


1080650

Well # 10004

|  |   |  |       |                               |
|--|---|--|-------|-------------------------------|
|  Wellington Office<br>PO Box 12-003<br>Wellington, NZ<br>Tel: +64 4 471 7000<br>Fax: +64 4 471 1291<br>www.opus.co.nz | <b>BOREHOLE LOG</b>                             |  |       | HOLE NO<br><b>BH1</b>         |
|  | PROJECT<br><b>Spring Creek Seismic Retrofit</b> | CO-ORD<br><b>1,880,567 E 5,411,287 N</b> | R.L.  | SHEET<br><b>1 of 2</b>        |
|  | LOCATION<br><b>Spring Creek, SH1</b>            | REF GRID<br><b>NZTM +/- 9m</b>           | DATUM | HOLE LENGTH<br><b>22.95 m</b> |

| GEOLOGY/UNIT              | MAIN DESCRIPTION   | R.L. (m) | DEPTH (m) | GRAPHIC LOG | TESTS         |                                    |  | ROCK STRENGTH | ROCK WEATHERING | DEFECT SPACING | DIP<br>degrees | DETAILED DESCRIPTION   | CORE    |                         |             | DRILLING        |                     |        | PIEZOMETER DETAILS | OTHER INSTRUMENTATION |
|---------------------------|--|----------|-----------|-------------|---------------|------------------------------------|--|---------------|-----------------|----------------|----------------|--|---------|-------------------------|-------------|-----------------|---------------------|--------|--------------------|-----------------------|
|                           |  |          |           |             | SPT 'N' VALUE | SPT BLOW COUNTS OR SHEAR VALUE     |  |               |                 |                |                |  | ROD (%) | TOTAL CORE RECOVERY (%) | SAMPLE TYPE | DRILLING METHOD | DRILLING FLUID LOSS | CASING |                    |                       |
| Repapura alluvial gravels | Dark grey, saturated SAND.   |          | 0         |             |               | 0 for 450mm (pushed on 9mm weight) |  |               |                 |                |                |  |         |                         | CC          |                 |                     |        |                    |                       |
|                           | Dark grey, saturated sandy GRAVEL.   |          | 1.8       |             | 18            | 4/10/8                             |  |               |                 |                |                | Gravel medium to coarse, unweathered, well rounded                                 | 62.5    | SPT                     |             |                 |                     |        |                    |                       |
|                           |  |          | 3.0       |             | 28            | 16/14/15                           |  |               |                 |                |                | Very poor SPT recovery - possibly due to high gravel content                       | 22      | SPT                     |             |                 |                     |        |                    |                       |
|                           | Dark brownish grey, saturated GRAVEL with some sand                                      |          | 6.0       |             | 42            | 9/16/24                            |  |               |                 |                |                | Fine to coarse slightly weathered gravels. Well rounded, some Fe staining          | 67      | SPT                     |             |                 |                     |        |                    |                       |
|                           | Oxidised water table, orange brown wash  |          | 7.0       |             |               |                                    |  |               |                 |                |                | Fe staining on chip samples.   |         | CC                      |             |                 |                     |        |                    |                       |
|                           | Dark brownish grey, moist SAND with some gravel. Trace of quartz minerals.               |          | 8.0       |             | 31            | 3/7/24                             |  |               |                 |                |                | Sand coarse with well rounded Fe stained slightly weathered fine to coarse gravels | 67      | SPT                     |             |                 |                     |        |                    |                       |
|                           | Light whitish grey SAND with some gravel.  |          | 9.0       |             | 28            | 4/8/20                             |  |               |                 |                |                |  | 56      | SPT                     |             |                 |                     |        |                    |                       |
|                           | Light brown, moist SAND with some silt. Dense, fine grained sand very very low cohesion. |          | 11.0      |             | 17            | 6/7/10                             |  |               |                 |                |                | Silt fraction ~5% - can be remoulded very weakly.                                  | 67      | SPT                     |             |                 |                     |        |                    |                       |
|                           | Dark grey, saturated GRAVEL with some sand.  |          | 12.0      |             | 32            | 4/12/20                            |  |               |                 |                |                | Coarse sand with fine to coarse unweathered gravels. Well rounded.                 | 67      | SPT                     |             |                 |                     |        |                    |                       |
|                           |  |          | 13.0      |             |               |                                    |  |               |                 |                |                |  |         |                         | CC          |                 |                     |        |                    |                       |
|                           |  |          | 14.0      |             | 50+           | 4/12/26 for 100mm                  |  |               |                 |                |                |  | 44      | SPT                     |             |                 |                     |        |                    |                       |
|                           |  |          |           |             |               |                                    |  |               |                 |                |                |  |         |                         | CC          |                 |                     |        |                    |                       |

