional protection to wetland ecosystems as the planting establishes.

It is recommended that a Native Planting and Management Plan be prepared as a condition of consent by a suitably qualified and experienced ecologist. This plan should detail planting locations, species selection, eco-sourcing and maintenance requirements, and outline weed management and long-term protection measures to ensure successful establishment and ongoing effectiveness of the planting.

5 SUMMARY AND RECOMMENDATIONS

An ecological assessment was undertaken at 284 and 458 Sandhills Road, Awanui, to evaluate the potential effects of the proposed free-range chicken farm on terrestrial and freshwater ecological values within and adjacent to the ZOI.

The terrestrial environment within the ZOI was highly modified and dominated by pasture, cropped land, and plantation forestry. Indigenous vegetation and high-quality terrestrial fauna habitat was largely absent. Vegetation removal associated with the proposal was limited to pasture, cropped land, and a small number of exotic pine trees, and will not result in the loss of indigenous vegetation or significant terrestrial habitat. Effects on terrestrial ecological values are therefore assessed as low.

Multiple natural inland wetlands were identified within the site, including bogs that meet the significance criteria of Appendix 5 of the NRPS. No direct vegetation removal or earthworks are proposed within, or within 10 m of wetlands, and no impervious surfaces are proposed within 30 m of wetlands.

Stormwater management has been designed to maintain existing catchment patterns, avoid reductions in runoff to wetlands during frequent rainfall events, and manage runoff through infiltration, vegetated swales, and erosion protection where required. Stormwater modelling indicates only minor increases in runoff volume to receiving wetlands, which are consistent with the natural hydrological function of bog wetlands and are not expected to result in adverse ecological effects. Onsite wastewater and manure management have been designed to avoid effects on wetlands and other receiving environments.

Overall, with the implementation of the proposed design and recommendations (summarised below), the proposal is expected to result in low overall ecological effects on terrestrial and freshwater ecological values.

5.1.1 Summary of recommendations

To further avoid or minimise potential ecological effects, the following recommendations are made:

- **Wetland protection** - All identified natural wetlands and their indigenous vegetation should be retained, with no earthworks, vegetation clearance, or infrastructure located within wetland boundaries.
- **Setbacks** - No impervious surfaces should be constructed within 30 m of any identified natural wetland, including wetlands greater than 1 ha in area, consistent with the intent of the FNDP.
- **Wetland Enhancement -** A Native Planting and Management Plan should be prepared by a suitably qualified and experienced ecologist and implemented following completion of site works. The plan should provide for native buffer planting within a 10 m wide area adjacent to identified wetlands, in locations where earthworks or infrastructure occur within 30 m of wetland edges, and specify appropriate indigenous species, eco-sourcing requirements, planting methods, maintenance, and weed management measures.
- **Stormwater management** - Stormwater should be managed in accordance with the proposed design, including the use of in-ground dispersal trenches, vegetated swales, filter strips, and erosion protection at discharge points, to maintain wetland hydrology and protect water quality.

- **Manure management** - Chicken manure should be stored temporarily in a sealed, covered concrete bunker and transported off site for disposal. This storage facility should be regularly inspected and maintained to avoid leachate generation and nutrient inputs to soils or wetlands.
- **Domestic wastewater** - Wastewater should be treated and disposed of via a subsurface drip irrigation system in suitable soils, with all components located at least 30 m from wetlands and other receiving environments.
- **Operational disturbance** - It is recommended that external lighting be designed and positioned to minimise light spill into adjacent wetlands, and that poultry access to natural wetlands and their immediate margins be avoided through fencing or operational management.

REFERENCES

Clarkson BR 2014. A vegetation tool for wetland delineation in New Zealand. Landcare Research Contract Report LC1793 for Meridian Energy Limited.

Clarkson BR, Fitzgerald NB, Champion PD, Forester L, Rance BD 2021. New Zealand wetland plant list 2021. Manaaki Whenua - Landcare Research contract report LC3975 for Hawke's Bay Regional Council.

Chester Consultants Limited 2026. Land Development Report: 284 & 458 Sandhills Road, Awanui. Te Rūnanga O Ngaitakoto Free Range Egg Farm. Draft. Dated 22 January 2026. Ref: 16007.

Cromarty P & Scott DA (eds) 1995. A Directory of Wetlands in New Zealand. Department of Conservation, Wellington, New Zealand Department of Conservation, PO Box 10 420 Wellington New Zealand.

Dunn NR, Allibone RM, Closs GP, Crow SK, David BO, Goodman JM, Griffiths M, Jack DC, Ling N, Waters J M, Rolfe JR 2018. Conservation status of New Zealand freshwater fishes, 2017. New Zealand Threat Classification Series 24. Department of Conservation, Wellington.

MfE 2022. Wetland delineation protocols. Wellington: Ministry for the Environment.

O'Donnell CFJ, Borkin KM, Christie J, Davidson-Watts I, Dennis G, Pryde M, Michel P 2023. Conservation status of bats in Aotearoa New Zealand, 2022. New Zealand Threat Classification Series 41. Department of Conservation, Wellington. 18 p.

Robertson H A, Baird, KA, Elliott G, Hitchmough R, McArthur N, Makan T, Miskelly C, O'Donnell CF, Sagar PM, Scofield RP, Michel P 2021. Conservation status of birds in Aotearoa New Zealand, 2021. Department of Conservation, Te Papa Atawhai. 2021.

Roper-Lindsay J, Fuller SA, Hooson S, Sanders MD, Ussher GT 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.

Singers N, Osborne B, Lovegrove T, Jamieson A, Boow J, Sawyer J, Hill K, Andrews J, Hill S, Webb C 2017. Indigenous terrestrial and wetland ecosystems of Auckland. Auckland Council.

Singers N 2018. A Potential Ecosystem Map for the Northland Region - Explanatory Information to Accompany the Map. Nicholas Singers Ecological Solutions.

Appendix A
Table describing the key characteristics of the natural inland wetlands within the ZOI

Table A1. Key characteristics of each wetland within the ZOI*.

Wetland label	Size (m^2)	Dominant Vegetation Type	Key flora species	Other notes:	Fenced ?
A	49,629	Machaerina-kuta sedgeland	Dominant species: *Machaerina articulata* (OBL), kuta (*Eleocharis sphacelata* - OBL) Other species noted: Budding clubrush (*Isolepis prolifera* - OBL), *Azolla* sp. (OBL)	Bog over 0.2 ha – largest wetland in ZOI Buffer of exotic pest plants (gorse/woolly nightshade) Large areas of standing water – At Risk dabchicks & black shag observed. Previous records of At Risk black mudfish. Mallards present.	Yes
B	22,756	Grazed Juncus rushland	Dominant species: wiwi/*Juncus sarophorus* (FACW) Other species noted: Kikuyu (*Cenchrus clandestinus* - FACU), mercer grass (*Paspalum distichum* - FACW), *Juncus articulatus* (FACW)	Pooling/standing water presence	No
C	6,635	Grazed Juncus rushland	Dominant species: wiwi (FACW) Other species noted: Kikuyu (FACU), mercer grass (FACW), *Juncus articulatus* (FACW)	Pooling/standing water presence	No
D	2,696	Open water	Dominant species: kuta (OBL) Other species noted: *Juncus* sp. (FACW), kuta (OBL), water pepper (*Persicaria hydropiper* – FACW)	Submerged macrophytes abundant in some areas (e.g. *Myriophyllum* sp.)	No
E	2,206	Grazed exotic-dominant	Dominant species: N/A Other species noted: soft rush (FACW), budding clubrush (OBL), kuta (OBL), water pepper (FACW), *Carex longii* (FAC)	Standing water	No

F	7,368	Machaerina-kuta sedgeland	Dominant species: *Machaerina articulata* (OBL), kuta (OBL), swamp millet (*Isachne globosa* - OBL) Other species noted: budding clubrush (OBL), *Carex longii* (FAC), mānuka (*Leptospermum scoparium* - FAC), cabbage tree (*Cordyline australis* - FAC), *Machaerina juncea* (FACW), pampas (*Cortaderia* sp. - FAC), kiokio (*Parablechnum novae-zelandiae* - FAC), pōhuehue (*Muehlenbeckia complexa var. complexa* - FACU)	Bog over 0.2 ha	Yes
G	7,317	Machaerina-kuta sedgeland	Dominant species: *Machaerina articulata* (OBL), kuta (OBL), budding clubrush (OBL) Other species noted: swamp millet (OBL), *Azolla* sp. (OBL)	Bog over 0.2 ha, large areas of open water	Yes
H	1,425	Grazed exotic-dominant	Dominant species: mercer grass (FACW), budding clubrush (OBL) Other species noted: raupō (*Typha orientalis* - OBL), common duckweed (*Lemna disperma* - OBL)	Standing/open water present, possibly previous human modification for drainage	No
I	7,122	Isolepis-kuta sedgeland	Dominant species: budding clubrush (OBL) Other species noted: kuta (OBL)	Bog over 0.2 ha	Yes
J	30,747	Machaerina-kuta sedgeland	Dominant species: *Machaerina articulata* (OBL), kuta (OBL), swamp millet (OBL), mānuka (FAC) Other species noted: flax/harakeke (*Phormium tenax* - FACW), *Dicksonia* sp., giant umbrella sedge (*Cyperus ustulatus* – FACW)	Bog over 0.2 ha	Yes

K	9,367	Grazed exotic-dominant	Dominant species: mercer grass (FACW) Other species noted: soft rush (FACW), lotus (*Lotus pedunculatus* - FAC), kikuyu (FACU), wiwi (FACW)	Heavily grazed	No
L	2,917	Grazed exotic-dominant	Dominant species: sweetgrass (*Glyceria* sp. - OBL) Other species noted: budding clubrush (OBL), mercer grass (FACW), wiwi (FACW), kikuyu (FACU)	Pooling water underfoot	No
M	2,225	Grazed exotic-dominant	Dominant species: *Glyceria* sp. (likely *G. fluitans* - OBL), budding clubrush (OBL), mercer grass (FACW) Other species noted: *Persicaria* sp., water starwort (*Callitriche stagnalis* - OBL), lotus (FAC), *Juncus articulatus* (FACW), water milfoil (OBL), wiwi (FACW), alligator weed (*Alternanthera philoxeroides* - FACW)	Open/standing water dominant	No

*It should be noted that the vegetation listed is not exhaustive for each wetland area, and flora species were recorded visually based on a general site walkover and where access was possible by foot into wetland areas.

