

TIMARU DISTRICT

SIGNIFICANT NATURAL AREAS
SURVEY

MESOPOTAMIA STATION



Report prepared for Timaru District Council by Mike Harding
May 2016

TIMARU DISTRICT SIGNIFICANT NATURAL AREAS SURVEY

PROPERTY REPORT

PROPERTY DETAILS:

Owners: Malcolm and Sue Prouting
Valuation Reference: ... 24640/004.02
Address: Rangitata Gorge Road, Geraldine 7992
Location:..... West side of upper Rangitata River
Ecological Districts:..... Hakatere and Two Thumb

ECOLOGICAL CONTEXT:

Mesopotamia Station lies on the west (true right) side of the upper Rangitata River, inland from Peel Forest, South Canterbury. It covers recent terraces alongside the Rangitata River, broad lateral moraines (Butler Downs and Brabazon Downs) rising to approximately 900m, and adjacent higher-altitude hill slopes. The property extends up the Havelock River valley where it adjoins public conservation land of the central Southern Alps. The underlying geology of lower altitude (below 900m) parts of the property is predominantly glacial till (lateral moraine) and outwash, grading to sandstone (greywacke) and mudstone (argillite) on adjacent mountain ranges, and recent alluvial deposits alongside the Rangitata River (Cox and Barrell, 2007).

Lower altitude parts of the property are in Hakatere Ecological District; higher slopes are within Two Thumb Ecological District (McEwen, 1987). Most parts of the Butler and Brabazon downs lie within the E4.1b and E4.2b Level IV Land Environments as defined by Leathwick *et al* (2003). Valley sides lie within the E1.4c and E1.4d Land Environments. Lower-altitude terraces along the Rangitata River boundary lie within J2.2a and K4.1c Land Environments. Indigenous vegetation within the E4.2b, J2.2a and K4.1c Land Environments is regarded as 'at risk' (Walker *et al*, 2006).

It is unclear how much of this part of Hakatere Ecological District was forested in pre-human times, though beech forest was more extensive on Butler Downs at the time of European settlement. Forested areas were most likely dominated by mountain beech (*Nothofagus solandri*), though mountain totara (*Podocarpus cunninghamii*), kowhai (*Sophora microphylla*), broadleaf (*Griselinia littoralis*) and kanuka (*Kunzea ericoides*) may have been present. Narrow-leaved snow-tussock (*Chionochloa rigida*) grassland is likely to have dominated frost-prone terraces and flats, with red tussock (*Chionochloa rubra*) grassland at damper sites and fescue tussock (*Festuca novae-zelandiae*) grassland on young surfaces. Sedgeland, rushland and reedland (wetland vegetation) would have been present at poorly drained sites.

Today indigenous vegetation cover in this part of Hakatere Ecological District is largely confined to undeveloped slopes and terraces, where tussockland and sedgeland (wetland) communities are present, and to small patches of beech forest. Habitats of indigenous fauna have been depleted or modified. However, the property is likely to provide habitat for karearea/eastern falcon (*Falco novaeseelandiae*), a species listed as 'at risk' (recovering) by Robertson *et al* (2012), and for 'at risk' and 'threatened' lizard species listed by Hitchmough *et al* (2012), such as common skink (*Oligosoma polychroma*) (declining).

SIGNIFICANT AREAS ON THE PROPERTY:

This property was not surveyed as part of the District-wide survey of Significant Natural Areas because permission for access was declined by the landowner. However, there is some survey data from an earlier pastoral lease tenure review survey. Also, there are good recent aerial images of the area. So it is possible to determine the indigenous vegetation and habitat that is likely to be present on the property.

Aerial images and roadside views indicate the presence of a number of mostly small areas of indigenous vegetation and habitat that are likely to be Significant Natural Areas (SNAs) when assessed against the Timaru District Plan and/or Canterbury Regional Policy Statement criteria. Note that only areas at altitudes lower than 900m were assessed (except for small patches of beech forest), as activities at higher-altitude areas are covered by other plan rules.