|       |   |   |              |                  |
|-------|---|---|--------------|------------------|
| NOTES | STARTED   | 22/09/2008  | FINISHED     | 23/09/2008       |
|       | DRILLER   | K. Wrigley  | DRILLING CO. | CW Drilling Ltd. |
|       | INCLINATION/ AZIMUTH  | -90°  | DRILLING RIG | CX Truck         |
|       | LOGGED  | P. Wrigley  | CHECKED      |                  |
|       | CLIENT  | Transit   | JOB NO       | 5-C1387.00       |
|       | LOGGED IN ACCORDANCE WITH NZ GEOTECHNICAL SOCIETY 2005 GUIDELINES | SEE ATTACHED KEY SHEET FOR EXPLANATION OF SYMBOLS |              |                  |

BOREHOLE\_LOG\_A3\_GEOTECH.GPJ OPUS W.G. REV:08/08.GDT 17/2/09



# BOREHOLE LOG

HOLE NO.  
**BH1**  
SHEET  
2 of 2  
HOLE LENGTH  
22.95 m

PROJECT: Spring Creek Seismic Retrofit  
CO-ORD: 1,880,567 E 5,411,287 N  
LOCATION: Spring Creek, SH1  
REF GRID: NZTM +/- 9m  
R.L. DATUM

| GEOLOGY/UNIT             | MAIN DESCRIPTION                               | R.L. (m) | DEPTH (m) | GRAPHIC LOG | TESTS         |                                | ROCK STRENGTH | ROCK WEATHERING | DEFECT SPACING | DIP<br><small>degrees SO</small> | DETAILED DESCRIPTION  | CORE    |                         |             | DRILLING        |                     |        | PIEZOMETER DETAILS | OTHER INSTRUMENTATION |                            |
|--------------------------|--|----------|-----------|-------------|---------------|--------------------------------|---------------|-----------------|----------------|----------------------------------|---|---------|-------------------------|-------------|-----------------|---------------------|--------|--------------------|-----------------------|----------------------------|
|                          |  |          |           |             | SPT 'N' VALUE | SPT BLOW COUNTS OR SHEAR VALUE |               |                 |                |                                  |   | ROD (%) | TOTAL CORE RECOVERY (%) | SAMPLE TYPE | DRILLING METHOD | DRILLING FLUID LOSS | CASING |                    |                       | BASE OF HOLE & WATER LEVEL |
| Rapaura alluvial gravels | Dark grey, saturated gravelly SAND.            |          | 16        |             | 50+           | 21/10/40 for 110mm             |               |                 |                |                                  | Gravels fine to medium, unweathered, rounded.                             | 36      | SPT                     |             |                 |                     |        |                    |                       |                            |
|                          | Dark brownish grey, moist SAND. In situ?       |          | 17        |             | 10            | 2/3/7                          |               |                 |                |                                  | Drillers notes: SPT sample likely to be 'heaving sands' from water table. | 67      | SPT                     |             |                 |                     |        |                    |                       |                            |
|                          | Dark brownish grey, wet gravelly SAND.         |          | 18        |             | 50+           | 41/35/15 for 60mm              |               |                 |                |                                  | Gravels fine to coarse, sub rounded, unweathered.                         | 78      | SPT                     |             |                 |                     |        |                    |                       |                            |
|                          | Dark brown, wet GRAVEL with some sand.         |          | 20        |             | 50+           | 12/1/50 for 120mm              |               |                 |                |                                  | Gravels fine to coarse, sub angular, unweathered.                         | 44      | SPT                     |             |                 |                     |        |                    |                       |                            |
|                          | Light brown, wet, sandy GRAVEL with minor silt |          | 21        |             | 50+           | 26/1/50 for 125mm              |               |                 |                |                                  | Gravels fine to coarse, sub angular, unweathered.                         | 56      | SPT                     |             |                 |                     |        |                    |                       |                            |
|                          | Dark grey, moist 'dense' SAND.                 |          | 22        |             | 20            | 21/7/13                        |               |                 |                |                                  | Trace of rounded 20mm gravels.  |         |                         |             |                 |                     |        |                    |                       |                            |
|                          | End of hole.                                   |          | 23        |             |               |                                |               |                 |                |                                  |   |         |                         |             |                 |                     |        |                    |                       |                            |
|                          |  |          |           | 24          |               |                                |               |                 |                |                                  |   |         |                         |             |                 |                     |        |                    |                       |                            |
|                          |  |          | 25        |             |               |                                |               |                 |                |                                  |   |         |                         |             |                 |                     |        |                    |                       |                            |
|                          |  |          | 26        |             |               |                                |               |                 |                |                                  |   |         |                         |             |                 |                     |        |                    |                       |                            |
|                          |  |          | 27        |             |               |                                |               |                 |                |                                  |   |         |                         |             |                 |                     |        |                    |                       |                            |
|                          |  |          | 28        |             |               |                                |               |                 |                |                                  |   |         |                         |             |                 |                     |        |                    |                       |                            |
|                          |  |          | 29        |             |               |                                |               |                 |                |                                  |   |         |                         |             |                 |                     |        |                    |                       |                            |

