

LIGHTWEIGHT STRUCTURAL FILL

6-Story Building

Trading heavy ground for light fill beneath affordable housing in Kelowna

LOCATION

Kelowna, BC

APPLICATION

Load-compensating
fill

GEOTECHNICAL

Ecora Consultants

MATERIAL

Enviro-Rock FGA

OVERVIEW

A new multifamily affordable housing development in Kelowna sits over deep, compressible glaciolacustrine clay. The geotechnical design solves that ground with sub-excavation and replacement: dig out 1.8 metres of heavy soil across the building footprint and put back foamed glass aggregate, with Enviro-Rock named as the basis of design. The building gains a foundation zone that weighs almost nothing, so the clay below barely feels it arrive.

THE CHALLENGES

The clay beneath the site was identified as the governing geotechnical constraint for the development. Without ground improvement, settlement analyses projected 85 to 115mm of total settlement and differential movement beyond 1:500 over the 50 year design life, far more than the building could tolerate on conventional shallow foundations.

THE SOLUTION

The design sub-excavates 1.8 metres below existing ground across the entire building footprint, extending 2.0 metres beyond the footings, then backfills with foamed glass aggregate at a compacted unit weight of about 2.5 kN/m³ up to top of footing elevation. Removing roughly 31.5 kPa of soil and replacing it with just 3 kPa of FGA unloads the clay by more than the new building loads it back, keeping settlement in the gentle recompression range.

<25 mm

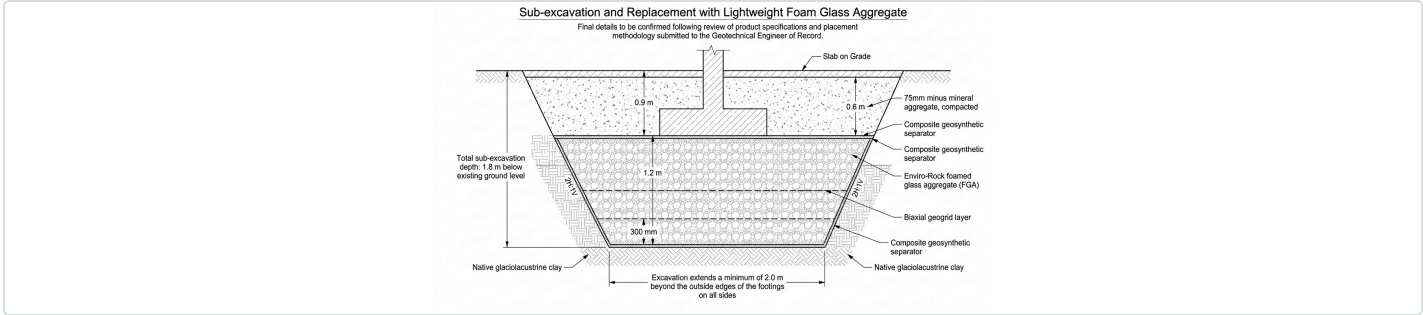
expected post-construction settlement over 50 years, down from a projected 85 to 115mm without ground improvement



2.5 kN/m³

compacted design unit weight of the FGA, versus 20 to 22 for the mineral aggregate above it

Ground improvement design



Sub-excavation and replacement detail with Enviro-Rock foamed glass aggregate.

PROJECT SPECIFICATIONS

Material	Foamed glass aggregate, Enviro-Rock basis of design
Sub-excavation	1.8 m deep, building footprint plus 2.0 m
FGA layer	1.2 m to top of footing, ~2.5 kN/m³ compacted
Reinforcement	Two biaxial geogrid layers within the FGA
Separation	Composite geosynthetic wrap, base, sides, and top
Recycled glass content	100% post-consumer

SPECIFIED METHOD

The section builds up from the native compressible clay. A composite geosynthetic lines the base and sides of the excavation to separate the fill from the clay below, then a 1.2 metre layer of Enviro-Rock foamed glass aggregate goes in, placed and compacted to spec, with two biaxial geogrid layers reinforcing it at roughly 300 and 600mm above the base. A second composite geosynthetic caps the aggregate, isolating it from the 75mm minus mineral aggregate that carries the section the rest of the way to the slab on grade. Footings bear at 0.9 metres below surface, within the engineered FGA zone, and the sub-excavation extends 2.0 metres beyond the footings on every side.

WHY FOAMED GLASS

Sub-excavation and replacement only works if the replacement is genuinely light. At about 2.5 kN/m³ compacted, the FGA layer returns barely a tenth of the weight of the soil it displaces, turning the excavation into a real net unloading of roughly 17.7 kPa on the clay below. The aggregate carries the footing loads through its compacted, geogrid-reinforced structure and drains freely, all from a material made from 100% post-consumer recycled glass. The design was independently peer reviewed, with every comment resolved and accepted before tender.

MATERIAL SPECIFICATION	VALUE	UNITS
Average grain size	25–75	mm
Dry bulk Density	250	kg/m³
Compressive strength @ 20% Compacted	1.01	MPa
Angle of friction (@ 65 kPa)	39	Degrees
Water absorption	7.2	%
R-Value per inch (dry)	2.4	ft² * hr *°F/BTU-in