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TRAFFIC PLANNING CONSULTANTS LTD

PROPOSED AGRICULTURAL DEVELOPMENT
TRANSPORT ASSESSMENT

284 SANDHILLS ROAD
AWANUI, FAR NORTH

Project Information:

Client	SmartSteel Buildings LTD & Te Runanga O NgaiTakoto Custodian Trustee LTD
Job Number	250116
Title	Proposed Agricultural Development, Transport Assessment 284 Sandhills Road, Awanui
Prepared By	Peter Kelly
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1.0 INTRODUCTION

This report describes and examines the traffic and parking effects of a proposal to construct an egg farm at 284 Sandhills Road, Awanui. The site is located on the western side of Sandhills Road, approximately 10 kilometres north of Ahipara and approximately 8.5 kilometres southwest of Kaitaia. Under the operative version of the Far North District Plan (FNDP), the site is zoned Rural Production.

The proposal is described in more detail within the application and illustrated within the plans. Basically, it comprises construction of a four shed hen laying and packing facility.

This report describes the nature of the local transport environment around the development; sets out the transport characteristics of the proposal; assesses its likely impacts on the surrounding transport environment (if any), including any mitigation measures that are considered necessary to minimise those impacts; and considers the application in terms of the Standards set out in Section 15 of the FNDP and its assessment criteria.

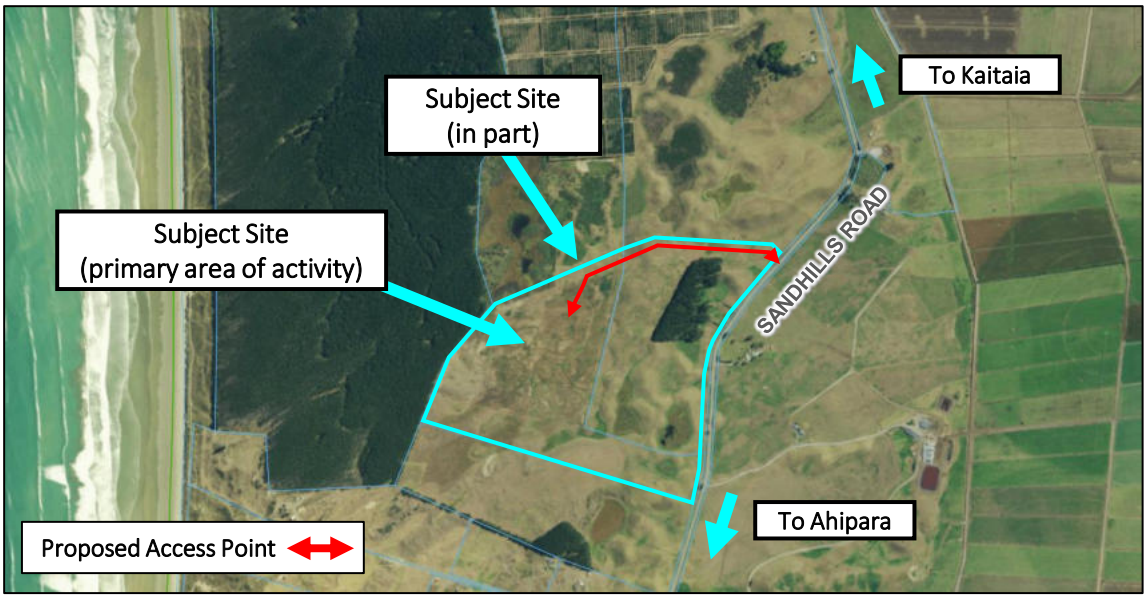


Figure 1: Site Location
Source: Far North District Council

1.0 EXISTING TRANSPORT ENVIRONMENT

1.1 Existing Site Environment

The site is located on the western side of Sandhills Road, in Awanui. The site is currently used for grazing activities with informal access points controlled by paddock gates.

Sandhills Road is two lane rural road which is unsealed for its majority. Near the subject site it has an approximate width of 8 metres. It has a speed limit of 60 km/h based on signs installed along Sandhills Road some 2 kilometres north of Ahipara Road and on Gill Road near its intersection with Sandhills Road.

Traffic volumes along Sandhills Road are not expected to exceed 200 vehicles per day, with approximately 20 vehicles during peak hours.

1.2 Area Crash History

Information from the New Zealand Transport Agency's 'Crash Analysis System' for the latest available ten-year period, January 2016 to 2026 (subject to delay at the time of the data was extracted in 2026), along the length of Sandhills Road, plus Gill Road (Sandhills Road to West Road), indicates that 12 crashes have been reported including 3 minor injury crashes. The crashes are summarised below:

- January 2017: Sandhills Road, 2.15km south of Clarke Road – Driver under influence of alcohol performing stunt driving, lost control and hit fence/pole. No injuries were reported.
- April 2017: Sandhills Road, 2.55km north of Kokopu Street – Driver evading law enforcement, hit another vehicle in carriageway. No injuries were reported.
- June 2018: Sandhills Road, 3.41km north of Clarke Road – Opposing drivers, both more central within two-lane road met at crest within road, hitting slightly and then overcorrecting, with one vehicle leaving the road. A minor injury was reported.
- December 2018: Sandhills Road, 5.533km south of Gill Road – Driver travelling at inappropriate speed, lost control through corner leaving the road. No injuries were reported.
- December 2019: Sandhills Road, 2.5km west of Gill Road – Driver lost control due to slippery road conditions. No injuries were reported.
- December 2019: Sandhills Road, 300m west of Gill Road – Driver lost control due to slippery road conditions. No injuries were reported.
- October 2020: Sandhills Road, 2.15km south of Clarke Road – Driver lost control and left road due to attention being diverted. No injuries were reported.
- June 2021: Gill Road, 30 metres east of West Road – New driver, under influence of alcohol, missed intersection/end of road and left the road. A minor injury was reported.
- August 2021: Intersection of Sandhills Road and Ahipara Road – Driver lost control and left road due when swerving to avoid animal. A minor injury was reported.
- April 2022: Sandhills Road, 1.9km south of Clarke Road – Driver perusing their stolen property was struck by one of the offenders on a motorbike. The offenders then fled the scene. No injuries were reported.

- June 2023: Sandhills Road, 4.38km south of Gill Road – Driver hit farm animal straying in road due to visibility being restricted by crest in road. No injuries were reported.
- July 2025: Sandhills Road, 4.08km west of Gill Road – Driver evading law enforcements, lost control due to speed and left road. No injuries were reported.

Based on the above information, there is no reason to suggest an inherent road safety issue concerning property access near the subject site.

2.0 THE PROPOSAL

2.1 General Site Layout Description

The proposal is described in more detail within the application, and the general layout of the ground floor is illustrated in **Figure 2**. It comprises the construction of a packhouse building in the middle of the site, along with four hen laying sheds. In addition, supporting storage buildings as well as a farm dwelling are proposed for the site.

The site will be served by a single vehicle access which will connect to Sandhills Road, approximately 5.3 kilometres west of Gill Road.

Further discussion of the appropriateness and formation of the access point and parking in relation to the FNDP is included later in this report.

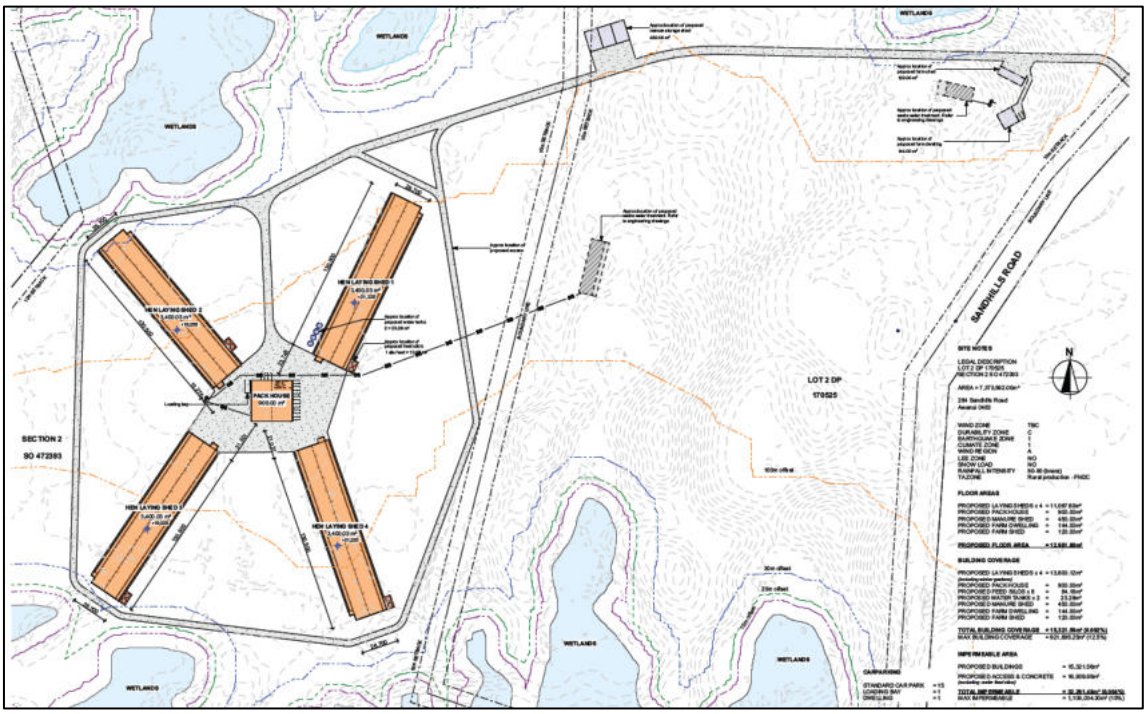


Figure 2: Proposed Site Layout
Image Source: Neo Architecture Studio

2.2 Site Operation and Trip Generation

Appendix 3 of the FNDP indicates that farming activities are exempt from traffic intensity provisions, however the site's activity does not fall into the definition of farming, but rather is factory farming, which has no specified traffic intensity factor (TIF). While not an accurate depiction for the site, the closest applicable TIF is industrial land-use. The site's pack house, laying sheds, and storage sheds have a Gross Business Area (GBA) of 12,538 m^2, resulting in a TIF of 1,254, plus the TIF for the associated farm dwelling (10). As such, the site activity has a technical TIF of 1,264, which is a Discretionary Activity.

In reviewing the TIF, it was determined that to apply the GBA for the entire site is not an entirely accurate approach, as large areas of the site will not explicitly generate vehicle movements but rather are ancillary to the core operation. In this instance the pack house (900 m^2) and the manure shed (450m^2) are considered to be the main activity centres, with the laying sheds and other

storage sheds supporting the packing of eggs. From this, the site would then have a TIF of 135 for the factory farming and 10 for the farm dwelling, resulting in a TIF of 145, which is a Restricted Discretionary Activity.

For additional context, information regarding the planned operations for the site was obtained in order to determine the likely trip generation associated with the site. The following outlines the expected staff and truck operations for the site:

- Hen laying = 25 workers (70 passenger vehicle movements per day)
- Feed drop = Three Class 4 trucks per week (6 truck movements per week)
- Manure collection = Three Class 4 trucks per week (6 truck movements per week)
- Egg collection = Five Class 5 trucks per week (10 truck movements per week)
- Farm dwelling = 1 family (10 passenger vehicle movement per day)

From this, on the site's busiest day, 25 workers and 3 truck movements are expected to frequent the site. This volume of use is estimated to generate approximately 70 passenger vehicle movements and six truck movements per day. These movements are most likely to occur in the early morning (start of workday) and early evening (end of workday) for passenger vehicles, with truck movements occurring mid-way through the day. A nominal number of trips was applied for workers which may leave the site during a break period throughout the day.

Considering the practical area TIF application and the trip generation assessment based on first principles, the site is likely to generate daily vehicle movements between 61-200, thereby classifying the activity as Restricted Discretionary.

Compared to the daily traffic volume of approximately 200 vehicles on Sandhills Road, the proposal represents a 35% increase in volumes on the road. While a significant increase, the overall volumes and peak hour volumes along Sandhills Road remain quite low and well within the acceptable range for an unsealed rural road. Considering this, the level of traffic generation from the site can be easily accommodated by the existing road environment without any additional mitigation and will have a less than minor effect.

2.3 Vehicle Access

Vehicular access to the site will occur from Sandhills Road near an existing farm access point. The site's access at the boundary will be approximately 6 metres wide, allowing for two-way vehicle movement. Where connecting to the carriageway of Sandhills Road appropriate splays between the road and the access of approximately 15 metres (in accordance with the FNDC-Engineering Standard Sheet 21 (Type 1B). This splay will allow for Class 5 trucks to suitably enter and exit the site.

From the site's vehicle crossing, sightlines along Sandhills Road will extend more than 200 metres to the north and south, allowing for suitable visibility to facilitate safe and efficient vehicle movement. **Figure 4** displays the indicative sightlines from the proposed vehicle crossing location.

Within the site, exact details regarding the access gradient are not presently known, however the access route has looked to best follow the existing contours of the site and an existing farm track. The future gradients of the road are anticipated to be suitable for heavy vehicles to navigate, with localised earthworks removing any cresting or depressions which would negatively impact on the access' performance. Any effects resulting from the proposed gradients would be contained within the site and would be less than minor onto users of the site, with no effects onto users of the public realm.

Figure 4: Vehicle Crossing Indicative Visibility
Image Source: Traffic Planning Consultants Ltd.

2.4 Parking and Loading

Under the FNDC standards, rural activities have no minimum parking requirement. However, the factory farming operation is considered to be more closely aligned with industrial operations which has parking requirement of 1 space per 100 m^2 of GBA. With 12,538 m^2 of GBA, the site has a technical requirement of 125 parking spaces, plus two spaces for the farm dwelling (127 total). However, similar to the TIF assessment in Section 3.2, it is considered that the pack house and manure shed are the main operation building (with human activity). With a combined GBA of 1,350 m^2, 14 parking spaces are required.

Within the main portion of the site, 15 parking spaces and one loading bay are proposed for employee and operations parking. At least two parking spaces will be made available for the farm dwelling. The parking spaces will be at least 5.4 metres deep and 2.4 metres wide, with more than 8 metres of manoeuvring depth. The loading bay will be 3.5 metres wide and 9.0 metres deep, although there will be no adjacent structures, thereby allowing for the space to accommodate larger trucks and semi-trailers with ease.

Within the site, the parking, loading and circulation area will be unsealed, which is appropriate for the rural environment. With the available space within the main area of the site, the non-marking of parking will not have any detrimental effect onto the operation of parking, as should drivers park more spaced out, there is amble space available to accommodate additional parking.

Overall, the site's parking and loading proposal is considered to suitably accommodate the likely demands associated with the operation.

2.5 Construction Related Traffic Impacts

The need to introduce truck and other vehicle movements during the construction phases of any development always has a potential to impact on the surrounding area and road network, but a certain degree of impact for what is normally a relatively short period of time (at least in the context of the life of the proposed development) is inevitable and should not normally be a reason for restricting development.

Based on the proposed scale of development, the number of truck movements delivering materials to the site for construction would be less than or equal to the number of trucks during regular operations of the site (once consented). Considering this, the construction activity for the site will have less than minor effects onto the surrounding road environment and as such no mitigation measures are required.

3.0 FAR NORTH DISTRICT PLAN STANDARDS

Section 15 of the operative version of the Far North District Plan (FNDP) sets out the development controls relating to transport. **Table 1** lists the relevant rules that apply to this development and comments on compliance. Where there is non-compliance, further assessment will be undertaken against the criteria set out in the FNDP.

Table 1: Transport Development Controls

Standard	Requirement/Details	Comment
15.1.6A Traffic	Sets out the requirement for maximum daily traffic movement for new developments within underlying zones. For development within the rural production zone, maximum daily one-way traffic movements should be no more than 60 vpd.	The site has a technical TIF of 1,264. Through the discussion in Section 3.2, the proposal is expected to have a TIF of 61-200 – restricted discretionary activity
15.1.6B.1.1 On-site Car Parking Spaces	Defines the minimum number of parking spaces for new developments. For rural activities, parking rates do not apply; however, the closest activity status for the site is industrial; which requires 1 per 100m^2.	The site has a technical parking requirement of 127 spaces, where 17 spaces are proposed – does not comply
15.1.6B.1.4 Accessible Car Parking Spaces	Defines the minimum number of accessible parking spaces for new developments. For 20 or less car parking spaces provided, a minimum of one accessible car parking space should be provided.	The proposal includes 15 formal parking spaces with no dedicated accessible parking space – does not comply
15.1.6B.1.5 Car Parking Spaces	Defines the size and formation of parking spaces. For regular user parking spaces, it spaces should be at least 4.9 metres deep with a minimum of 6.7-metre-deeo manoeuvring space for a 2.5-metre-wide and 90-degree parking space. All parking, loading, access drives and manoeuvring areas shall be formed and provided with an all-weather surface, drained, marked out and maintained to the satisfaction of the Council, and shall be kept free and available for the uses intended.	All spaces will be set out as 90-degree spaces. They will be 2.4 metres wide and 5.4 metres deep with a manoeuvring depth of more than 8 metres – complies All parking, loading and access areas will be formed and drained – complies Parking and loading areas will not be marked – does not comply
15.1.6B.1.6 Loading Spaces	Defines the minimum number, size and formation of loading spaces.	The proposal includes a pack house which is 900 m^2. One loading space will be provided – does not comply