| NOTES | STARTED |            | FINISHED     |                  |
|-------|---------|------------|--------------|------------------|
|       |         | 22/09/2008 |              | 23/09/2008       |
|       |         | K. Wrigley | DRILLING Co. | CW Drilling Ltd. |
|       |         | -90°       | DRILLING RIG | CX Truck         |
|       |         | P. Wrigley | CHECKED      |                  |
|       |         | Transit    | JOB No.      | 5-C1387.00       |

BOREHOLE LOG A1 GEOTECHNICAL OPUS WLG REVISED 08.GDT 17/2009

- Topographic survey of the bridge abutments and approach embankments  
The locations of the borehole and CPT tests are shown on Illustration 2.

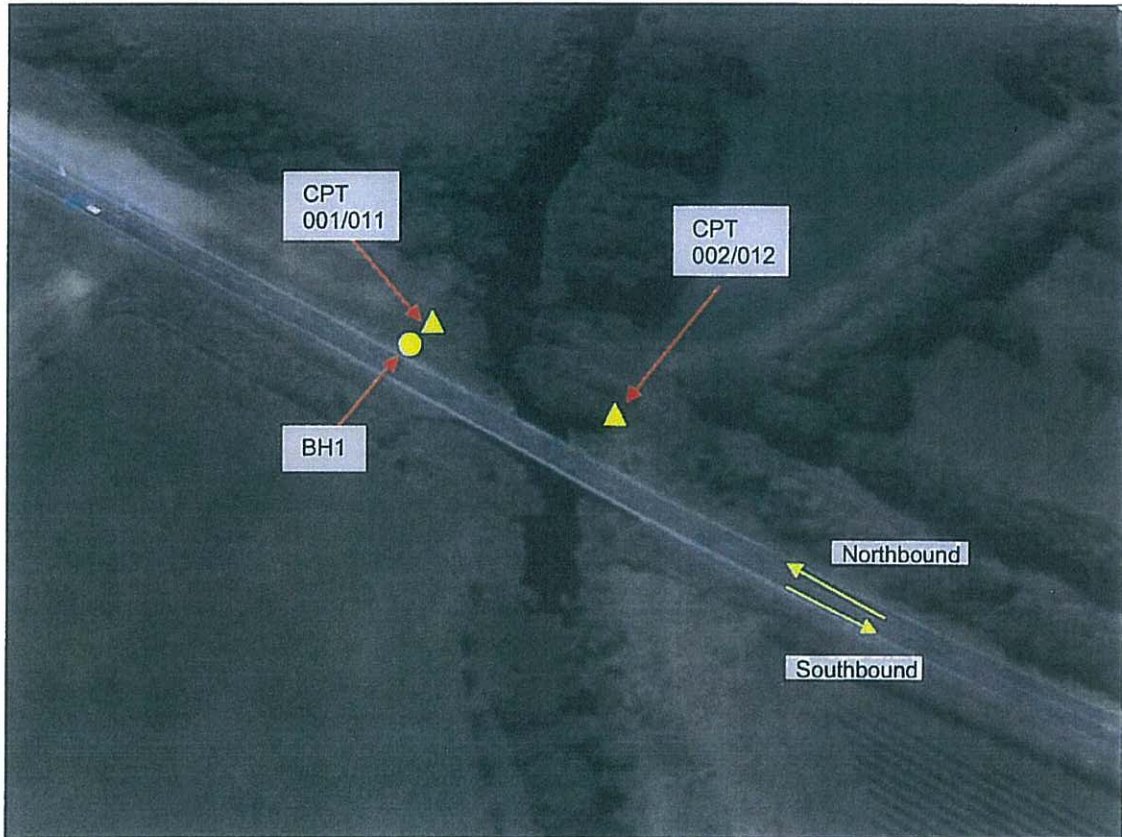


Illustration 2 – Location of Ground Investigations

#### 4.2 Drilling of Borehole

Drilling and Standard Penetration testing work was executed by CW Drilling in September 2008 (Illustration 3). The soil samples were logged by an Opus Engineering Geologist. The borehole log is included in Appendix A.

#### 4.3 Cone Penetration Testing and Associated SPTs

CPT work (and associated SPT in gravelly materials) was executed by McMillan Specialist Drilling Services in October 2008 (Illustration 4). The driller's CPT and SPT logs as listed below are included in Appendix B.

The attached CPT / SPT logs are as follows: