6 STATEMENT OF PROFESSIONAL OPINION AS TO THE SUITABILITY OF LAND FOR BUILDING DEVELOPMENT

I, R.J. Knowles, of Coffey Geotechnics (NZ) Limited, Auckland, hereby confirm that:

1. I am a Chartered Professional Engineer experienced in the field of geotechnical engineering as defined in section 1.2.3 of NZS 4404 and was retained by the Owner/Developer as the Geotechnical Engineer on Stage 2AC of the Beachwood Estate residential subdivision.

2. The extent of preliminary investigations carried out to date are described in Geotechnical Investigation Report number 12407, dated 14 July 2006, and the conclusions and recommendations of that document have been re-evaluated in the preparation of this report. The results of all tests carried out are appended.

3. In my professional opinion, not to be construed as a guarantee, I consider that:

   (a) The earth fills shown on the appended cut/ fill contours as-built plans have been placed in compliance with NZS 4431, the Legacy Rodney District Council District Plans and related documents.

   (b) The completed earthworks give due regard to land slope and foundation stability considerations within the residential lots, but as shown on the appended Batter Restriction Zone Plan, areas on lots 26 to 31 and 52 to 59 have gradients steeper than 1 in 4 or are adjacent to land having such gradients and accordingly, batter set-backs incorporating **specific design zones** and/ or **leading edge pile zones** have been applied.

No building construction and no earthworks should take place within the designated **specific design zone areas** or elsewhere if similar gradients exist unless endorsed by design of all foundations and retaining walls and by construction inspections undertaken by a Chartered Professional Engineer experienced in geomechanics, as such operations may, in certain circumstances, have detrimental effects on overall site stability.

Building development within the designated **leading edge pile zones** within lots 52 to 59 will need to be piled to account for a 1 metre deep soil creep zone / lateral load. Accordingly the piles should be designed in shear and bending to resist an 'at-rest' lateral soil load equivalent to 3 pile diameters applied to a depth of 1 metre. The minimum pile depth within this zone should be 2 metres. The following design parameters may be assumed:

Ø' = 30 degrees
Su = 100 kPa
Geotechnical ultimate end bearing capacity beyond 1.8m depth = 450 kPa
Ultimate side adhesion beyond 1m depth = 25 kPa. Ignore side adhesion in the top 1m.

The structural designer should attend to the details of pile type, spacing, diameter and load capacity and must also ensure that the design allows for any differential movement that may occur between the piled and un-piled portions of any building.

(c) The appended Batter Restriction Zone Plan also indicates the extents of Resource Consent Setback Restriction Areas on lots 58 to 60 inclusive. Any buildings on these lots must be separated from the eastern site boundary by at least 6 metres.

(d) A geotechnical ultimate bearing capacity of 300 kPa may be assumed for shallow foundation design on lots 26 to 32 and 52 to 60.

Where a geotechnical bearing capacity greater than 300 kPa is required, (ie outside the limits of NZS 3604, such as when piling is undertaken), further specific site investigation and design of foundations should be carried out prior to building consent application.

(e) The backfilling and compaction of the stormwater and sanitary sewer trenches on this subdivision has where possible been carried out to appropriate standards having regard for the prevailing ground conditions and associated compaction induced pipe loadings.

Nevertheless, no building development should take place within the 45 degree zone of influence of drain inverts unless endorsed by a Chartered Professional Engineer experienced in geomechanics to ensure that lateral stability and differential settlement issues are addressed and that building loads are transferred beyond the influence of the pipe and beyond the extent of the trench backfill.

This requirement is most likely to impact on areas adjacent to the stormwater lines that lie inside the front boundaries of lots 26 to 32 and 52.

(f) No building construction, including the construction of additional retaining walls and no earthworks should take place should take place within the designated retaining wall

setback areas adjacent to the retaining walls on lots 26 to 32 and 52 to 60 as shown on the appended Retaining Wall Restriction Zone Plan unless endorsed by specific designs and by construction inspections undertaken by a Chartered Professional Engineer experienced in geomechanics to ensure that no additional loads are applied to the walls. Specific site investigation should not be required.

(g) The assessed AS 2870 expansive site Class for all lots is S (slight)

(h) Subject to the geotechnical limitations, restrictions, recommendations and expansive soil assessments associated with 3(b), 3(c), 3(d), 3(e), 3(f) and 3(g) above:

(i) The filled and undisturbed original ground within residential lot boundaries is generally suitable for residential buildings constructed in accordance with NZS 3604 (that incorporates specific foundation and associated structural design on account of the expansive soils site class) and related documents.

(ii) On all residential lots foundation design may be carried out in accordance with AS 2870 (Class S) or alternatively, a specific foundation and structural design may be undertaken by a Chartered Professional Engineer who should allow for expansive soil effects in the design. In this latter case, the minimum foundation depth below cleared ground level following topsoil removal and benching of building platform areas is 450mm for NZS3604 type shallow strip and pad foundations.

4. Road subgrades and lot accessway subgrades have been formed having due regard for slope stability and settlement, although CBR values do vary between natural and filled ground as is to be expected.

5. Geotechnical aspects of slope and bund stability and pond permeability within local purpose drainage reserve lot 601 have been appropriately addressed and in these respects the pond is suitable for its intended use.

The appended table summarises the status of each residential lot covered by this Suitability Statement.

The professional opinion contained within this report is furnished to the Auckland Council, Cabra Developments Limited and their professional advisors for their purposes alone on the express condition that it will not be relied upon by any other person. Prospective purchasers should still satisfy themselves as to any specific conditions pertaining to their particular land interest.

For and on behalf of Coffey Geotechnics (NZ) Limited

Richard Knowles

Principal Geotechnical Engineer, CPEng

Prepared By:

Greg Snook

Engineering Geologist

TABLE 3: SUITABILITY STATEMENT SUMMARY (refer to Project Evaluation and Suitability Statement for details)

Lot No.	Comments	Topsoil Depth (mm)	Ultimate Bearing (kPa)	AS2870 :1996 Class
26	Batter specific design zone restrictions Retaining wall set-back area restrictions Stormwater Line within lot, no building development with 45 degree zone of influence of drain invert, unless endorsed by CP Eng. Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	210	300	S
27	Batter specific design zone restrictions Retaining wall set-back area restrictions Stormwater Line within lot, no building development with 45 degree zone of influence of drain invert, unless endorsed by CP Eng. Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	200	300	S
28	Batter specific design zone restrictions Retaining wall set-back area restrictions Stormwater Line within lot, no building development with 45 degree zone of influence of drain invert, unless endorsed by CP Eng. Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	350	300	S
29	Batter specific design zone restrictions Retaining wall set-back area restrictions Stormwater Line within lot, no building development with 45 degree zone of influence of drain invert, unless endorsed by CP Eng. Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	350	300	S
30	Batter specific design zone restrictions Retaining wall set-back area restrictions Stormwater Line within lot, no building development with 45 degree zone of influence of drain invert, unless endorsed by CP Eng. Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	220	300	S

Lot No.	Comments	Topsoil Depth (mm)	Ultimate Bearing (kPa)	AS2870 :1996 Class
31	Batter specific design zone restrictions Retaining wall set-back area restrictions Stormwater Line within lot, no building development with 45 degree zone of influence of drain invert, unless endorsed by CP Eng. Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	340	300	S
32	Retaining wall set-back area restrictions Stormwater Line within lot, no building development with 45 degree zone of influence of drain invert, unless endorsed by CP Eng. Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	320	300	S
52	Batter specific design zone restrictions Leading edge piling zone restriction Retaining wall set-back area restrictions Stormwater Line within lot, no building development with 45 degree zone of influence of drain invert, unless endorsed by CP Eng. Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	220	300	S
53	Batter specific design zone restrictions Leading edge piling zone restriction Retaining wall set-back area restrictions Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations. Protection of swale drain	280	300	S
54	Batter specific design zone restrictions Leading edge piling zone restriction Retaining wall set-back area restrictions Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations. Protection of swale drain	220	300	S

55	Batter specific design zone restrictions Leading edge piling zone restriction Retaining wall set-back area restrictions Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations. Protection of swale drain	300	300	S
56	Batter specific design zone restrictions Leading edge piling zone restriction Retaining wall set-back area restrictions Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations. Protection of swale drain	300	300	S
57	Batter specific design zone restrictions Leading edge piling zone restriction Retaining wall set-back area restrictions Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations. Protection of swale drain	300	300	S
58	Batter specific design zone restrictions Retaining wall set-back area restrictions Resource Consent restriction area Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S
59	Batter specific design zone restrictions Resource Consent restriction area Retaining wall set-back area restrictions Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	250	300	S
60	Resource Consent restriction area Retaining wall set-back area restrictions Elsewhere, AS 2870 foundation design or specific CP Eng design with minimum footing depth 450mm for NZS3604 type strip or pad foundations.	300	300	S