In summary, likely SNAs identified in this report are:

- eight beech forest remnants (four moderate-sized and four small) on valley sides and on Butler Downs (total area c.127 ha)
- one area of shrubland on the Bush Stream fan (c.20 ha)
- one wetland on Rangitata River terraces (c.23 ha)

The active bed (floodplain) of the Rangitata River and two areas of shrubland on the Bush Stream fan adjacent to the property are also listed as SNAs.

The likely values and boundaries of these areas are described on the SNA Forms in this report. Note that the boundaries of the SNAs are indicative, rather than precise. These areas are likely to meet the ecological criteria in the Timaru District Plan (criteria i-vi, pages B18-B19) (and Canterbury Regional Policy Statement), and are considered to be sustainable in the long term, or sustainable with appropriate management (criterion vii, page B19). SNAs are subject to confirmation by Council after regarding the matters listed in the District Plan (pages B19-B20). It is expected that SNAs will be listed in the District Plan by way of a plan review.

At present, consent is required from Council for clearance of areas of indigenous vegetation or habitat which meet the Interim Definitions in the District Plan. Clearance includes burning, track construction, spraying with herbicides and over-planting. To assist with the protection and management of any SNA, landowners can apply to Council for financial assistance. Any questions regarding the protection, management and use of SNAs should be directed to the District Planner.

There may be other areas of significant indigenous vegetation or habitat on the property. This report should not be regarded as a comprehensive assessment; instead, it describes areas that are readily assessed from aerial photography and roadside views. Other possible significant sites include smaller areas of shrubland and wetland vegetation not readily discernible from aerial photographs, and other habitats of threatened plant or animal species.

Area Name: Mesopotamia beech forest remnants	Property: Mesopotamia Station	
Ecological District: Hakatere/Two Thumb	Nearest Locality: Peel Forest	
802 central map ref. (NZTM): 1427400E-5170730N	Area Size (ha): c. 8.3	Altitude (m): 580-620
803 central map ref. (NZTM): 1426860E-5170470N	Area Size (ha): c. 21.3	Altitude (m): 580-600
804 central map ref. (NZTM): 1427430E-5167660N	Area Size (ha): c. 25.7	Altitude (m): 560-600
805 central map ref. (NZTM): 1427600E-5162900N	Area Size (ha): c. 7.8	Altitude (m): 720-780
806 central map ref. (NZTM): 1426950E-5162140N	Area Size (ha): c. 19.0	Altitude (m): 780-840
807 central map ref. (NZTM): 1426530E-5156730N	Area Size (ha): c. 36.9	Altitude (m): 800-900
808 central map ref. (NZTM): 1425730E-5155950N	Area Size (ha): c. 4.7	Altitude (m): 900-940
809 central map ref. (NZTM): 1424400E-5155970N	Area Size (ha): c. 4.0	Altitude (m): 900+
Assessor: Mike Harding	Survey Time: n/a	Survey Date: n/a

General Description:

These eight SNAs comprise patches of remnant and regenerating beech forest. SNAs 802 and 803 are located on steep slopes at the property boundary adjacent to Black Birch Creek. SNA 804 is located on steep slopes of the terrace scarp of lower Bush Stream. SNA 805 is an isolated forest remnant on the scarp adjacent to upper Scour Stream. SNA 806 adjoins a larger area of protected forest on Butler Downs. SNA 807 is in the incised lower valley of Moonlight Stream. SNA 808 is on a terrace between Moonlight Stream and Felt Hut. And, SNA 809 adjoins protected forest at Felt Hut. They were viewed and boundaries selected from aerial photographs. The eight SNAs together comprise approximately 127 hectares.

