KEY

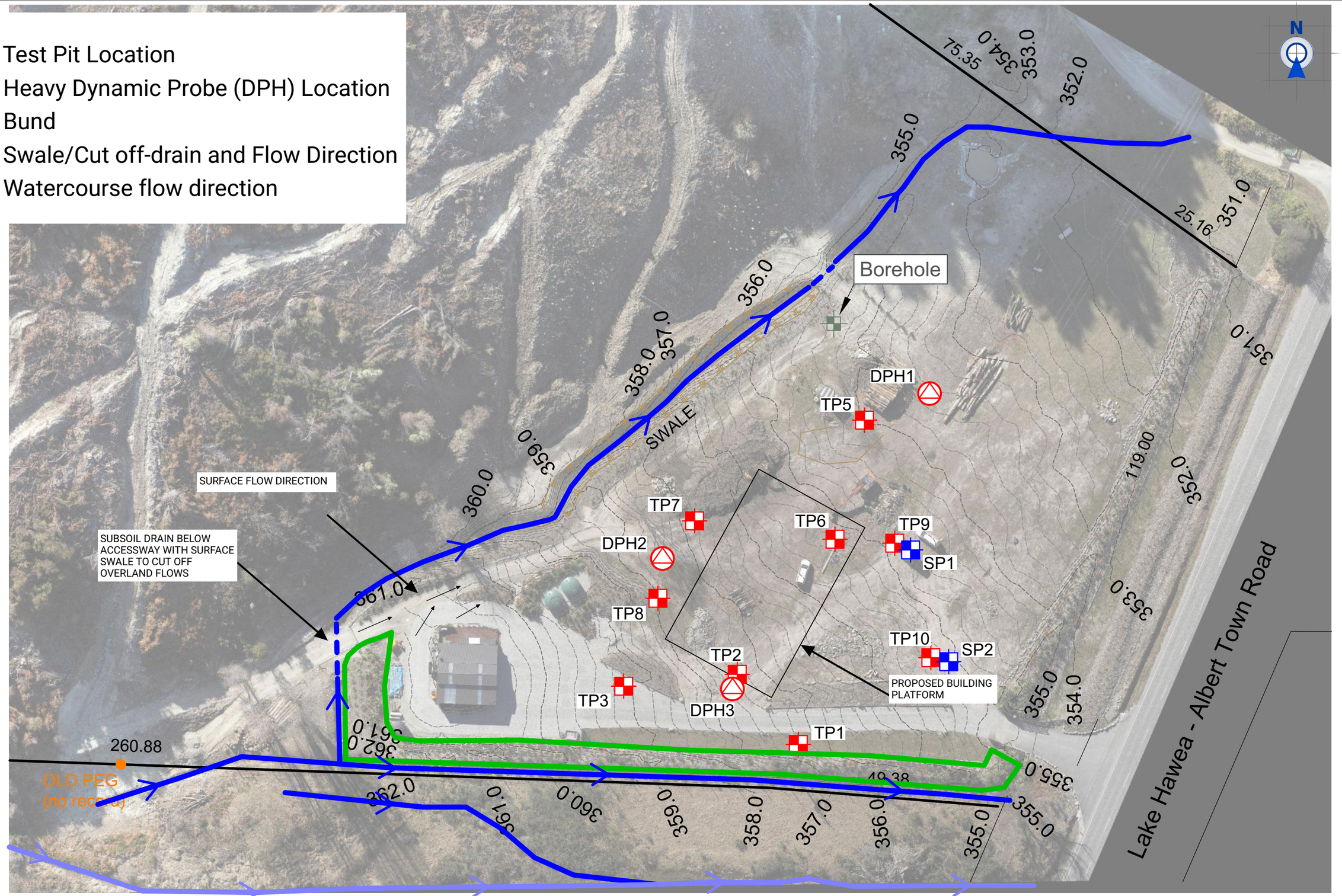
= Test Pit Location

= Heavy Dynamic Probe (DPH) Location

= Bund

= Swale/Cut off-drain and Flow Direction

= Watercourse flow direction




Notes:
1. These drawings have been prepared for the benefit of The D L Kenton Family Trust with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.
2. Base image for Plan provided by Paterson Pitts Group Wanaka - Drawing Reference W5982 - 105C, dated 8/2/24

SCALE 1:750

0 7.5 15 22.5 30 37.5 (m)


GEOSOLVE

Level 1, 70 MacAndrew Road, South Dunedin
www.geosolve.co.nz


| | | |
|---|---|---|
| DRAWN | MDP | Mar.24 |
| DRAFTING CHECKED | | |
| APPROVED | | |
| CADFILE: | | |
| SCALES (AT A3 SIZE): | 1:750 | |
| PROJECT No: | 190350 | |

The D L Kenton Family Trust

Geotechnical Assessment

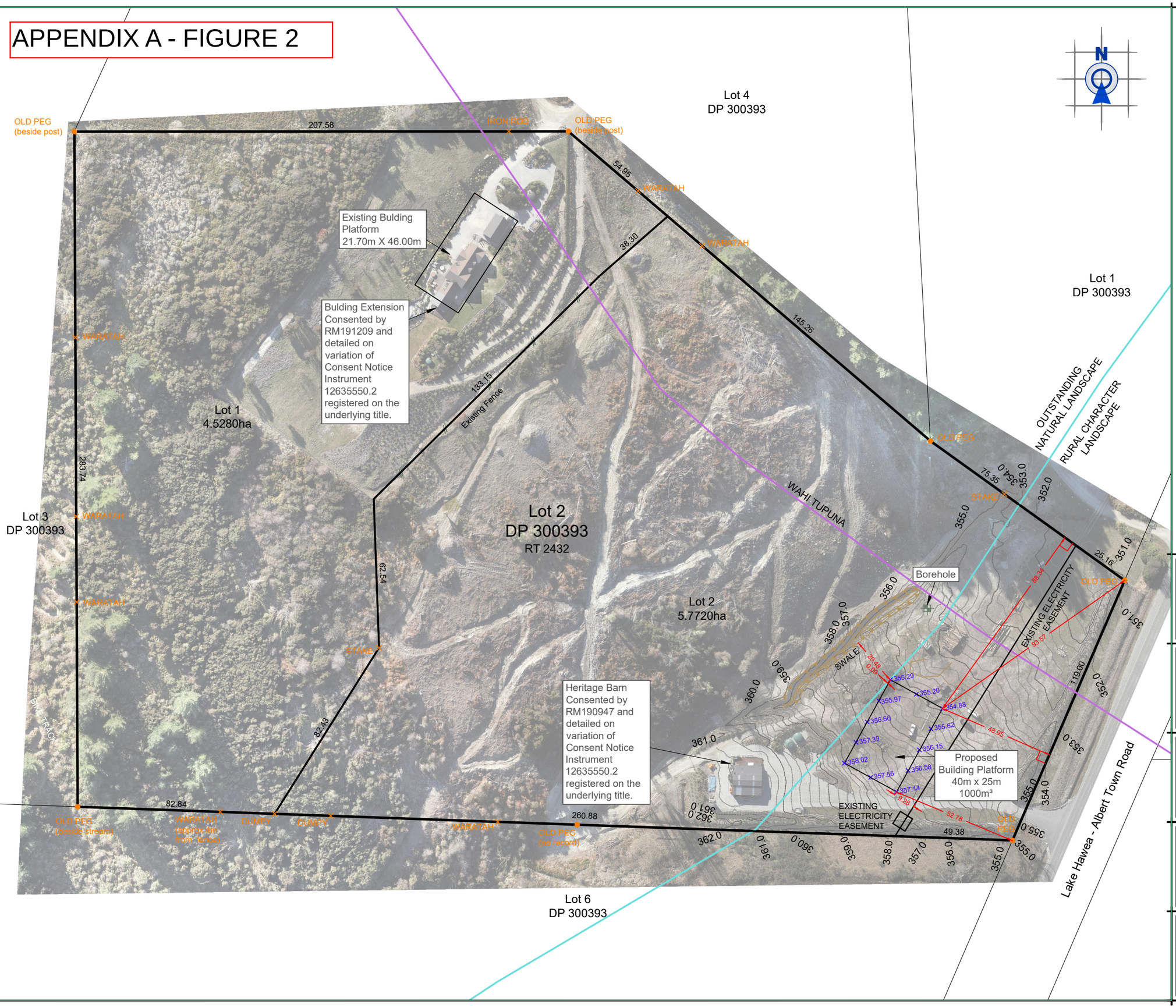
1147B Lake Hawea-Albert Town Road

Site Plan

FIG No: Figure 1

REV. 0

# APPENDIX A - FIGURE 2




NOTES:

Coordinates are in terms of Lindis Peak 2000
Origin of coordinates: D 216 (MOW) [BAUA]
810613.818mN
381238.26mE

Elevation in Terms of: Dundein Datum 1958
Origin of Levels: D 216 (MOW) [BAUA]
RL= 400.071

Areas and dimensions are subject to resource consent and legal survey.

Further easements may be required for services.

Lot 2 DP 300393 benefits from existing right of way easements over neighbouring parcels Lots 1 and 4 DP 300393 and Lot 2 DP 22638.

Lot 2 DP 300393 benefits from existing services easements over neighbouring parcels Lots 4 and 5 DP 300393.

The Record of Title 2432 for Lot 2 DP 300393 is subject to a number of consent notices, associated variations and land covenants that should be carefully checked prior to preparing and submitting a subdivision consent.


PATERSONPITTSGROUP
Your Land Professionals
www.ppgroup.co.nz
0800 PPGROUP

WANAKA
19 Reece Crescent
or P.O. Box 283
Wanaka 9343
T 03 443 0110
E wanaka@ppgroup.co.nz




Client & Location:

D. Kenton
1147B Lake Hawea-Albert Town Road

Purpose & Drawing Title:

Scheme Plan
Lot 2 DP 300393

| | | | |
|---|---|---|---|
| Surveyed by: | CB/ARB | Original Size: | Scale: |
| Designed by: | - | A3 | 1:1500 @ A3 |
| Drawn by: | CB/ARB | | |
| Checked by: | HBM | | DO NOT SCALE |
| Approved by: | HBM | | |
| Job No: W5982 | Drawing No: 001 | Sheet No: 105C | Revision No: 0 / Date Created: 08/02/24 |

# **Appendix B** – Investigation Data

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 1**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

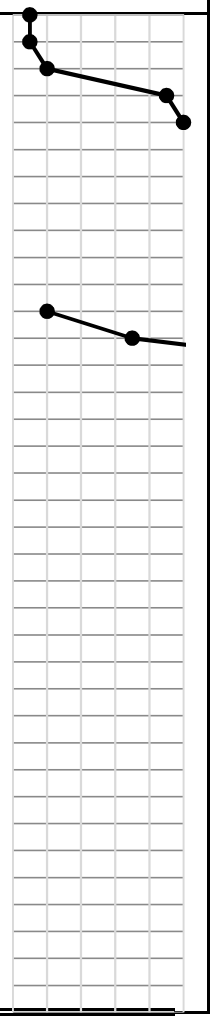
| | | | | | | |
|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.4 | TOPSOIL | | Dark brown/black, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 1.3 | FAN ALLUVIUM | | Light grey, silty SAND with some gravel, cobbles and boulders. Sand is fine to medium. Boulders up to 600 mm. Silt is non-plastic. Medium dense. Moist. | | |
| 1.7 | FAN ALLUVIUM | | Light grey, silty gravelly SAND with some cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular. Boulders up to 700 m. Silt is non-plastic. Medium dense. Moist. | | Minor seepage |
| 1.9 | BURIED TOPSOIL | | Greyish brown, organic SILT with minor sand and trace roots and rootlets. Silt is non-plastic. Moist. | | |
| 2.6 | FAN ALLUVIUM | | Grey/mottled orange, SILT with some gravel. Silt is non-plastic. Firm to stiff. Moist to wet. | | Moderate seepage |
| 2.8 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor silt. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. | | Moderate seepage |
| 3.3 | FAN ALLUVIUM | | Grey, silty gravelly SAND with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 500 mm. Silt is non-plastic. Medium dense. Bedded. Moist to wet. | | |
| 3.7 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor silt. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Medium dense. Bedded. Saturated. | | |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 3.7 m

COMMENT:

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 2**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

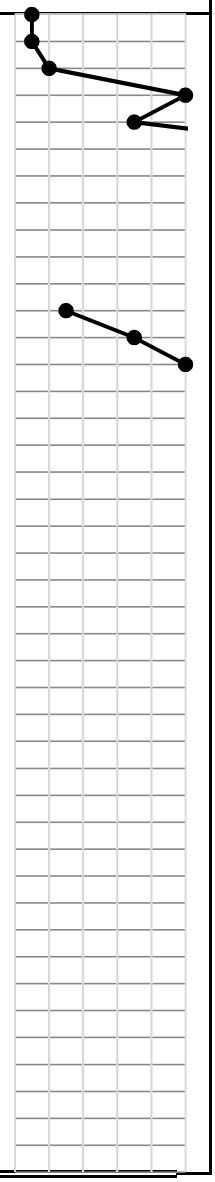
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.3 | TOPSOIL | | Dark brown/black, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 0.9 | FAN ALLUVIUM | | Dark grey, sandy GRAVEL with trace rootlets. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Loose. Loose bedding. Moist. | | |
| 1.6 | FAN ALLUVIUM | | Light grey, silty sandy GRAVEL with some cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 700 mm. Silt is non-plastic. Medium dense. Wet. | | |
| 2.4 | ORGANIC FAN ALLUVIUM | | Dark grey, SILT with minor sticks. Silt is non-plastic. Firm. Wet. | | Moderate to strong seepage |
| 2.8 | BURIED TOPSOIL | | Black, organic SILT with trace rootlets. Silt is non-plastic. Soft. Wet. | | |
| 3.7 | ORGANIC FAN ALLUVIUM | | Light grey/dark brown, organic silty SAND with minor gravel, cobbles, boulders and sticks. Sand is fine to medium. Boulders up to 600 mm. Loose. Wet. | | |
| 4.3 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 500 mm. Medium dense. Bedded. Saturated. | | |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.3 m

COMMENT: Hole collapsing below seepage

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 3**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

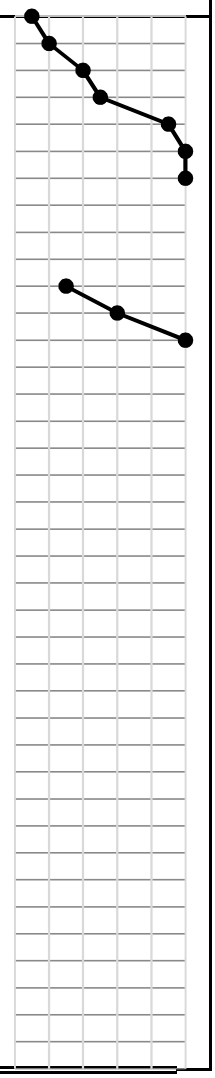
| | | | | | | |
|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.2 | TOPSOIL | | Dark brown/black, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 1.9 | FAN ALLUVIUM | | Grey, silty sandy GRAVEL with some cobbles and minor boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 700 mm. Silt is non-plastic. Loose. Moist to wet. | | |
| 3.4 | ORGANIC FAN ALLUVIUM | | Grey/dark brown, silty sandy GRAVEL with some organics, cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 600 mm. Loose. Moist. | | Strong seepage |
| 3.6 | FAN ALLUVIUM | | Grey, SAND with minor gravel. Sand is fine to medium. Loose to medium dense. Bedded. Moist to wet. | | |
| 3.9 | FAN ALLUVIUM | | Grey, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 300 mm. Medium dense. Bedded. Saturated. | | |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 3.9 m

| | |
|---|---|
| COMMENT: Surface cleared of slash/trees prior to investigations which removed some of the surface topsoil | Logged By: MDP |
| | Checked Date: |
| | Sheet: 1 of 1 |

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 4**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

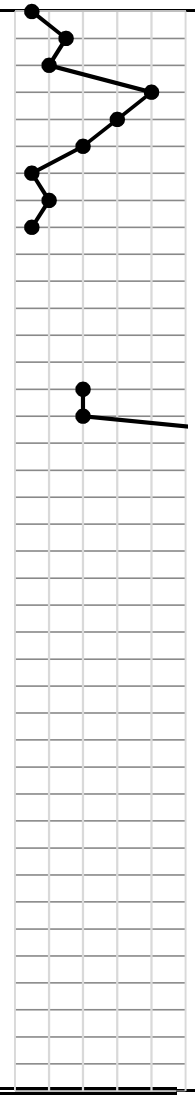
| | | | | | | |
|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.25 | TOPSOIL | | Dark brown/black, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 0.65 | FAN ALLUVIUM | | Light grey mottled orange, silty SAND with some gravel. Sand is fine to medium. Silt is non-plastic. Loose. Dry to moist. | | |
| 1.2 | FAN ALLUVIUM | | Grey, SILT with minor sand. Silt is non-plastic. Firm. Dry to moist. | | |
| 1.7 | FAN ALLUVIUM | | Light grey mottled light brown, sandy GRAVEL with some silt. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Medium dense. Bedded. Dry to moist. | | |
| 4.0 | FAN ALLUVIUM | | Light grey, sandy SILT. Silt is non-plastic. Stiff. Thinly laminated. Dry. | | NO SEEPAGE |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4 m

COMMENT: No seepage observed. Hole stood well during excavation

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 5a**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

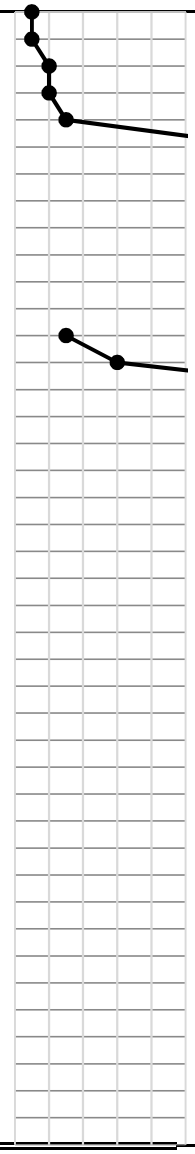
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.3 | TOPSOIL | | Dark brown, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 0.8 | FAN ALLUVIUM | | Grey, gravelly SAND with trace cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 300 mm. Loose. Moist. | | |
| 1.0 | BURIED TOPSOIL | | Brown, organic SILT with trace rootlets. Silt is non-plastic. Moist. | | |
| 1.7 | FAN ALLUVIUM | | Grey, gravelly SILT with some sand and minor cobbles and boulders. Gravel is fine to coarse and sub-rounded to sub-angular. Boulders up to 300 mm. Silt is non-plastic. Stiff. Moist. | | |
| 4.2 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor cobbles and trace boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 500 mm. Medium dense. Bedded. Moist. | | NO SEEPAGE |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.2 m

COMMENT: Northeast end of TP

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 5b**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE | SCALA PENETROMETER |
|---|---|---|---|---|---|---|
| 0.3 | TOPSOIL | | Dark brown, organic SILT with rootlets. Silt is non-plastic. Moist. | | | |
| 0.8 | FAN ALLUVIUM | | Grey, gravelly SAND with trace cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 300 mm. Loose. Moist. | | | |
| 1.7 | FAN ALLUVIUM | | Grey, gravelly SILT with some sand and minor cobbles and boulders. Gravel is fine to coarse and sub-rounded to sub-angular. Boulders up to 300 mm. Silt is non-plastic. Stiff. Moist. | | | |
| 4.2 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor cobbles and trace boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 500 mm. Medium dense. Bedded. Moist. | | NO SEEPAGE | |

Total Depth = 4.2 m

| | |
|---|---|
| COMMENT: Southwest end of TP | Logged By: MDP |
| | Checked Date: |
| | Sheet: 1 of 1 |

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 6**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

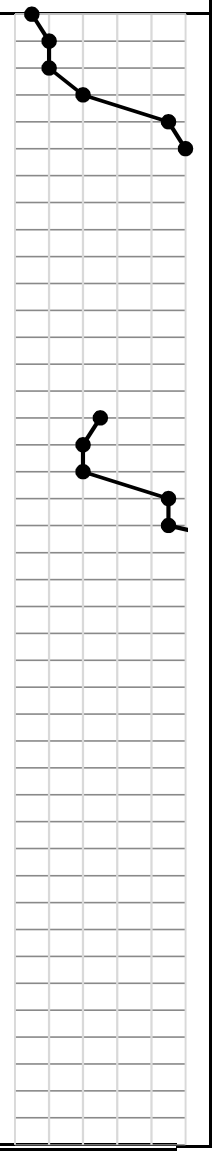
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.25 | TOPSOIL | | Dark brown, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 1.0 | FAN ALLUVIUM | | Light grey mottled orange, silty gravelly SAND with trace rootlets. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Silt is non-plastic. Loose to medium dense. Moist. | | |
| 1.3 | FAN ALLUVIUM | | Light grey mottled orange, gravelly SAND. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Medium dense. Moist. | | |
| 1.7 | BURIED TOPSOIL | | Purplish brown, sandy organic SILT with trace rootlets. Sand is fine to medium. Silt is non-plastic. Moist. | | |
| 2.0 | FAN ALLUVIUM | | Grey mottled orange, SILT. Silt is non-plastic. Stiff to very stiff. Moist. | | |
| 4.2 | FAN ALLUVIUM | | Light brown, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 600 mm. Medium dense. Bedded. Dry to moist. | | NO SEEPAGE |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.2 m

| COMMENT: | Logged By: MDP |
|---|---|
| | Checked Date: |
| | Sheet: 1 of 1 |

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 7**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

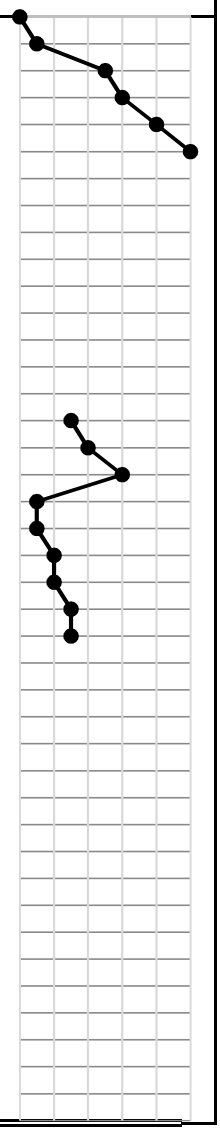
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.3 | TOPSOIL | | Dark brown, organic SILT with roots and rootlets. Silt is non-plastic. Moist. | | Minor seepage |
| 1.0 | FAN ALLUVIUM | | Light grey, silty gravelly SAND with some cobbles and minor boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 300 mm. Silt is non-plastic. Loose. Moist to wet. | | Moderate seepage |
| 1.8 | ORGANIC FAN ALLUVIUM | | Grey, silty SAND with some gravel and trace tree stumps. Sand is fine to coarse. Silt is non-plastic. Loose. Moist to wet. | | |
| 2.5 | ORGANIC FAN ALLUVIUM | | Grey/dark brown, organic silty SAND. Sand is fine to medium. Silt is non-plastic. Loose. Moist to wet. | | Moderate to strong seepage |
| 3.5 | FAN ALLUVIUM | | Grey, SILT. Silt is non-plastic. Firm. Laminated. Saturated. | | |
| 4.1 | FAN ALLUVIUM | | Light brown, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 300 mm. Medium dense. Bedded. Saturated. | | |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.1 m

| | |
|---|---|
| COMMENT: | Logged By: MDP |
| | Checked Date: |
| | Sheet: 1 of 1 |

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 8**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

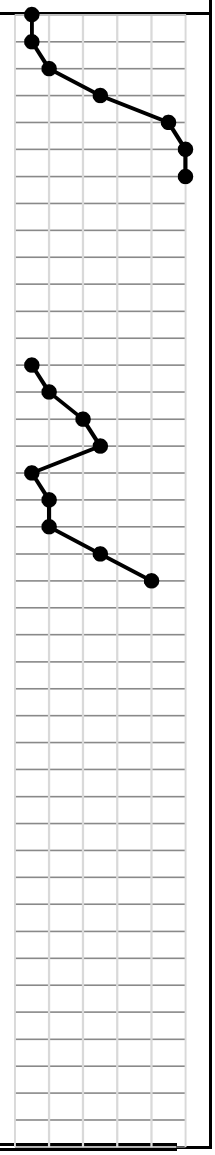
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.2 | TOPSOIL | | Dark brown, organic SILT with roots and rootlets. Silt is non-plastic. Moist. | | |
| 1.2 | FAN ALLUVIUM | | Grey, silty gravelly SAND with some cobbles and minor boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 600 mm. Silt is non-plastic. Loose to medium dense. Moist. | | Minor seepage |
| 1.7 | ORGANIC FAN ALLUVIUM | | Grey, silty SAND with some gravel and minor tree stumps. Sand is fine to coarse. Silt is non-plastic. Loose to medium dense. Moist. | | |
| 2.1 | BURIED TOPSOIL | | Dark brown, organic SILT. Silt is non-plastic. Moist. | | |
| 2.4 | FAN ALLUVIUM | | Grey, silty SAND to sandy SILT with lense of sandy GRAVEL. Sand is fine to medium. Silt is non-plastic. Firm. Moist. | | |
| 3.0 | FAN ALLUVIUM | | Light grey, SILT with minor sand. Silt is non-plastic. Stiff. Laminated. Moist to wet. | | Moderate seepage |
| 4.2 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 400 mm. Medium dense. Bedded. Saturated. | | |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.2 m

COMMENT:

Logged By: MDP

Checked Date:

Sheet: 1 of 1

# TEST PIT LOG

**HOLE NO.:** TP09

**CLIENT:** D L Kenton Family Trust

**PROJECT:** 1147BLakeHaweaAlbertTownRd

**JOB NO.:** 190350

**SITE LOCATION:** 1147B Lake Hawea-Albert Town Rd, Hawea
**CONTRACTOR:**
**START DATE:** 20/03/2024

**COORDINATES:** 1302111 mE, 5052932 mN (NZTM2000)
**EQUIPMENT:** 5.5T excavator
**END DATE:** 20/03/2024

**LOCATION METHOD:** Handheld GPS
**ACCURACY:** ± 3 m
**LOGGED BY:** JMJ

**ELEVATION:** Existing ground level
**OPERATOR:** Bruce
**CHECKED DATE:** 21/03/2024

| SOIL / ROCK TYPE | MATERIAL DESCRIPTION (See Classification & Symbology sheet for details) | SAMPLES | DEPTH / RL | LEGEND | SCALA PENETROMETER (Blows / 0 mm) | SHEAR STRENGTH (kPa) Vane: Values | WATER |
|---|---|---|---|---|---|---|---|
| TOPSOIL | Organic SILT with some sand and gravel, brown. Soft to firm, dry to moist, sand, fine to medium; gravel, fine to medium, subangular. Some rootlets. 0.20 m | | | TS | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 | 50 100 150 200 | Groundwater Not Encountered |
| FAN ALLUVIUM | Sandy silty fine to coarse GRAVEL, brownish grey. Medium dense, dry, sand, fine to coarse; gravel, subangular. 0.40 m | | 0.5 | | | | |
| | Sandy fine to coarse GRAVEL with minor cobbles and boulders and a trace to minor silt, grey. Medium dense, dry, sand, fine to coarse; gravel, subangular; boulders up to 500 mm diameter. 1.50 m | | 1.0 | | | | |
| | SILT with minor to a trace of sand, light greyish brown with orange mottle. Stiff, moist, low plasticity, sand, fine. 2.30 m | | 1.5 | | | | |
| | SILT with minor sand and a trace of gravel, light greyish brown. Stiff, moist, low plasticity, sand, fine; gravel, fine to coarse, subangular to subrounded. 3.00 m | | 2.0 | | | | |
| | End Of Hole: 3.00 m | | 2.5 | | | | |

## PHOTO(S)

## REMARKS

Target depth achieved. Pit walls remained vertical during excavation.

Soakage test (SP1) undertaken at 0.8 m bgl adjacent to test pit.

## WATER

- Standing Water Level
- Out flow
- In flow

Generated with CORE-GS by Geroc - Test Pit x Hand Auger - scala & vane bars - 21/03/2024 11:32:25 am

# TEST PIT LOG

**HOLE NO.:** TP10

**CLIENT:** D L Kenton Family Trust

**PROJECT:** 1147BLakeHaweaAlbertTownRd

**JOB NO.:** 190350

**SITE LOCATION:** 1147B Lake Hawea-Albert Town Rd, Hawea

**CONTRACTOR:**

**START DATE:** 20/03/2024

**COORDINATES:** 1302112 mE, 5052905 mN (NZTM2000)

**EQUIPMENT:** 5.5T excavator

**END DATE:** 20/03/2024

**LOCATION METHOD:** Handheld GPS

**ACCURACY:** ± 3 m

**LOGGED BY:** JMJ

**ELEVATION:** Existing ground level

**OPERATOR:** Bruce

**CHECKED DATE:** 21/03/2024

| SOIL / ROCK TYPE | MATERIAL DESCRIPTION (See Classification & Symbology sheet for details) | SAMPLES | DEPTH / RL | LEGEND | SCALA PENETROMETER (Blows / 0 mm) | SHEAR STRENGTH (kPa) Vane: Values | WATER |
|---|---|---|---|---|---|---|---|
| TOPSOIL | Organic SILT with some sand and gravel, brown. Soft to firm, dry to moist, sand, fine to medium; gravel, fine to medium, subangular. Some rootlets. 0.20 m | | | TS | | | |
| FAN ALLUVIUM | Sandy silty fine to coarse GRAVEL, brownish grey. Medium dense, dry, sand, fine to coarse; gravel, subangular. Minor rootlets. 0.40 m | | | | | | Groundwater Not Encountered |
| | Sandy fine to coarse GRAVEL with some silt and minor cobbles and boulders, light grey. Medium dense, dry, silt is in discontinuous layers, sand, fine to coarse; gravel, subangular; boulders up to 1200 mm diameter. 1.50 m | | 0.5, 1.0 | | | | |
| | SILT with minor sand and a trace of gravel, brownish grey orange mottled. Stiff, moist, low plasticity, sand, fine; gravel, fine, subangular. 2.10 m | | 1.5, 2.0 | | | | |
| | Silty fine to coarse GRAVEL with some to minor sand and a trace of cobbles, dark orangish brown. Medium dense, moist, sand, fine to coarse; gravel, subangular to subrounded. 2.40 m | | | | | | |
| | SILT with minor sand and a trace of gravel, brownish grey orange mottled. Stiff, moist, low plasticity, sand, fine; gravel, fine, subangular. 2.70 m | | 2.5 | | | | |
| | Silty fine to coarse GRAVEL with some to minor sand and a trace of cobbles, dark orangish brown. Medium dense, moist, sand, fine to coarse; gravel, subangular to subrounded. 3.00 m | | | | | | |
| | End Of Hole: 3.00 m | | | | | | |

Scala penetrometer: 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Shear strength (kPa) Vane: 50 100 150 200

## PHOTO(S)

## REMARKS

Target depth achieved. Pit walls remained vertical during excavation.

Soakage test (SP2) undertaken at 0.8 m bgl adjacent to test pit.

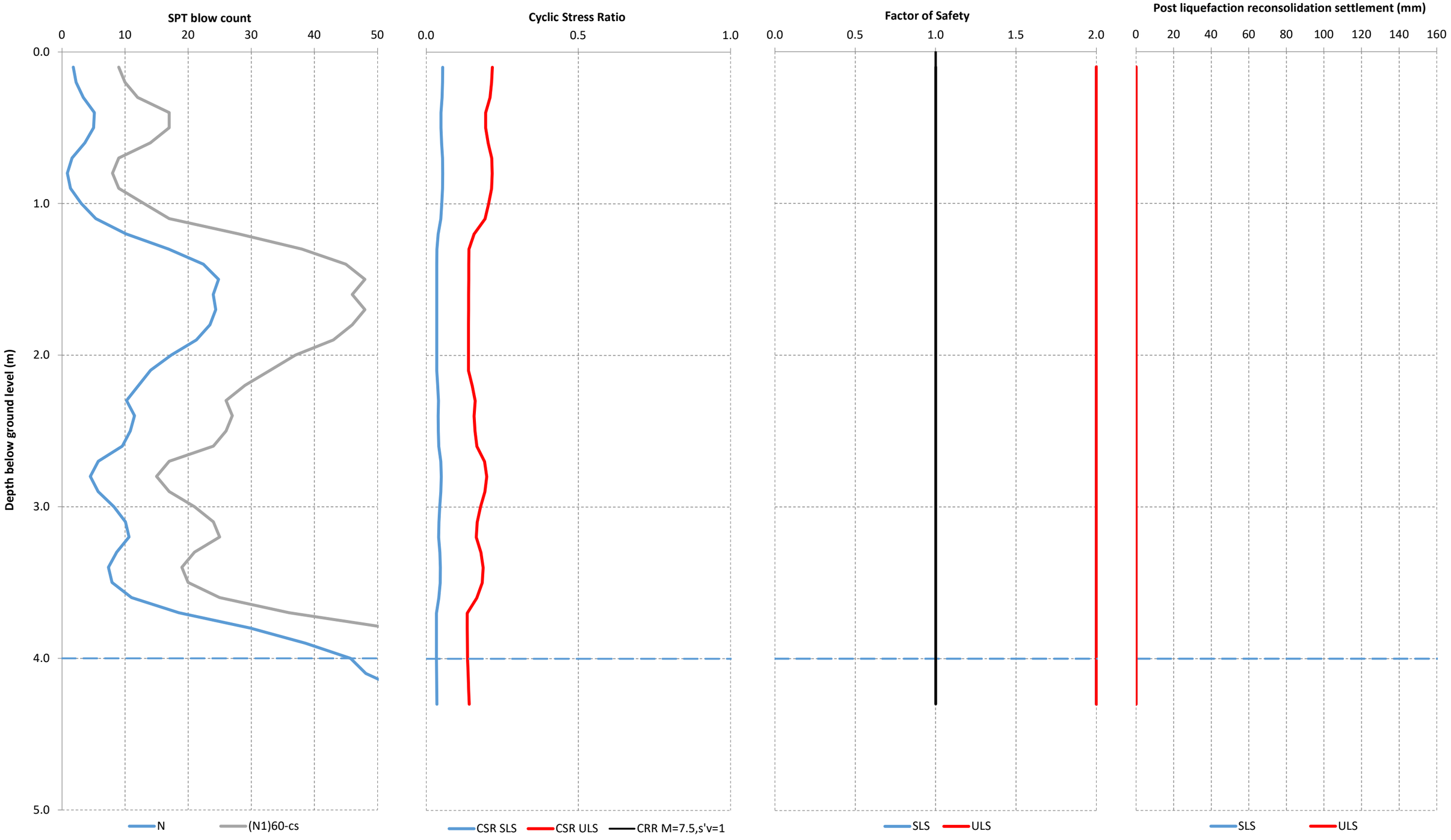
## WATER

- Standing Water Level
- Out flow
- In flow

Generated with CORE-GS by Geroc - Test Pit x Hand Auger - scala & vane bars - 21/03/2024 11:32:29 am

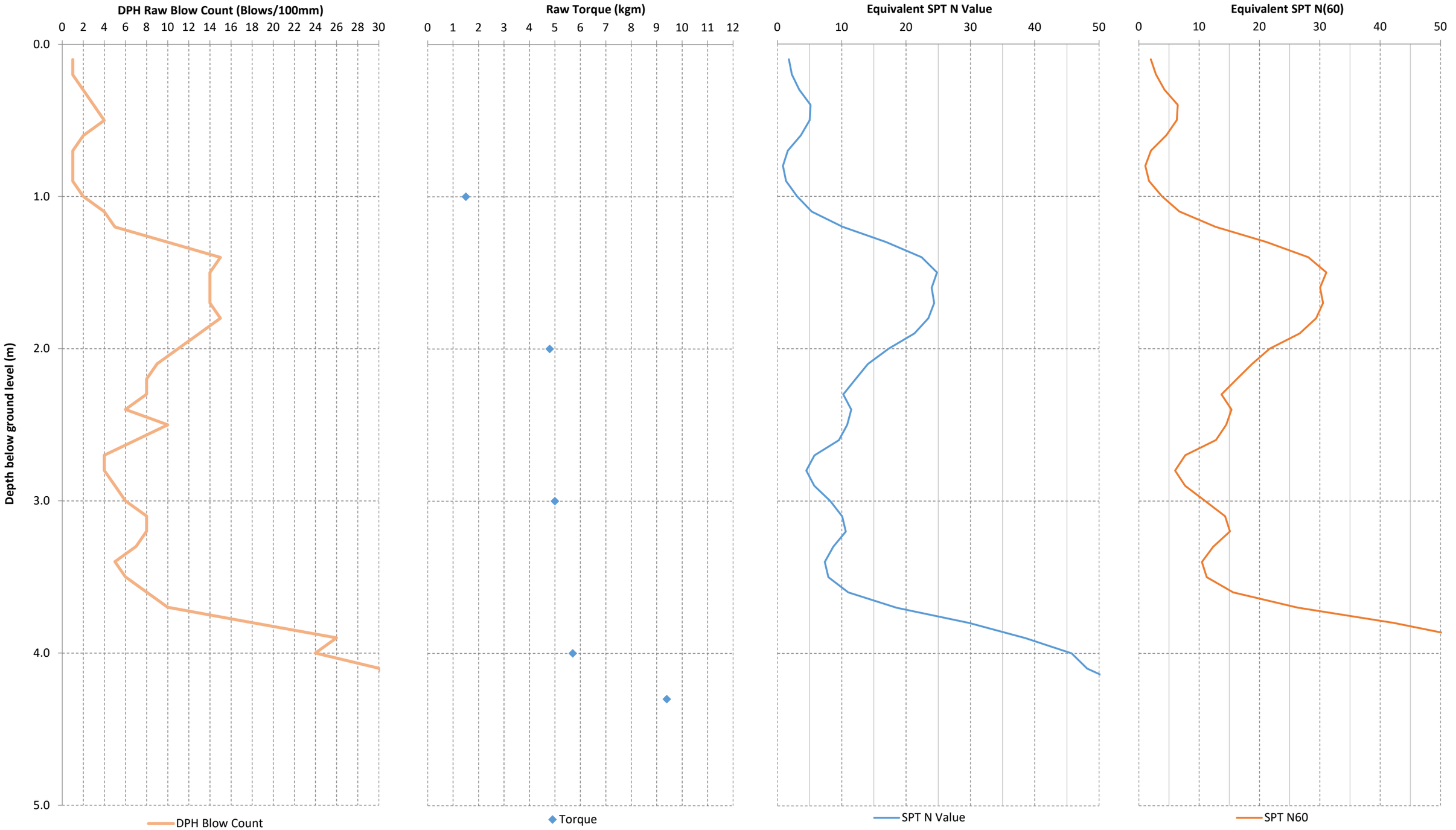
# **Appendix C** – Liquefaction Analysis

| LSN (SLS) | LSN (ULS) | Crust Thickness (SLS) | Crust Thickness (ULS) |
|---|---|---|---|
| 0.0 | 0.0 | 0.0 | 0.0 |



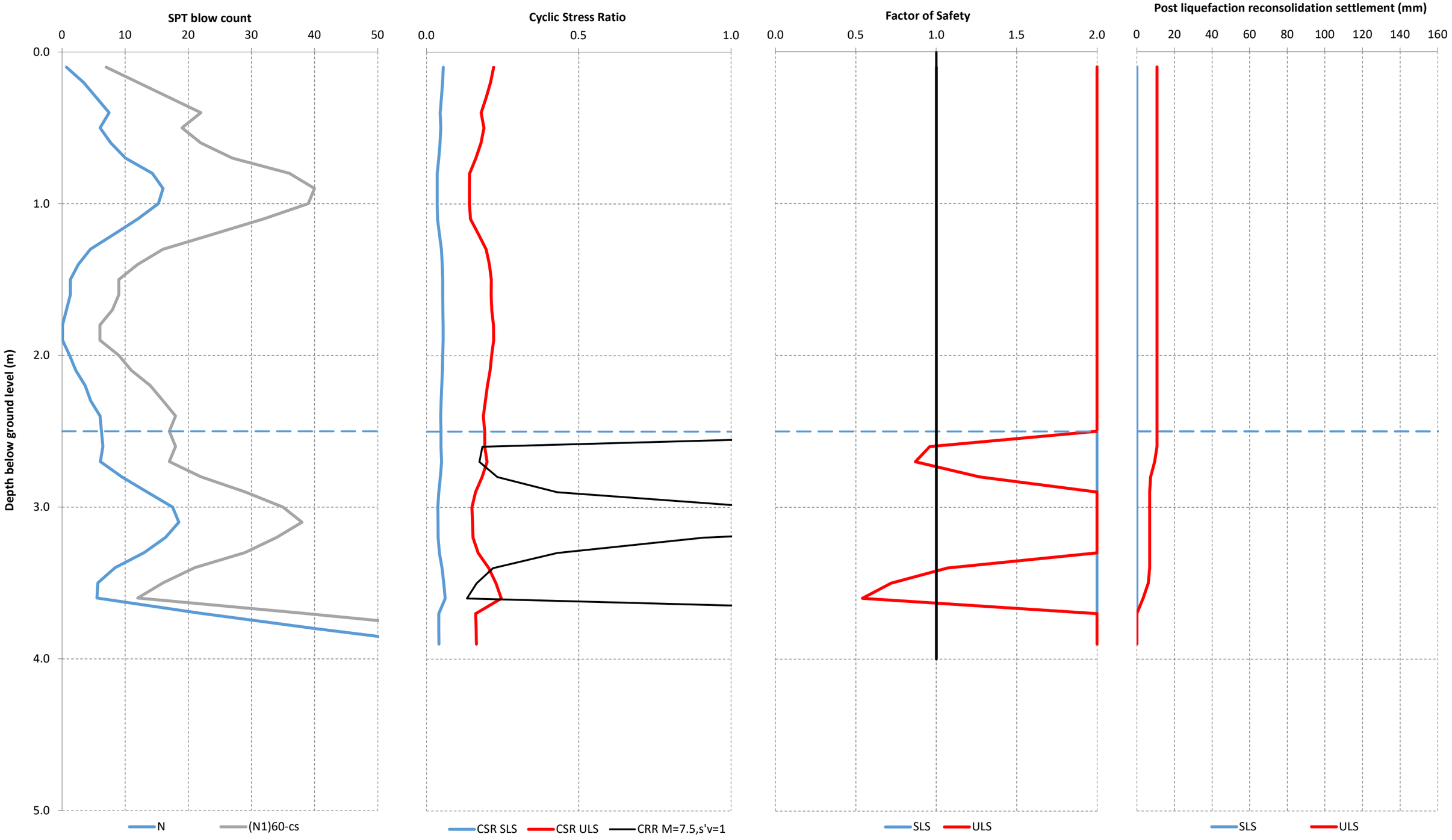

Note: Settlements as per Idriss and Boulanger (2014)

| | | | |
|---|---|---|---|
| PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust |
| DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH1 |
| LOCATION | Hawea | DATE | 15/07/2019 |
| | | LOGGED BY | RC |
| | | ANALYSED BY | MDP |
| | | CHECKED BY | FAW |



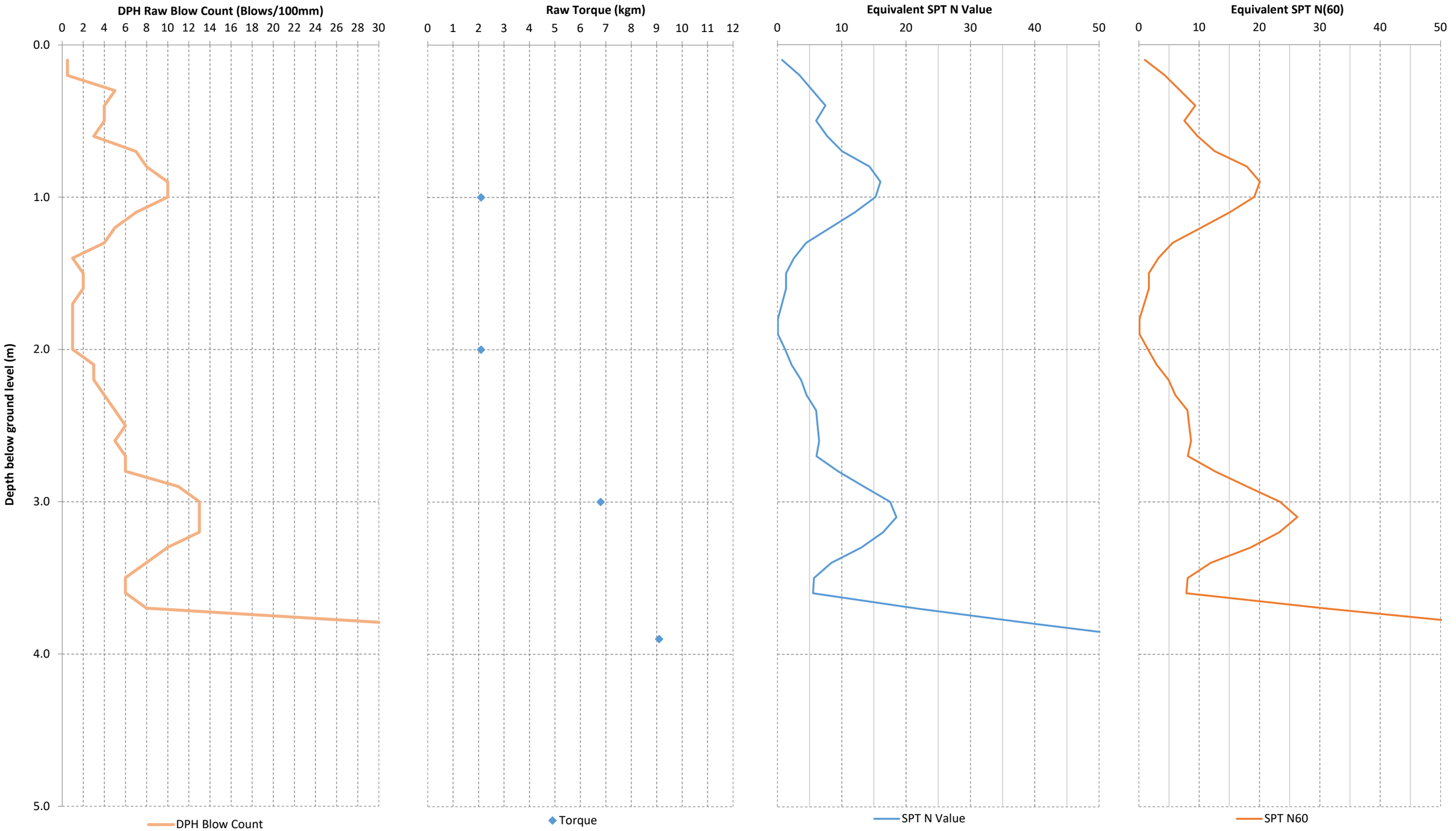

| | | | |
|---|---|---|---|
| PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust |
| DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH1 |
| LOCATION | Hawea | DATE | 15/07/2019 |
| | | LOGGED BY | RC |
| | | ANALYSED BY | MDP |
| | | CHECKED BY | FAW |

| LSN (SLS) | LSN (ULS) | Crust Thickness (SLS) | Crust Thickness (ULS) |
|---|---|---|---|
| 0.0 | 3.4 | 0.0 | 2.5 |



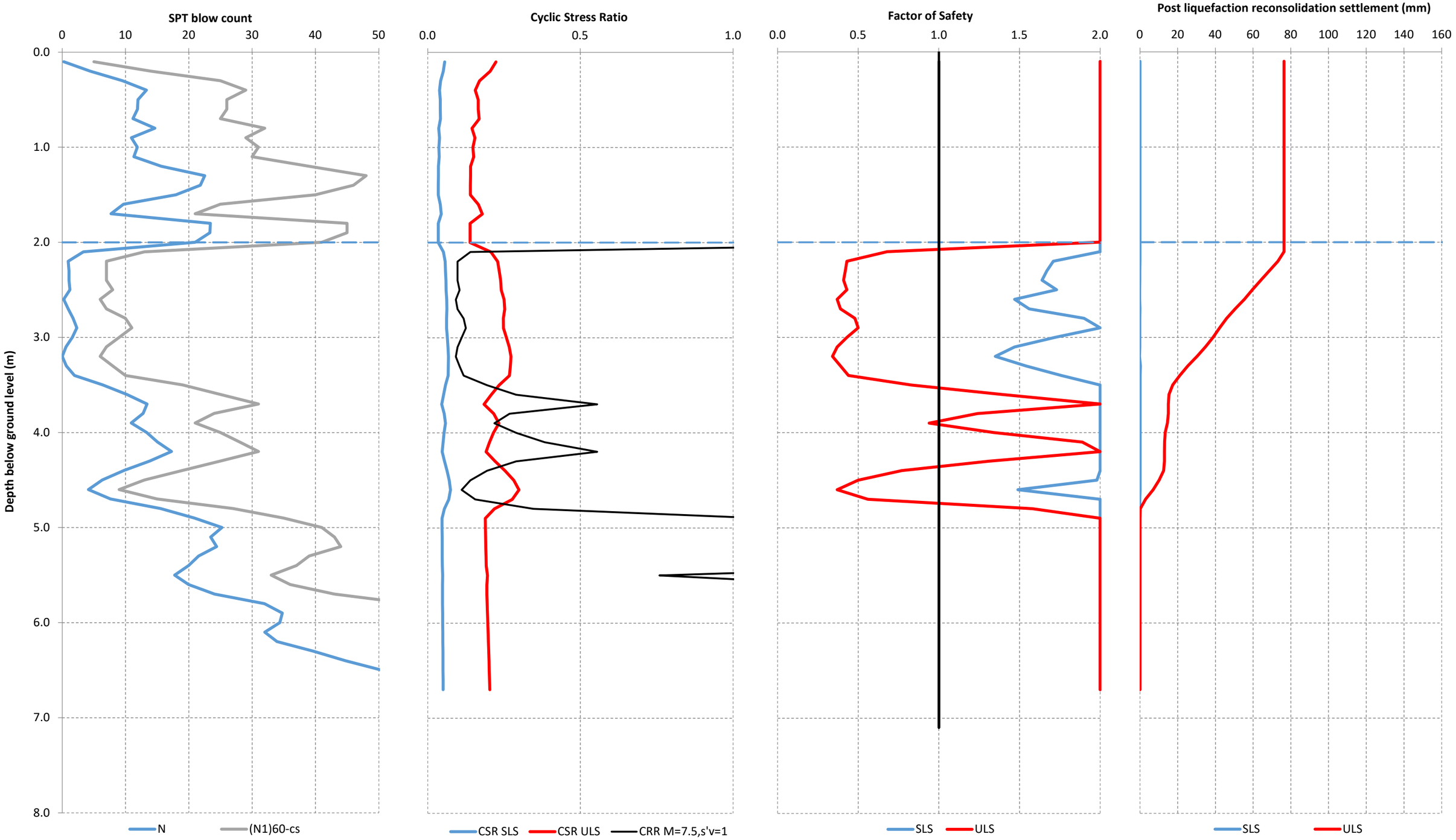

Note: Settlements as per Idriss and Boulanger (2014)

| | | | |
|---|---|---|---|
| PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust |
| DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH2 |
| LOCATION | Hawea | DATE | 15/07/2019 |
| | | LOGGED BY | RC |
| | | ANALYSED BY | MDP |
| | | CHECKED BY | FAW |



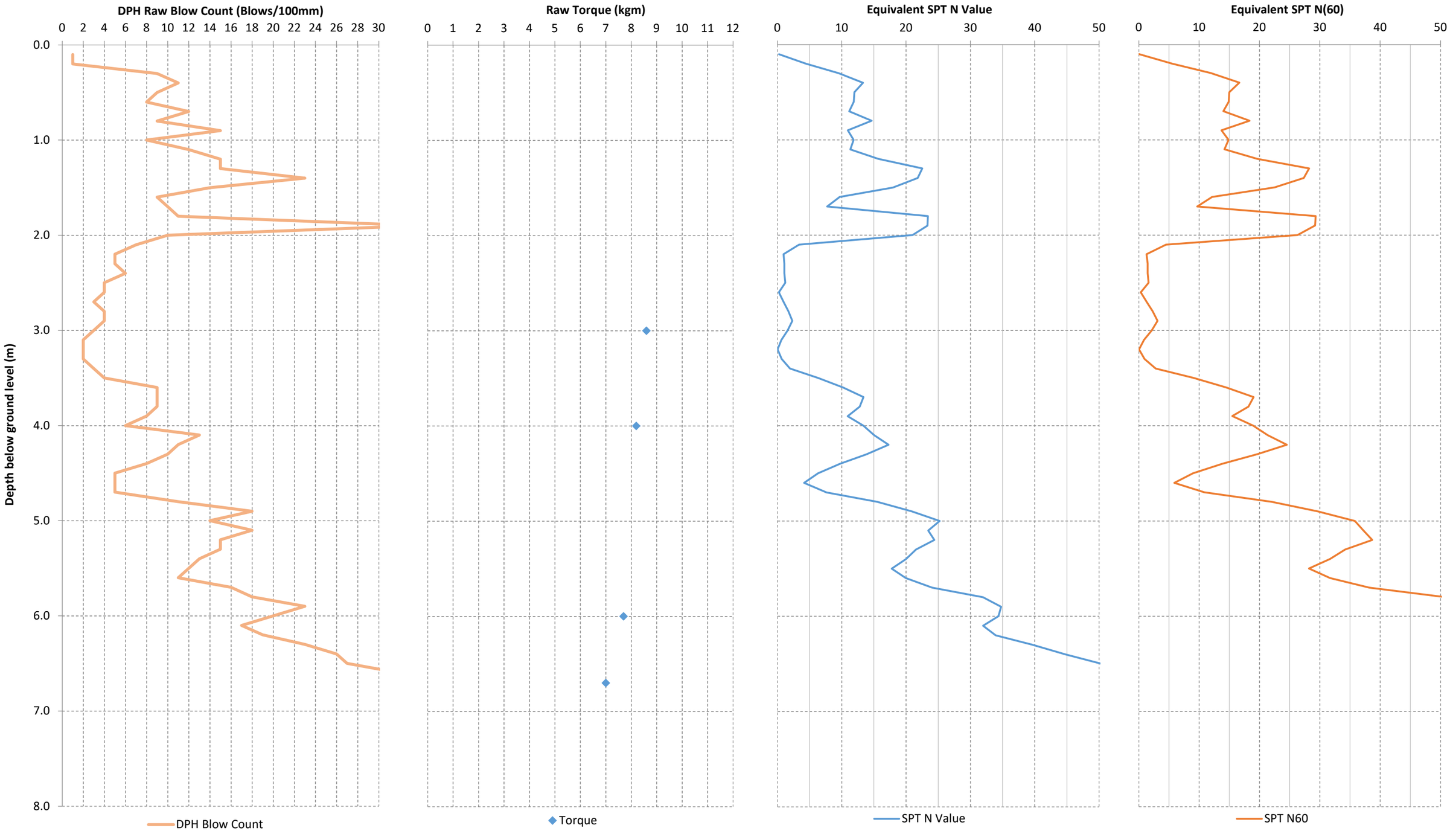

| | | | | | |
|---|---|---|---|---|---|
| GEOSOLVE | PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust | LOGGED BY RC |
| | DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH2 | ANALYSED BY MDP |
| | LOCATION | Hawea | DATE | 15/07/2019 | CHECKED BY FAW |

| LSN (SLS) | LSN (ULS) | Crust Thickness (SLS) | Crust Thickness (ULS) |
|---|---|---|---|
| 0.0 | 25.9 | 0.0 | 2.0 |



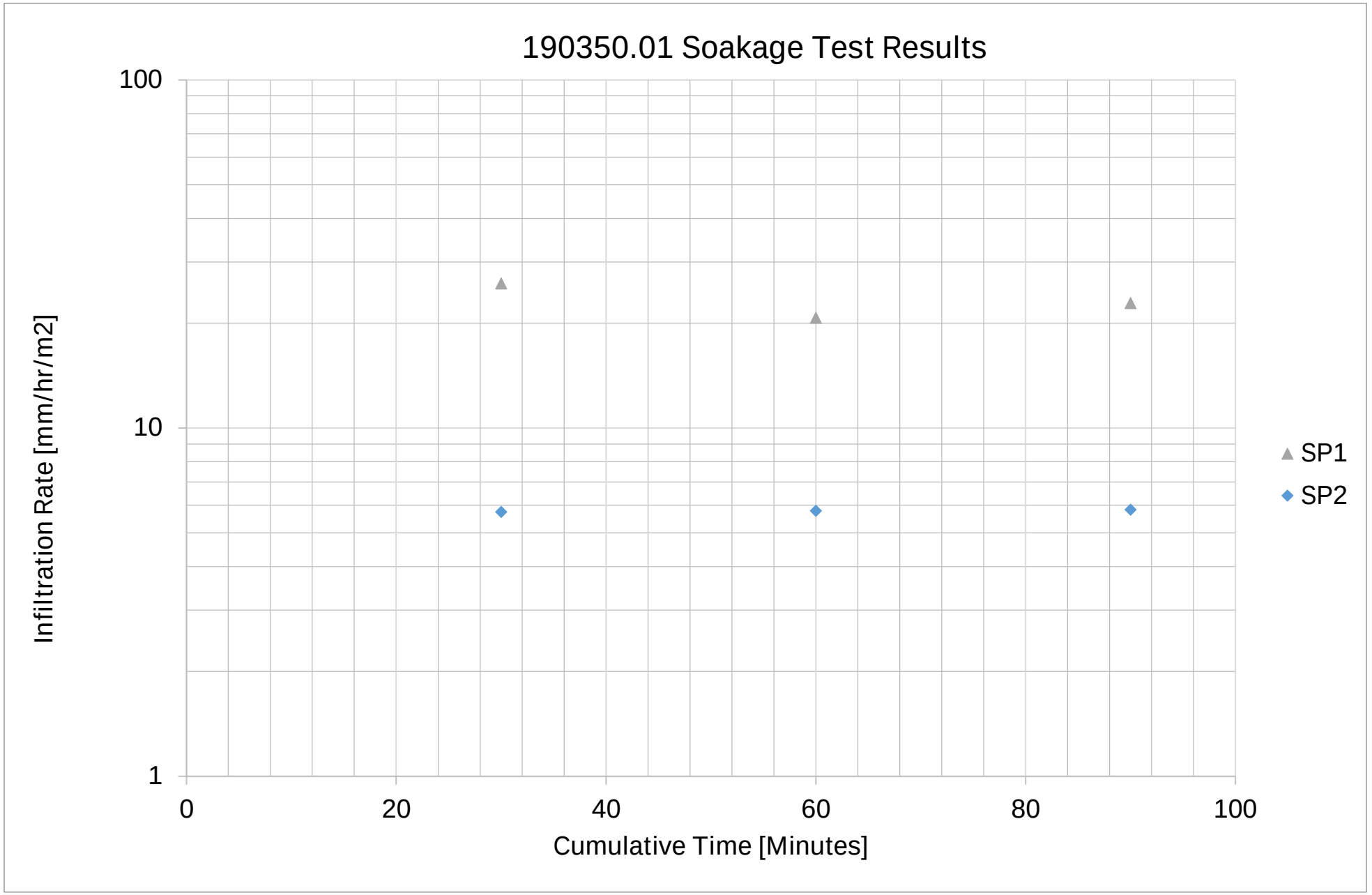

Note: Settlements as per Idriss and Boulanger (2014)

| | | | |
|---|---|---|---|
| PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust |
| DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH3 |
| LOCATION | Hawea | DATE | 15/07/2019 |
| | | LOGGED BY | RC |
| | | ANALYSED BY | MDP |
| | | CHECKED BY | FAW |




| | | | |
|---|---|---|---|
| PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust |
| DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH3 |
| LOCATION | Hawea | DATE | 15/07/2019 |
| | | LOGGED BY | RC |
| | | ANALYSED BY | MDP |
| | | CHECKED BY | FAW |

# **Appendix D** – Soakage Results




Document Set ID: 7982035
Version: 1, Version Date: 09/04/2024

**APPENDIX D – GEOTECH REPORT**

# Geotechnical Report for Resource Consent

1147B Lake Hawea-Albert Town Road, Hawea

**Report prepared for:**

D L Kenton Family Trust

**Report prepared by:**

GeoSolve Limited

**Distribution:**

D L Kenton Family Trust

GeoSolve Limited (File)

**July 2019**

**GeoSolve Ref: 190350**

| Revision | Issue Date | Purpose | Author | Reviewed |
|---|---|---|---|---|
| 1 | **30.07.19** | Client issue | MDP | FAW |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

GEOTECHNICAL WATER RESOURCES PAVEMENTS

# Table of Contents

# 1 Introduction

## 1.1 General

This report presents the results of geotechnical investigations carried out by GeoSolve Ltd in order to determine subsoil conditions, assess natural hazards and provide geotechnical inputs and recommendations for a proposed barn and accessway at 1147B Lake Hawea-Albert Town Road, Hawea.

**Photo 1 – Proposed building site, 1147B Lake Hawea-Albert Town Road**

The investigations were carried out for the D L Kenton Family Trust in accordance with GeoSolve Ltd's proposal dated 14 June 2019, which outlines the scope of work and conditions of engagement. This report will supplement a resource consent application.

## 1.2 Development

We understand that it proposed to construct a barn and accessway within the above property. A plan of the development is attached in Appendix A, Figure 1.

Preliminary earthworks plans have been provided by Paterson Pitts.

# 2 Site Description

## 2.1 General

The subject property is located approximately 900 m southwest of central Hawea as shown in Figure 1 below.


**Figure 1 – Site location plan in relation to Hawea.** (source: http://maps.qldc.govt.nz/qldcviewer/)

The property is accessed from Lake Hawea-Albert Town Road. The site is currently undeveloped. The site surface is typically covered with grass however some trees have been removed in the west of the development area. To the west of the proposed development area the land slopes moderately upslope to the west where it is heavily vegetated.

The property is bounded to the north 1147A and C Lake Hawea-Albert Town Road, with undeveloped farmland to the west and south, and Lake Hawea-Albert Town Road to the east.

## 2.2 Topography and Surface Drainage

The development area has been surveyed and the site topography is shown in Figure 1, Appendix A.

The development site occupies an alluvial fan surface that slopes at approximately 5° to the north. To the west the site slopes moderately to a terrace approximately 80 m above the level of the development.

A shallow watercourse is present approximately 15 m to the west of the proposed barn, this channel is approximately 0.5 m deep. A shallow diversion drain was also observed approximately 20 m south of the southern boundary of the site.

# 3 Geotechnical Investigations

An engineering geological site inspection has been undertaken with confirmatory subsurface investigations. GeoSolve Ltd visited the subject property in June and July 2019, undertaking geotechnical investigations comprising eight test pits and associated Scala penetrometer testing which were advanced to a maximum depth of 4.3 m and 3 heavy dynamic probe (DPH) tests to a maximum depth of 7.7 m, where refusal was met. Geological and geomorphological site mapping was also completed to assess the alluvial fan hazard.

Test pit and Scala penetrometer locations and logs are contained in Appendices A and B respectively.

DPH locations and logs are contained in Appendices A and C respectively.

# 4 Subsurface Conditions

## 4.1 Geological Setting

The site is located in the Hawea Basin, a feature formed predominantly by glacial advances. The schist bedrock within the basin has been extensively scoured by ice and lies at considerable depth below this site. Overburden material above the schist in this region includes glacial till, outwash gravel, fan alluvium and lake sediment.

Active fault traces were not observed at the site, although the property is located approximately 750 m northwest of the active Nevis-Cardrona Fault. However, due to the estimated 30,000-year average return period for earthquakes on this fault the seismic risk from this structure is considered low. Significant seismic risk exists in this region from potentially strong ground shaking, likely to be associated with a rupture of the Alpine Fault, located along the West Coast of the South Island. There is a high probability that an earthquake with an expected magnitude of over 8 will occur along the Alpine Fault within the next 50 years.

## 4.2 Stratigraphy

The underlying geology generally consists of the following:

- 0.2-0.4 m of **topsoil**, overlying;
- 0.5-3.8+ m of **fan alluvium**, overlying;
- 0.5-1.5 m of **organic fan alluvium**, overlying;
- 0.2-0.4 m of **buried topsoil**, overlying;
- 0.5-3.2 m+ of **fan alluvium**.

**Topsoil** comprising dark brown/black organic SILT with roots and rootlets was observed at the surface of each test pit to depths of between 0.2-0.4 m.

**Fan alluvium** was observed to underlie the topsoil in all test pits. Fan alluvium was observed to comprise grey, brown, grey mottled orange and orange/light brown, loose to medium dense/firm to stiff silty SAND with some gravel, cobbles and boulders, silty gravelly SAND to silty sandy GRAVEL some cobbles and some to minor boulders, sandy GRAVEL, SILT with minor sand, sandy GRAVEL with some silt, sandy SILT, gravelly SAND. **Fan alluvium** was also observed to underlie the organic fan alluvium/buried topsoil in TPs 1-3, 5a and 6-8. Fan alluvium underlying organic fan alluvium/buried topsoil was observed to comprise grey, grey mottled orange, orange/light brown, firm to very stiff/loose to medium dense, SILT with

some gravel, sandy GRAVEL with minor silt, cobbles and minor to trace boulders, SAND with minor gravel, gravelly SILT with some sand, minor cobbles and boulders and silty SAND to sandy SILT. Fan alluvium was observed at the termination depth of all test pits between 3.7 and 4.3 m bgl. Sandy GRAVEL was observed at the base of all test pits, except TP4.

**Organic fan alluvium** was observed to underlie the upper fan alluvium in TPs 2, 3, 7 and 8 at 0.5 to 1.5 m bgl. Organic fan alluvium was observed to comprise grey/dark brown, firm/loose SILT with minor sticks, silty sandy GRAVEL with some organics, cobbles and boulders, silty SAND with some gravel and trace tree stumps, silty SAND with some gravel and minor tree stumps and organic silty SAND with minor gravel, cobbles, boulders and sticks.

The upper fan alluvium and organic fan alluvium were typically underlain by **buried topsoil**, in some cases the organic fan alluvium was mixed into the buried topsoil. Buried topsoil was observed in TPs 1, 2, 5a, 6 and 8. Large topsoil patches were observed within the organic fan alluvium in TP3. The buried topsoil unit was not observed in TPs 4 and 5b. Buried topsoil comprises soft, dark brown to brown/purplish brown sandy organic SILT with trace sticks and rootlets, and organic SILT with trace rootlets.

Full descriptions of the observed subsurface stratigraphy at the site is provided in the test pit logs in Appendix B.

## 4.3 Groundwater

Groundwater seepage was observed in all TPs except 4-6, minor seepages were observed in TPs 1, 7 and 8 between 0.5 and 1.6 m bgl, where moderate to strong seepages were observed in TPs 1-3, 7 and 8 between 1.4 and 3.4 m bgl.

# 5 Liquefaction Analysis

## 5.1 Design Earthquakes

The site is located within an area with soils identified as being 'possibly susceptible to liquefaction' by the QLDC hazard register.

Two earthquakes scenarios have been assessed in accordance with NZS1170 – Structural Design Actions[1] for an Importance Level 2 structure with a 50-year design life.

Peak horizontal ground accelerations and effective magnitudes were calculated using the procedure from the NZTA Bridge Manual[2]. Table 5.1 below summarises the scenarios considered.

The site has been assessed as subsoil category *Class C – Shallow soils* site in accordance with NZS1170 – Structural Design Actions.

**Table 5.1 – Earthquake accelerations and effective magnitudes for liquefaction assessment**

| Scenario | Performance Requirements | Annual Probability of Exceedance | Peak Horizontal Ground Acceleration (PGA) | Effective Magnitude |
|---|---|---|---|---|
| **Serviceability Limit State (SLS)** | *Avoid damage that would prevent the structure being used as originally intended without repair* | 1/25 | 0.10 g | 6.1 |
| **Ultimate Limit State (ULS)** | *Avoid collapse of the structural system* | 1/500 | 0.40 g | 6.2 |

## 5.2 Liquefaction Summary

For the liquefaction assessment the groundwater level was adopted based on the adjacent completed test pits.

Analyses were performed to evaluate the liquefaction potential of the underlying fan alluvium, utilising the methods recommended by Idriss & Boulanger (2014)[3]. These methods use information obtained from soil logging and in situ testing, such as soil type, fines content, layer thicknesses, and blow count.

Water levels were based on the observations from test pits completed adjacent to DPH test locations.

The liquefaction analysis indicates the following:

- No liquefaction is predicted for the SLS design earthquake;
- No to moderate liquefaction is predicted for the ULS design earthquake;
- Liquefaction triggered at between 0.14g and 0.22g for DPHs 2 and 3 (no liquefaction is predicted for DPH1), AEP of between approximately 1/50 and 1/125.

[1] NZS1170-5 (2004) Structural Design Actions, Part 5: Earthquake Actions – New Zealand.
[2] NZTA Bridge Manual (2014). SP/M/022, third edition amendment 1, Effective from September 2014.
[3] Boulanger R.W. and Idriss, I.M. (2014). 'CPT and SPT Based Liquefaction Triggering Procedures,' Report No. UCD/CMG–14/01, Dept. of Civil & Environmental Engineering, University of California at Davis.

A summary of the factors considered to assess the consequences of the predicted liquefaction is presented in Table 5.2 below:

**Table 5.2 – Summary of liquefaction results to assess the consequences of the predicted liquefaction.**

| Factor | Assessment | | Implications |
|---|---|---|---|
| **Crust thickness** | Crust thickness varies between 2 and 2.5 m for DPHs 2 and 3. Crust thickness undefined in DPH1 (no liquefaction observed to 4.3 m depth where refusal was met).<br>Data from the Canterbury earthquake sequence plus other historic earthquakes[4] has been collated and observed surface damage compared with crust thickness. This data indicates that surface damage is likely for crusts of less than about 3.5 m thickness. | | Crust not sufficiently thick to limit surface damage in a ULS event alone for DPH3. No to minor liquefaction predicted in DPHs 1 and 2, crust sufficiently thick in this case. |
| **LSN** | 1/500 AEP (ULS) | LSN range = 0-26 | Moderate surface expression of liquefaction likely in DPH3, no to minor expression of liquefaction predicted in DPHs 1 and 2. |
| **Free field settlement** | 1/500 AEP (ULS) | 0-80 mm | Some differential settlement likely across the tested area. |
| **Lateral spread** | Lateral spreading under seismic loading is not expected to occur as the site is gently sloping and lacks any nearby free faces. | | |

Liquefaction assessment results are attached in Appendix C.

Foundation recommendations are discussed below in section 6.8.

[4] Bowen, H.J. and Jacka, M.E. (2013). Liquefaction induced ground damage in the Canterbury Earthquake: Predictions versus reality. Proceedings of the 19th NZGS Geotechnical Symposium. Editor CY Chin. Queenstown, New Zealand.

# 6 Engineering Considerations

## 6.1 General

The recommendations and opinions contained in this report are based upon ground investigation data obtained at discrete locations and historical information held on the GeoSolve database. The nature and continuity of subsoil conditions away from the investigation locations is inferred and cannot be guaranteed.

## 6.2 Geotechnical Parameters

Table 6.1 provides a summary of the recommended geotechnical design parameters for the soil materials expected to be encountered during construction of the proposed development.

**Table 6.1 – Recommended geotechnical design parameters**

| Unit | Thickness (m) | Bulk Density $\gamma$ (kN/m$^3$) | Effective Cohesion $c'$ (kPa) | Effective Friction $\phi'$ (deg) | Elastic Modulus E (kPa) | Poissons Ratio $\nu$ |
|---|---|---|---|---|---|---|
| **Topsoil and Buried Topsoil** (organic SILT with roots and rootlets and sandy organic SILT) | 0.2-0.4 | 16 | N/A | N/A | N/A | N/A |
| **Fan Alluvium** (loose to medium dense/firm to very stiff, silty SAND, silty gravelly SAND to silty sandy GRAVEL, sandy GRAVEL, sandy SILT, gravelly SAND, SILT with some gravel, SAND, gravelly SILT) | 0.5-3.8+ | 18-19 | 0 | 31-32 SILT and SAND<br>34-36 gravelly SAND, sandy GRAVEL and silty sandy GRAVEL | 5,000-20,000 | 0.3 |
| **Organic Fan Alluvium** (firm/loose, SILT with minor sticks, silty sandy GRAVEL with some organics, silty SAND with some gravel and minor to trace tree stumps and organic silty SAND) | 0.5-1.5 | 18 | 0 | 28 | 3,000 | 0.3 |

## 6.3 Site Preparation

Due to the depth to the base of the buried topsoil and organic content observed below the site, it is recommended that foundations are constructed to bear upon piles extending through the buried topsoil/organic fan alluvium layer observed to 1.0 to 3.7 m bgl. As the barn foundation is likely to extend on piles only the surficial topsoil (0.2-0.4 m) will be required to be removed at the start of construction.

Owing to the moderately erodible nature of some of the soils present across the site, sediment control measures should be instigated during earthworks construction.

Water should not be allowed to pond or collect near or under a foundation. Positive grading of the subgrade should be undertaken to prevent water ingress or ponding.

All fill that is utilised as bearing for foundations should be placed and compacted in accordance with the recommendations of NZS 4431:1989 and certification provided to that effect.

## 6.4 Excavations

Preliminary earthworks plans have been provided by Paterson Pitts which indicate minor cuts/fills for the accessway and barn. It is expected cuts will be primarily formed within topsoil and fan alluvium.

Minor seepages were encountered between 0.5 and 1.6 m bgl in all TPs except 4-6. Moderate to strong seepages were observed in TPs 1-3, 7 and 8 between 1.4 and 3.4 m bgl. Excavations should be minimised to not encounter seepages, it is unlikely a moderate to strong seepage will be encountered during surface excavations, however may be encountered within pile holes. A geotechnical practitioner should inspect any seepage or spring flow should they be encountered during construction.

## 6.5 Engineered Fill

As only minor cut and fills are expected on site within topsoil and shallow variable fan alluvium (that is unsuitable to use as engineered fill), it is recommended where fill is required that it is imported to the site. A gravel fill surface may be required during construction as a working layer for vehicles and machines. Imported engineered fill will be required for pavement areas.

Site won soils can be used for landscaping and for the construction of the bund adjacent to the southern boundary.

## 6.6 Ground Retention

Earthworks and the requirement for retaining walls are currently yet to be confirmed for the site. All retaining walls that are load bearing or over 1.5 m high should be designed by a chartered professional engineer. All retaining walls should be designed using the geotechnical parameters recommended in Table 6.1 of this report. Due allowance should be made during the detailed design of all retaining walls for any additional loads upslope of the wall (i.e. surcharge due to backslope, traffic, buildings and seismic forces).

All temporary slopes for retaining wall construction should be battered at 1.5H:1V within fan alluvium.

Regular seepages were observed in test pits and have the potential to develop following completion of the earthworks, in particular as a result of heavy or prolonged rainfall. To ensure potential groundwater seeps and flows are properly controlled behind the retaining walls, the following recommendations are provided:

- A minimum 0.3 m width of durable free draining granular material should be placed behind all retaining structures;
- A heavy duty non-woven geotextile cloth, such as Bidim A14, should be installed between the natural ground surface and the free draining granular material to prevent siltation and blockage of the drainage media; and

- A heavy-duty (TNZ F/2 Class 500) perforated pipe should be installed within the drainage material at the base of all retaining structures to minimise the risk of excessive groundwater pressures developing. This drainage pipe should be connected to the council stormwater system;
- Comprehensive waterproofing measures should be provided to the back of the face of all basement retaining walls to minimise groundwater seepage into the finished buildings;
- The outlet of all sub-soil or horizontal drains should be connected to the permanent piped storm water system.

## 6.7 Groundwater Issues

The watertable is expected to be below any excavations required for this development however floor levels are yet to be confirmed. Note that minor seepages were observed within the upper 0.5-0.6 m within fan alluvium in TPs 7 and 8 and observed to be moist to wet from 0.2 to 1.9 m bgl adjacent to the existing watercourse.

The area surrounding the proposed barn was observed to be wet underfoot during excavations, depending on the proposed cut/fill proposed in this area a diversion drain could be constructed below the ground surface in this area to re-direct any seepages close to the surface back towards the existing watercourse.

Stormwater flow and site drainage should be assessed during detailed design.

It is important that GeoSolve be contacted should there be any seepage, spring flow or under-runners encountered during construction.

## 6.8 Settlement and Foundations

### 6.8.1 General

It is recommended the foundation excavations be inspected by a suitably qualified and experienced geotechnical specialist to confirm the conditions are in accordance with the assumptions and recommendations provided in this report.

As there are organic soils interbedded within the fan deposits there is a risk of long-term creep settlement for any surface structures at the site due to decomposition overtime. The organic soils extend to depths where excavation, removal of organic soils and re-compaction with imported engineered fill is unlikely to be cost effective.

In addition, some liquefaction settlement is predicted around DPH3.

### 6.8.2 Piled Foundations Extending to Sandy GRAVEL

To reduce the risk of any long-term settlement and mitigate liquefaction effects it is recommended that the barn is constructed on piles, ensuring that pile toes are well below the organic soils encountered.

It is recommended that foundations are constructed on piles bearing within the medium dense, sandy GRAVEL fan alluvium first observed between 1.7 and 3.7 m.

The presence of cobbles and boulders within the fan deposits can obstruct pile construction. The pile construction technique will need to cater for these obstructions and bored piles are likely to be the most appropriate option, although driven piles can also be considered.

For bored piles installed at least 3 pile diameters into the medium dense, sandy GRAVEL fan alluvium, the following preliminary design parameters are recommended.

**Table 6.2: Pile design parameters for bored/driven piles bearing within medium dense sandy GRAVEL fan alluvium.**

| Material Type | Geotechnical Ultimate Design Parameters (kPa) | |
|---|---|---|
| | Skin Friction | End Bearing[1] |
| Sandy GRAVEL fan alluvium | 15 | 3000 |

1. Assumes piles are embedded a minimum of 3 pile diameters within the target strata;
2. Additional end bearing can be achieved with deeper piling.

A strength reduction factor of 0.5 is considered applicable to be applied to the design parameters presented in Table 6.2, when comparing with ULS loads.

Negative skin friction (NSF) from the consolidation of the underlying buried topsoil and organic fan alluvium should be considered during design of the piles. A nominal 10 kPa should be used for the barn.

During test pitting buried topsoil and organic material was first observed underlying the upper fan alluvium between 0.8 and 1.9 m bgl. The buried topsoil/organic fan alluvium was observed to extend to between 1.0 and 3.7 m bgl. Piles will be required to extend below the organic material in all cases to mitigate the effects of settlement as the organic material decays over time. Piles extending through the organic material to competent sandy GRAVEL fan alluvium, observed at 1.7 to 3.7 m in all TPs except TP4, will also mitigate the liquefaction risk in the upper soils. The gravel depth is inferred to be at 4.1 m at TP4, inferred from DPH results.

Bored piles will likely require casing due to the regular seepages and soft soils observed in test pits.

Driven piles can be considered, although the above noted obstructions will need to be considered and trials before construction is recommended to assess that piles can feasibly be installed to the target depth. Piles will need to be driven to both a target depth and set.

Test pits and DPH testing indicate pile depths of between 1.7 and 4.7 m below existing ground level (additional depth for 3 pile diameter embedment required) will provide suitable bearing capacity and are sufficient depth to extend below any liquefaction susceptible soils. Further test pits and DPH testing can be undertaken during detailed design to further define the required pile depths for the proposed barn. Table 6.3 below shows indicative pile target depths in the completed test pit and DPH locations.

Table 6.3: Depth to the underlying sandy GRAVEL fan alluvium unit at discrete points across site

| Test Pit/DPH Location | Depth to sandy GRAVEL fan alluvium (m) |
|---|---|
| TP1 | 3.3 |
| TP2 | 3.7 |
| TP3 | 3.6 |
| TP4 | Not Observed within 4.0 m – DPH 1 undertaken adjacent to TP4 location |
| TP5 | 1.7 |
| TP6 | 2.0 |
| TP7 | 3.5 |
| TP8 | 3.0 |
| DPH1 | 4.1 (inferred based on SPT data) |
| DPH2 | 3.8 (inferred based on SPT data) |
| DPH3 | 4.9 (inferred based on SPT data) |

## 6.9 Alluvial Fan/Debris Flow Assessment

### 6.9.1 Alluvial Fan Assessment

The proposed development is located on the distal toe of a broad alluvial fan which has developed eastward from the range front (see Figure 2 below). The alluvial fan is identified as being a fan less recently active on the ORC natural hazards database. From the test pit logs, topsoil development around the proposed site area is good and ranges in thickness from 0.2-0.4 m. There is no evidence of recent alluvial fan activity around the development area, however there is extensive evidence for debris flows near the apex of the fan. Coarse grained lobate and ridge like deposits characteristic of debris flows can be observed amongst the scrub and there is also a notable lack of topsoil development around the apex of the alluvial fan.

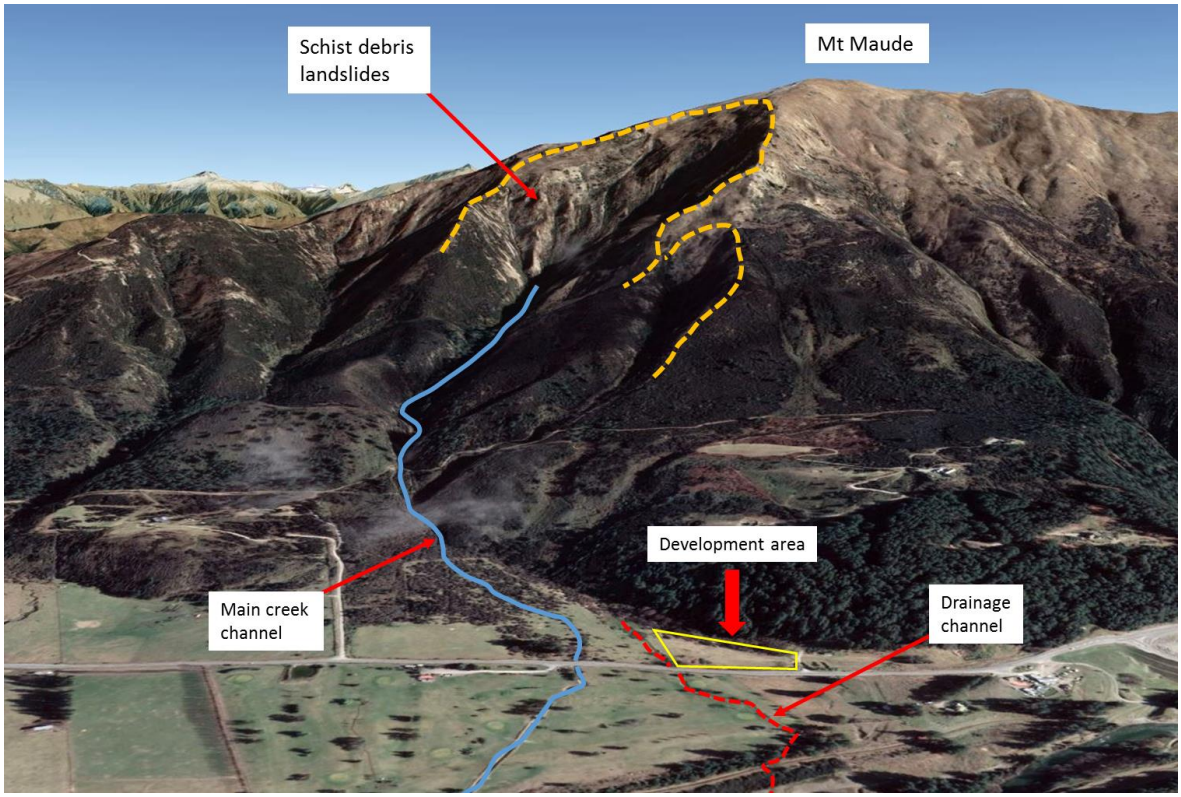



**Figure 2 – Annotated Google Earth image showing the relationship of the proposed development area to the upslope catchment and the main creek channel.**

Slowly creeping schist debris landslides are evident in the head of the upslope catchment below Mt Maude and can be observed in the field from the main highway and on aerial imagery. The schist landslides are well beyond the proposed development area but will almost inevitably contribute more material for future debris flow events onto the alluvial fan. The alluvial fan has obviously been highly active in the recent geologic past, however it now appears to be in a period of relative quiescence. However, in the event of extreme rainfall, particularly if preceded by a significant seismic event, landsliding could potentially mobilise in the catchment and initiate future debris flows onto the fan surface. Such debris flow deposits have been observed within the test pits.

