

GRAPPLING with GREYWACKE

Greywacke, the basis and signature of Canterbury.
From the sharp fragments shattered from the Waimakariri mountainlands,
tumbled and worn rounded to build the plains that meet the volcano
at Otautahi Christchurch.

Outwash plains.

Overall a vast horizontal surface. Flat.

In detail, a complex of terraces, humps and hollows.

Overall a complex of varying massing of greywacke units.

Coarse to fine, as laid down by the waterways. Rich soils to bony.

Greywacke from boulder to silt. Transported, sifted and sorted.

Streams meandering, cutting a step here, building a beach there.

Cut matched with fill. Cut slopes through layers, striations of stones.

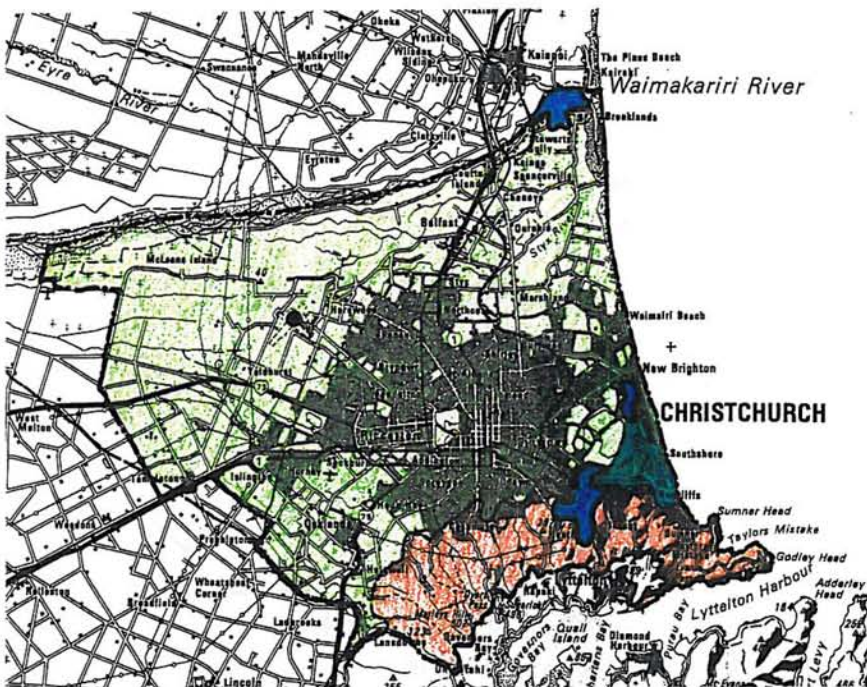
Vertical greywacke cuts. Steep. Layered. A lip. Capped with vegetation.

Grey on grey. Uniform yet varied.

Roundness expressing the journey from the hills.

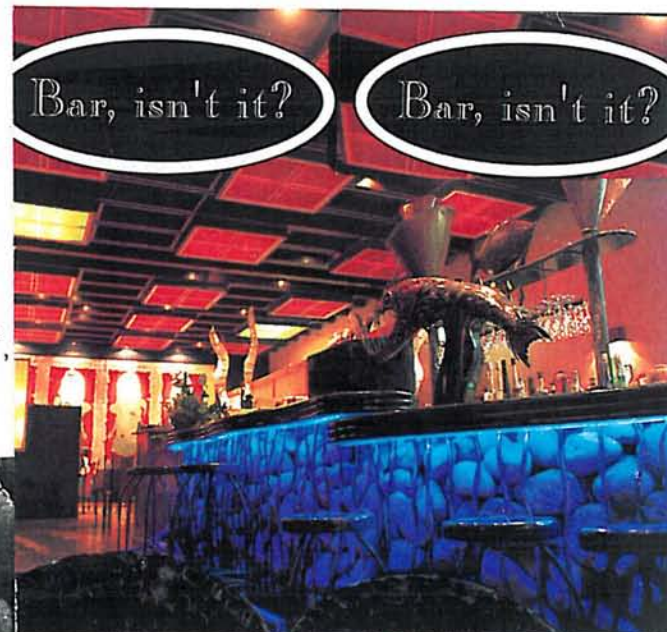
Mobile. Dynamic. Telling a story of travels.