Standard	Requirement/Details	Comment
	For building GFA between 500 m^2 and 5,000m^2, two loading spaces should be provided. Loading spaces shall be designed to accommodate the largest size of truck expected to use them. All loading areas shall be formed and provided with an all-weather surface, drained, marked out and maintained to the satisfaction of the Council, and shall be kept free and available for the uses intended.	The truck loading space has been designed to accommodate a design vehicle of 19-metre truck and trailer – **complies** All loading areas will be formed and drained – **complies**
15.1.6C.1.1 Private Accessway in All Zones	Sets out the requirements for the vehicle access. For rural production activities with more than 50 vpd (5 household equivalent), the carriageway width should be at least 5.0 metres, and the legal width should be more than 735 metres. The access must have stormwater drainage. The access should be no steeper than 1 in 5 (20%). The access should not be: ▪ onto a State Highway ▪ onto a local road within 30 metres of its intersection with an arterial or collector road.	The access will be predominantly 6 meters wide and widens for manoeuvring within the site – **complies** The access will be formed with stormwater drainage – **complies** The access will have a maximum gradient less than 1 in 5 (20%) – **complies** The access will be located onto a rural road and will be more than 100 metres from any intersection – **complies**
15.1.6C.1.3 Passing Bays on Private Accessways in All Zones	Sets out the requirements for the passing bays. Where required, passing bays on private accessways are to be at least 15 metres long and provide a minimum usable access width of 5.5 metres.	The access will have a minimum formed width of 6 metres allowing for two-way vehicle movement – **complies**
15.1.6C.1.4 Access over Footpaths	Sets out the requirements for the access over footpaths.	There is no footpath along Sandhills Road – **does not apply**
15.1.6C.1.5 Vehicle Crossing Standard in Rural Zones	Sets out the requirements for the vehicle crossing in rural zone. Vehicle crossings are to be constructed to Council's engineering standard. They are to be sealed when connecting to a sealed road.	The vehicle crossing will be formed as per FNDC-Engineering Standard Sheet 21 (Type 1B) – **complies** The vehicle crossing will be unsealed, where connecting to an unsealed road – **complies** The vehicle crossing will be two-way – **complies**

Standard	Requirement/Details	Comment
	They are to be two-way when serving more than one dwelling.	
15.1.6C.1.7 General Access Standards	Sets out the requirements for the private access within the site. Provision shall be made such that there is no need for vehicles to reverse off a site serving four or more parking spaces. All bends and corners on the private accessway are to be constructed to allow for the passage of a Heavy Rigid Vehicle.	Vehicle access has been configured so that all anticipated vehicles are able to enter and leave the site in a forward direction and heavy vehicles are able to travel through the access with adequate clearance to any obstructions – **complies**

4.0 FAR NORTH DISTRICT COUNCIL OPERATIVE PLAN ASSESSMENT CRITERIA

Chapter 15 – Transportation, Section 1 – Traffic, Parking and Access of the Far North District Council – Operative Plan (FNDP) sets out the assessment criteria for activities and design elements which do not comply with the standard. For this proposal, consent is required under the following standards:

- 15.1.6A – Traffic
- 15.1.6B.1.1 – On-Site Parking Spaces
- 15.1.6B.1.4 – Accessible Parking Spaces
- 15.16B.1.5 – Car Parking Spaces
- 15.1.6B.1.6 – Loading Spaces

The following lists the relevant assessment criteria for these standards and comments as applied to this development.

4.2 Traffic – Discretionary Activities Assessment Criteria

(a) The extent by which the expected traffic intensity for a proposed activity exceeds the assumed value set by the Traffic Intensity Factor contained in Appendix 3A in Part 4 of the Plan

(b) The time of day when the extra vehicle movements will occur.

(c) The distance between the location where the vehicle movements take place and any adjacent properties.

(d) The width and capability of any street to be able to cope safely with the extra vehicle movements.

(e) The location of any footpaths and the volume of pedestrian traffic on them.

(f) The sight distances associated with the vehicle access onto the street.

(g) The existing volume of traffic on the streets affected.

(h) Any existing congestion or safety problems on the streets affected.

(i) With respect to effects in local neighbourhoods, the ability to mitigate any adverse effects through the design of the access, or the screening of vehicle movements, or limiting the times when vehicle movements occur.

(j) With respect to the effects on through traffic on arterial roads, strategic roads and State Highways, any measures such as right-turn bays, flush medians, left turn deceleration tapers, etc. proposed to be installed on the road as part of the development to accommodate traffic turning into and out of the site.

(k) The extent to which the activity may cause or exacerbate natural hazards or may be adversely affected by natural hazards, and therefore increase the risk to life, property and the environment.

(l) Whether providing or having access to bicycle parking, shower/changing facilities or alternative transportation would reduce the number of vehicle movements associated with the proposed activity.

(m) The provision of safe access for pedestrians moving within or exiting the site.

4.3 Parking and Loading Provisions – Discretionary Activities Assessment Criteria

(a) Whether it is physically practicable to provide the required car parks on site.

(b) Whether there is an adequate alternative supply of parking in the vicinity, such as a public car park or angled road parking.

(c) Whether there is another site nearby where a legal agreement could be entered into with the owner of that site to allow it to be used for the parking required for the application.

(d) Whether it can be shown that the actual parking demand will not be as high as that indicated in Appendix 3C.

(e) Adequacy of the layout and design of the car parking areas in terms of other recognised standards, including the provision made to mitigate the effects of stormwater runoff, and any impact of roading and access on waterways, ecosystems, drainage patterns or the amenities of adjoining properties.

(f) Degree of user familiarity with the car park and length of stay of most vehicles.

(g) Total number of spaces in the car park.

(h) Clear space for car doors to be opened even if columns, walls and other obstructions intrude into a car parking space.

(i) For sites with a frontage with Kerikeri Road between its intersection with SH10 and Cannon Drive:

i. the visual impact of hard surfaces and vehicles on the natural environment;

ii. the effectiveness of any landscape plantings in screening hard surfaces and vehicles associated with parking areas.

(j) Whether cycling facilities or open green space have been considered or are appropriate as an alternative to car parking.

(k) Whether adequate consideration has been given to providing accessible car parking spaces for those with disabilities, the location of these spaces and regulating inappropriate use of the spaces.

(l) The extent to which the site can be accessed by alterative transport means such as buses, cycling or walking.

(m) The extent to which the reduced number of car parking spaces may increase congestion along arterial and strategic roads.

(n) The degree to which provision of on-site car parking spaces may have resulted in adverse visual effects or fragmented pedestrian links.

(o) Whether a financial contribution in lieu of car parking spaces is appropriate.

(p) Consideration given to shared parking options between adjacent sites and activities that have varying peak parking demands.

(q) The varying parking requirements for staff and customers.

4.4 Assessment of Non-Compliance: 15.1.6A – Traffic

The reason for consent under this standard relates to the number of daily vehicle movements generated by the site activity. Under the standard, rural production sites are permitted to generate up to 60 vehicle movements per day, whereas the proposal is forecast to accommodate approximately 70 vehicle movements per day. The following points are made in regard to the proposal:

- The site encompasses a large swath of land within the rural production area, which would be able to consist of multiple smaller titles which, if subdivided would be able to produce a larger aggregate number of vehicle movements.
- Sandhills Road carries relatively low volumes of vehicle movements throughout the day and the proposal while increasing the volume of traffic, will not have any significant impact on its operation, or to adjoining key intersections:
    - Sandhills Road and Ahipara Road.
    - Sandhills Road and Gill Road.
    - Gill Road and State Highway 1.
- The vehicle movements generated by the site will be largely employees, who will be familiar with the road environment and as such would not be surprised by any of the vertical/horizontal curvature of the road layout. Similarly, truck drivers to the site would be likely to frequent the site regularly and thereby also be familiar with the road and subject site.
- The site access point onto Sandhills Road is provided with good visibility to both the north and south allowing for vehicle movements to occur safely.
- Sandhills Road is a low volume rural road, which is expected to accommodate very few pedestrian and cyclist movements, thereby minimising risk exposure to these vulnerable road users.
- A review of the road safety history for Sandhills Road showed no evidence of endemic road safety concerns for its length between Ahipara Road and Gill Road.

Considering these points, the proposed activity's trip generation will have less than minor effects onto the overall safety and operational performance of the surrounding road environment.

4.5 Assessment of Non-Compliance: 15.1.6B.1.1 – On-Site Parking Spaces

The reason for consent under this standard relates to the site proposing a total of 17 parking spaces, where the standard requires 127 spaces to be provided. It was considered that to apply the GBA for the entire site to determine the parking required would not be an accurate approach, as large areas of the site will not explicitly generate vehicle movements but rather are ancillary to the core operation (such as the laying sheds). In this instance the pack house (900 m^2) and the manure shed (450m^2) are considered the main generators of the site, as the 11,067m^2 of laying sheds, will predominantly house hens, with eggs being collected via an automated conveyor system. As such, with the pack house and manure shed having a combined GBA of 1,350m^2, this area of the site would have a more practical parking requirement of 14 spaces, of which the site complies. Further, additional space is available within the site's access area for additional vehicles to park, should the demand dictate. Under no circumstances would parking from the site be expected to extend beyond the property boundaries.

Overall, the site's parking supply is considered to be appropriate and will have less than minor effects onto users of the site and to the surrounding area.

4.6 Assessment of Non-Compliance: 15.1.6B.1.4 – Accessible Parking Spaces

The reason for consent under this standard relates to the site proposing a total of 15 formal parking spaces within the main activity portion of the site, with none of the parking spaces being formally provided as an accessible parking space. Based on the proposed site activity and its jobs, a certain degree of physical ability is required to perform the required tasks. Considering this, the employees of the site would not be likely to require an accessible parking space, as an inability to utilise a standard parking space would also likely preclude them from performing the required duties. As such, it is considered that there is no practical demand for accessible parking spaces within the site. Notwithstanding, within the site additional space is available for vehicles to park with greater clearances from each other, thereby allowing additional width for accessible needs if required. Additionally, parking closest to building entrances can be informally reserved for an employee if their needs require.

Considering this, the proposal to not provide an accessible parking space will have less than minor effects and therefore is acceptable.

4.7 Assessment of Non-Compliance: 15.1.6B.1.5 – Car Parking Spaces

The reason for consent under this standard relates to the site's parking not being marked as required by the standard. As the parking area and circulation access will be unsealed, the formal marking of parking spaces is not practical as it would wear off relatively quickly due to the surface type. Within the parking and access area, there is suitable space available for additional parking should vehicles park more widely spread due to the absence of line marking. Further, with the amount of space available within the site, parking demands for the activity will be able to be fully contained within the site, irrespective of line marking. The proposal's non-marking of parking spaces will have less than minor effects and therefore is acceptable.

4.8 Assessment of Non-Compliance: 15.1.6B.1.6 – Loading Space

The reason for consent under this standard relates to the site proposing a single loading space for the operations where under the standard, two loading spaces are required. Similar to the other non-compliances regarding parking provision, the access and parking area around the pack house facility is provided with a generous unsealed area which would allow for two trucks to park on site, should it ever be required. However, given the likely frequency of truck movements to the site it is unlikely that more than one truck would attend the site at a given time. Considering this, the proposal for one identified loading space on site will have less than minor effects and therefore is acceptable.

5.0 CONCLUSIONS

Based on the analyses described in this report, the following conclusions can be made in respect of the proposal to establish a hen laying facility at 284 Sandhills Road, Awanui:

- The proposed hen laying facility is feasible from a transportation perspective.
- The estimated traffic generation of the proposal is likely to be about 70 vehicle movements per day.
- The traffic generated by the proposal to and from the site can be accommodated on the road network with no significant impact on the performance of Sandhill Road.
- Review of the transport standards has identified the following items which require consent under the Section 15 of the operative version of Far North District Plan:
  - 15.1.6A – Traffic
  - 15.1.6B.1.1 – On-Site Parking Spaces
  - 15.1.6B.1.4 – Accessible Parking Spaces
  - 15.16B.1.5 – Car Parking Spaces
  - 15.1.6B.1.6 – Loading Spaces

Overall, it is considered that the traffic engineering effects of the proposal can be accommodated on the road network without compromising its function, capacity or safety. Therefore, from a traffic engineering perspective it is considered that the proposal will have less than a minor impact on the surrounding road network.

Prepared by.

Peter Kelly
Director
Traffic Planning Consultants

Soil and Resource Report for 424 Sandhills Road, Awanui.

Prepared By: Ian Hanmore

Prepared For: Ngai Takoto

26th March 2025

Hanmore Land Management

TABLE OF CONTENTS

1.0 INTRODUCTION

This report has been prepared at the request of the client to assess the Land Use Capability (LUC) classifications of a proposed development site located at 424 Sandhills Road, Awanui. The New Zealand Land Resource Inventory (NZLRI) maps have classified the proposed site as LUC class 3. As such, it could potentially fall under the National Policy Statement for Highly Productive Land (NPS-HPL).

The purpose of the report is to map the site and identify any HPL as defined by the NPS-HPL. To achieve this a site visit was carried out to map the soils and land use capability units on this area and assess them in relation to the NPS-HPL.

This report presents the description of each of the soil types identified on the property as well as descriptions of each of the LUC units mapped. This information is then used to determine and quantify any highly productive land present. This information is accompanied by LUC, soil and soil classification maps along with the relevant LUC unit and soil profile descriptions.

2.0 MAPPING METHOD

A site visit was carried out on the 18th of March 2025 to evaluate and describe the soil types and the LUC units present. The property was mapped at a scale of 1:5,000.

LUC mapping was carried out in accordance with the methods described in the 3rd Edition of the Land Use Capability Survey Handbook (Lynn et al 2009). This process involves making a land resource inventory (LRI) of the property in which soil types, soil parent materials, land slopes, erosion type and severity and land cover are recorded. Whenever any of these land features changes a new unit is made.

Specific field work activities include digging and describing soil profiles on each landform with supporting holes dug or profiles observed on bank/drain cuttings to establish soil boundaries, measuring slopes with a clinometer, and gathering any other data that may be of assistance in assessing the suitability of the land for primary production such as erosion, susceptibility of the land to flooding, winter wetness and/or cold, high temperatures, exposure to salt winds, aspect, and accessibility. This information is then used to determine the specific LUC units, as described in the LUC Classifications of the Northland Region (Harmsworth, 1996) for the area. At times when mapping at a scale finer than Harmsworth (1996) of 1:50,000, new LUC units are recorded and are noted with an * in the LUC description table.

3.0 SITE DESCRIPTION

This proposed site is located within Ngai Takoto's land holding at 424 Sandhills Road. It is flat with excessively drained Pinaki soil and raw sand and covers approximately 7ha. The Pinaki soil is only slightly more developed than raw dune sand with and increase in organic matter in the top approximately 150mm. Many areas across the proposed site have raw windblown sand.

3.1 Soil Profiles and Descriptions

The soils identified across the proposed area are presented and described in the table below with their distribution shown on the soil map in Section 6.0 of this report.

Soil Profile	Soil Profile Description
	**Soil Name:** Pinaki sand (PN) **Soil classification:** Weakly to moderately leached yellow-brown sands from the Pinaki suite. **Parent material:** Sand. **Soil description:** 0-160 Very friable, very weak to no development, single grain, non-sticky, non-plastic sand, 10yr 5/3 160-1m Very friable, no development, single grain, non-sticky, non-plastic, sand, 10yr 6/6 to 10yr 5/6 - bit firm but breaks easily **Overall drainage:** Excessively drained.
	**Soil Name:** Raw aeolian sand **Soil classification:** Undeveloped. **Parent material:** Sand. **Soil description:** Single grain sand **Overall drainage:** Excessively drained.

3.2 Land Use Capability Descriptions

LUC classifications categorize land into eight classes according to its long-term capability to sustain one or more productive uses.

- Classes 1-4 have arable potential with limitations to this land use moving from class one being the most versatile, multi-use land with minimal physical limitations for arable use and increasing to severe limitations under class four land. These classes are also suitable to viticulture, berry production, pastoralism, tree crops and production forestry.
- Classes 5-7 are suitable for pastoral farming and production forestry.
- Class 8 land has no productive use and is rather managed for catchment protection and conservation purposes.

The LUC units mapped on the site are presented in the table below with copies of the full unit descriptions taken from Harmsworth (1996) contained in Appendix 1. An LUC map showing the distribution of the mapped units the land resource inventory (LRI) data acquisition points made during the survey for this report is contained in Section 6.

Resource information	Luc unit	Total area (ha)	Parent material	Dominant soil type	Slope (degree)	Land Cover	Erosion degree & severity		Landuse suitability	Stock carrying capacity (su/ha) Forestry site index (FSI)
							Actual	Potential		
6e15 Sand dunes and sand plains on recent relatively unstable windblown sands		7.8	Windblown sand	Weakly weathered yellow-brown sands on aeolian sand	4-25^0	Patchy pasture	Nil	Moderate to severe wind, sheet, and gully. Moderate soil slip	Limited grazing Forestry	Average: 7 Top: 8 Potential: 9 FSI: 27-30
7e10 Sand dunes and sand plains immediately inland (generally >400m from the mean high tide mark) from 8e 1, where the dunes and slightly more stable.			Windblown sands	Little or no soil development on aeolian sands	0-25^0	Patchy pasture Bare sand	Nil	Very severe to extreme wind. Very severe sheet and gully	Very limited grazing Erosion control forestry	Average: 2 Top farmer: 3 Potential: 5 FSI:21-26m **Revised** Average: 7 Top: 8 Potential:9

Land use capability unit descriptions are taken from the author's field work, and the Land Use Capability Classification of the Northland Region (Harmsworth, 1996).

Revised stock carry capacities are taken from a review of Harmsworth (1996) stock carry capacities by Bob Cathcart in 2017.

4.0 SOIL CLASSIFICATIONS

4.1 Highly Productive Land

The NPS-HPL came into effect on 17th October 2022 and was updated in August 2024 with the amendments taking effect from 14th September 2024. This policy seeks to protect highly productive land for use in land-based primary production, both now and for future generations. The policy statement defines highly productive land as land that has been mapped in accordance with clause 3.4 of the NPS-HPL and is included in an operative regional policy statement as required by clause 3.5. There is an interim regime for identifying highly productive land prior to a regional policy statement containing maps of highly productive land in the region is operative. Under clause 3.5(7) of the NPS-HPL, highly productive land in the interim period includes land that is: (i) zoned general rural or rural production; and (ii) LUC 1, 2, or 3 land; but is not: (i) identified for future urban development; or (ii) subject to a Council initiated, or an adopted, notified plan change to rezone it from general rural or rural production to urban or rural lifestyle.

The following definition of LUC 1, 2, or 3 land is taken from section 1.3, page 4 of the NPS-HPL:

> *LUC 1, 2, or 3 land means land identified as Land Use Capability Class 1, 2, or 3, as mapped by the New Zealand Land Resource Inventory or by any more detailed mapping that uses the Land Use Capability classification.*

A recent Environment Court ruling (Blue Glass Limited v Dunedin City Council) concluded that during the interim period the mapping by the NZLRI is the means by which LUC classes 1-3 are defined and more detailed mapping carried out since the NPS-HPL came into effect cannot be used to redefine those classifications.

4.2 Site Classifications

The table below shows the LUC area breakdown for the proposed site as well as the percentage of highly productive land.

Mapped LUC Units	Area (ha)	HPL Classification	% of total Area
6e15+7e10	7.8	Not HPL	100.0
Total area	**7.8**		
Area HPL	**0.0**	**Total % HPL**	**0.0**
Total area non-HPL	**7.8**	**Total % non-HPL**	**100**

4.3 NZLRI Mapping

The NZLRI is based on an LUC assessment of the whole of New Zealand and has been carried out at a scale of 1:50,000. It is intended for regional use and planning and is not meant to be used at a farm scale. The 3rd Edition of The Land Use Capability Survey Handbook (Lynn et al

2009) cautions against enlarging LUC data beyond the scale at which it was gathered as it can produce unreliable and misleading results and at time results that are nonsense.

At a scale of 1:50,000, on average one mapping observation is made every 25ha but could be a little as one every 100ha (Hewitt and Lilburne 2003, Grealish 2019). As such, it is likely that no information has been gathered from the proposed site. For the purpose of this report, with a site covering 7.8ha the appropriate scale of mapping is 1:5,000 or one to four observations per hectare (Lynn et al 2009).

Using the NZLRI for site specific information is outside of its intended purpose and outside of its parameters of reliability. At best it can only provide an indication of the possible LUC units present. The correct process for mapping soil types and LUC at a site of this size is to carry out a site survey at the correct scale by a suitably qualified person as has been done for this report.

4.4 Reclassified LUC Units

The proposed site has been mapped by the NZLRI as LUC unit 3w 4. Based on the farm scale survey carried out for this report, this classification was found to be incorrect. The 3w 4 unit includes peat soils and has a moderate wetness limitation. The site has no peat soil or wetness limitation. The soil at the site is Pinaki sand or raw sand. The one exception was one isolated location where Te Kopuru sand was identified. As such the site has no wetness limitation but is highly vulnerable to erosion due to the lack of soil development.

5.0 OVERALL SITE ASSESSMENT

An assessment of the site has been made based on the definition of HPL under the NPS-HPL. It is acknowledged that for technical purposes based on the Blue Grass ruling referred to in Section 4.1 of this report that all of the proposed site is classified as HPL. However, for the reasons outlined in Section 4.3 of this report the findings of this report are relevant to the productive use of the site and its potential use in a highly productive capacity.

As stated above the NZLRI has incorrectly mapped the proposed site as 3w 4 and recorded it as having Houhora sand and Ruakaka peaty sandy loam soils. If these soil types were present the LUC class 3 classification would be correct (though the actual units would be 3s 4 and likely 3w 4). However as can be seen from the soil profile pictures and the picture below the site is actual either raw sand or weakly developed Pinaki sand.

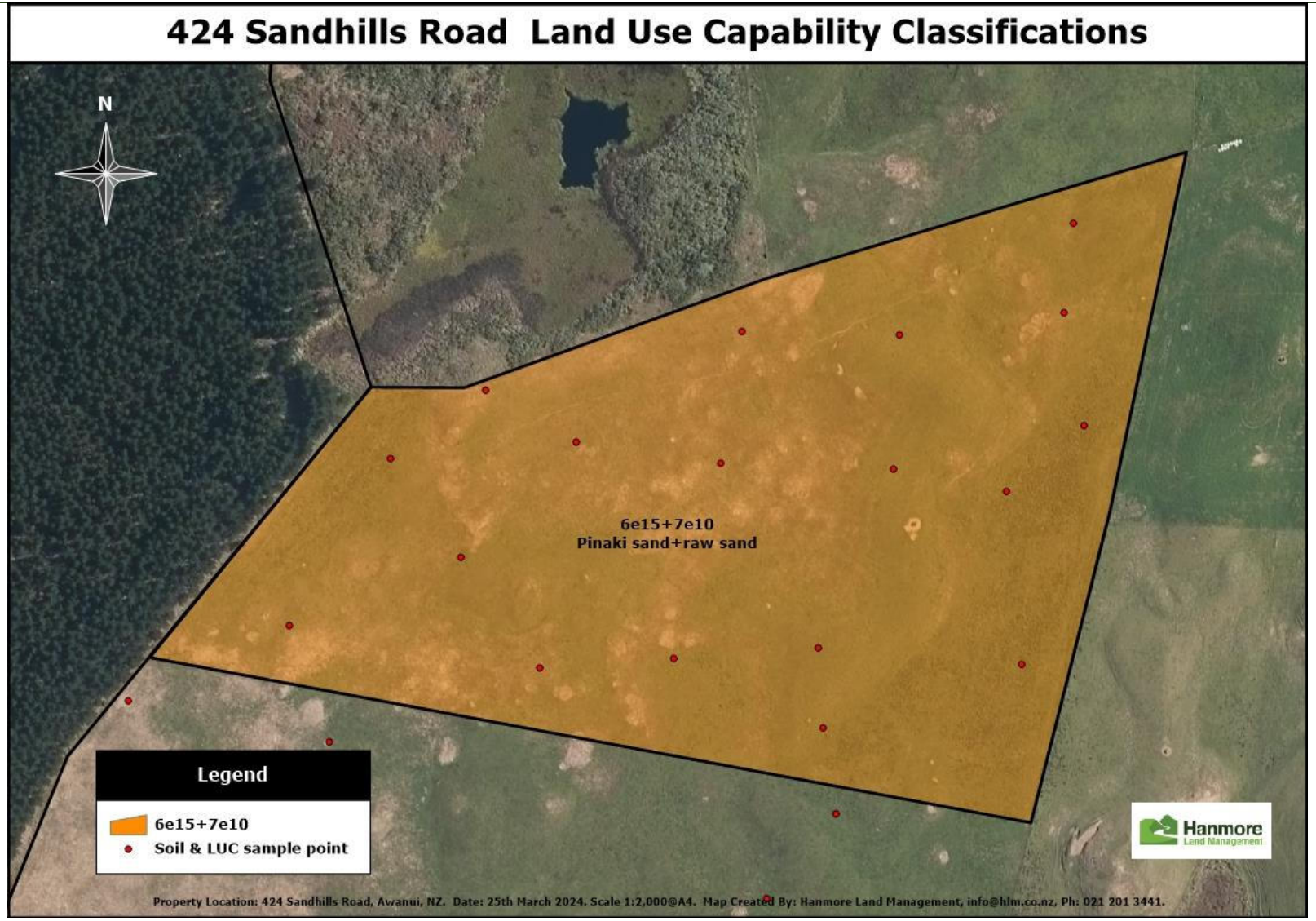
As such the site has LUC class 6 and 7 classifications. These classifications are made due to the extreme vulnerability of the sand soils and sand to wind and sheet erosion (gully erosion is not included at this site as it only has flat to undulating slopes). The lack of soil development and coarse texture adds further to the limitations of the site as they are drought prone, excessively drained and easily leach nutrients.

Figure1. An example of the raw sand at the potential site.

5.1 Conclusions

- Under the interim NPS-HPL all LUC units in LUC classes 1, 2 and 3 as mapped by the NZLRI are classified as HPL. As such, the whole 7.8ha proposed site is classified as HPL under the interim definition.
- The NZLRI classification of the site is incorrect both in its LUC classification and the soil types mapped at the site.
- The sand soil at the site is extremely vulnerable to wind erosion and cannot support arable use. Combined with its lack of development it is only suited to very limited grazing and forestry.
- The limited physical potential is a permanent constraint to the sites potential productive use.

6.0 MAPS


424 Sandhills Road Land Use Capability Classifications
N
6e15+7e10
Pinaki sand+raw sand
Legend
6e15+7e10
Soil & LUC sample point
Hanmore
Land Management
Property Location: 424 Sandhills Road, Awanui, NZ. Date: 25th March 2024. Scale 1:2,000@A4. Map Created By: Hanmore Land Management, info@hlm.co.nz, Ph: 021 201 3441.

7.0 APPENDICES

7.1 Appendix 1 – LUC units used in this report.

LUC unit:		**VIe15** (15 716 ha)
LUC suite:		1. Coastal sand country
LUC subsuite:		1a. Young unstable sand dune complex: (LUC units VIe15, VIIe10, VIIIe1)
Description:		Sand dunes and sand plains on recent relatively unstable windblown (aeolian) sands usually further inland from VIIe10 in more sheltered environments, where younger sands are recorded adjacent to old dune sands. Soils weakly developed and mainly weakly weathered, weakly to moderately leached yellow-brown sands. Potential for moderate to severe wind and sheet erosion. Vegetation comprises kikuyu grass and lupins, exotic forest, and lesser sand dune vegetation. Pasture is usually low producing and grazing extensive.
Type location:		Q10/256108 Wilson Road. Near Lake Kareta
Altitudinal range:		0–100 m
Slope:		Undulating to moderately steep (B-E), 4–25°
Landform:		Sand plains and sand dune hills with typically hummocky surface form. Landform generally undulating to strongly rolling; slopes can range from flat to moderately steep generally below 15°.
Rock type:		Windblown sand (Wb).
Soils:		Weakly weathered yellow-brown sands on aeolian sand. Weakly weathered, weakly to moderately leached yellow-brown sands of Pinaki suite (PNH, PN, MDH, MD, WD) and weakly weathered, strongly leached to podzolised yellow-brown sands of Pinaki suite (OE, OEy).
Erosion:	*Present:*	Slight (1) to moderate (2) wind (W) and sheet (Sh). Negligible (0) to slight (1) gully (G) and soil slip (Ss)
	Potential:	Moderate (2) to severe (3) wind (W) and sheet (Sh) and gully (G). Moderate (2) soil slip (Ss)
Vegetation:		Exotic conifer forest (fF), semi-improved pasture (gS), improved pasture (gI), sand dune vegetation (gD), manuka (SM), coastal scrub (SO), lupins (sL).
Annual rainfall range:		1000–1200 mm
Land use:	*Present:*	Forestry – Production – exotic spp. Undeveloped Grazing – Limited – Present average carrying capacity (s.u./ha) = 7 – Top farmer carrying capacity (s.u./ha) = 8
	Potential:	Grazing – Attainable physical potential carrying capacity (s.u./ha) = 9 Cropping – Unsuitable Forestry – Production – site index for *Pinus radiata* = 27–30
Soil conservation management:		Prevent surface disturbance. Capable of productive use if conservation measures applied. Permanent vegetative cover is advised. Reduce the risk of wind erosion; wind breaks recommended. Erosion control forestry on VIIe10 on the seaward side of unit provides shelter and improves the soil moisture regime of adjacent inland sites. – Grazing should be monitored and controlled. Avoid overstocking and concentrated stock movement, and take care in siting tracks, fencelines, troughs, etc.
Comments:		Pasture growth and quality limited by long periods of soil moisture deficit. Summer droughts common.

LUC unit: VIIe10 (52 547 ha)

LUC suite: 1. Coastal sand country

LUC subsuite: 1a. Young unstable sand dune complex:
(LUC units VIe15, VIIe10, VIIIe1)

Description: Sand dunes and sand plains immediately inland (generally more than 400 m from the mean high-water mark) from VIIIe1, where the dunes are slightly more stable. Land formed on recent unconsolidated windblown (aeolian) sands and includes 'active' sand dunes. A very conspicuous unit on the western side of Northland, exposed to strong salt-laden winds. Has potential for very severe to extreme wind and sheet erosion. Soils if present are weakly developed and excessively drained. Since 1920s extensive plantings of sand dune vegetation and exotic forest have greatly minimised erosion on unstable sands and protected inland areas. Much exotic forest cover but large areas of bare ground recorded with sparse scattered vegetation. Smaller areas covered in sand-dune vegetation, lupins, coastal scrub and kanuka. Limited grazing basically restricted to further inland sites. Erosion mostly negligible under extensive exotic forest cover but potential for very severe to extreme wind erosion; careful management required.

Type location: Q10/340960 Inland Road, Woodhill State Forest

Altitudinal range: 0–100 m

Slope: Flat or undulating to moderately steep (A-E), 0–25°

Landform: Old foredunes, coastal deflation zones, sand plains, old truncated dune fields. Younger transverse dunes, parabolic dunes. Slopes commonly under 15° but may steepen away from coast with increasing compaction and aging of sands and increasing soil development. Level of dissection of dunes generally increases with age.

Rock type: Windblown sands (Wb).

Soils: Little or no soil development on aeolian sands. Developed soil is weakly to moderately leached and weakly weathered. Yellow-brown sands of Pinaki suite (PNH, MDH, PN, MD, WD) are occasionally recorded.

Erosion: *Present:* Negligible (0) to severe (3) wind (W), sheet (Sh), and gully (G)
Potential: Very severe (4) to exteme (5) wind (W). Very severe (4) sheet (Sh) and gully (G)

Vegetation: Sand dune vegetation (gD), exotic conifer forest (fF), lupin (sL), coastal scrub (sO), Exotic broadleaved forest (fR).

Annual rainfall range: 1000–1200 mm

Land use:
Present:
Forestry – Production and erosion control – exotic spp.
Undeveloped
Grazing – Present average carrying capacity (s.u./ha) = 2
– Top farmer carrying capacity (s.u./ha) = 3
Potential:
Forestry – Erosion control and production
– site index for *Pinus radiata* = 21–26
Grazing – Attainable physical potential carrying capacity (s.u./ha) = 5
Cropping – Unsuitable
Ideally suited to erosion-control forestry.

Soil conservation management:

Prevent surface disturbance. Unit capable of productive use if conservation measures applied.

- Permanent vegetative cover advised. Measures should be taken to stabilise dunes in 'active' areas (migrating sands) with sand-binding species. Stabilisation of these areas best achieved by planting in erosion control forestry which serves both a production and protection function. Planting programmes usually carried out in the following sequence:
  1. planting of sand-binding species such as marram, spinifex, pingao;
  2. planting of lupins for nitrogen enrichment;
  3. Exotic forest species such as *Pinus radiata* planted when conditions are suitable.
- Grazing should be controlled and fencing is important.

8.0 REFERENCES

[2024] NZEnvC 083 Blue Glass Limited v Dunedin City Council

Grealish G. 2019. New Zealand soil mapping protocols and guidelines. Manaaki Whenua – Landcare Research.

Harmsworth, G.R. 1996. Land Use Capability classification of the Northland region. A report to accompany the second edition (1:50,000) NZLRI worksheets. Landcare Research Science Series 9. Lincoln, Manaaki Whenua Press.

Hewitt A, Lilburne L 2003. Effects of scale on the information content of soil maps. NZ Soil News 51: 78-81

Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF 2009. NZ Land Use Capability Survey Handbook – a New Zealand handbook for the classification of land 3rd Edition. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science.

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Proposal: Free range chicken farm, laying sheds, packhouse, stormwater and drainage, on-site domestic wastewater and treatment system, access and parking, and bulk earthworks

Address: 284, 424 and 485 Sandhills Road, Ahipara

District Plan: Operative Far North District Plan (ODP) and Proposed Far North District Plan (PDP)

Operative Far North District Plan

Site Zoning	
Zone	Rural Production
Overlays/Controls	Nil
Designations	Nil

Rule	Compliance	Non-Compliance
Chapter 8 - Rural Environment - Section 6 – Rural Production Zone		
8.6.5.1 Permitted Activities		
8.6.5.1.1 Residential Intensity	The subject site is 737.3562 ha which would enable 61 residential units as a permitted activity. The proposal will establish a single residential unit to provide for an onsite farm manager to reside onsite. **Permitted activity.**	
8.6.5.1.2 Sunlight	All proposed buildings comply with sunlight standard. **Permitted activity**	
8.6.5.1.3 Stormwater Management	Proposed building coverage will be 32,261.40m² (0.004%). **Permitted activity**	
8.6.5.1.4 Setback from Boundaries	All proposed buildings comply with 10m setback from boundary. **Permitted activity**	
8.6.5.1.5 Transportation	See assessment below.	
8.6.5.1.6 Keeping of Animals	The proposed egg farm (factory farm) will be further than 50m from the site boundary. **Permitted activity.**	
8.6.5.1.7 Noise	The proposed activity will comply with noise standards. **Permitted activity**	

Rule	Compliance	Non-Compliance
8.6.5.1.8 Building Height	The proposed buildings will comply with 12m in height: • Egg sheds 1 - 4 7.557m in height (with roof vents which are 2.443m in height) • Packhouse 6.480m^2 in height at the highest point • Manure bunker – no higher than 10m • Residential unit – no higher than 8m • Ancillary shed – no higher than 8m **Permitted activity**	
8.6.5.1.9 Helicopter Landing Area	N/A	
8.6.5.1.10 Building Coverage	Proposed building coverage will be 15,321.56m² (0.002%). **Permitted activity**	
8.6.5.1.11 Scale of Activities	The proposal is factory farming, due to the size of the site 700 persons could engaged at any one period onsite. • The proposed Egg Farm will support 20 – 25 FTE. • Orchard = 13 – 14 full time workers • Dairy Farm = 6-7 full time workers (within subject site) Equating to 45-50 workers onsite. **Permitted activity**	
8.6.5.1.12 Temporary Events	N/A	
8.6.5.2 Controlled Activities		
8.6.5.2.1 Stormwater Management	Permitted see above.	
8.6.5.2.2 Papakainga Housing	N/A	
8.6.5.2.3 Minor Residential Unit	N/A	
8.6.5.2.4 Noise Limits for Temporary Military Training	N/A	

Rule	Compliance	Non-Compliance
8.6.5.2.5 Building Coverage	Permitted see above.	
8.6.5.3 Restricted Discretionary Activities		
8.6.5.3.1 Transportation	See assessment below.	
8.6.5.3.2 Building Height	Permitted see above.	
8.6.5.3.3 Sunlight	Permitted see above.	
8.6.5.3.4 Setback from Boundaries	Permitted see above.	
8.6.5.3.5 Noise	Permitted see above.	
8.6.5.3.6 Residential Intensity	Permitted see above.	
8.6.5.3.7 Scale of Activities	Permitted see above.	
8.6.5.4 Discretionary Activities		
8.6.5.4.1 Residential Intensity	Permitted see above.	
8.6.5.4.2 Integrated Development	N/A	
8.6.5.4.3 Helicopter Landing Area	N/A	
8.6.5.4.4 Scale of Activities	Permitted see above.	
Chapter 12 - Natural and Physical Resources		
Section 1 – Landscape and Natural Features	N/A the subject site is not identified as Outstanding Natural Landscape or Outstanding Natural Feature.	
Section 2 - Indigenous Flora and Fauna		
Permitted Activities		
12.2.6.1.4 Indigenous Vegetation Clearance in other zones	No indigenous vegetation clearance is proposed. **Permitted activity.**	
Discretionary Activities		
12.2.6.3.1 Indigenous Vegetation Clearance in the Rural Production and Minerals Zones	Permitted see above.	
Section 3 – Soils and Minerals		
Permitted Activities		
12.3.6.1.1 Excavation and/or Filling, Excluding Mining and Quarrying, in the Rural Production Zone or Kauri Cliffs Zone		Bulk enabling earthworks of approximately 3,6875m^3 cut, 28,170m^3 (-8705m^3 net) over approximately 102,730m^2.

Rule	Compliance	Non-Compliance
		Discretionary activity pursuant to rule 12.3.6.3(c).
Restricted Discretionary Activities		
12.3.6.2.3 Excavation and Filling, Excluding Mining and Quarrying, in the Rural Production Zone or Kauri Cliffs Zone.		Bulk enabling earthworks of approximately 3,6875m^3 cut, 28,170m^3 (-8705m^3 net) over approximately 102,730m^2. **Discretionary activity pursuant to rule 12.3.6.3(c).**
Section 4 – Natural Hazards		
Permitted Activities		
12.4.6.1.2 Fire Risk to Residential Units	The proposed residential unit will be located further than 20m from the woodlot onsite. **Permitted activity**	
Section 5 – Heritage	N/A	
Section 6 – Air	N/A	
Section 7 – Lakes, Rivers, Wetlands and the Coastline		
Permitted Activities		
12.7.6.1.1 Setback from Lakes, Rivers and the Coastal Marine Area		Proposed Hen Laying Shed 2 and internal access (impervious area) will be located within 30m of wetlands. Refer to architecture plans for details (**Appendix 2**). **Discretionary activity in accordance with rule 12.7.6.3(b).**
12.7.6.1.3 Preservation of Indigenous Wetlands		The proposal will result in the change to the natural range of water levels to wetlands as a result in realignment of stormwater catchments. **Discretionary activity in accordance with rule 12.7.6.3(b).**
Non-complying Activities		
12.7.6.4	N/A	
Section 8 – Hazardous Substances		
Permitted Activities		

Rule	Compliance	Non-Compliance
12.8.6.1.1 Consent status indices for permitted activities	Any hazardous substances will comply with permitted standards. **Permitted Activity**	
Discretionary Activities		
12.8.6.3.1 Consent Status Indices for Discretionary Activities	Permitted activity – see above	
Section 9 – Renewable Energy and Energy Efficiency - N/A		
Chapter 13 – Subdivision – N/A		
Chapter 15 - Transportation		
15.1.6A Traffic		
15.1.6A.2-6 Traffic Intensity		The proposed activity falls within the definition of factory farming, applying the industrial TIF of Appendix 3 the activity will result in 1,254 movements associated with industrial activities. The proposal includes a residential unit which is not the first onsite, plus 10 movements. Total TIF 1,264. **Discretionary activity in accordance with rule 15.1.6A.5.1.**
15.1.6B Parking		
15.1.6B.1.1 On-Site Car Parking Spaces		The proposed activity falls within the definition of factory farming, applying the industrial parking factor of Appendix 3 being 1 per 100m^2 GBA, the activity will result in the requirement to provide 125 onsite car parks associated with industrial activities. The proposal will allow space for at least 15 parking spaces within the site.

Rule	Compliance	Non-Compliance
		Discretionary activity in accordance with rule 15.1.6B.3.
15.1.6B.1.2 Williams Road On-Site Car Parking Spaces	N/A	
15.1.6B.1.3 Kerikeri Road On-Site Car Parking Spaces	N/A	
15.1.6B.1.4 Accessible Car Parking Spaces		The proposal includes 15 formal parking spaces with no dedicated accessible parking space. **Discretionary activity in accordance with rule 15.1.6B.3.**
15.1.6B.1.5 Car Parking Space Standards		• All spaces will be set out as 90-degree spaces. They will be 2.4 metres wide and 5.4 metres deep with a manoeuvring depth of more than 8 metres. • All parking, loading and access areas will be formed and drained. • Parking and loading areas will not be marked **Discretionary activity in accordance with rule 15.1.6B.3.**
15.1.6B.1.6 Loading Spaces		• The proposal includes a pack house which is 900 m^2. One loading space will be provided. • The truck loading space has been designed to accommodate a design vehicle of 19-metre truck and trailer. • All loading areas will be formed and drained. **Discretionary activity in accordance with rule 15.1.6B.3.**
15.1.6B.2.1 Cycling Facilities	N/A	
15.1.6B.2.2 Green Space	N/A	
15.1.6B.3.1 Any Activity on Williams Road Car Park, Paihia	N/A	
15.1.6C Access		

Rule	Compliance	Non-Compliance
15.1.6C.1.1 Private Accessway in All Zones	• The access will be predominantly 6 meters wide and widens for manoeuvring within the site. • The access will be formed with stormwater drainage. • The access will have a maximum gradient less than 1 in 5 (20%). • The access will be located onto a rural road and will be more than 100 metres from any intersection **Permitted activity**	
15.1.6C.1.2 Private Accessways in Urban Zones	N/A	
15.1.6C.1.3 Passing Bays on Private Accessways in All Zones	The access will have a minimum formed width of 6 metres allowing for two-way vehicle movement. **Permitted activity**	
15.1.6C.1.4 Access Over Footpaths	N/A	
15.1.6C.1.5 Vehicle Crossing Standards in Rural and Coastal Zones		
15.1.6C.1.6 Vehicle Crossing Standards in Urban Zones	N/A	
15.1.6C.1.7 General Access Standards	Vehicle access has been configured so that all anticipated vehicles are able to enter and leave the site in a forward direction and heavy vehicles are able to travel through the access with adequate clearance to any obstructions. **Permitted activity**	
15.1.6C.1.8 Frontage to Existing Roads	N/A	
15.1.6C.1.9 New Roads	N/A	
15.1.6C.1.10 Service Lanes, Cycle and Pedestrian Accessways	N/A	

Rule	Compliance	Non-Compliance
15.1.6C.1.11 Road Designations	N/A	
Chapter 16 – Signs and Lighting – N/A		

Proposed Far North District Plan

Site Zoning	
Zone	Rural Production
Overlays/Controls	Treaty Settlement Land Overlay
Designations	Nil

Rule	Compliance	Non-Compliance
Rules and Standards That Have Immediate Legal Effect under the PDP		
Part 2 – District Wide Matters / Historical and Cultural Values		
Heritage Areas	N/A	
Historic Heritage	N/A	
Notable Trees	N/A.	
Sites and Areas of Significance to Māori	N/A	
Part 2 – District Wide Matters / National Environment Values		
Ecosystems and Indigenous Biodiversity IB-R1 Indigenous vegetation pruning, trimming and clearance and any associated land disturbance for specified activities. IB-R4 Indigenous vegetation clearance and any associated land disturbance outside of Significant Natural Area.	**Complies** No indigenous vegetation clearance proposed.	
Part 2 – District Wide Matters / General District Wide Matters		
Earthworks		
EW-R12 Earthworks and the Discovery of Suspected Sensitive Material	**Complies** - Accidental discovery protocols will be followed as necessary.	

Rule	Compliance	Non-Compliance
EW-R13 Earthworks and Erosion and Sediment Control	**Complies** - All necessary erosion and sediment control guidelines.	