Considering that the proposed development is located on the distal toe of an alluvial fan, there is a risk that debris could potentially encroach into the development area during an extreme event in the future. Any debris incursion into the site would likely comprise alluvial silts, sands and gravels accompanied by sheet flooding rather than destructive coarse-grained or bouldery debris flows. The grain size of soils observed in test pits is also typically fine-grained.

### 6.9.2 Rockroll

During investigations minor boulders were observed on the terrace slope immediately west of the site. This area is currently thickly vegetated obscuring the slope from view, however the trees are proposed to be removed as part of this development. As the trees are removed from the slope it is recommended that any boulders are also picked off the slope to ensure no boulders endanger the proposed development following a significant seismic event.

### 6.9.3 Recommended Mitigation Measures

The alluvial fan hazard mentioned above can be mitigated by installing a diversion bund and heel trench combination along the southern edge of the development parallel with the southern property boundary. The heel trench will be constructed on the upslope (southern) side of the bund, and excavated materials from the heel trench can be reused to construct the bund. The bund should be at least 750 mm high above natural ground and should extend westward to tie into high ground with a 600 mm diameter culvert to accommodate low flows into the existing swale drain on the western edge of the development. The bund will not require specific engineering design and input other than being well compacted with rolling or heavy plate compaction (minimum 400 kg). The heel trench should be at least 300 mm deep and 2 m wide. Site won soils can be reused to construct the bund. The 600 mm diameter culvert is intended to allow the continuous seepage of surface water through the bund without turning the heel trench into a preferential flow path for existing surface flows. During an extreme event in the future the culvert will accommodate low flows, however it is not intended to convey sediment and will likely block.

The existing swale drain on the western edge of the development at the base of the terrace should also be cleaned out and re-established. The swale should be continued along the base of the terrace to the southern property boundary but start inside the bund and heel trench. These measures will isolate a triangular perimeter around the outside of the development area from the risk of future debris flow/flooding.

Elevation of the barn finished floor level by a minimum of 225 mm above adjacent ground level and the construction of a perimeter swale will also offer additional mitigation for any residual flooding risk. It is recommended that the floor level of the barn is raised on a gravel raft to allow for the construction of a suspended concrete floor slab, the gravel raft will allow for a surface for the concrete slab to be formed upon. All loadings including slab bearing should be transferred through the piles as the shallow site soils are not suitable for bearing.

It is recommended that a flood sensitive design is applied to the structure fitout to minimise impact of any potential inundation. It is also recommended that flood provisions for the barn are reviewed if the barn is converted for habitation in the future.

As discussed onsite any boulders observed during removal of vegetation on the terrace upslope of the proposed development should be picked off the slope to ensure no boulders have the potential to mobilise towards any building following a significant seismic event.

## 6.10 Site Subsoil Category

For detailed design purposes it is recommended the magnitude of seismic acceleration be estimated in accordance with the recommendations provided in NZS 1170.5:2004.

Schist bedrock was observed to outcrop on the slope directly to the west of the proposed development and therefore it is considered likely that schist lies within 50 m of the surface, however the depth to schist is unknown directly under the proposed buildings. As the surface of the site is predicted to be within 50 m of the schist contact the site is estimated to be Class C in accordance with NZS 1170.5:2004 seismic provisions. This has been adopted as it is a conservative assumption for seismic loading for liquefaction analysis purposes, however it is recommended that Class D is adopted for structural seismic design as this will provide a conservative design without categorically proving the depth to schist bedrock.

## 6.11 Further Investigations

Further investigations can be undertaken to further define the geological model at the site and allow design of the foundations to be as efficient and cost effective as possible. These are detailed below:

- It is recommended when the barn position is finalised that further DPH testing and/or test pitting is completed to further define required pile depths at the site. This will allow more accuracy in pile dimensions and may allow for reduced pile lengths for the structure. A DPH test should be undertaken at the corners of the proposed barn to determine the depth to a suitable bearing layer.

# 7 Neighbouring Structures/Hazards

**Natural Hazards:** Known seismic hazards affecting the development are detailed in Section 4.1 and appropriate allowance should be made for seismic loading during detailed design of the proposed building, foundations, and retaining walls.

The development is located within a regional scale composite alluvial fan and is identified as being a fan less recently active on the ORC natural hazards database. The alluvial fan hazard has been assessed and mitigation measures are detailed in Section 6.9.

The site is located within the mapped possibly susceptible liquefaction area on the QLDC database. A site-specific investigation including DPH testing has been undertaken and is detailed in Section 5.

**Distances to adjoining structures:** The closest existing building is more than 50 m from the site boundary. No adverse geotechnical implications apply for neighbouring properties during construction of the proposed development.

**Aquifers:** No aquifer resource will be adversely affected by the development.

**Erosion and Sediment Control:** The site presents some potential to generate silt runoff during heavy rainfall events and this would naturally drain downslope. Effective systems for erosion control are runoff diversion drains and contour drains, while for sediment control, options are earth bunds, silt fences, vegetation buffer strips and sediment ponds. Only the least amount of subsoil should be exposed at any stage and surfacing established as soon as practical. Details for implementation are given within the following link: http://esccanterbury.co.nz/

**Noise:** It is expected that conventional earthmoving equipment, such as excavators, trucks, piling rigs, plate compactors and rollers will be required during construction. The earthworks contractor should take appropriate measures to control the construction noise and ensure QLDC requirements are met in regard to this issue.

**Dust:** Regular dampening of soil materials with sprinklers should be effective if required.

**Vibration:** No vibration induced settlement that will influence any existing neighbouring structure is expected.

# 8 Conclusions and Recommendations

- The site is underlain by fan alluvium which overlies organic fan alluvium and buried topsoil which in turn overlies further fan alluvium that extends to at least 4.3 m bgl in the area of the proposed development;
- Preliminary earthworks plans have been provided by Paterson Pitts which indicate minor cut/fills for the proposed development. As the majority of cuts are expected to be undertaken within topsoil and shallow fan alluvium, it is recommended that any fill is imported to site. Site won soils can be used for landscaping and for the construction of the bund adjacent to the southern boundary;
- It is recommended that the foundations for the proposed barn are constructed on piles extending through the buried topsoil/organic fan alluvium layer. Foundation recommendations and parameters are provided in section 6.8;
- A liquefaction assessment has been undertaken based on DPH testing at the site. The liquefaction analysis indicates no to moderate liquefaction of soils within the upper 4.5 m, below the water table at the site. It is recommended piles are installed at least 3 pile diameters into the underlying medium dense sandy GRAVEL fan alluvium which is considered sufficiently free draining and of a relative density that will not liquefy during a significant seismic event;
- Any fill that is utilised as bearing for foundations should be placed and compacted in accordance with NZS 4431:1989 and certification provided to that effect;
- A geotechnical practitioner should inspect all excavations, pile driving sets, and additionally any seepage, spring flow or under-runners that may be encountered during construction;
- Class C seismic loading has been adopted for liquefaction analysis purposes as the depth to schist bedrock below the site is unknown. Class C is the conservative assumption in regard to liquefaction analysis as per the NZTA Bridge Manual. For structural design it is recommended that seismic class D is adopted in accordance with NZS 1170.5:2004 seismic provisions as this will provide a conservative design based on the unknown depth to bedrock;
- To mitigate the alluvial fan hazard it is recommended that a bund and heel trench is constructed adjacent to the southern boundary. It is also recommended that the existing swale to the west of the proposed development is further incised to increase its capacity following a significant rainfall event. Due to the potential flooding hazard from the upslope alluvial fan it is also recommended that the barn foundation is constructed upon a localised gravel raft raised 225 mm above the surface ground level and a perimeter swale constructed to ensure any sheet flows pass round the building. Alluvial fan hazard and mitigation measures are discussed in Section 6.9.

# 9 Applicability

This report has been prepared for the benefit of the D L Kenton Family Trust with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

It is important that we be contacted if there is any variation in subsoil conditions from those described in this report.

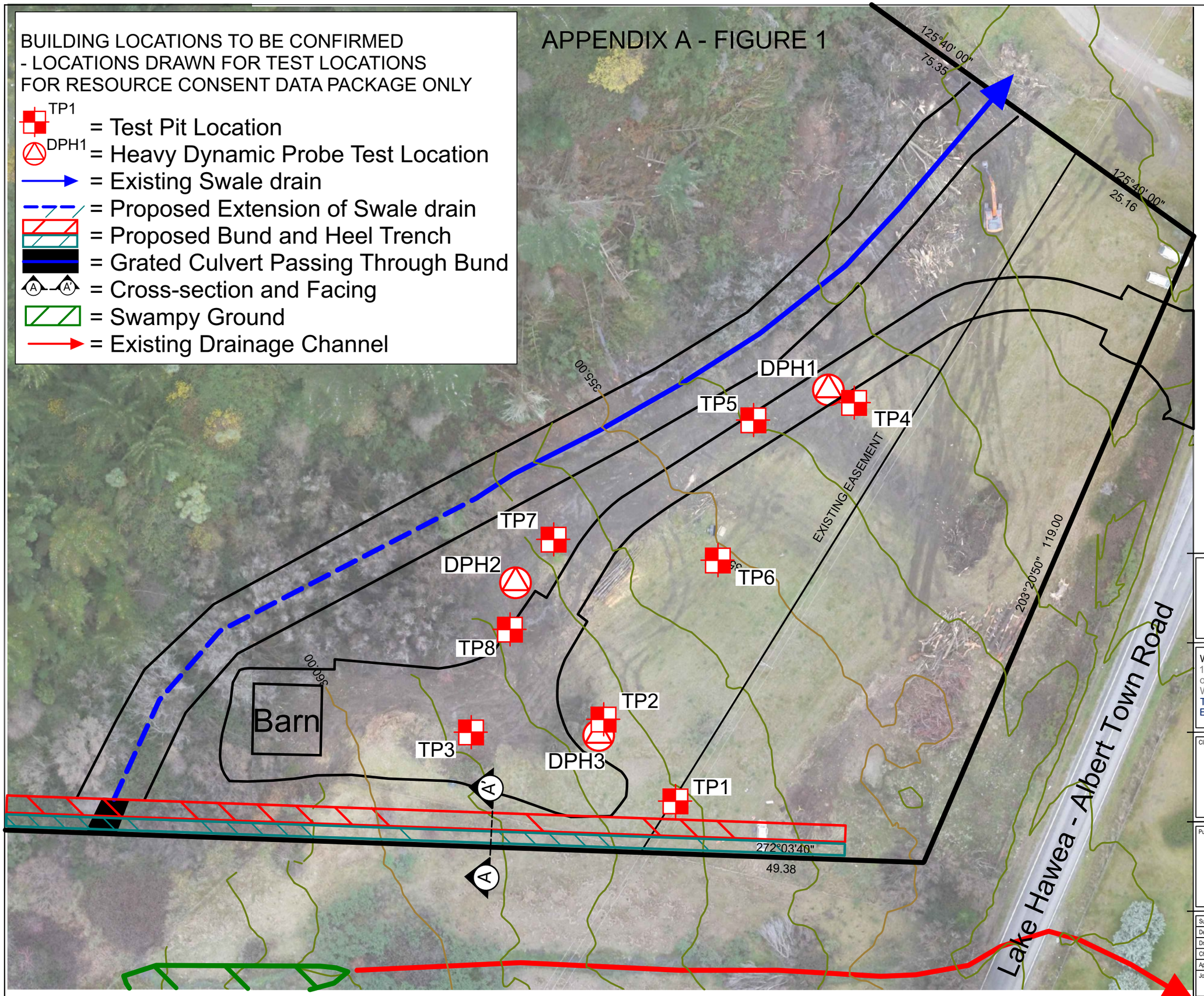
| Report prepared by: | Reviewed for GeoSolve Ltd by: |
|---|---|
|  |  |
| ..... | ..... |
| Mike Plunket<br>Geotechnical Engineer | Fraser Wilson<br>Senior Engineering Geologist |

# Appendix A: Site Investigation Plan

# APPENDIX A - FIGURE 1

BUILDING LOCATIONS TO BE CONFIRMED
- LOCATIONS DRAWN FOR TEST LOCATIONS
FOR RESOURCE CONSENT DATA PACKAGE ONLY

TP1 = Test Pit Location
DPH1 = Heavy Dynamic Probe Test Location
= Existing Swale drain
= Proposed Extension of Swale drain
= Proposed Bund and Heel Trench
= Grated Culvert Passing Through Bund
A A' = Cross-section and Facing
= Swampy Ground
= Existing Drainage Channel




NOTES:

Coordinates are in terms of Lindis Peak 2000
Origin of coordinates: D 216 (MOW) [BAUA]
810613.818mN
381238.26mE

Elevation in Terms of: Dundein Datum 1958
Origin of Levels: D 216 (MOW) [BAUA]
RL= 400.071

Contours have been generated from the Overview Surveying Ground Surface model. Critical positions and levels should be surveyed conventionally.

Contour Intervals = 1.00m


WANAKA
19 Reece Crescent
or P.O. Box 283
Wanaka 9343
T 03 443 0110
E wanaka@ppgroup.co.nz




Client & Location:

D. Kenton
1147B Lake Hawea-Albert Town Road

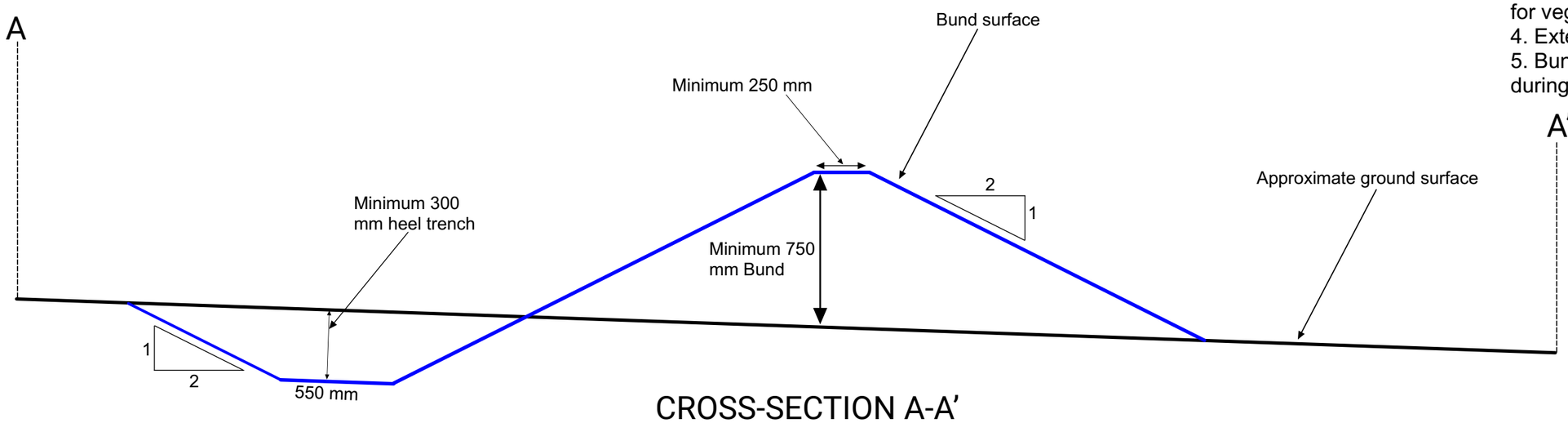
Purpose & Drawing Title:

Base Site Plan
Lot 2 DP 300393

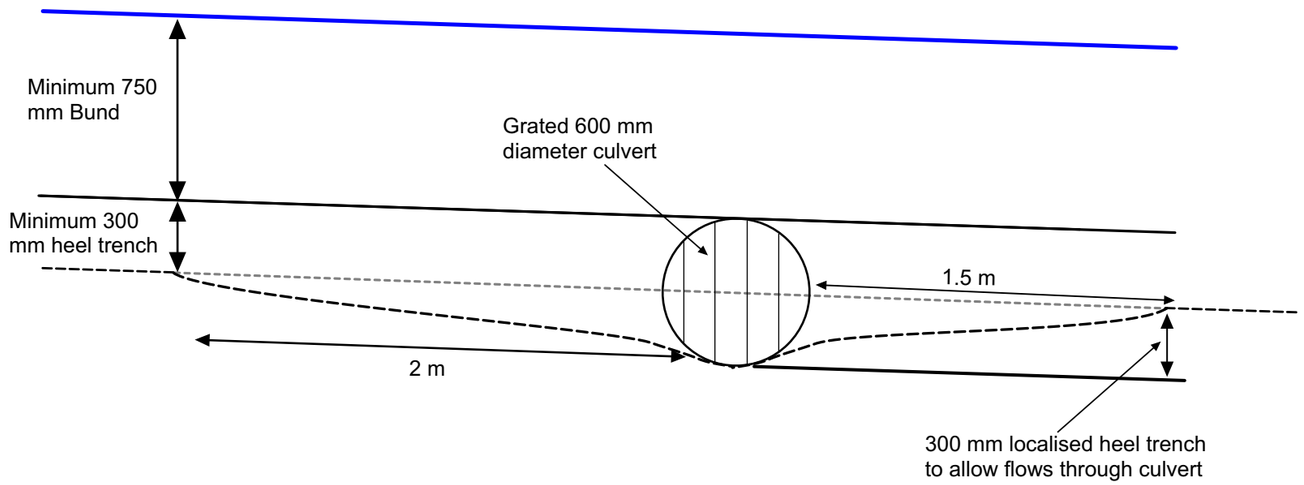
| | | | |
|---|---|---|---|
| Surveyed by: | OTHER | Original Size: | Scale: |
| Designed by: | - | A3 | 1:625 @ A3 |
| Drawn by: | HBM | | |
| Checked by: | DLW | | DO NOT SCALE |
| Approved by: | DLW | | |
| Job No: W5982 | | Sheet No: 100 | Revision No: A |
| | | | Date Created: 24/06/2019 |

L:CANNERHMANSON#TEMP PDFW5982 BASE PLAN.DWG

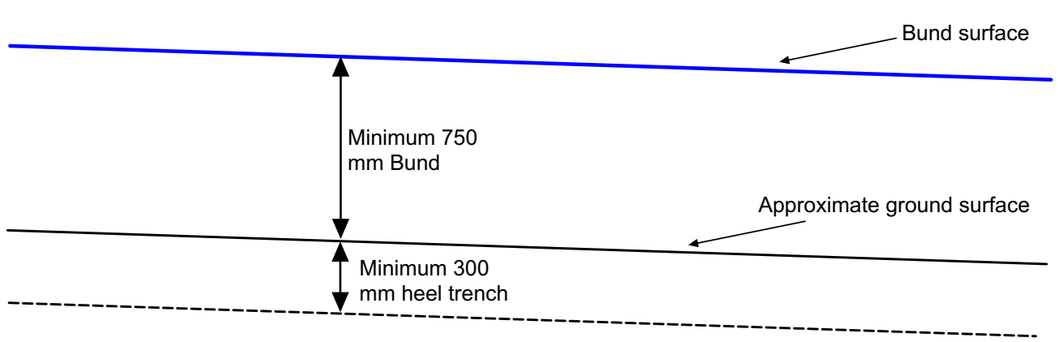
NOTES:
1. Bund can be constructed of site won fill material as approved by the Engineer;
2. The bund should be compacted in layers of no more than 200 mm;
3. The bund should be capped with topsoil upon completion to allow for vegetation covering.
4. Extent of bund to confirmed onsite
5. Bund to be inspected by GeoSolve during construction




CROSS-SECTION A-A'




BUND ELEVATION - CULVERT




BUND ELEVATION

SCALE 1:25
0 10 20 30 40 (m)

GEOSOLVE
Level 1, 70 MacAndrew Road, South Dunedin
www.geosolve.co.nz

| | | |
|---|---|---|
| DRAWN | MDP | Jul.19 |
| DRAFTING CHECKED | HS | Jul.19 |
| APPROVED | FAW | Jul.19 |
| CADFILE: | | |
| SCALES (AT A3) 1:25 | | |
| SIZE): PROJECT No: 190122 | | |

D L Kenton Family Trust
1147B Lake Hawea-Albert Town Road
Geotechnical Investigation
Typical Bund Details

FIG No: Appendix A, Figure 2
REV. 0

# Appendix B: Investigation Data

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 1**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

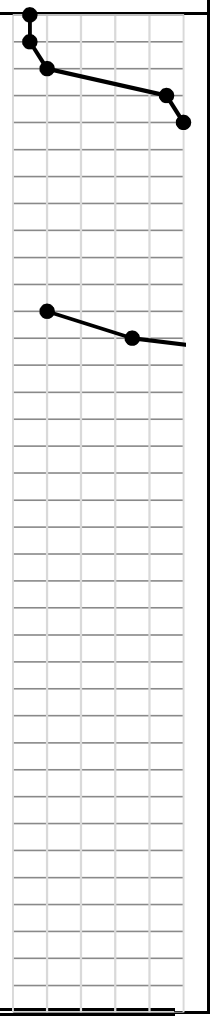
| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.4 | TOPSOIL | | Dark brown/black, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 1.3 | FAN ALLUVIUM | | Light grey, silty SAND with some gravel, cobbles and boulders. Sand is fine to medium. Boulders up to 600 mm. Silt is non-plastic. Medium dense. Moist. | | |
| 1.7 | FAN ALLUVIUM | | Light grey, silty gravelly SAND with some cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular. Boulders up to 700 m. Silt is non-plastic. Medium dense. Moist. | | Minor seepage |
| 1.9 | BURIED TOPSOIL | | Greyish brown, organic SILT with minor sand and trace roots and rootlets. Silt is non-plastic. Moist. | | |
| 2.6 | FAN ALLUVIUM | | Grey/mottled orange, SILT with some gravel. Silt is non-plastic. Firm to stiff. Moist to wet. | | Moderate seepage |
| 2.8 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor silt. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. | | Moderate seepage |
| 3.3 | FAN ALLUVIUM | | Grey, silty gravelly SAND with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 500 mm. Silt is non-plastic. Medium dense. Bedded. Moist to wet. | | |
| 3.7 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor silt. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Medium dense. Bedded. Saturated. | | |

Total Depth = 3.7 m

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



| | |
|---|---|
| COMMENT: | Logged By: MDP |
| | Checked Date: |
| | Sheet: 1 of 1 |

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 2**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

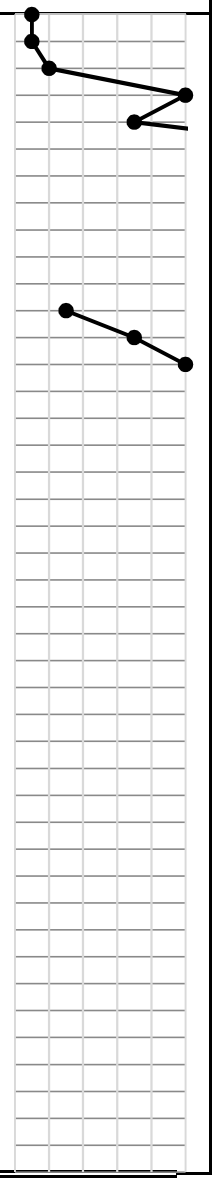
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.3 | TOPSOIL | | Dark brown/black, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 0.9 | FAN ALLUVIUM | | Dark grey, sandy GRAVEL with trace rootlets. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Loose. Loose bedding. Moist. | | |
| 1.6 | FAN ALLUVIUM | | Light grey, silty sandy GRAVEL with some cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 700 mm. Silt is non-plastic. Medium dense. Wet. | | |
| 2.4 | ORGANIC FAN ALLUVIUM | | Dark grey, SILT with minor sticks. Silt is non-plastic. Firm. Wet. | | Moderate to strong seepage |
| 2.8 | BURIED TOPSOIL | | Black, organic SILT with trace rootlets. Silt is non-plastic. Soft. Wet. | | |
| 3.7 | ORGANIC FAN ALLUVIUM | | Light grey/dark brown, organic silty SAND with minor gravel, cobbles, boulders and sticks. Sand is fine to medium. Boulders up to 600 mm. Loose. Wet. | | |
| 4.3 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 500 mm. Medium dense. Bedded. Saturated. | | |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.3 m

COMMENT: Hole collapsing below seepage

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 3**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

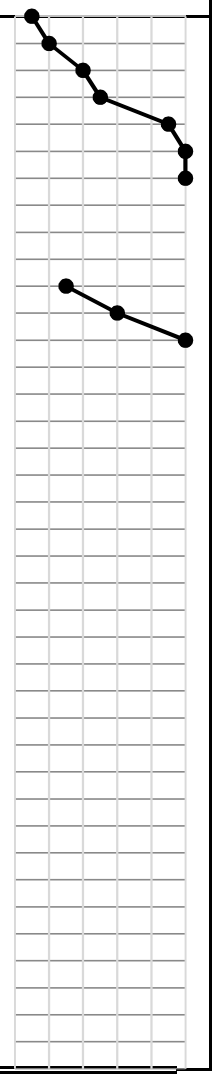
| | | | | | | |
|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.2 | TOPSOIL | | Dark brown/black, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 1.9 | FAN ALLUVIUM | | Grey, silty sandy GRAVEL with some cobbles and minor boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 700 mm. Silt is non-plastic. Loose. Moist to wet. | | |
| 3.4 | ORGANIC FAN ALLUVIUM | | Grey/dark brown, silty sandy GRAVEL with some organics, cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 600 mm. Loose. Moist. | | Strong seepage |
| 3.6 | FAN ALLUVIUM | | Grey, SAND with minor gravel. Sand is fine to medium. Loose to medium dense. Bedded. Moist to wet. | | |
| 3.9 | FAN ALLUVIUM | | Grey, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 300 mm. Medium dense. Bedded. Saturated. | | |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 3.9 m

COMMENT: Surface cleared of slash/trees prior to investigations which removed some of the surface topsoil

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 4**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

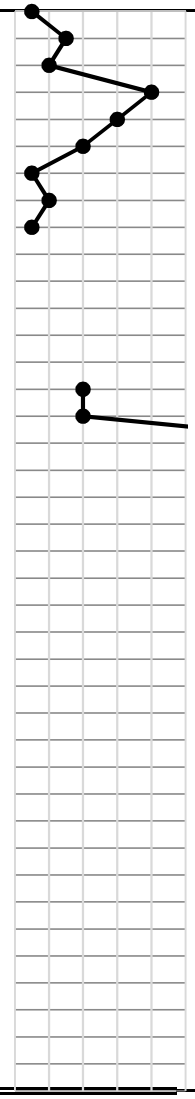
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.25 | TOPSOIL | | Dark brown/black, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 0.65 | FAN ALLUVIUM | | Light grey mottled orange, silty SAND with some gravel. Sand is fine to medium. Silt is non-plastic. Loose. Dry to moist. | | |
| 1.2 | FAN ALLUVIUM | | Grey, SILT with minor sand. Silt is non-plastic. Firm. Dry to moist. | | |
| 1.7 | FAN ALLUVIUM | | Light grey mottled light brown, sandy GRAVEL with some silt. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Medium dense. Bedded. Dry to moist. | | |
| 4.0 | FAN ALLUVIUM | | Light grey, sandy SILT. Silt is non-plastic. Stiff. Thinly laminated. Dry. | | NO SEEPAGE |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4 m

COMMENT: No seepage observed. Hole stood well during excavation

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 5a**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

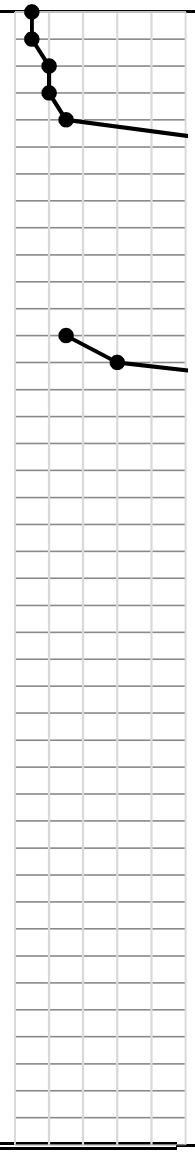
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.3 | TOPSOIL | | Dark brown, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 0.8 | FAN ALLUVIUM | | Grey, gravelly SAND with trace cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 300 mm. Loose. Moist. | | |
| 1.0 | BURIED TOPSOIL | | Brown, organic SILT with trace rootlets. Silt is non-plastic. Moist. | | |
| 1.7 | FAN ALLUVIUM | | Grey, gravelly SILT with some sand and minor cobbles and boulders. Gravel is fine to coarse and sub-rounded to sub-angular. Boulders up to 300 mm. Silt is non-plastic. Stiff. Moist. | | |
| 4.2 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor cobbles and trace boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 500 mm. Medium dense. Bedded. Moist. | | NO SEEPAGE |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.2 m

COMMENT: Northeast end of TP

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 5b**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE | SCALA PENETROMETER |
|---|---|---|---|---|---|---|
| 0.3 | TOPSOIL | | Dark brown, organic SILT with rootlets. Silt is non-plastic. Moist. | | | |
| 0.8 | FAN ALLUVIUM | | Grey, gravelly SAND with trace cobbles and boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 300 mm. Loose. Moist. | | | |
| 1.7 | FAN ALLUVIUM | | Grey, gravelly SILT with some sand and minor cobbles and boulders. Gravel is fine to coarse and sub-rounded to sub-angular. Boulders up to 300 mm. Silt is non-plastic. Stiff. Moist. | | | |
| 4.2 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor cobbles and trace boulders. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Boulders up to 500 mm. Medium dense. Bedded. Moist. | | NO SEEPAGE | |

Total Depth = 4.2 m

| | |
|---|---|
| COMMENT: Southwest end of TP | Logged By: MDP |
| | Checked Date: |
| | Sheet: 1 of 1 |

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 6**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

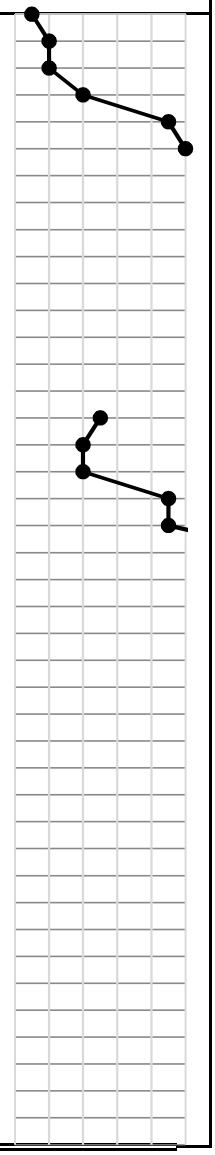
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.25 | TOPSOIL | | Dark brown, organic SILT with rootlets. Silt is non-plastic. Moist. | | |
| 1.0 | FAN ALLUVIUM | | Light grey mottled orange, silty gravelly SAND with trace rootlets. Sand is fine to coarse. Gravel is fine to coarse and sub-angular to sub-rounded. Silt is non-plastic. Loose to medium dense. Moist. | | |
| 1.3 | FAN ALLUVIUM | | Light grey mottled orange, gravelly SAND. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Medium dense. Moist. | | |
| 1.7 | BURIED TOPSOIL | | Purplish brown, sandy organic SILT with trace rootlets. Sand is fine to medium. Silt is non-plastic. Moist. | | |
| 2.0 | FAN ALLUVIUM | | Grey mottled orange, SILT. Silt is non-plastic. Stiff to very stiff. Moist. | | |
| 4.2 | FAN ALLUVIUM | | Light brown, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 600 mm. Medium dense. Bedded. Dry to moist. | | NO SEEPAGE |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.2 m

COMMENT:

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 7**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

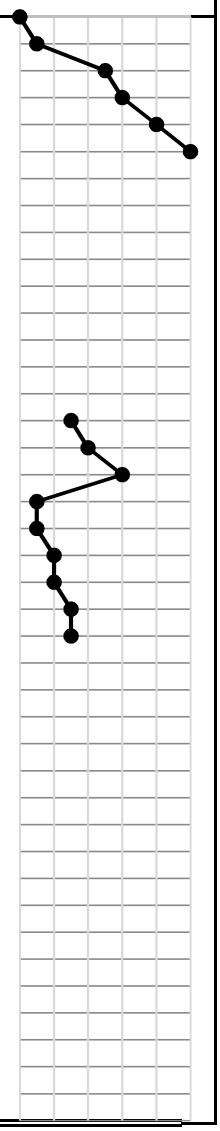
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.3 | TOPSOIL | | Dark brown, organic SILT with roots and rootlets. Silt is non-plastic. Moist. | | |
| 1.0 | FAN ALLUVIUM | | Light grey, silty gravelly SAND with some cobbles and minor boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 300 mm. Silt is non-plastic. Loose. Moist to wet. | | Minor seepage |
| 1.8 | ORGANIC FAN ALLUVIUM | | Grey, silty SAND with some gravel and trace tree stumps. Sand is fine to coarse. Silt is non-plastic. Loose. Moist to wet. | | Moderate seepage |
| 2.5 | ORGANIC FAN ALLUVIUM | | Grey/dark brown, organic silty SAND. Sand is fine to medium. Silt is non-plastic. Loose. Moist to wet. | | |
| 3.5 | FAN ALLUVIUM | | Grey, SILT. Silt is non-plastic. Firm. Laminated. Saturated. | | Moderate to strong seepage |
| 4.1 | FAN ALLUVIUM | | Light brown, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 300 mm. Medium dense. Bedded. Saturated. | | |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.1 m

COMMENT:

Logged By: MDP

Checked Date:

Sheet: 1 of 1

GEOSOLVE

# EXCAVATION LOG

EXCAVATION NUMBER: **TP 8**

| | | | |
|---|---|---|---|
| PROJECT: | 1147B Albert Town Lake Hawea Rd | JOB NUMBER: | 190350 |
| LOCATION: | INCLINATION: | | |

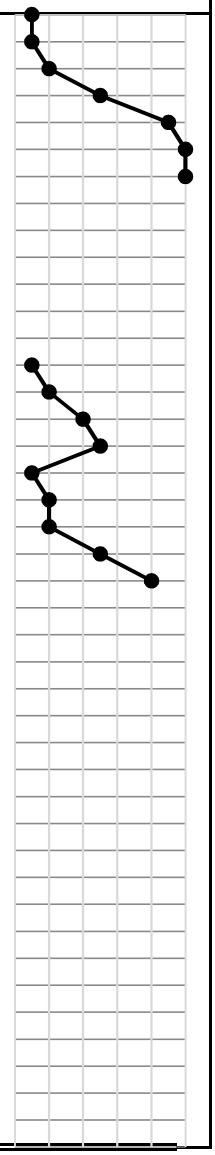
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EASTING: | | mE | EQUIPMENT: | 20 T Excavator | OPERATOR: | Mike |
| NORTHING: | | mN | INFOMAP NO. | | COMPANY: | Client |
| ELEVATION: | | m | DIMENSIONS: | | HOLE STARTED: | 21-Jun-19 |
| METHOD: | | | EXCAV. DATUM: | | HOLE FINISHED: | 21-Jun-19 |

| DEPTH (m) | SOIL / ROCK TYPE | GRAPHIC LOG | DESCRIPTION | USCS GROUP | GROUNDWATER / SEEPAGE |
|---|---|---|---|---|---|
| 0.2 | TOPSOIL | | Dark brown, organic SILT with roots and rootlets. Silt is non-plastic. Moist. | | |
| 1.2 | FAN ALLUVIUM | | Grey, silty gravelly SAND with some cobbles and minor boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 600 mm. Silt is non-plastic. Loose to medium dense. Moist. | | Minor seepage |
| 1.7 | ORGANIC FAN ALLUVIUM | | Grey, silty SAND with some gravel and minor tree stumps. Sand is fine to coarse. Silt is non-plastic. Loose to medium dense. Moist. | | |
| 2.1 | BURIED TOPSOIL | | Dark brown, organic SILT. Silt is non-plastic. Moist. | | |
| 2.4 | FAN ALLUVIUM | | Grey, silty SAND to sandy SILT with lense of sandy GRAVEL. Sand is fine to medium. Silt is non-plastic. Firm. Moist. | | |
| 3.0 | FAN ALLUVIUM | | Light grey, SILT with minor sand. Silt is non-plastic. Stiff. Laminated. Moist to wet. | | Moderate seepage |
| 4.2 | FAN ALLUVIUM | | Orange/light brown, sandy GRAVEL with minor cobbles and boulders. Sand is fine to coarse. Gravel is fine to medium and sub-angular to sub-rounded. Boulders up to 400 mm. Medium dense. Bedded. Saturated. | | |

SCALA PENETROMETER

Blows per 100mm

0 2 4 6 8 10



Total Depth = 4.2 m

COMMENT:

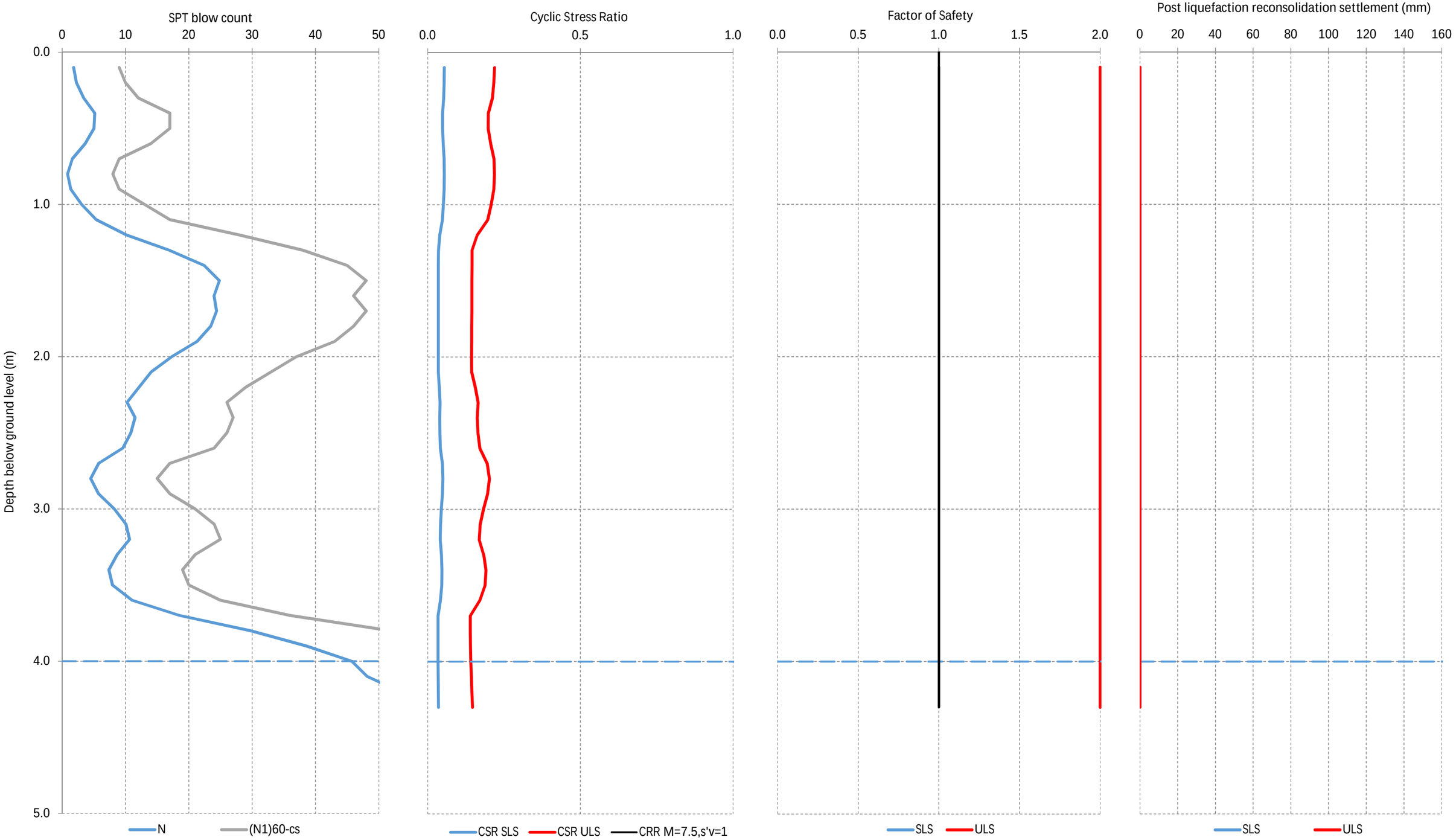
Logged By: MDP

Checked Date:

Sheet: 1 of 1

# Appendix C: Liquefaction Analysis

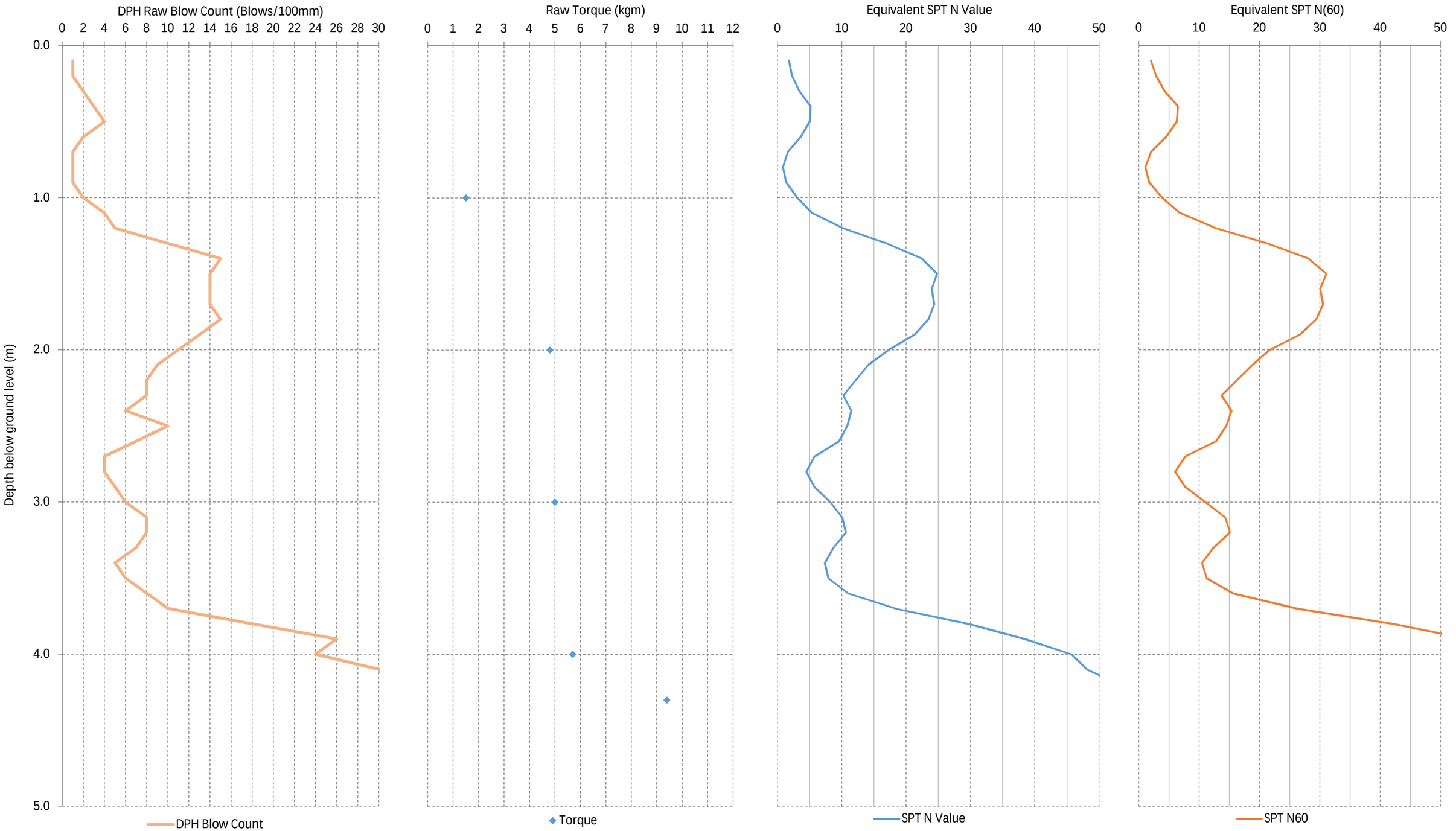
| LSN (SLS) | LSN (ULS) | Crust Thickness (SLS) | Crust Thickness (ULS) |
|---|---|---|---|
| 0.0 | 0.0 | 0.0 | 0.0 |




Note: Settlements as per Idriss and Boulanger (2014)

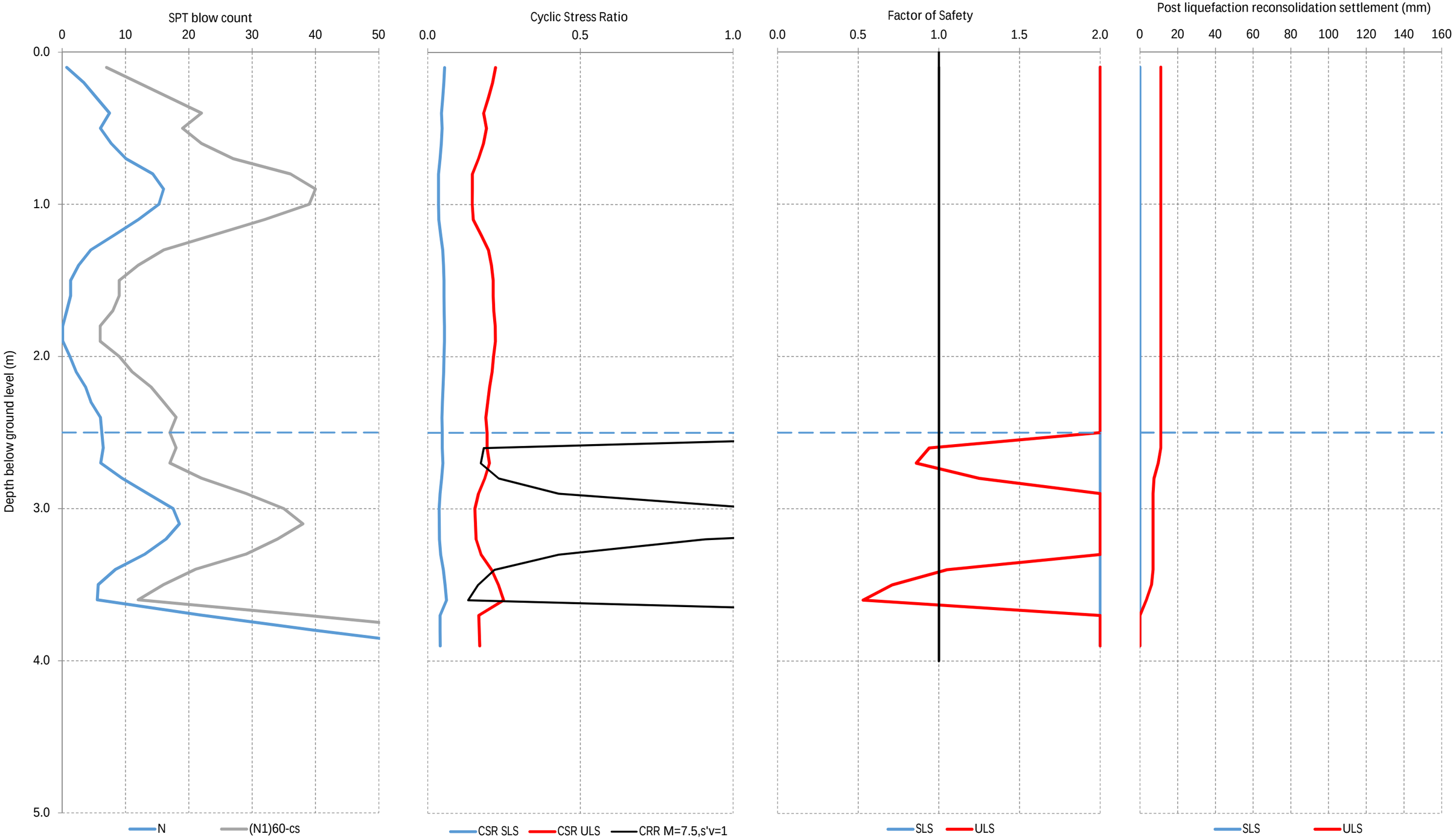
GEOSOLVE

| | | | |
|---|---|---|---|
| PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust |
| DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH1 |
| LOCATION | Hawea | DATE | 15/07/2019 |
| | | LOGGED BY | RC |
| | | ANALYSED BY | MDP |
| | | CHECKED BY | FAW |



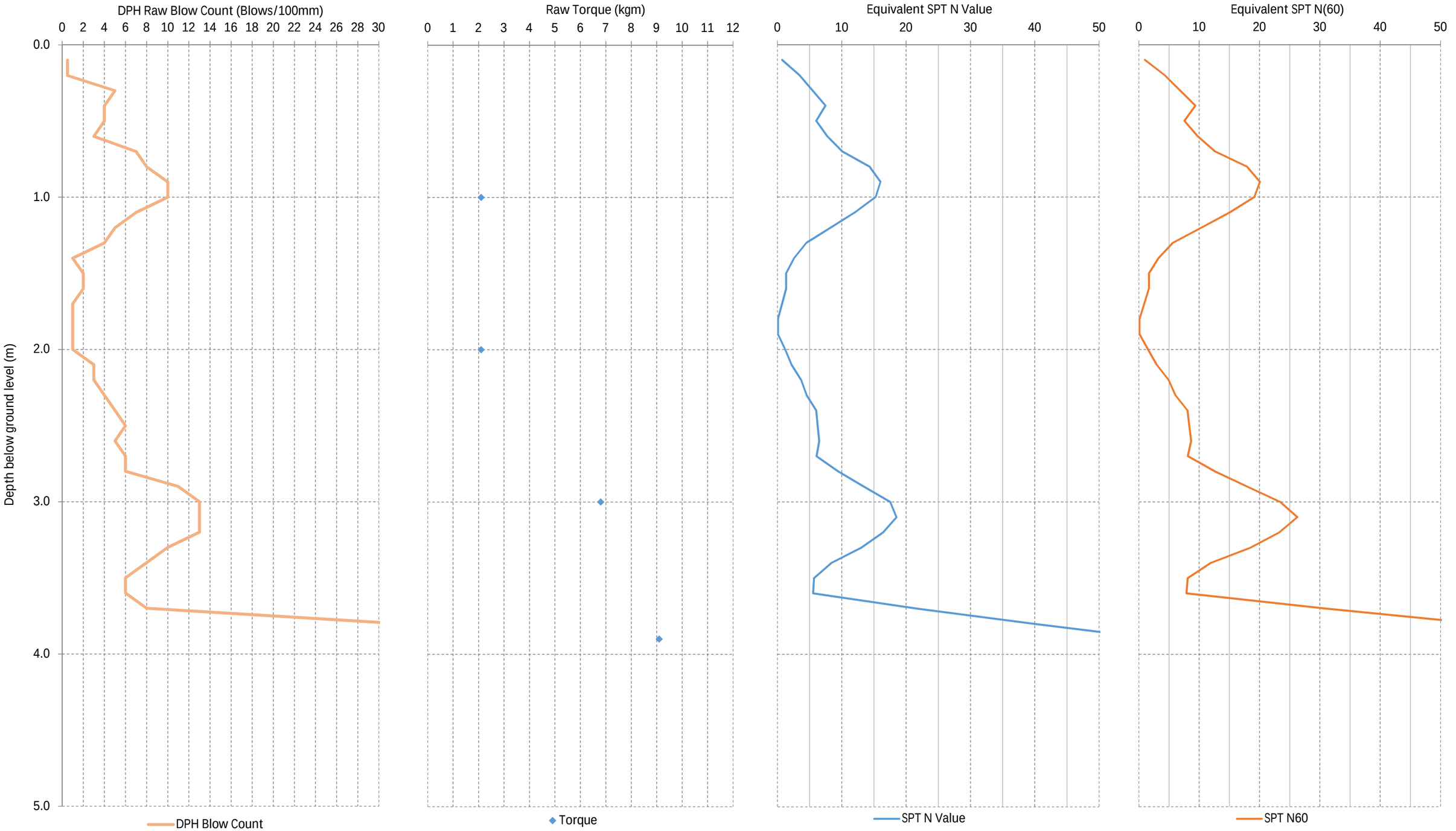

| | | | |
|---|---|---|---|
| GEOSOLVE | PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT: D L Kenton Family Trust |
| | DESCRIPTION | Liquefaction Analysis | TEST NUMBER: DPH1 |
| | LOCATION | Hawea | DATE: 15/07/2019 |
| | | | LOGGED BY: RC |
| | | | ANALYSED BY: MDP |
| | | | CHECKED BY: FAW |

| LSN (SLS) | LSN (ULS) | Crust Thickness (SLS) | Crust Thickness (ULS) |
|---|---|---|---|
| 0.0 | 3.5 | 0.0 | 2.5 |



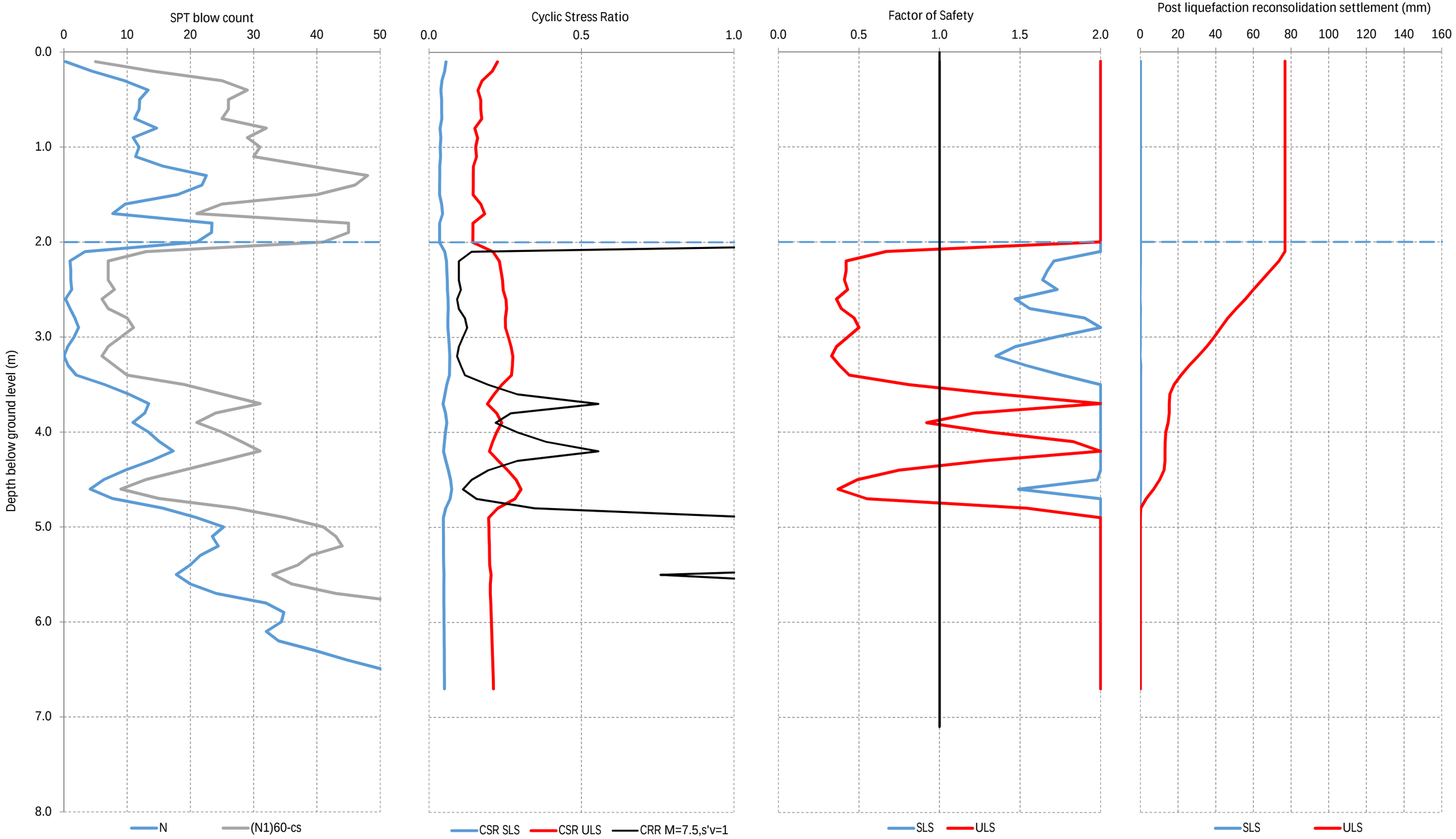

Note: Settlements as per Idriss and Boulanger (2014)

| | | | |
|---|---|---|---|
| PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust |
| DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH2 |
| LOCATION | Hawea | DATE | 15/07/2019 |
| | | LOGGED BY | RC |
| | | ANALYSED BY | MDP |
| | | CHECKED BY | FAW |




| | | | |
|---|---|---|---|
| PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust |
| DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH2 |
| LOCATION | Hawea | DATE | 15/07/2019 |
| | | LOGGED BY | RC |
| | | ANALYSED BY | MDP |
| | | CHECKED BY | FAW |

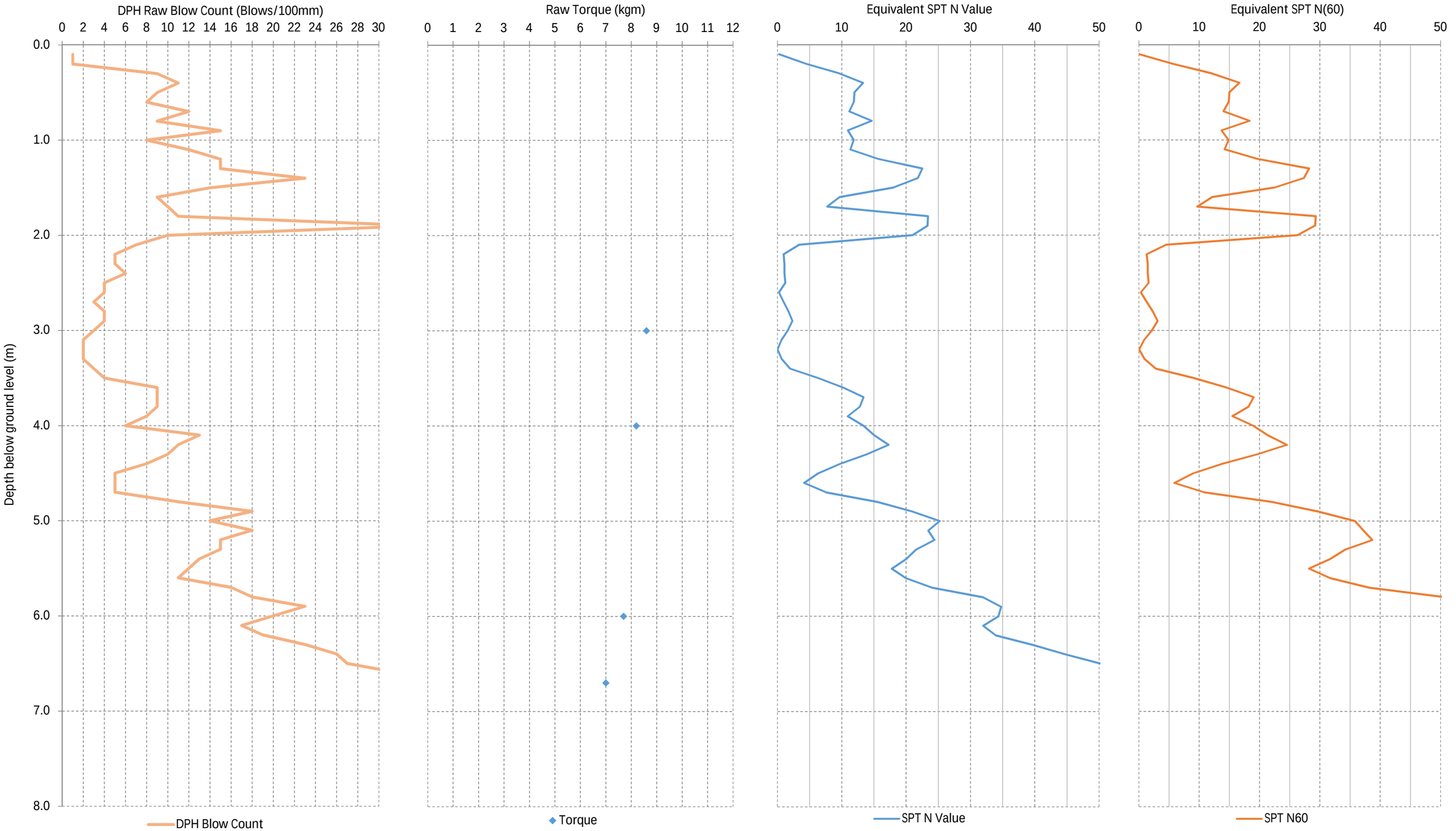
| LSN (SLS) | LSN (ULS) | Crust Thickness (SLS) | Crust Thickness (ULS) |
|---|---|---|---|
| 0.0 | 26.1 | 0.0 | 2.0 |




Note: Settlements as per Idriss and Boulanger (2014)

GEOSOLVE

| | | | |
|---|---|---|---|
| PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT | D L Kenton Family Trust |
| DESCRIPTION | Liquefaction Analysis | TEST NUMBER | DPH3 |
| LOCATION | Hawea | DATE | 15/07/2019 |
| | | LOGGED BY | RC |
| | | ANALYSED BY | MDP |
| | | CHECKED BY | FAW |




| | | | |
|---|---|---|---|
| GEOSOLVE | PROJECT | 190350 - 1147B Albert Town-Lake Hawea Road | CLIENT: D L Kenton Family Trust |
| | DESCRIPTION | Liquefaction Analysis | TEST NUMBER: DPH3 |
| | LOCATION | Hawea | DATE: 15/07/2019 |
| | | | LOGGED BY: RC |
| | | | ANALYSED BY: MDP |
| | | | CHECKED BY: FAW |

# Appendix C - Liquefaction Analysis

## General

Liquefaction occurs when susceptible, saturated soils attempt to move to a denser state under cyclic shearing. In this report, liquefaction is defined as when pore pressures rise to reach the overburden stress. When this occurs, the following effects can happen at flat sites:

- loss of strength;
- ejection of material under pressure to the ground surface; and
- post-liquefaction volumetric densification as the materials reconsolidate.

In addition, sloping sites or sites with a 'free face' may experience lateral spreading or movement.

## Liquefaction Susceptibility

Soils susceptible to liquefaction have the following characteristics:

- Saturated. Below the ground water level;
- Have "sand like" behaviour[5]; and
- Are in loose or medium dense condition.

Soils which are susceptible to liquefaction require a certain level of earthquake shaking (trigger) to cause them to liquefy. Denser soils require more intense and/or longer duration of shaking (higher trigger) than less dense soil.

## Analysis Method

Liquefaction analyses were undertaken on the test data using the Boulanger & Idriss (2014)[7] deterministic method.

## Assessment of Consequences of Liquefaction

The following can be assessed to estimate the consequences of liquefaction at this site:

- Crust thickness.
- Liquefaction severity index.
- Free field settlements.
- Lateral spread.

## Crust Thickness

The non-liquefiable upper layer of soils (crust) provides some protection against ground surface damage as a result of liquefaction. The thicker the crust, the less ground surface damage is expected with significant protection provided by thicknesses of more than 5 m.

Empirical correlations have been developed by Ishihara[6] to quantify the thickness of non-liquefiable crust required to prevent the formation of sand boils resulting from the liquefaction of underlying soil layers. These correlations indicate that for a given thickness

[5] "Geotechnical earthquake engineering practice: Module 1 Guideline for the identification, assessment and mitigation of liquefaction hazards", Rev 0, July 2010. New Zealand Geotechnical Society. This document states that soil with: Fc <30%, or; Fc >30% and PI < 7% (where Fc= percent passing a 0.075mm sieve and PI=plasticity index) is considered as "sand-like" and is susceptible to liquefaction.

[6] Ishihara, K. (1985). "Stability of natural deposits during earthquakes," Theme lecture, Proc. 11th Int. Conf. On Soil Mechanics and Foundation Engineering, San Francisco, 2, 321-376pp.

of liquefiable soil, as the peak ground acceleration increases a greater thickness of non-liquefiable soil is required to prevent liquefaction damage from manifesting on the surface.

## Liquefaction Severity Number

Liquefaction severity number (LSN) is a single value which can be calculated from a liquefaction assessment considering the thickness density and depth of liquefiable layers and the intensity of earthquake shaking. Based on observations of ground surface damage in Christchurch an indicative correlation has been developed between ground surface damage from liquefaction and LSN as described below.

As the LSN increases, so does the risk of severe effects on the land and structure. In general, the following surface effects are considered likely at sites with various LSN values.

**Table 1C - Liquefaction Severity Number**

| LSN | Effects |
|---|---|
| 0 – 10 | Little to no expression of liquefaction, minor effects |
| 10 – 20 | Minor expression of liquefaction, some sand boils |
| 20 – 30 | Moderate expression of liquefaction, with sand boils and some structural damage |
| 30 – 40 | Moderate to severe expression of liquefaction, settlement can cause structural damage |
| 40 – 50 | Major expression of liquefaction, undulations and damage to ground surface, severe total and differential settlement of structures |
| > 50 | Severe damage, extensive evidence of liquefaction at surface, severe total and differential settlements affecting structures, damage to services |

## Free Field Settlements

This describes the settlement of ground not occupied by a building, occurring due to dissipation of excess pore water pressure generated during earthquake shaking. Where appropriate, we have estimated reconsolidation settlement of any potentially liquefiable layers using the methodology recommended by Idriss & Boulanger (2014)[7].

A component of building settlement may also occur due to yield of any liquefied founding soils. This component of settlement is very difficult to predict and depends on the interaction of the building and the soil it is founded on.

**AURORA ENERGY LIMITED**
PO Box 5140, Dunedin 9058
PH 0800 22 00 05
WEB www.auroraenergy.co.nz

21 February 2024

Di Kenton

Sent via email only: di.kenton@xtra.co.nz

Dear Di,

**ELECTRICITY SUPPLY AVAILABILITY FOR A PROPOSED SUBDIVISION.**
**1147B LAKE HAWEA ALBERT TOWN ROAD WANAKA. LOT 2 DP 300393.**

Thank you for your inquiry outlining the above proposed development.

Subject to technical, legal and commercial requirements, Aurora Energy can make a Point of Supply[1] (PoS) available for this development.

**Disclaimer**

This letter confirms that a PoS **can** be made available. This letter **does not** imply that a PoS is available now, or that Aurora Energy will make a PoS available at its cost.

**Next Steps**

To arrange an electricity connection to the Aurora Energy network, a connection application will be required. General and technical requirements for electricity connections are contained in Aurora Energy's Network Connection Standard. Connection application forms and the Network Connection Standard are available from www.auroraenergy.co.nz.

Yours sincerely

**Niel Frear**

CUSTOMER INITIATED WORKS MANAGER

[1] Point of Supply is defined in section 2(3) of the Electricity Act 1993.

## Blair Devlin

**Subject:** FW: ECP 34 snippet

**From:** Craig Skeggs <Craig.Skeggs@auroraenergy.nz>
**Sent:** Wednesday, February 7, 2024 11:34 AM
**To:** 'di.kenton@xtra.co.nz' <di.kenton@xtra.co.nz>
**Subject:** ECP 34 snippet

Hi Di

The lines we were talking about are at 11000V going to makaora

## 3.4 MINIMUM SAFE DISTANCES OF CONDUCTORS FROM BUILDINGS AND OTHER STRUCTURES WITH SPECIFIC ENGINEERING ADVICE

3.4.1 Table 3 sets out the minimum safe distance of distances for conductors from buildings and other structures where a detailed engineering assessment has been carried out.

3.4.2 The minimum safe distances from a conductor of an overhead electric line to any structure, building or line support *(other than a support for the line under consideration or any line crossing the line under consideration)* shall not be less than those specified in Table 3.

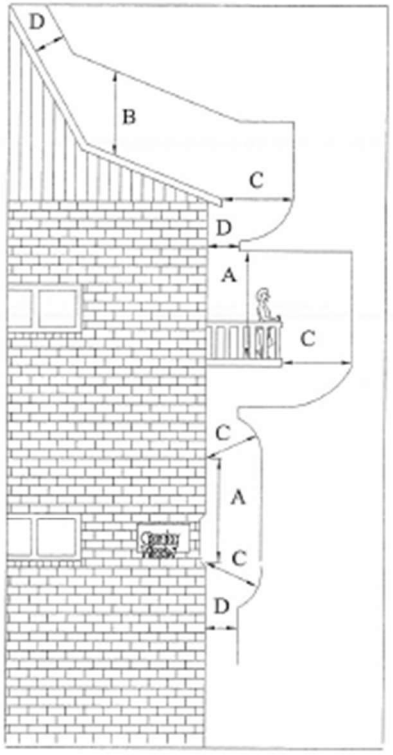
3.4.3 The Table 3 distances do not apply to insulated conductors or cables supported along the façade of a structure or building.

3.4.4 Figures 3 and 4 illustrate the application of the Table 3 to a particular building. The letters A to D refer to the distances A to D as set out in Table 3.

3.4.5 The distances specified in A and B of Table 3 shall also be maintained above an imaginary horizontal line extending outward for the distance specified in C.

3.4.6 For Figure 4, the greater distance of either A, or B (from Table 3) plus the height of the balcony, shall apply, as this latter calculation may result in a distance greater than A.

**FIGURES 3 AND 4 BUILDING ELEVATION AND BALCONY SECTION**



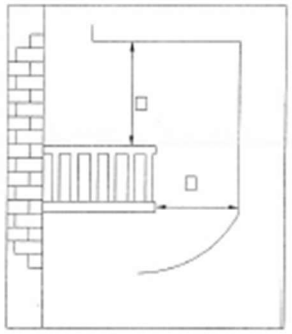



**TABLE 3 MINIMUM SAFE DISTANCES OF CONDUCTORS FROM BUILDINGS AND OTHER STRUCTURES WHERE SPEC CALCULATION OF CONDUCTOR MOVEMENT HAS BEEN CARRIED OUT**

| Safe distance conditions | Not exceeding 1 kV | | | Exceeding 1 kV | | Exceeding 1 kV but not exceeding 33 kV | Exceeding 33 kV but not exceeding 110 kV | Exceeding 110 kV but not exceeding 220 kV | Exceed k a.c. |
|---|---|---|---|---|---|---|---|---|---|
| | Insulated m | Bare neutral m | Bare active m | Insulated with earthed screen m | Insulated without earthed screen m | Bare or covered m | Bare m | Bare m | B |
| **A** Vertically above those parts of any structure normally accessible to persons | 2.7 | 2.7 | 3.7 | 2.7 | 3.7 | 4.5 | 5 | 6.5 | |
| **B** Vertically above those parts of any structure not normally accessible to persons but on which a person can stand | 0.1 | 2.7 | 2.7 | 0.1 | 2.7 | 3.7 | 4.5 | 6 | ( |
| **C** In any direction (other than vertically above) from those parts of any structure normally accessible to persons, or from any part not normally accessible to persons but on which a person can stand | 0.1 | 0.9 | 1.5 | 0.1 | LV 1.5 | HV 2.1 | 3 | 4.5 | |
| **D** In any direction from those parts of any structure not normally accessible to persons | 0.1* | 0.3* | 0.6* | 0.1 | 0.6 | 1.5 | 2.5 | 3.5 | |
| **E** In any direction from the ground | Refer to Table 4 | | | | | | | | |

* This distance can be further reduced to allow for termination at the point of attachment

**CRAIG SKEGGS**
NETWORK ACCESS PLANNER

**EMAIL** craig.skeggs@auroraenergy.nz
**DDI** +64 (27) 429 7547 **MOB** +64 (27) 429 7547
**PH** 0800 22 00 05 **WEB** www.auroraenergy.co.nz
Aurora Energy, 10 Halsey Street, Dunedin 9016
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## Chorus New Zealand Limited


28 February 2024

Chorus reference: 10753598

**Attention:** Diane Kenton

**Quote: New Property Development**

**1 connections at 1147B Lake Hawea-Albert Town Road, Albert Town, Queenstown-Lakes District, 9382**

**Your project reference: N/A**

Thank you for your enquiry about having Chorus network provided for the above development.

Chorus is pleased to advise that, as at the date of this letter, we are able to provide reticulation for this property development based upon the information that has been provided:

| | |
|---|---|
| Fibre network | $40,524.54 |
| Pre-built fibre | $0.00 |

The total contribution we would require from you is **$46,603.22 (including GST)**. This fee is a contribution towards the overall cost that Chorus incurs to link your development to our network. This quote is valid for 90 days from 28 February 2024. This quote is conditional on you accepting a New Property Development Contract with us for the above development.

If you choose to have Chorus provide reticulation for your property development, please log back into your account and finalise your details. If there are any changes to the information you have supplied, please amend them online and a new quote will be generated. This quote is based on information given by you and any errors or omissions are your responsibility. We reserve the right to withdraw this quote and requote should we become aware of additional information that would impact the scope of this letter.

Once you would like to proceed with this quote and have confirmed all your details, we will provide you with the full New Property Development Contract, and upon confirmation you have accepted the terms and paid the required contribution, we will start on the design and then build.

For more information on what's involved in getting your development connected, visit our website www.chorus.co.nz/develop-with-chorus

Kind Regards

Chorus New Property Development Team

**AURORA ENERGY LIMITED**
PO Box 5140, Dunedin 9058
PH 0800 22 00 05
WEB www.auroraenergy.co.nz

21 February 2024

Di Kenton

Sent via email only: di.kenton@xtra.co.nz

Dear Di,

**ELECTRICITY SUPPLY AVAILABILITY FOR A PROPOSED SUBDIVISION.**
**1147B LAKE HAWEA ALBERT TOWN ROAD WANAKA. LOT 2 DP 300393.**

Thank you for your inquiry outlining the above proposed development.

Subject to technical, legal and commercial requirements, Aurora Energy can make a Point of Supply[1] (PoS) available for this development.

**Disclaimer**

This letter confirms that a PoS **can** be made available. This letter **does not** imply that a PoS is available now, or that Aurora Energy will make a PoS available at its cost.

**Next Steps**

To arrange an electricity connection to the Aurora Energy network, a connection application will be required. General and technical requirements for electricity connections are contained in Aurora Energy's Network Connection Standard. Connection application forms and the Network Connection Standard are available from www.auroraenergy.co.nz.

Yours sincerely

NAFrear.

**Niel Frear**
CUSTOMER INITIATED WORKS MANAGER

[1] Point of Supply is defined in section 2(3) of the Electricity Act 1993.

## Blair Devlin

**Subject:** FW: ECP 34 snippet

**From:** Craig Skeggs <Craig.Skeggs@auroraenergy.nz>
**Sent:** Wednesday, February 7, 2024 11:34 AM
**To:** 'di.kenton@xtra.co.nz' <di.kenton@xtra.co.nz>
**Subject:** ECP 34 snippet

Hi Di

The lines we were talking about are at 11000V going to makaora

## 3.4 MINIMUM SAFE DISTANCES OF CONDUCTORS FROM BUILDINGS AND OTHER STRUCTURES WITH SPECIFIC ENGINEERING ADVICE

3.4.1 Table 3 sets out the minimum safe distance of distances for conductors from buildings and other structures where a detailed engineering assessment has been carried out.

3.4.2 The minimum safe distances from a conductor of an overhead electric line to any structure, building or line support *(other than a support for the line under consideration or any line crossing the line under consideration)* shall not be less than those specified in Table 3.

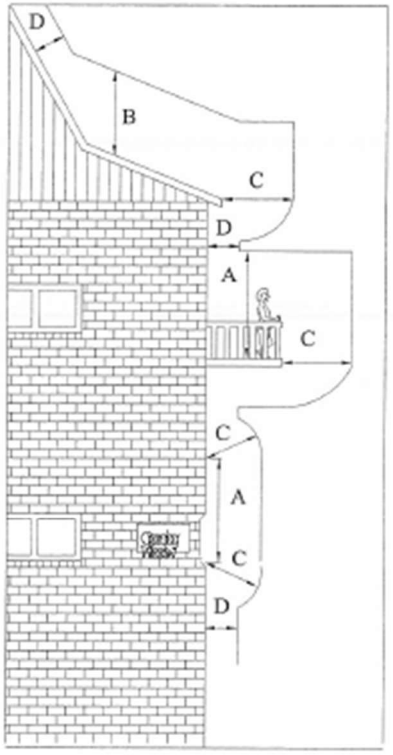
3.4.3 The Table 3 distances do not apply to insulated conductors or cables supported along the façade of a structure or building.

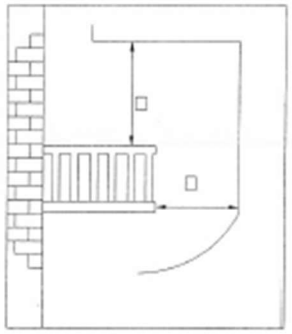
3.4.4 Figures 3 and 4 illustrate the application of the Table 3 to a particular building. The letters A to D refer to the distances A to D as set out in Table 3.

3.4.5 The distances specified in A and B of Table 3 shall also be maintained above an imaginary horizontal line extending outward for the distance specified in C.

3.4.6 For Figure 4, the greater distance of either A, or B (from Table 3) plus the height of the balcony, shall apply, as this latter calculation may result in a distance greater than A.

**FIGURES 3 AND 4 BUILDING ELEVATION AND BALCONY SECTION**



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| **C** In any direction (other than vertically above) from those parts of any structure normally accessible to persons, or from any part not normally accessible to persons but on which a person can stand | 0.1 | 0.9 | 1.5 | 0.1 | LV 1.5 | HV 2.1 | 3 | 4.5 | |
| **D** In any direction from those parts of any structure not normally accessible to persons | 0.1* | 0.3* | 0.6* | 0.1 | 0.6 | 1.5 | 2.5 | 3.5 | |
| **E** In any direction from the ground | Refer to Table 4 | | | | | | | | |

* This distance can be further reduced to allow for termination at the point of attachment

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# 1147B Lake Hawea-Albert Town Road

## Preliminary Site (HAIL) Assessment Report
## The D. L. Keaton Family Trust

## Contact Details

*Name: Elizabeth Hannon*

Tarbert Buildings, 69 Tarbert Street
PO Box 273, Alexandra 9340
New Zealand

Telephone: +64 3 440 2400
Mobile: +64 27 571 3939

*Document Details:*

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*Prepared By*

Elizabeth Hannon
Graduate Engineer - Environmental

*Reviewed By*

Lisa Bond
Principal Consultant - Environmental
SQEP

*Approved for Release By*

Rob Bond
Work Group Manager - Geotechnical and Environmental

# Contents



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# 1 Site Description

The site is located at 1147B Lake Hawea- Albert Town Road, approximately 12km northeast of Wanaka town centre as shown on Figure 1 below. The site details are provided in Table 1, with the Quickmap site boundaries shown in Figure 2.

*Table 1: Site Identification*

| | | |
|---|---|---|
| Site Address | 1147B Lake Hawea- Albert Town Road, Wanaka | |
| Territorial Authority | Queenstown Lakes District Council | |
| Legal Description | Lot 2 Deposited Plan 300393 | |
| Title | 2432 | |
| Valuation No. | 29082-03707 | |
| Owner | Diane Lesley Kenton<br>Martin Horan | |
| Approximate total site area | 10.3013ha | 103,013m$^2$ |
| NES Permitted Activity threshold volumes:<br>1) disturbance, and<br>2) yearly off-site movement of soil based on the approximate site area | 1) 5,150m$^3$<br>2) 1,030m$^3$ | |
| Geology | The GNS geology map (extract shown in figure 3) indicates the majority of the site to be underlain by undifferentiated Rakaia terrane Permian-Triassic TZIIB Semischist deposits comprising well foliated psammitic & subordinate pelitic Semischist with rare metaconglomerate.<br><br>The southern corner of the site is underlain by Holocene fan deposits commonly comprising loose, commonly angular, boulders gravel, sand and silt forming alluvial fans.<br><br>The eastern section of the site is underlain by Late Pleistocene river deposits commonly comprising unweathered to slightly weathered, well sorted sandy gravel forming large outwash terraces in River Clutha catchment basin.<br><br>The closest fault, the NW Cardrona Fault (#8968), is ~750m south east. The fault has a low slip rate and a recurrence interval of >5,000 to <= 10,000 years. No other information is known about the fault. | |
| Hydrogeology | The site is located directly to the west of the Hawea Basin Aquifer. Its elevation above the river deposits indicates that groundwater on the terrace above the road is unlikely to be in direct continuity with the lower alluvial fan and outwash terraces. The majority of groundwater within the aquifer will be fed from Lake Hawea to the north. | |

| | |
|---|---|
| Nearest Surface Water Body | There is a pond that collects water for irrigation directly north of the north-eastern corner of the site, and a small stream runs east towards the Hawea River along the southern boundary of the site.<br>The Hawea River is located approximately 320m east of the site leading from Lake Hawea 1.2km north east of the site. |
| No. of known Boreholes and wells within 500m | There is one borehole consent nearby relating to investigative drilling associated with the state highway. However, it should be noted that within 650m east of the site, on the opposite bank of the Hawea River; there are two groundwater take permits for household use. |
| Topography | The site is stepped with a small terrace in its centre; there are slopes facing southeast. above and below this terrace. The southeast section of the site, adjacent to the State Highway 6 road reserve, is flat and generally level with SH6. The slope below the central terrace lies approximately at a 40˚ angle and is about 100m high. The slope above the terrace is lies approximately at a 35˚ angle and is 50m high. |
| Recognised Hail Status | Otago regional Council was contacted regarding the HAIL status of the site. ORC stated that:<br>*"The above land does not currently appear on the database;*<br>*If your enquiry relates to a rural property, please note that many current and past activities undertaken on farms may not be listed on the database, as they can be more difficult to identify. Activities such as use, storage, formulation, and disposal of pesticides, offal pits, landfills, animal dips, and fuel tanks have the potential to contaminated land.*<br>*Similarly, the long-term use of lead-based paints on buildings can, in some cases, cases cause soil contamination. The use of lead-based paint is generally not recorded on the database."* |
| Proposed Site Use | It is understood that there is a proposal to construct chalets on the site for commercial purposes. |
| Details of Resource Consents | • 2002: Construct an accessory tractor shed/workshop at Lake Hawea-Albert Town Road, Wanaka<br>• 2009: Construct a dwelling and undertake associated earthworks at 1147 Lake Hawea-Albert Town Road, Wanaka<br>• 2013: Vary plans approved under RM090002, Variation of existing consent notice & a shed at 1147 Lake Hawea-Albert Town Road, Wanaka |
| Details of Building Consents | • 2012: Erect New Dwelling<br>• 2014: New Garage - Domestic |


*Figure 1: Site Location Plan*

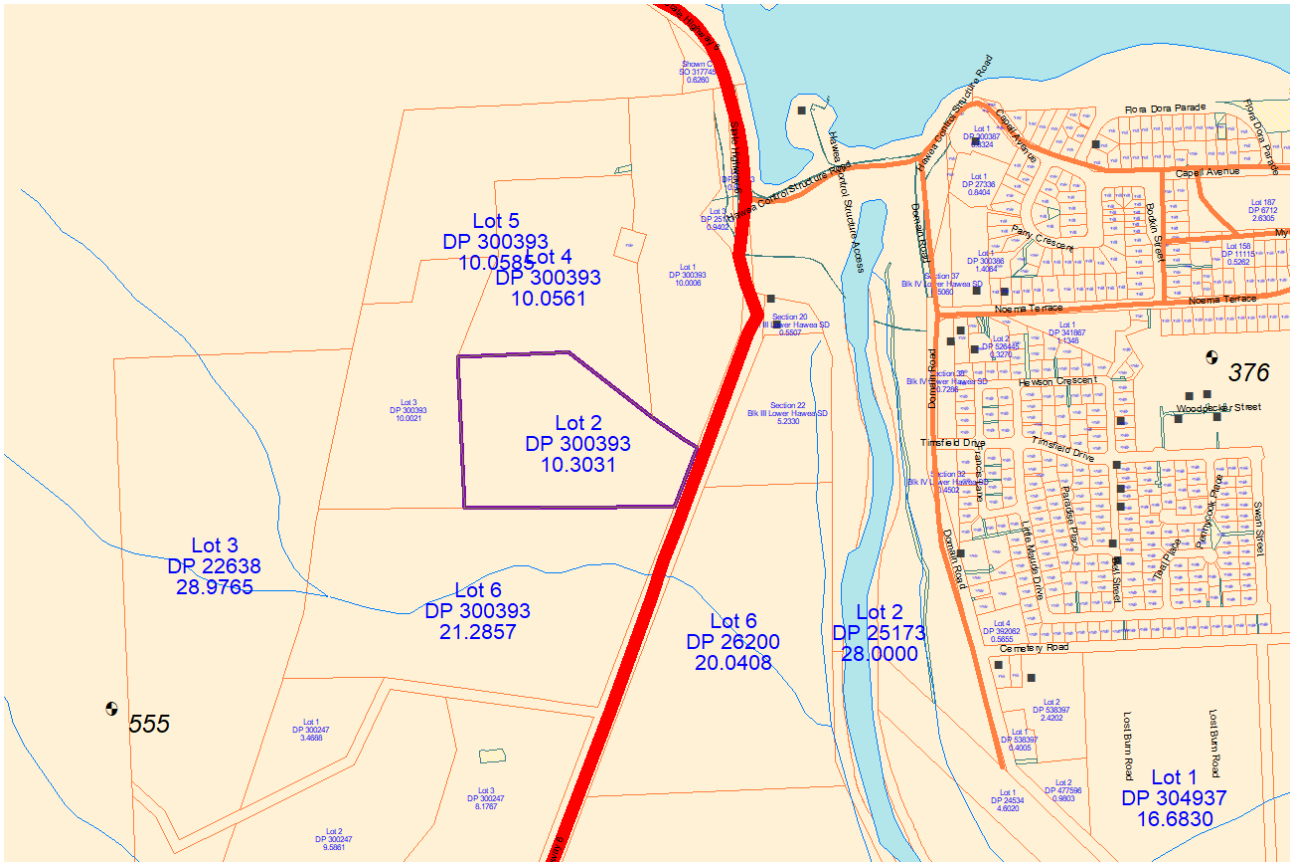



*Figure 2: Quickmap plan of site and surrounds*

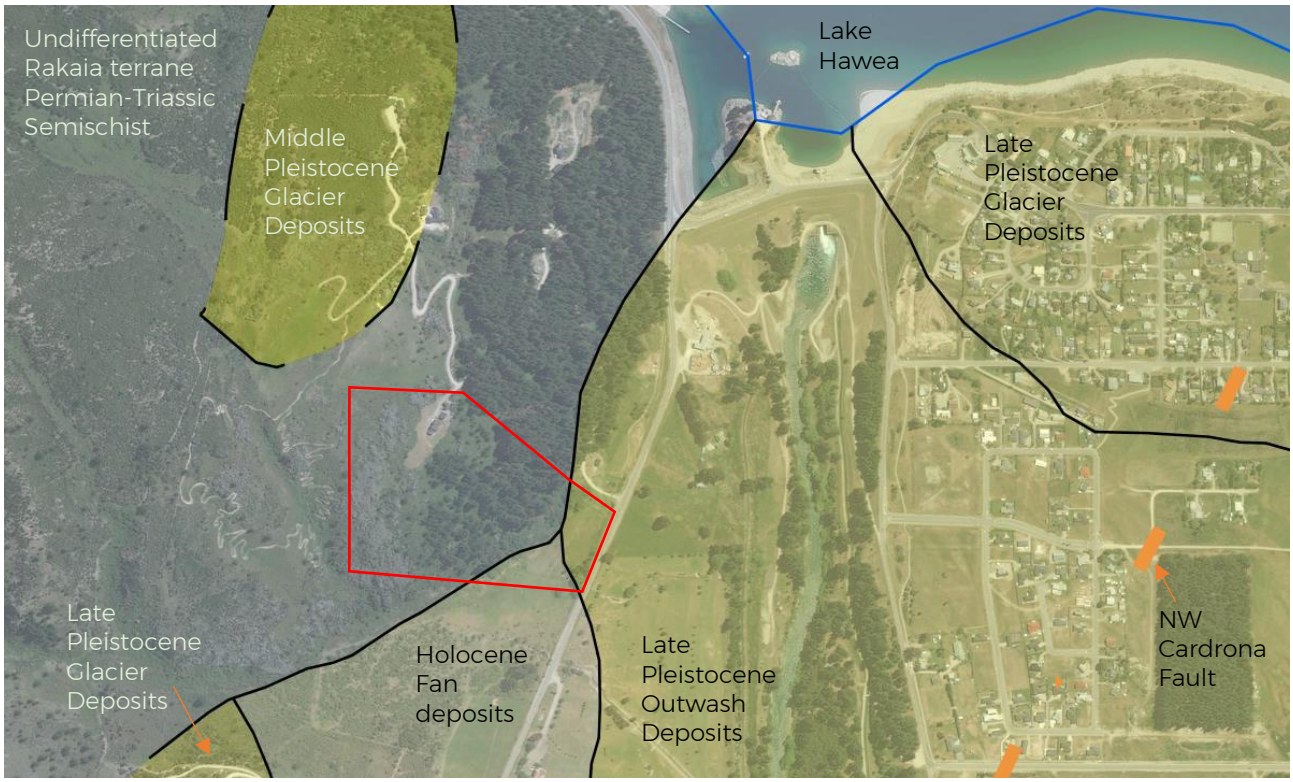



*Figure 3: GNS geology web map extract (approximate site location is outlined in red)*

# 2 Site History

Details of the site history have been gained from a review of sources including historical aerial photographs from Google Earth and Retrolens, historical topographical maps from Maps Past, a review of Opus's Quickmap ArcGIS database and a search of council records. Further information is presented in Appendix A.

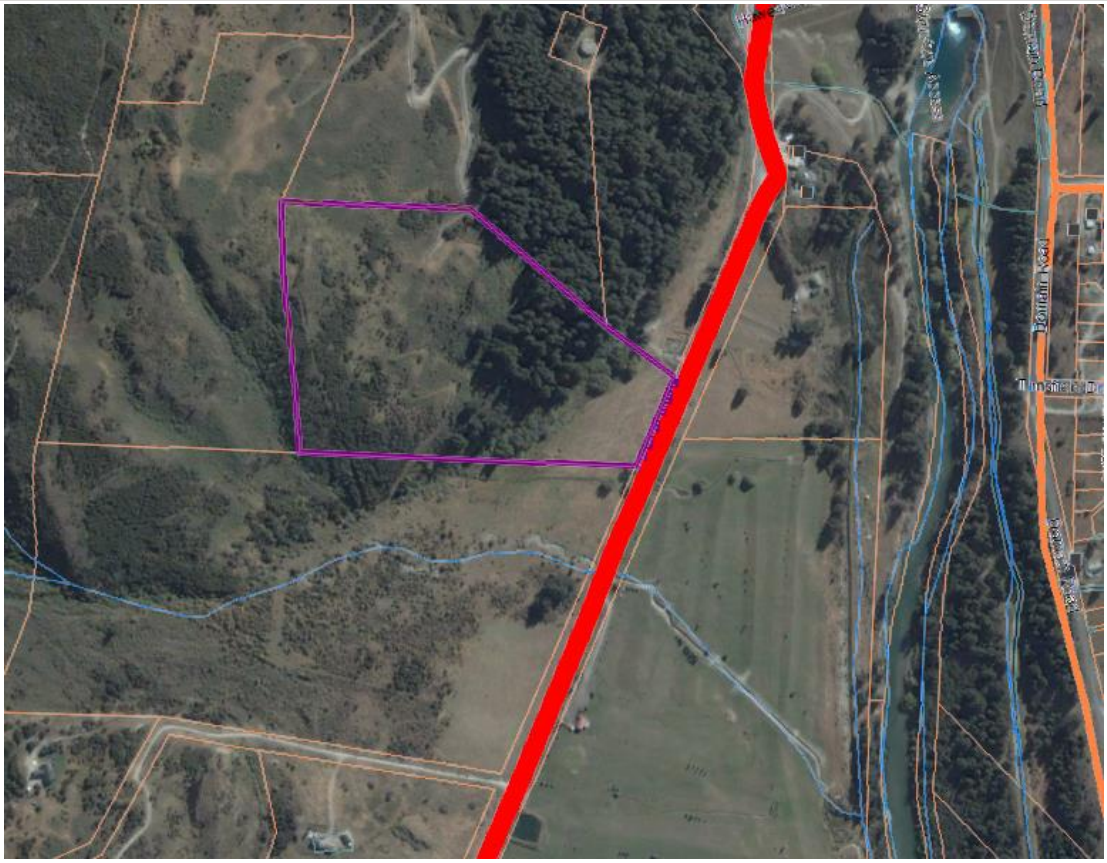
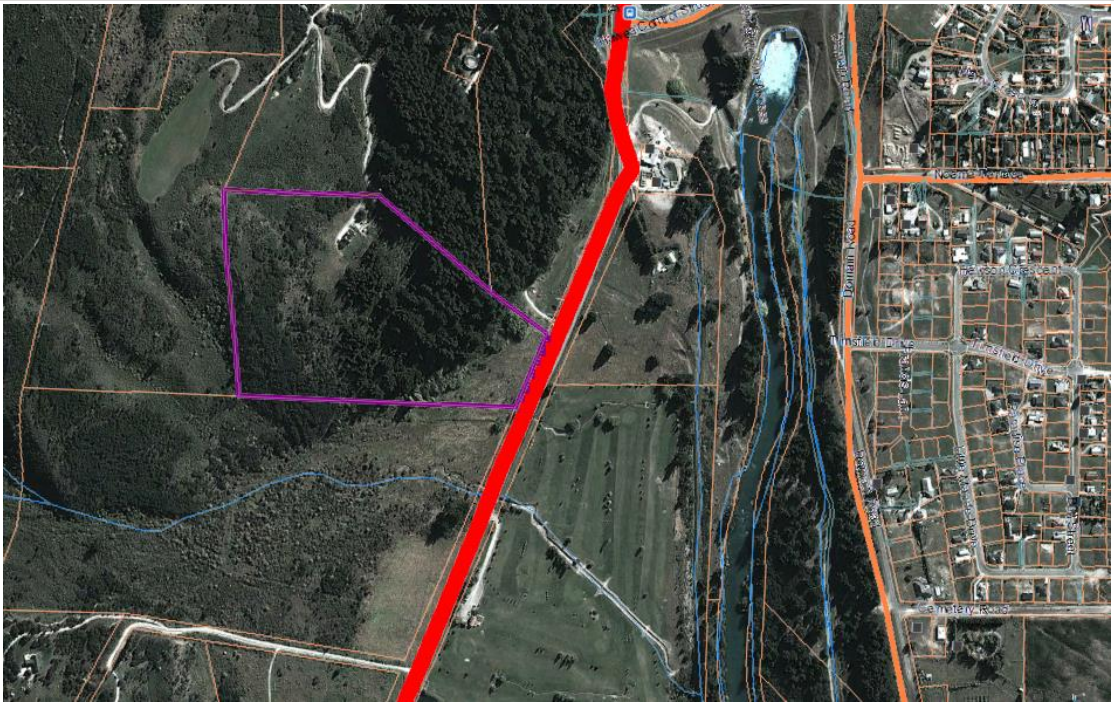
The conditions on the site over the timeframe searched are summarised in Table 2.

*Table 2: Site History, (approximate site location is outlined in red)*

| Photograph Year and Source | Observations |
|---|---|
| 1955<br>Retrolens |  <br>The site does not appear to be developed at this time, it appears to be rough pasture with some trees noticeable close to SH6; the western part of the site is steeply sloped with no apparent terrace at this time. A stream runs east towards the Hawea River along the southern site boundary. State highway 6 is easily identifiable as is Hawea Township on the eastern bank of the Hawea River. |

| Photograph Year and Source | Observations |
|---|---|
| **1964**<br>Retrolens |  <br>There are no apparent changes to the site apart from the removal of some of the trees noted previously. Surrounding area also appears to be mostly unchanged. |
| **1974**<br>Retrolens |  <br>There are more trees noted in the lower elevation of the site, a switchback track has been cut into the slope in the western part of the site. Hawea township is growing as more residential dwellings are developed, in the northern area. |

| Photograph Year and Source | Observations |
|---|---|
| **1983**<br>Retrolens |  <br>Trees from north of the site are starting to encroach on the central slope. North of the site is now more heavily densely by trees. |
| **1984**<br>Maps Past |  <br>There is a new track that enters the site from the north. However directly north of the site a new track has been cut into the hillside, and Hawea township continues to develop. |

| Photograph Year and Source | Observations |
|---|---|
| **2005**<br>Google Earth |  <br>No apparent changes have occurred on the site |
| **2011**<br>Google Earth |  <br>A residential dwelling has been constructed in the northern section of the site. |

| Photograph Year and Source | Observations |
|---|---|
| **2016**<br>Google Earth |  <br>No changes appear to have occurred on the site at this time. |

## 2.1 Discussion

A review of the historical aerial photographs for the site indicate that prior to a residential dwelling being constructed in 2009 the site more likely than not comprised open or wooded grazing land with no structures present on the site.

Correspondence with Diane Keaton of the D. L. Keaton Family Trust indicates that there have been 'no orchards or vineyards on the site. There were some fruit trees planted, but there has been no spray in them whatsoever.'

# 3 Walkover Survey

A site walkover/drive-over was undertaken as part of the Preliminary Site Assessment Report on 8th October 2018 by a SQEP. Photographs are included with Appendix B.

*Table 3: Walkover Summary*

| | |
|---|---|
| Site Access | State Highway 6 |
| Current Site Use | A residential dwelling is located in the northern section of the site, the remainder is used for grazing. |
| Existing Structures | A residential building and associated structures are located in the northern part of the site. A shed is noted directly north of the north-eastern corner of the site<br>Power poles run adjacent to SH6 across the eastern section of the site. |
| Existing Vegetation | Unimproved (grazed) grass paddocks |
| Odours | None |
| Adjoining Sites Uses | North of the site is residential, to the east lies road reserve, south and west of the site there is rough grass or scrubland |
| Surface Water Bodies | A number of springs were noted running out of the lower slope towards the south of the site; in addition, there are small ponds and small streams evident in the south west of the site. |
| Site Observations | The site area proposed for development is the area located next to the road reserve on the eastern (lower level) part of the site. The north west of this area has recently been cleared of bramble, bracken and some trees. The remainder of this area is grassed paddock with no structures present apart from power poles that run adjacent to the road. |

# 4 Conceptual Site Model

In order to develop an understanding of the subject site a conceptual site model (CSM) has been formed using the available geological and hydrogeological information, site observations, historical information, anecdotal evidence and topography.

The five basic activities associated with developing the CSM are:

- Identification of potential contaminants;
- Identification and characterisation of the source(es) of contamination;
- Delineation of potential migration pathways through environmental media, such as groundwater, surface water, soils sediment, biota, air, service lines;
- Identification and characterisation of potential receptors (human, ecological or building infrastructure);
- Determination of the limits of the study area or system boundaries.

Data gaps and uncertainties are identified during the preparation of the CSM, which assists in designing any detailed investigations that may follow, should it be necessary.

In terms of environmental risk, for there to be an effect on receptors there must be a contamination source and a mechanism (pathway) for the contamination to affect human health or the environment (receptor).

Using the provided information for the site, a conceptual site model has been developed as shown in Table 4.

A possible pollutant linkage between the contaminant source and receptor is defined as one that has the potential to represent unacceptable risks to human health or the environment. Where a possible pollutant linkage has been identified, investigation and risk assessment will establish whether a significant pollutant linkage exists.

*Table 4: Conceptual Site Model*

| | |
|---|---|
| Likely sources of impact | A review of all data sources and anecdotal evidence indicates that the site has been subject to pastoral activities, with no evidence that storage or application of chemicals has occurred on the site. |
| Potentially impacted media | Impacts are likely to be limited to shallow soils (the upper several metres), although there is the potential for some more mobile contaminants to migrate to groundwater, if groundwater is shallow. |
| Contaminants of concern | The identified potential contaminants of concern comprise:<br>• Heavy metals<br>• Multi-residue pesticides |
| Migration pathways | Potential migration pathways for the contaminants of concern comprise:<br>• airborne migration of dust, vapour or fibres<br>• surface runoff containing impacted soil or dissolved contaminants<br>• infiltration of contaminants in soil<br>• groundwater transport through soil, including in preferential pathways (service trenches, through higher permeability soils) |
| Potential exposure pathways | Potential exposure pathways comprise:<br>• inhalation of dust, vapours or fibres<br>• ingestion or dermal contact with impacted soil, including surface soils including during excavation work<br>• ingestion or dermal contact with impacted surface water or extracted groundwater. |
| Potential sensitive receptors | Identified sensitive receptors comprise:<br>• workers and visitors at the site during the proposed site works<br>• workers, visitors and animals following redevelopment of the site<br>• workers during future soil disturbance<br>• future residents |

# 5 Conclusion

The conceptual site model and initial qualitative human health risk assessment presented herein is based upon information gained from a site inspection, anecdotal evidence, information gained from ORC, QLDC and other sources.

The site identified within this investigation has been assessed to determine the applicability of the NES with respect to the proposed development. The site history, anecdotal evidence, historical aerial photography and site inspections have identified that no HAIL activities have taken place on the site.

Based on the findings of this Preliminary Site (HAIL) Assessment report including the proposed land use, the site condition and site history, it is considered **highly unlikely** that there will be a risk to human health if the proposed development is undertaken on this site.

## 5.1 NES Implications

This Preliminary Site (HAIL) Assessment identifies that **No HAIL activities** have been undertaken on the site. As such, **the NES regulations do not apply to this site**.

## 5.2 Safety in Design

Safety in Design (SID) considers the safety of those who are involved in the construction of, maintenance of, cleaning of, repair of and demolition of a structure, or anything that has been constructed.

As part of the assessment of this site we have taken reasonably practicable steps to assess the potential for hazards associated with potentially contaminated land to exist. We have, through the development of a conceptual site model assessed the qualitative level of risk posed to human health and have made various recommendations to address the plausible risks.

## 5.3 Recommendations

Based on the results of this investigation, WSP Opus recommends that:

- The site is suitable for future development of chalets within a rural residential end use;
- Should any ground conditions be encountered across the site which are not anticipated from the findings of this report a Suitably Qualified and Experienced Practitioner (SQEP) should be consulted to reassess the risks to human health;
- This Preliminary Site Assessment report is submitted to the consenting authority; and
- This Preliminary Site Assessment report is submitted to the regional authority in to facilitate updating the HAIL database.

# 6 Applicability and Limitations

This report has been produced on behalf of The D. L. Keaton Family Trust and no responsibility is accepted to any third party for all or any part. This report should not be relied upon or transferred to any other parties without the express written authorisation of WSP Opus. If any unauthorised third party comes into possession of this report, they rely on it at their own risk and the authors owe them no duty of care or skill. This report should only be reproduced in full.

This investigation concentrates on contamination levels in the soil throughout the proposed subdivision site. However, any earthworks should be undertaken with due care and should ground conditions other than those anticipated be encountered work should cease and an SQEP consulted to further assess the risks to human health.

This report has been prepared for a specific purpose, as agreed between WSP Opus and the Client. A tailored scope of works has been used to achieve the objectives, and the report should therefore not be used for different objectives.

This report has been prepared by WSP Opus with all reasonable skill and care within the terms of the Contract with the Client and taking account of the information made available by the Client, as well as the staff and resources devoted to it by agreement with the Client. The findings and opinions conveyed via this report are based on information obtained from a variety of sources, as detailed, which WSP Opus believes are reliable. Nevertheless, WSP Opus cannot and does not guarantee the authenticity or reliability of any information supplied by other parties.

The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry best practice. Due to the inherent variation in spatial and temporal patterns of contamination, the interpretation of site conditions at the specific locations investigated is not a complete description of all material at the site. Should further data be obtained that differs from that presented in this report, then conclusions and recommendations may no longer be valid.

The report is valid at the date of release. The condition of the site may change with time so that the results and interpretation are no longer valid. In addition, guidelines and legislation may change, making assessment of results and recommendations invalid.

# *Appendix A: ORC Contaminated Land Enquiry*

Otago Regional Council

8 October 2019

Dear Elizabeth Hannon,

Thank you for your enquiry regarding information that the Otago Regional Council may hold regarding potential soil contamination at the properties indicated below:

| Address | Valuation Number / Legal Description |
|---|---|
| 1147B Lake Hawea-Albert Town Road, Albert Town | 29082/03707 Lot 2 DP 300393 |

The Otago Regional Council maintains a database of properties where information is held regarding current or past land-uses that have the potential to contaminated land. Land-uses that have the potential to contaminate land are outlined in the Ministry for the Environment's Hazardous Activities and Industries List (HAIL).

Where investigation has been completed, results have been compared to relevant soil guideline values. The database is continually under development, and should not be regarded as a complete record of all properties in Otago. The absence of available information does not necessarily mean that the property is uncontaminated; rather no information exists on the database. You may also wish to examine the property file at the relevant City or District Council to check if there is any evidence that activities occurring on the HAIL have taken place.

I can confirm that:

The above land does not currently appear on the database.

If your enquiry relates to a rural property, please note that many current and past activities undertaken on farms may not be listed on the database, as they can be more difficult to identify. Activities such as use, storage, formulation, and disposal of pesticides, offal pits, landfills, animal dips, and fuel tanks have the potential to contaminated land.

Similarly, the long-term use of lead-based paints on buildings can, in some cases, cases cause soil contamination. The use of lead-based paint is generally not recorded on the database.

Please feel free to contact me if you have any other enquires, or you would like to discuss the matter further,

Regards,

Jessie Callaghan
Environmental Officer

The enclosed/attached information is derived from the Otago Regional contaminated land register and is being disclosed to you pursuant to the Local Government Official Information and Meetings Act 1987. This information reflects the Otago Regional Council's current understanding of this site, which is based solely on the information obtained by the Council and held on record. It is disclosed only as a copy of those records and is not intended to provide a full, complete or entirely accurate assessment of the site. Accordingly, the Otago Regional Council is not in a position to warrant that the information is complete or without error and accepts no liability for any inaccuracy in, or omission from, this information. Any person receiving and using this information is bound by the provisions of the Privacy Act 1993.

| HAIL Status | |
|---|---|
| Verified HAIL | Information has been provided confirming, more likely than not, that an activity or industry described in the HAIL is being or has been undertaken on the site. |
| Unverified HAIL | Information has been provided that suggests an activity or industry described in the HAIL is or has been undertaken on the site; however, this information has not been verified. |
| Verified non-HAIL – more likely than not | It has been established, more likely than not, that an activity or industry described in the HAIL has not been undertaken on the site at the time of listing. |

| Contamination Status | |
|---|---|
| Contaminated for <Context> | The site has been investigated and results demonstrate that there are hazardous substances in or on the land at the site that have, or are reasonably likely to have significant adverse effects on the environment. <Context> refers to the current or proposed site use and/or on/off-site ecological receptors. |
| Managed for <Context> | The site has been investigated and results demonstrate that there are hazardous substances present at the site that have the potential to pose risks to human health or the environment. However, those risks are considered managed for <context> because<br>- The nature of the use of the site prevents human and/or ecological exposure to the hazard; and/or<br>- The land has been altered in some way and/or restrictions have been placed on the way it used to prevent human and/or ecological exposure to the hazard. |
| Acceptable for <Context> | The site has been investigated and results demonstrate that there are hazardous substances present at the site, but assessment indicates that any adverse effects or risks to human health are considered to be so low as to be acceptable for <context>. |
| At or Below Background Concentrations | The site has been investigated or remediated. The investigation or post-remediation validation results confirm that there are no hazardous substances above local background concentrations. Local background concentrations are those that occur naturally in the area. The investigation or validation sampling has been sufficiently detailed to characterize the site. |
| Partially investigated | The site has been partially investigated. Investigations have been conducted that –<br>- Demonstrate there are hazardous substances present; however, there is insufficient information to quantify any adverse effects or risks to human health or the environment; or,<br>- Do not adequately verify the presence or absence of contamination associated with all HAIL activities that have been undertaken on the site. |
| Not Investigated | The soils at the site have not been subject to investigation. Contamination may have occurred but should not be assumed to have occurred. |
| New Information | New information has been received. This information is currently being assessed prior to assigning a site status. |

# *Appendix B: Site Photographs*

*Plate 1: View south across proposed development area.*

*Plate 2: view north from the north-eastern corner of the site, the shed and some fruit trees are visible.*

*Plate 3: area that has been cleared of brush and trees*

Plate 4: Detailed vied of cleared area, standing water and a drainage channel are viable.

Plate 5: Debris piles waiting to be turned inti mulch, small yellow diesel tank visible in front of these, no evidence of leaks was noted.

Plate 6: stagnant water identified in areas

Plate 7: Portable diesel tank, appeared to be clean and in good repair.

WSP | OPUS

www.wsp-opus.co.nz

# WATER TREATMENT PROPOSAL

PROJECT:

**DI KENTON - ALBERT TOWN ROAD**

PROJECT NUMBER: 120863

PREPARED BY: MICHAELA LEE

DATE: 07/03/2024

Puretec®
PERFECTING WATER

With over 30 years in the water filtration industry, Puretec remains a family-owned and run company with an unrivalled reputation for quality, innovation and reliability.

Puretec manufactures innovative solutions to achieve the best possible outcome for your water filtration needs. Puretec's dedication to manufacturing a wide range of leadingedge products with a seamless backup has ensured the water filtration products are of impeccable quality and are true to the tagline 'perfecting water'.

**CUSTOMER SERVICE**
The Puretec team is passionate about perfecting water. Call us with questions, as we are here to help. Solutions are never far away.

**AFTER SALES SUPPORT**
Our dedicated Customer Care Team are specialists in the industry providing help and support. We strive to go the extra mile to support our customers queries, warranties and recommendations.

**ESTABLISHED MANUFACTURER**
We've been designing and manufacturing water filtration products since 1989 - for both domestic and commercial applications. Every year, we invest in ongoing research and development.

PURETEC AUSTRALIA ABN: **44 164 806 688**
PURETEC NZ LP REG NUMBER: **50081773**

## EXECUTIVE SUMMARY

Based on the analysis supplied (Sample No. 3219419), Hardness is the main concern with the water. Being an unsecured water source, harmful bacteria can be present and a clear result today is no guarantee of tomorrow's safety.

Treatment of the hardness will involve sediment filtration and ion exchange (softener); for a typical household, the retail price for the Puretec components is approximately $4,500. A Puretec UV disinfection system to protect a single household from harmful bacteria on a private water supply ranges from $2,500-8,000.

Comments on the characteristics of concern are as follows:

Hardness causes white scale deposits, most commonly seen in warm water areas such as kettles and shower outlets. Scale on water heating elements causes increased energy use and reduced life of appliances such as hot water cylinders and dishwashers. Can cause dry and irritated skin.

Bacteria contamination can't always be detected through sight, smell or taste. Because bacteria can change very quickly, even a clear result only indicates safety at the time of sampling. For drinking water, Puretec will always recommend a filtration and disinfection system for your safety.

Typical Layout:

Bore --> tank --> Bag filter --> S0L40-E3 --> Hybrid

As with all our recommendations, we back the performance of this water treatment solution. Thanks for choosing Puretec and the support of your local dealer.

**Disclaimer:** Due to the nature of water chemistry, the many varied issues that occur & the potential health-impacting substances that are sometimes present in water supplies, Puretec recommends that you engage your own independent periodic testing & regular maintenance regime to protect yourself & others from any potential harm.

## WATER ANALYSIS RESULTS

| Analyte | Sample No. 2992796 | Analyte | Sample No. 2992796 |
|---|---|---|---|
| **E. Coli** (MPN / 100ml) | <1 | **Chloride** (mg/L) | 1.3 |
| **Coliforms** (MPN / 100ml) | - | **Sulphate** (mg/L) | 6.9 |
| **pH** (pH Units) | 8 | **Total Alkalinity** (mg/L as $CaCO_3$) | 135 |
| **Turbidity** (NTU) | 2.5 | **Nitrate-N** (mg/L) | Not Detected |
| **TDS** (mg/L) | 190 | **Lead** (mg/L) | 0.00056 |
| **Total Hardness** (mg/L as $CaCO_3$) | 132 | **Arsenic** (mg/L) | 0.004 |
| **Total Iron** (mg/L) | 0.11 | **Copper** (mg/L) | Not Detected |
| **Dissolved Iron** (mg/L) | - | **Zinc** (mg/L) | 0.021 |
| **Total Manganese** (mg/L) | 0.083 | **Silica** (mg/L) | - |
| **Sodium** (mg/L) | 6.1 | **Fluoride** (mg/L) | - |
| **Other Notes** | - | | |

## ASSUMPTIONS

| | | | |
|---|---|---|---|
| **Daily Volume** | 1000 L/day | **Flow Rate From Storage** | 40 L/min |
| **Flow Rate From Source** | - | **Bore/Well Depth** | unknown |
| **Application** | Household | | |
| **Other** | - | | |
| **Client to review & confirm accuracy of above detail.** | | | |

**STAGE 1**

| | PRODUCT CODE | DETAILS |
|---|---|---|
|  | **MPB202B** | MaxiPlus Bag filter housing assembly, fitted with MPBR filter bags to remove large sediment.<br>**Quantity -** 1 |
|  | **MPBR052** | **WHY:** Suits MPB202B<br>Bag Filter, 20inch 5um, Maxi Plus<br>**Quantity -** 1 |
|  | **SOL40-E3** | Removes hardness to prevent scale. Under certain conditions, iron and manganese may also be removed. Uses salt to automatically regenerate and has replaceable resin media with a typical life of 8-10 years. Backwashes based on water usage.<br>**Quantity -** 1 |
|  | **WTV5000** | Adjustable bypass valve for servicing.<br>**Quantity -** 1 |

**Note:** Any pricing (if included) is recommended retail only, valid for 30 days from date of proposal. Talk to your local dealer for firm price. All Puretec supply items are listed above. Other components ( e.g. Pump, tank, labour, consumables) may also be required.

**STAGE 2**

| | PRODUCT CODE | DETAILS |
|---|---|---|
|  | **HYBRID-G8** | To provide protection against sediment - in two stages down to 1um - and harmful bacteria.<br><br>**Quantity -** 1 |

**Note:** Any pricing (if included) is recommended retail only, valid for 30 days from date of proposal. Talk to your local dealer for firm price. All Puretec supply items are listed above. Other components ( e.g. Pump, tank, labour, consumables) may also be required.

**PROGRAMMING NOTES:**

SOL40-E3 - program SOL softener to '9 Grains' which will ensure it regenerates at least every 28 days, or on reaching its capacity, approximately every 11,000L.

**INSTALLATION / COMMISSIONING REQUIREMENTS (BY OTHERS):**

The pump feeding the treatment system will need to be on a pressure system in order to facilitate backwash on demand.

**TYPICAL MAINTENANCE REQUIREMENTS:**

MPB202B - Replace bag filter as required by pressure loss, or at least every 12 months.

SOL40-E3 - Addition of coarse grain pool salt/water softener salt, as required. Salt is best purchased locally and is not supplied with the unit. Where iron/manganese is being removed, SS5000 should be added at a rate of 1/2 a cup per bag of salt, to the brine tank.

HYBRID-G8 - Cartridge life is dependant on inlet water quality and water usage. Replace filters as required by pressure loss, or at least every 12 months. UV lamp life is 12 months. These components can be purchased separately, or as part of the Hybrid Maintenance Kit.

**Note:** Please refer system user guides for full maintenance requirements.

# MPB SERIES

## GENERAL INFO

## MAXIPLUS™ BAG FILTER HOUSING

The Puretec MaxiPlus™ bag filter housing assembly is commonly used in high sediment, chemical and process applications where longer service life is required.

Durable and lightweight polypropylene construction is used giving a compact assembly.

The Puretec MPB Series is capable of flow rates of up to 180 litres per minute, 38°C temperature, and a maximum pressure of 620* kPa.

Available in 1½" connection size. The Bag filters come to suit in 1, 5, 10, 25, 50 ,100 and 200 micron grades. Duplex systems, manifolded together are recommended for higher and/or uninterrupted flows. Custom design manifolds can be designed and supplied.

## FEATURES & BENEFITS

- High capacity housings for flow rates up to 180 litres per minute
- Suitable for high flow applications
- Robust design for longevity and reliability
- Tough polypropylene construction
- Compact and economical, ideal for duplex systems
- Connection size 1½"

## STANDARD INCLUSIONS

- 1x High Quality PP filter housing with drain port and ball valve
- 1x Polypropylene filter basket
- 1x pressure gauge
- 1x mounting bracket
- 1x spanner wrench

## MATERIALS OF CONSTRUCTION

| | |
|---|---|
| Housing | Polypropylene |
| Cap | Polypropylene |
| Gauge | Bismuth Brass (lead free) |
| Vent Plug | Polypropylene |
| Drain Plug | High Density Polypropylene |
| Ball Valve | PVC/Buna-N Seals |
| Basket | Polypropylene |
| O-Ring and Gaskets | Buna-N |
| Maximum Temperature | 38°C |

## APPLICATIONS

- Desalination Prefiltration
- Waste water treatment
- Reverse Osmosis prefiltration
- Electronics chemical process
- Fine chemical process

*Before use, please refer to published reference materials for chemical.*

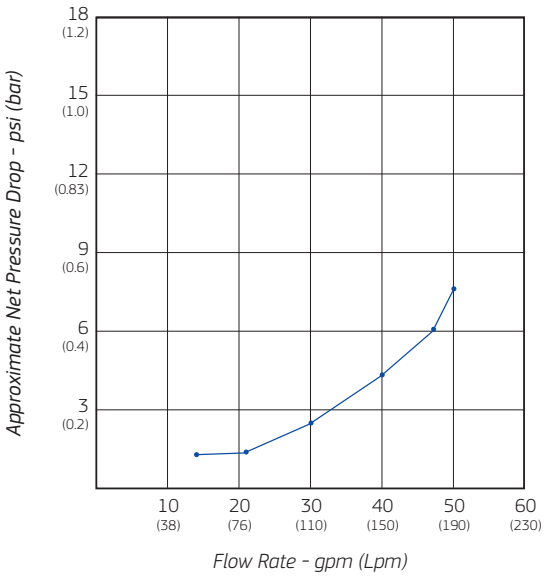
## HOUSING SPECIFICATIONS AND PERFORMANCE DATA

| Ordering Code: | MPB2020B |
|---|---|
| Material: | Polypropylene |
| Filter Elements: | MPBR Series<br>Polypropylene media |
| Flow: | 0 - 180 Lpm |
| Connection: | 1½" |
| Operating Pressure Min/Max: | 0 - 620* kPa |
| Operating Temperature Min/Max: | 0 - 38 °C (protect from freezing) |
| Gauge Size: | ¼" NPTF |
| O-ring: | B-Buna |
| Warranty: | 3 years^ |

^3 year warranty is 1 year parts and labour, plus 2 years parts only. *Where line pressure exceeds 500 kPa, an approved pressure limiting device must be installed to comply with Australian & New Zealand Plumbing Standards. (Ref. AS/NZS 3500.1:2021, Clause 3.3.4).

| Bag Filter Replacements | Size (inches) | Description | Flow Rate (Lpm) |
|---|---|---|---|
| **MPBR012** | 20" | 1 micron rating | 135 |
| **MPBR052** | 20" | 5 micron rating | 140 |
| **MPBR102** | 20" | 10 micron rating | 145 |
| **MPBR252** | 20" | 25 micron rating | 158 |
| **MPBR502** | 20" | 50 micron rating | 165 |
| **MPBR1002** | 20" | 100 micron rating | 170 |
| **MPBR2002** | 20" | 200 micron rating | 180 |

## PRESSURE / FLOW RATE CHART

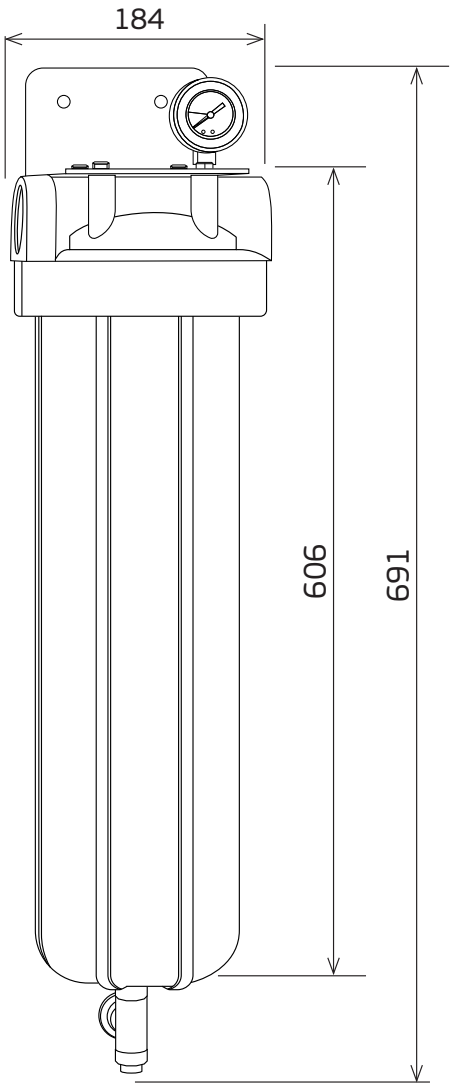



## SPARE PARTS

| Ordering Code | Description |
|---|---|
| **MPBOR** | O-ring, suits MPB202 housing |

MPBOR

**PRODUCT DIMENSIONS** Measurements in Millimeters (mm)

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2. This document and all its contents are copyright protected. All rights are reserved, particularly alteration, translation and reproduction using electronic systems.
3. ^Warranties in this document cover parts for the period stated and include cover for parts and labour for the first year where applicable, subject to approval. Our Water Filtration Specialists can provide you with advice to suit your needs.

Puretec
PERFECTING WATER

# SOL SERIES

## GENERAL INFO

**SOFTROL™ WATER SOFTENING APPLIANCE**

Provides softened, purified water throughout your facility.

A WaterMark approved water softener to reduce scaling and spotting in your home. Insist on a certified system.

Hard water is water that contains dissolved minerals such as limestone, iron, sulphur, magnesium and calcium. If these minerals are not removed from your water, they will cause scaling, eventually blocking plumbing and shortening the life of appliances - particularly hot water units, dishwashers, washing machines, etc.

## FEATURES & BENEFITS

- A WaterMark approved water softener to reduce scaling and spotting in your water system.
- Glassware is now clear and shiny with no scale, smear or spots.
- Protects against premature replacement of hot water systems and many other appliances and fixtures.
- Enjoy washing your car with a scale-free finish.
- It's easier to wash soap and shampoo out completely so your shower screen is easier to clean.
- Now ice cubes look clearer and more appealing.
- Can also remove traces of metals such as copper, iron and manganese.
- Sleek, modern design to complement your facility.
- Class-leading efficiency due to premium resins and optimised flow dynamics.

SOL30-E3
Volumetric E3-matic, 30 Lpm, 25mm connection

SOL40-E3
Volumetric E3-matic, 40 Lpm, 25mm connection

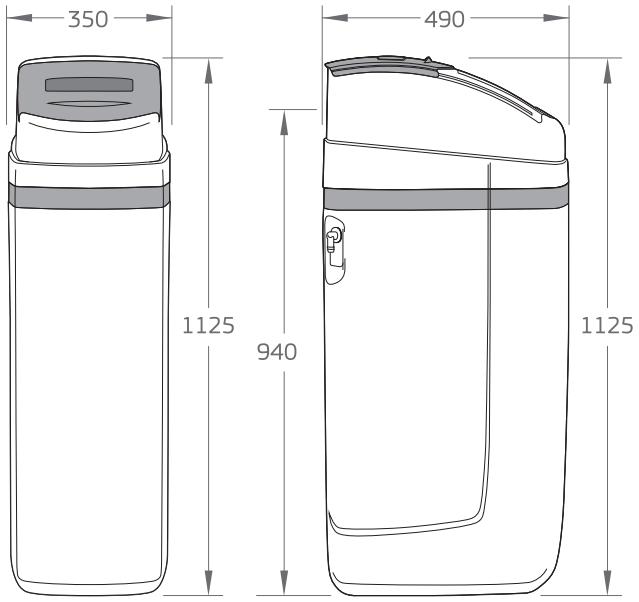
SOL30-E1
Automatic E1-matic, 30 Lpm, 25mm connection

SOL40-E1
Automatic E1-matic, 40 Lpm, 25mm connection

| Ordering Code: | SOL30-E3 | SOL40-E3 | SOL30-E1 | SOL40-E1 |
|---|---|---|---|---|
| Valve: | Volumetric E3-matic | Volumetric E3-matic | Automatic E1-matic | Automatic E1-matic |
| Service Flow Rate: | 30 Lpm | 40 Lpm | 30 Lpm | 40 Lpm |
| Maximum Flow Rate: | 70 Lpm | 100 Lpm | 70 Lpm | 100 Lpm |
| *Capacity: | 12,000 litres | 18,000 litres | 12,000 litres | 18,000 litres |
| Inlet / Outlet / Drain Connections: | 1" Male BSPT, 1/2" Drain | 1" Male BSPT, 1/2" Drain | 1" Male BSPT, 1/2" Drain | 1" Male BSPT, 1/2" Drain |
| Min/Max Operating Pressure: | 138 - 862 kPa | 138 - 862 kPa | 138 - 862 kPa | 138 - 862 kPa |
| Operating Temperature: | 4 - 45°C | 4 - 45°C | 4 - 45°C | 4 - 45°C |
| Power Supply: | 230V AC / 50 Hz | 230V AC / 50 Hz | 230V AC / 50 Hz | 230V AC / 50 Hz |
| Warranty: | 6 years^ | 6 years^ | 6 years^ | 6 years^ |
| Replacement Media Kits: | RMK-SOL30 | RMK-SOL40 | RMK-SOL30 | RMK-SOL40 |
| Optional Accessories and media: | WTV5090 - Micro switch for automation of external equipment.<br>WTV5000 - Bypass assembly for testing, and maintenance.<br>PTE30 - Hardness test kit | | WTV5050 - Blending valve for partial hardness removal.<br>SS5000 - SoftenerSafe Media, 5 litres | |

*Note: Chlorine (free chlorine) tolerance is 1ppm - high chlorine levels permanently damage the softening resin & is not covered under warranty. If chlorine exceeds this limit, we recommend a carbon pre-filter such as the WH2 or CFS Series. Please refer to Puretec for a specific recommendation. In any case, a carbon pre-filter is recommended to protect against chlorine spikes & prolong the resin life.*

## PRODUCT DIMENSIONS Measurements in Millimeters (mm)




SOL30 & SOL40 SERIES

## ADDITIONAL INFORMATION

Capacities are based on a hardness of 100ppm. The flow rate while the filter backwashes, needs to be equal to the stated service flow to maintain proper backwash functionality, which is critical for optimum performance of filtration systems.

Backwashing is an essential preventative maintenance procedure for these systems in order for filter media to be regenerated, and to ensure the system is functioning correctly. Any spent backwash water is discharged, without treatment, down the drain. For any further information or system-specific volumes, please contact Puretec.

WaterMark
WMTS103:2016
Licence No. WM 74593
Pro-Switch

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2. This document and all its contents are copyright protected. All rights are reserved, particularly alteration, translation and reproduction using electronic systems.
3. ^Warranties in this document cover parts and labour for the first year, plus 5 years parts only. Subject to approval.

Our Water Treatment Specialists can provide you with advice to suit your needs.

Puretec
PERFECTING WATER

# WTV5000

## GENERAL INFO

BYPASS ASSEMBLY

The Puretec WTV5000 bypass valve is typically used to isolate the control valve from the plumbing system's water pressure in order to perform control valve repairs or maintenance. The WTV5000 bypass valve is particularly unique in the water treatment industry due to its versatility and state of the art design features.

The 1" full flow bypass valve incorporates four positions, including a diagnostic position that allows service personnel to work on a pressurized system while still providing untreated bypass water to the facility or residence. Its completely non-metallic, all-plastic design allows for easy access and serviceability without the need for tools.

All seals are self-lubricating to help prevent valve seizing after long periods of non-use. Internal O-rings can easily be replaced if service is required.

## FEATURES & BENEFITS

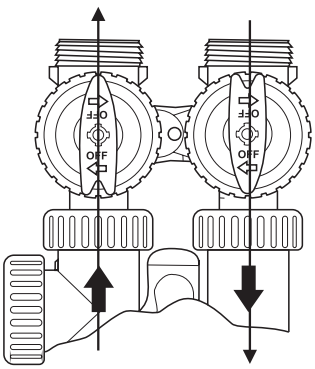
- Fits any Puretec 1" control valve, in/out head.
- Easy and ready to install.
- 4 positions, including uninterupted diagnostic position.
- Partial bypass can be configured to provide a level of blending.
- Self-lubricating seals to prevent seizing.
- Easy service with no tools required.
- Ideal for carbon filtration, sediment removal, iron removal, pH neutralising and water softener systems.

| Ordering Code: | WTV5000 |
|---|---|
| Connection: | 1" |
| Min/Max Operating Pressure: | 140 - 860 kPa |
| Operating Temperature: | 4 - 43°C (40 - 110°F) |
| Dimensions: | 115mm (h) x 145mm (w) x 115mm (d) |

## POSITIONS

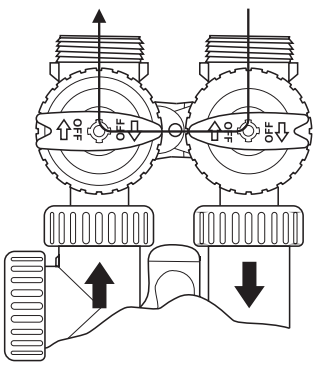
**Normal Operation**

'TREATED' WATER EXITS | SUPPLY WATER ENTERS



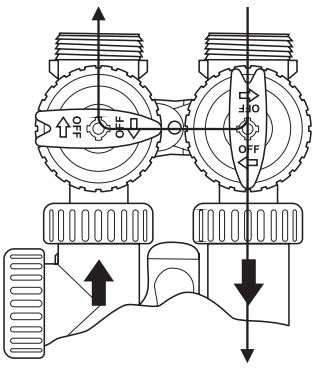

**Bypass Operation**

SUPPLY WATER EXITS | SUPPLY WATER ENTERS



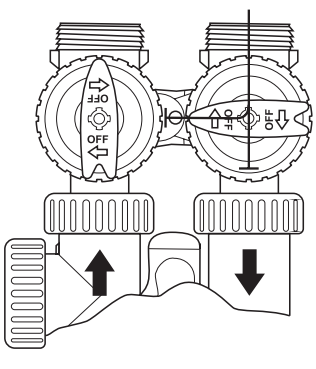

**Diagnostic Mode**

SUPPLY WATER EXITS | SUPPLY WATER ENTERS




**Shut Off Mode**

NO WATER EXITS | SUPPLY WATER IS SHUT OFF FROM THE HOUSE & THE VALVE



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# HYBRID-G SERIES

## GENERAL INFO

FILTRATION AND ULTRAVIOLET ALL-IN-ONE UNIT WITH WEATHER COVER

Provides safe and bacteria-free water for your whole house.

Suited to small to large households, these systems are designed for both mains and rainwater supply. This unit features a weather protection cover that is suitable for outdoor installation and an anti-tamper & childproof lockable lid.

## FEATURES & BENEFITS

- Quick and easy plug-and-play installation.
- Reduces sediment, chemicals including chlorine, bad taste and odour. (Hybrid G6 & G7 Models).
- Reduces sediment, silt, sludge, dirt, rust, coarse & fine particles. (Hybrid G8 & G9 Models).
- Kills 99.99% of E. coli, Giardia and Cryptosporidium cysts with Radfire™ ultraviolet technology, a natural purification process that's completely eco-friendly and chemical free.
- Turns your tank and mains water into pure, safe, delicious drinking water.
- Filtration and ultraviolet all-in-one unit.
- High strength aluminium bracket for durability.
- Designed for harsh climate.
- Equipped with a lamp count-down timer and alarm.
- Anti-tamper & childproof lockable lid.
- Anti-corrosion construction.
- Hinged lid for easy access for lamp change.


HYBRID-G6 (AU MODEL)

10", 1 connection, max. flow: 75 Lpm


HYBRID-G7 (AU MODEL)

20", 1 connection, max. flow: 130 Lpm


HYBRID-G8 (NZ MODEL)

10", 1 connection, max. flow: 75 Lpm


HYBRID-G9 (NZ MODEL)

20", 1 connection, max. flow: 130 Lpm

| Ordering Code: | **HYBRID-G6** (AU MODEL) | **HYBRID-G7** (AU MODEL) | **HYBRID-G8** (NZ MODEL) | **HYBRID-G9** (NZ MODEL) |
|---|---|---|---|---|
| Replacement parts and cartridges: | | | | |
| Stage 1 filtration: | PL05MP1 | PL05MP2 | PL20MP1 | PL20MP2 |
| Stage 2 filtration: | DP10MP1 | DP10MP2 | PX01MP1 | PX01MP2 |
| UV lamp, 46 W: | RL6 | RL6 | RL6 | RL6 |
| Quartz sleeve: | RQS6 | RQS6 | RQS6 | RQS6 |
| Flow rate @40mJ/cm2: | 54 Lpm | 54 Lpm | 54 Lpm | 54 Lpm |
| Flow rate @30mJ/cm2: | 70 Lpm | 70 Lpm | 70 Lpm | 70 Lpm |
| Flow rate @16mJ/cm2: | 130 Lpm | 130 Lpm | 130 Lpm | 130 Lpm |
| Connection: | 1" BSP [25mm] | 1" BSP [25mm] | 1" BSP [25mm] | 1" BSP [25mm] |
| Supply pressure: | 300 - 875* kPa | | | |
| Water temperature range: | 0 - 52°C (protect from freezing) | | | |
| Warranty: | 3 years^ | | | |

Important Note: Use only genuine Puretec replacement cartridges. Flow rate @30mJ/cm² is the industry standard for drinking water. Puretec Hybrid UV systems are designed for common rainwater. The effectiveness of a UV system is dependent on the clarity of water present. If you are unsure of the clarity of your water Puretec can arrange a UVT test to verify that no further filtration is required before the UV. Contact Puretec on 1300 140 140 (AU) or 0800 130 140 (NZ) for further information on this. * Where line pressure exceeds 500 kPa, an approved pressure limiting device must be installed to comply with Australian & New Zealand Plumbing Standards. (Ref. AS/NZS 3500.1:2021, Clause 3.3.4).

Puretec
PERFECTING WATER

# HYBRID-G SERIES

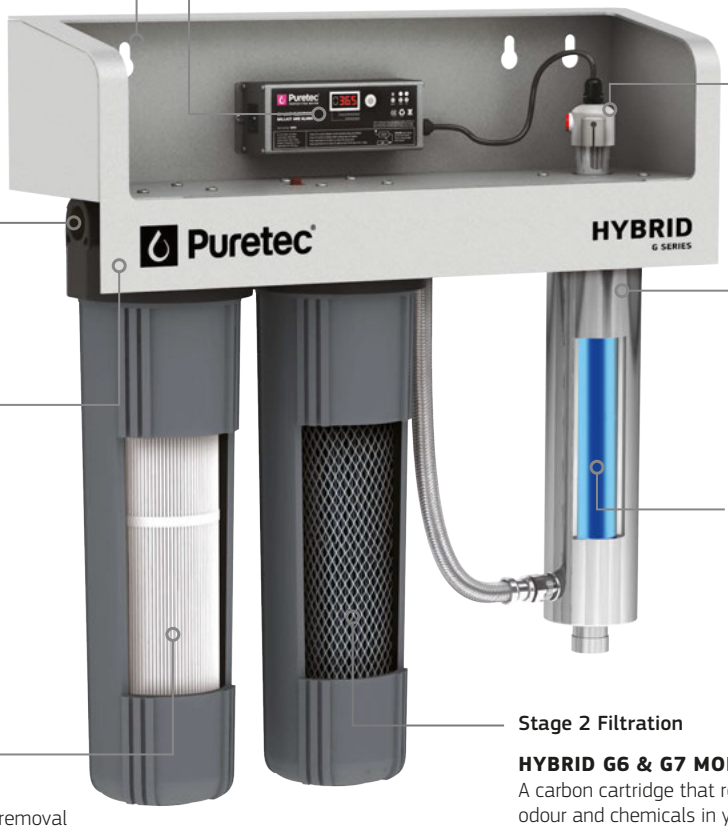
## DIAGRAM & FILTRATION TECHNOLOGY

4 mounting points for quick and easy installation.

Neatly Concealed Control Panel

Monitors the lamp life, failure alarm (audible & visible) and total running days of the Radfire™ UV unit.

Maintenance is simple and can be completed in minutes - without tools. It's as easy as replacing the UV lamp once a year and periodically cleaning the sleeve.




Retainer cap enables effortless lamp replacement. No tools are required.

Quick and easy plug-and-play installation.

Radfire's unique water chamber optimises hydraulic performance and increases disinfection efficiency. Chamber and hardware are stainless steel for dependable long life.

Designed for harsh climate, it incorporates a weather cover for outdoor installations. The lightweight bracket is made from coated aluminium to ensure no rusting.

Ultraviolet Protection

Kills 99.9% of bacteria with Radfire™ ultraviolet technology, a natural purification process that's completely eco-friendly and chemical-free.

**Stage 1 Filtration**

**HYBRID G6 & G7 MODELS**
A washable 5 micron sediment removal filter to remove silt, sludge, dirt and rust.

**HYBRID G8 & G9 MODELS**
A washable 20 micron sediment filter to remove silt, sludge, dirt, rust and other coarse particles.

**Stage 2 Filtration**

**HYBRID G6 & G7 MODELS**
A carbon cartridge that reduces bad taste, odour and chemicals in your water.

**HYBRID G8 & G9 MODELS**
A solid 1 micron filter to remove fine particles.

PURETEC RADFIRE

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**Weather Protection & Anti-Corrosion Construction**

The Hybrid G Series incorporates a weather cover for outdoor installations. The durable lightweight mounting bracket is made from coated aluminium to ensure no rusting.


**Dual Stage Filtration with UV Protection**

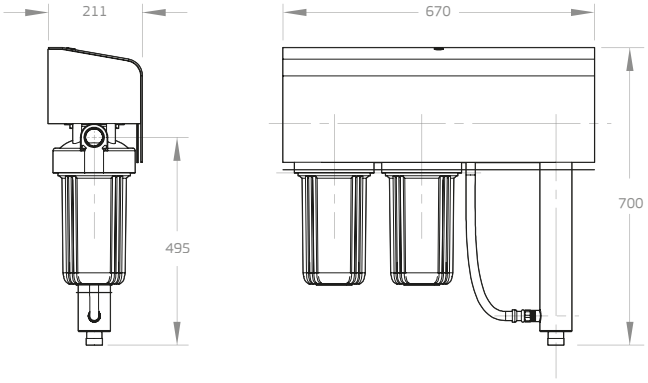
Highly effective and efficient at removing dirt, rust, sediment, bad taste and odour in your water, providing good general purpose filtration.

## OPTIONAL EXTRAS

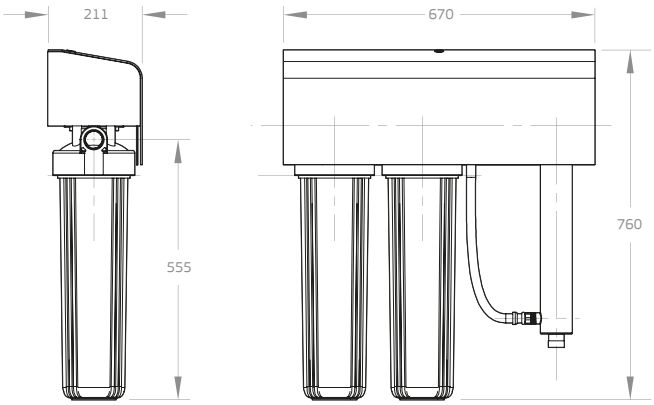
| Ordering Code: | Description | Suits |
|---|---|---|
| *PC-HYBRID-3M* | *Hybrid series power cord, **3 metres**, for applications where a longer cord is required.* | *Hybrid G, R & P series* |

## PRODUCT DIMENSIONS Measurements in Millimeters (mm)

HYBRID G6 & G8




HYBRID G7 & G9




## ADDITONAL INFORMATION

Where the water being treated contains unusually high levels of dissolved solids particularly hard water, iron, manganese or biological organisms, a deposit build up on the quartz sleeve may occur over time. Maximum recommended parameters are as follows:

| | |
|---|---|
| Iron: | less than 0.3 mg/L |
| Hydrogen Sulfide: | less than 0.05 mg/L |
| Suspended Solids: | less than 10mg/L |
| Manganese: | less than 0.05 mg/L |
| Hardness: | less than 110mg/L |

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**Note:**

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3. ^Warranties in this document cover parts for the period stated and include cover for parts and labour for the first year where applicable, subject to approval. Plus 2 years parts only.

Our Water Filtration Specialists can provide you with advice to suit your needs.

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**AUSTRALIA**

Phone: 1300 140 140
Web: www.puretec.com.au

**NEW ZEALAND**

Phone: 0800 130 140
Web: www.puretec.co.nz