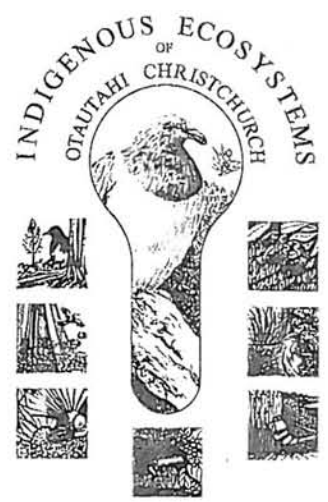
THE ROCK UNDERLAYERS OF CHRISTCHURCH



"Hey, guess what - Grey Wacke's in town!"

Notes by Lucas Associates landscape architects, Di Lucas & Warwick Moffat; with thanks to Allen Ingles, engineer, Woodward Clyde; Ian Lynn, Manaaki Whenua Landcare Research; Anthony (Spike) Spijkerman, Production Manager, Firths; and, Maccaferri December 1996





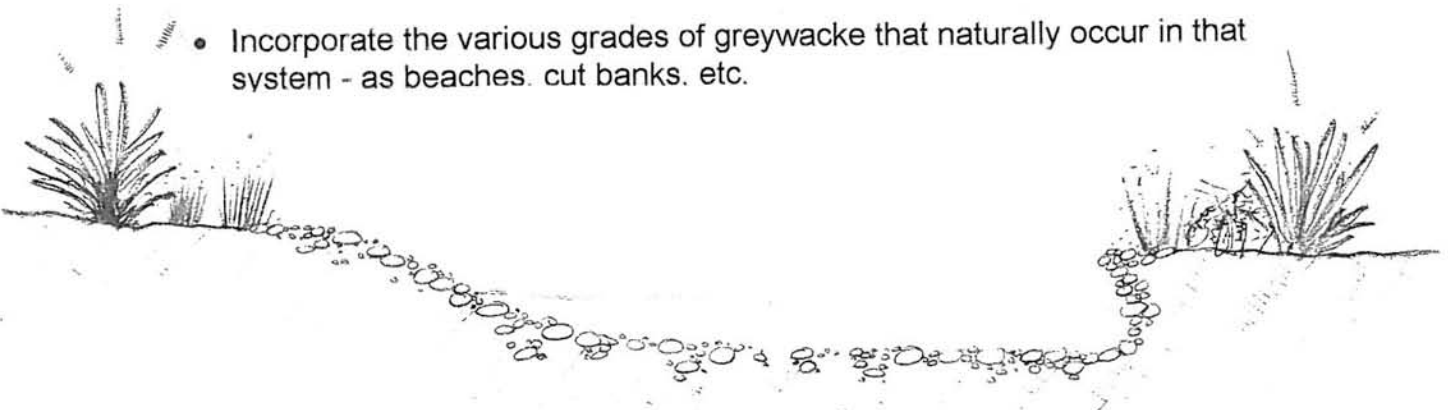
SET 2: The coastal plains of Hagley-Perrywood & Burnwood-Pegasus for Christchurch-Otautahi. Agenda 21 Committee

PRINCIPLES FOR STREAM BANK STABILISATION

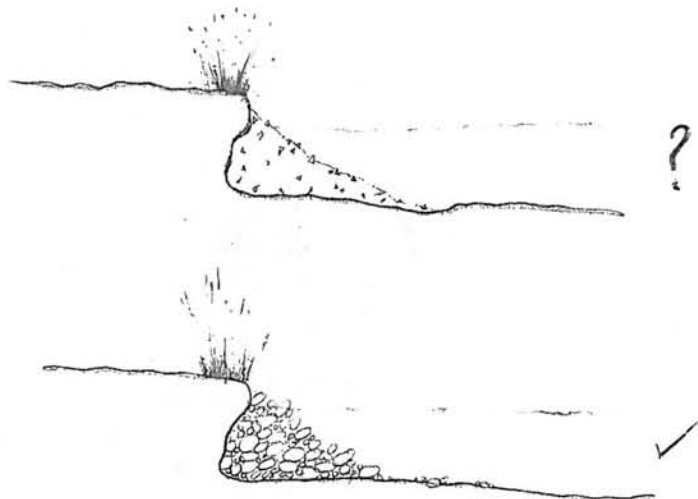
Identify whether the stream is part of a volcanic, estuarine, or greywacke-based plains ecosystem. (The latest printings of *Indigenous Ecosystems of Otautahi Christchurch - Set 1, 2 & 3* - give guidance as to the presence and type of greywacke that belongs in each part of plains Christchurch)

For streams in the greywacke plains systems:

- Where there is adequate space, restore the meander, terrace, cut and beach forms that naturally occur in a plains stream situation. Seek to replicate the curves and slopes of the natural system.
- Incorporate the various grades of greywacke that naturally occur in that system - as beaches, cut banks, etc.



- For in-stream management, incorporate the local forms of greywacke, as riffles; to strengthen the toe of slopes; etc. Use the greywacke in its intact form - i.e. rounded, not crushed.



- Where space is limited, seek to incorporate dimensions of the natural landforms, e.g. there may not be room for a gentle slope on one streamside, so use a cut slope on both sides rather than just the one.



STRENGTHENING THE GREYWACKE

Where space is limited and level changes require support, a range of greywacke-friendly options are suggested:

- **FREE RANGE**

Greywacke stones of larger local dimension, heaped and ramped, forming a gravel ridge or bank as occurs naturally. Usually at some 30-37° slope angle. Planted at the crest and toe.

To a degree, the plains streams dynamics should be accepted. Movement of the stones may require they be refurbished, but perhaps only every 10 years.

- **CONTAINMENT**

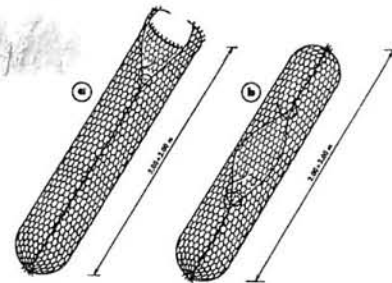
Rounded greywacke, adept at rolling down rivers, can be held in place by containing rods or mesh. "Bar Isn't It?" has expressed the plains dynamics beautifully in their steel rod containment of the boulders. Other options are available for streambanks:

- **Mesh Baskets - Gabions**

Used too formally in the past, the harsh vertical and horizontal lines and rigid step profile are not the only options.

Curves and slopes are possible.

There is great potential for rounded and informal gabion use. Finer mesh liners allow finer fill materials to be retained in the basket.

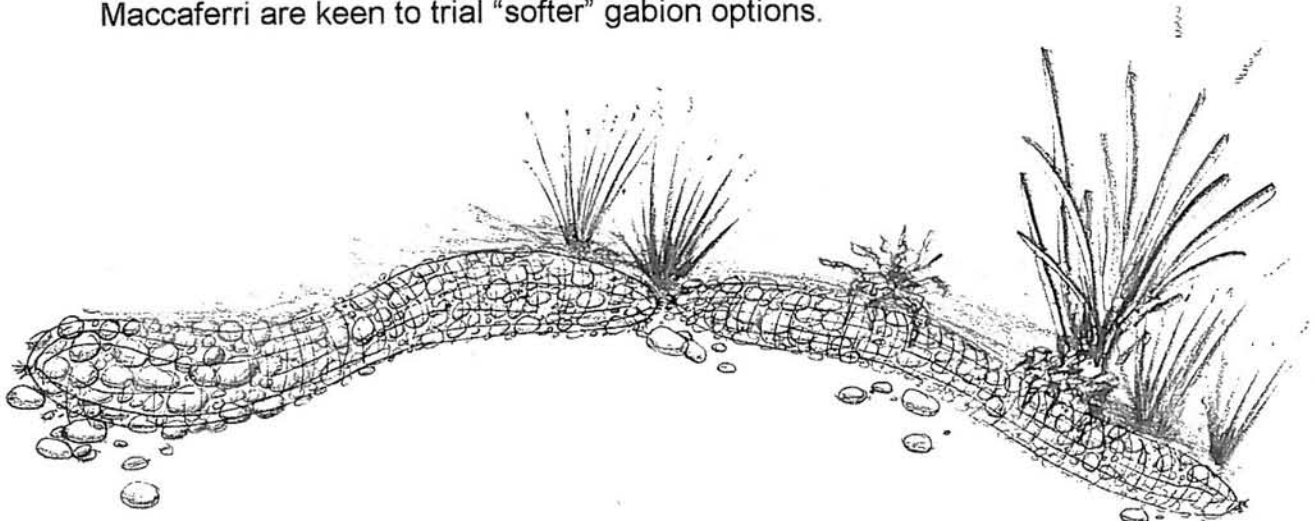


The "**sausage gabion**", together with variable backfilling and planting, can form a pleasant stabilised greywacke bank.

The gabion can sag into areas of scour at its base and not compromise structural integrity.

Voids in the gabions can be filled with soil and the inside face of the steel mesh lined with biodegradable matting (such as straw) for the establishment of vegetation.

Maccaferri are keen to trial "softer" gabion options.



- **Precast Units**

Greywacke-faced pre-cast units provide a flexible option.

Stony hedgehog blocks are being developed as a useful bank stabilising tool. (see Firths first attempt)

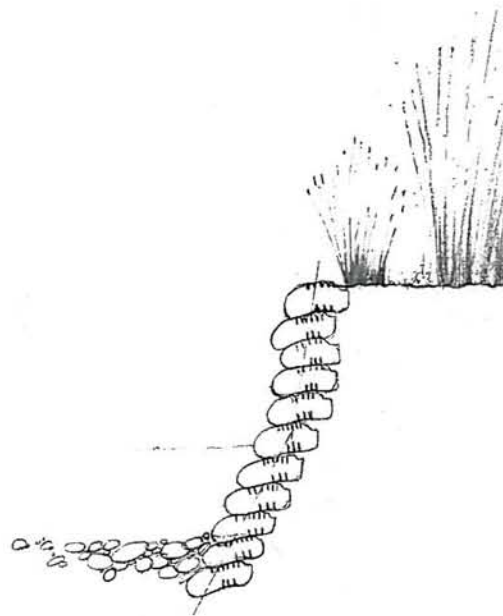
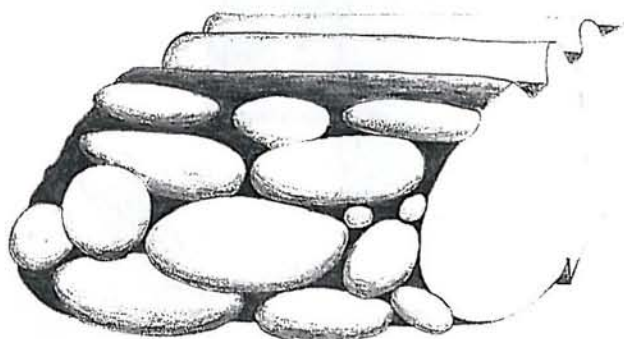
The blocks each weigh 25 kg, can be stacked up vertically, or sloped, to replicate stony cut banks.

No footing is necessary.

Small voids can be left between blocks for occasional vegetation.

A gentle curved alignment is possible.

The face of intact greywacke stones can replicate horizontal river sorting patterns.



ALTERNATIVES

For strengthening streambanks at waterline, in restoration and natural enhancement seek to AVOID:

- In situ concrete.
- Rock not of the plains, such as basalt & other volcanics e.g. Halswell stone.

Appropriate non-greywacke options include:

- geotextiles, vegetated.
- durable timber.



Lucas Associates

Marokapara 351 Manchester Street

Otautahi Christchurch

Ph. / Fax (03) 3650 789

Email lucasdi@xtra.co.nz