These SNAs lie within Hakatere Ecological District but close to the boundary of Two Thumb Ecological District (McEwen, 1987). Most lie on or very near to glacial deposits (moraine); the eastern forest patch (SNA 809) lies on greywacke/argillite. Moraine is an 'originally rare' ecosystem, in which indigenous vegetation is listed as 'threatened' (nationally vulnerable) (Holdaway *et al*, 2012).

Plant Communities:

These forest patches are dominated by mountain beech (*Nothofagus solandri* var. *cliffortioides*). Earlier surveys of beech forest in this area (Harding, 2002) indicate that yellow mistletoe (*Alepis flavida*) and red mistletoe (*Peraxilla tetrapetala*) are likely to be present in the forest canopy. Typical understorey species are mingimingi (*Coprosma propinqua*), *Coprosma dumosa*, celery pine (*Phyllocladus alpinus*), snow totara (*Podocarpus alpinus*) and bush lawyer (*Rubus cissoides*). Ground-cover species likely to be present are prickly shield fern (*Polystichum vestitum*), thousand-leaved fern (*Hypolepis millefolium*), *Blechnum penna-marina*, *Blechnum minus*, mountain kiokio (*Blechnum montanum*), *Lagenifera strangulata*, wall lettuce* (*Mycelis muralis*), *Chiloglottis cornuta* and moss species.

Additional species in northern (up-valley) beech forests are lancewood (*Pseudopanax crassifolius*), fuchsia (*Fuchsia excorticata*), mountain akeake (*Olearia aviceniifolia*), *Olearia arborescens*, *Helichrysum lanceolatum*, *Hebe traversii*, korokio (*Corokia cotoneaster*), *Leptecophylla juniperina*, *Coprosma rhamnoides*, yellowwood (*Coprosma linariifolia*), *Pittosporum divaricatum*, bush snowberry (*Gaultheria antipoda*), *Asplenium richardii* and necklace fern (*Asplenium flabellifolium*).

The lack of access to the areas of forest precluded effective survey of indigenous fauna. However, bird species observed in the Forest Creek area were rifleman (*Acanthisitta chloris*), grey warbler (*Gerygone igata*), tomtit (*Petroica macrocephala*), welcome swallow (*Hirundo tabitica*), harrier hawk (*Circus approximans*), black shag (*Phalacrocorax carbo*) and two adult falcon (*Falco novaeseelandiae*), presumably a pair. Other bird species likely to be present are bellbird (*Anthornis melanura*), fantail (*Rhipidura fuliginosa*) and silvereye (*Zosterops lateralis*). Open rubbly slopes and shrubland adjacent to forest patches are likely to provide favourable habitat for lizards, including common skink (*Oligosoma polychroma*).

Notable Flora, Fauna and Habitats:

Notable features of these SNAs are the presence of remnant indigenous vegetation (beech forest) in an area where woody vegetation is substantially depleted and that most lie on a ‘nationally vulnerable’ ecosystem (moraine).

Populations of two plant species listed ‘at risk’ by de Lange *et al* (2012) are likely to be present:

- yellow mistletoe (*Alepis flavida*).....declining
- red mistletoe (*Peraxilla tetrapetala*)declining

Two NZ falcon/karearea were observed nearby and are likely to utilize similar habitats throughout the area. Falcon are listed by Robertson *et al* (2012) as an ‘at risk’ (recovering) species. Areas adjacent to the beech forest appear to provide favourable habitat for common skink, a species listed as ‘at risk’ by Hitchmough *et al* (2012).

Notable Plant and Animal Pests:

Assessment of plant and animal pests was not practical, however important plant pests recorded during an earlier survey (Harding, 2002) were rowan (*Sorbus aucuparia*) and wilding Douglas fir (*Pseudotsuga menziesii*) trees.

Boundaries (buffering, fencing, adjoining plant communities and habitats):

The boundaries of these SNAs have been drawn to include the main areas of forest and adjacent areas of rocky ground or shrubland. Ground survey would be required to confirm the accuracy of these proposed boundaries.

ASSESSMENT AGAINST DISTRICT PLAN CRITERIA:

Primary Criteria	Rank	Notes
Representativeness	H	Indigenous vegetation which is highly representative of the original vegetation and typical of that remaining in the ecological district.
Rarity	M/H	Likely to support populations of two ‘at risk’ plant species. Likely to provide habitat for an ‘at risk’ bird species (falcon). Forest is rare in this part of the ecological district.
Diversity and pattern	?	Unclear
Distinctiveness/special features	M	Part of a network of forest patches in the area that collectively provide important habitat for indigenous fauna.
Other Criteria		
Size/shape	M	Small to moderate-sized SNAs that are well buffered by their locations.
Connectivity	M	These SNAs lie close to other forest patches in the area and provide a network of forest bird habitat.
Long-term Sustainability	M/H	Continued control of animal pests (e.g. possums) and possibly plant pests (rowan and Douglas fir) will be required to maintain ecological values in the long term.

ASSESSMENT AGAINST REGIONAL POLICY STATEMENT CRITERIA:

Criteria	Yes/No	Comments
Representativeness	Yes	Indigenous vegetation that is highly representative and is typical/characteristic of the natural diversity of the ecological district.
Rarity/Distinctiveness	Yes	Indigenous vegetation that is reduced to less than 20% of its former extent in the ecological district. Likely to support two ‘at risk’ plant species. Provides habitat for an ‘at risk’ bird species.
Diversity and Pattern	?	Unclear
Ecological Context	Yes	Part of a network of forest patches in the area that collectively provide important habitat for indigenous fauna.

Final Consideration (of other matters: Section D, page B-19 of Timaru District Plan):

These areas represent remnants of the indigenous vegetation that was once widespread in this area. The older parts of the forest patches have presumably escaped earlier disturbance (notably fire) due to their locations at sheltered sites. These areas have only very limited potential for development.

Discussion:

If the above assessment is accurate, these sites easily meet the District Plan and Regional Policy Statement criteria for significant natural areas (SNAs). Important values are the presence of highly representative indigenous vegetation, likely populations of ‘at risk’ plant species, and important habitat for an ‘at risk’ bird species.



SNAs 802 and 803, presumed extent



SNA 804, presumed extent



SNAs 805 and 806, presumed extent



SNAs 807, 808 and 809, presumed extent

TIMARU DISTRICT SNA SURVEY

SNAs 798, 799 and 801

Area Name: Bush Stream fan shrublands	Property: Mesopotamia Station and UCL	
Ecological District: Hakatere	Nearest Locality: Peel Forest	
798 central map ref. (NZTM): 1429715E-5167300N	Area Size (ha): c. 20.6	Altitude (m): 500-540
799 central map ref. (NZTM): 1430425E-5167720N	Area Size (ha): c. 26.5	Altitude (m): 480-550
801 central map ref. (NZTM): 1430220E-5168500N	Area Size (ha): c. 189.6	Altitude (m): 490-550
Assessor: Mike Harding	Survey Time: n/a	Survey Date: 08-04-16

General Description:

These SNAs are located on the alluvial fan of lower Bush Stream. SNA 798 is on the property; the other two SNAs (799 and 801) are outside the property on (presumably) Unallocated Crown Land (UCL). Permission for access for a ground survey was denied by the landowner. The shrubland plant community was surveyed at SNA 801 and views from the road indicate that SNAs 798 and 799 support a similar plant community. The SNA boundaries were selected from aerial photographs.

The SNAs lie on recent alluvial gravel, deposited by Bush Stream. They are within Hakatere Ecological District (McEwen, 1987). The Bush Stream fan lies within the J2.2a Level IV Land Environment, within which indigenous vegetation is regarded as 'at risk' (Walker *et al*, 2006).

Plant Communities:

These SNAs support scattered to dense shrubland. The composition of this plant community at part of SNA 801 is described below. Naturalized (exotic) species are indicated with an asterisk*.

Shrubland:

The shrubland canopy is dominated by matagouri (*Discaria toumatou*), with sweet brier* (*Rosa rubiginosa*) common. Other shrub species less commonly present are porcupine shrub (*Melicytus alpinus*), broom* (*Cytisus scoparius*) and barberry* (*Berberis glaucocarpa*).



matagouri shrubland on Bush Stream fan (SNA 801)

Dominant ground-cover species are browntop* (*Agrostis capillaris*) and woolly moss (*Racomitrium pruinosum*). Other species are fescue tussock (*Festuca novae-zealandiae*), sweet vernal* (*Anthoxanthum odoratum*), blue wheat grass (*Anthosachne solandri*), *Rytidosperma pumilum*, blue tussock (*Poa colensoi*), Chewings fescue* (*Festuca rubra*), silvery hair grass* (*Aira caryophylla*), plume grass (*Dichelachne crinita*), *Helichrysum depressum*, creeping pohuehue (*Muehlenbeckia axillaris*), mouse-ear hawkweed* (*Pilosella officinarum*), king devil hawkweed* (*Pilosella piloselloides* subsp. *praealta*), St John's wort* (*Hypericum perforatum*), haresfoot trefoil* (*Trifolium arvense*), patotara (*Leucopogon fraseri*), harebell (*Wahlenbergia albomarginata*), *Pimelea prostrata*, mat coprosma (*Coprosma atropurpurea*), catsear* (*Hypochaeris radicata*), sheep's sorrel* (*Rumex acetosella*), scabweed (*Raoulia australis*), sandwort* (*Arenaria serpyllifolia*), woolly mullein* (*Verbascum thapsus*), wire moss (*Polytrichum juniperinum*) and *Hynum cupressiforme*.

Additional species at stony sites are *Epilobium melanocaulon*, *Vittadinia australis*, *Lachnagrostis* sp. Deptford pink* (*Dianthus armeria*) and viper's bugloss* (*Echium vulgare*).

Survey of indigenous fauna was not possible, although shrubland on this stony substrate is likely to provide important habitat for lizards, such as common skink.



Pimelea prostrata at SNA 801

Notable Flora, Fauna and Habitats:

Notable features of these SNAs are the presence of indigenous vegetation that is representative of the original vegetation, within an 'at risk' Land Environment, and likely providing important habitat for lizards.

Notable Plant and Animal Pests:

Assessment of plant and animal pests on the property (SNA 798) was not possible. However, two important plant pests are present at SNA 801: barberry and broom. Other important woody plant pests recorded in the area are gorse (*Ulex europaeus*) and cotoneaster (*Cotoneaster microphylla*).

Boundaries (buffering, fencing, adjoining plant communities and habitats):

The boundaries of these SNAs have been drawn to include the main areas of shrubland vegetation, as determined from aerial photographs. Ground survey would be required to confirm the accuracy of these proposed boundaries.

ASSESSMENT AGAINST DISTRICT PLAN CRITERIA:

Primary Criteria	Rank	Notes
Representativeness	M/H	Indigenous vegetation which is representative of that originally present in the ecological district, and typical of that remaining in the ecological district.
Rarity	M/H	Indigenous vegetation within an 'at risk' land environment.
Diversity and pattern	M	Moderate plant species diversity (at SNA 801).
Distinctiveness/special features	M/H	The diversity of native grasses is notable.
Other Criteria		
Size/shape	M-H	Large sites, although SNAs 798 and 799 are long and narrow and not well buffered.
Connectivity	M	The sites are linked by grassland and hydrologically by flood events.
Long-term Sustainability	M	Plant pest control will probably be necessary to maintain ecological values in the long term. The sites are on an unstable fan that will most likely be affected by future flooding of Bush Stream.

ASSESSMENT AGAINST REGIONAL POLICY STATEMENT CRITERIA:

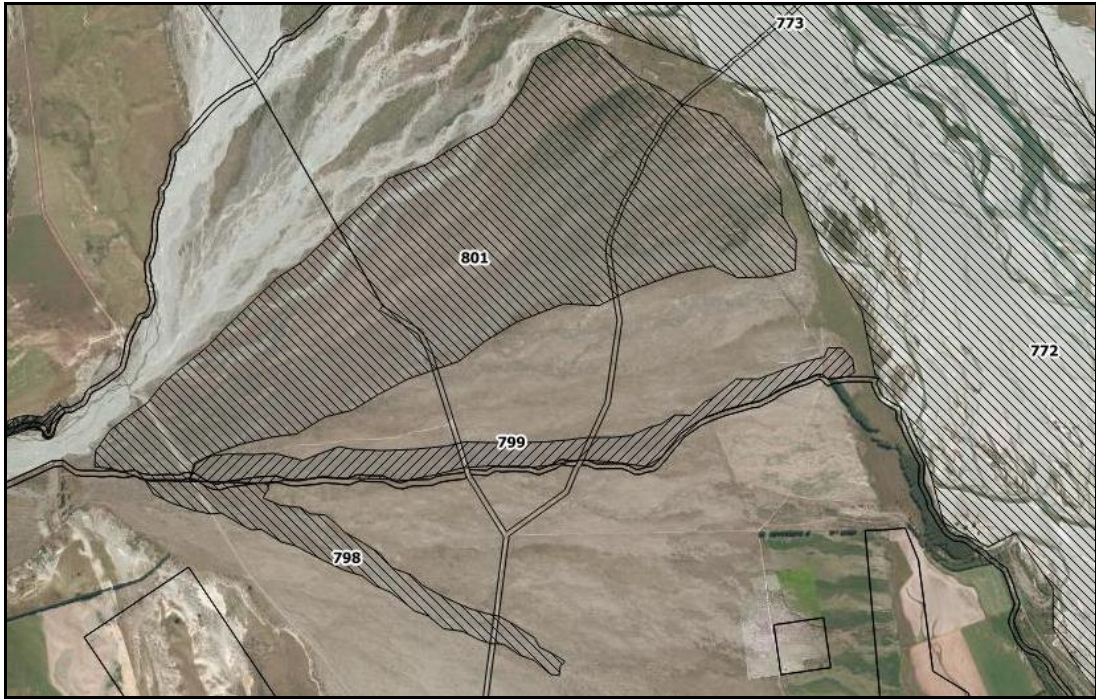
Criteria	Yes/No	Comments
Representativeness	Yes	Indigenous vegetation that is representative and is typical/characteristic of the natural diversity of the ecological district. SNA 801 is a large example of this vegetation.
Rarity/Distinctiveness	?	Indigenous woody vegetation which is 'at risk' (reduced to 20-30% of its former extent in the Land Environment).
Diversity and Pattern	?	Unclear.
Ecological Context	Yes	Vegetation and habitat that buffers stream channels and plays an important role in the hydrological functioning of the stream.

Final Consideration (of other matters: Section D, page B-19 of Timaru District Plan):

These areas appear to have been set aside from pasture development. They have only limited potential for further development, due to the risk of future flooding.

Discussion:

If the above assessment is accurate, these sites meet the Timaru District Plan and Canterbury Regional Policy Statement criteria for significant natural areas. Important values are the presence of woody (shrubland) vegetation on a river fan and the habitat they likely provide for lizards.



Bush Stream fan SNAs 798, 799 and 801, presumed extent



native sub-shrub Helichrysum depressum (rear); Vittadinia australis (foreground) at SNA 801

Area Name: Rangitata River terrace wetland	Property: Mesopotamia Station
Ecological District: Hakatere	Nearest Locality: Peel Forest
797 central map ref. (NZTM): 1431980E-5165050N	Area Size (ha): c. 23.2 Altitude (m): c. 460
Assessor: Mike Harding	Survey Time: n/a Survey Date: n/a

General Description:

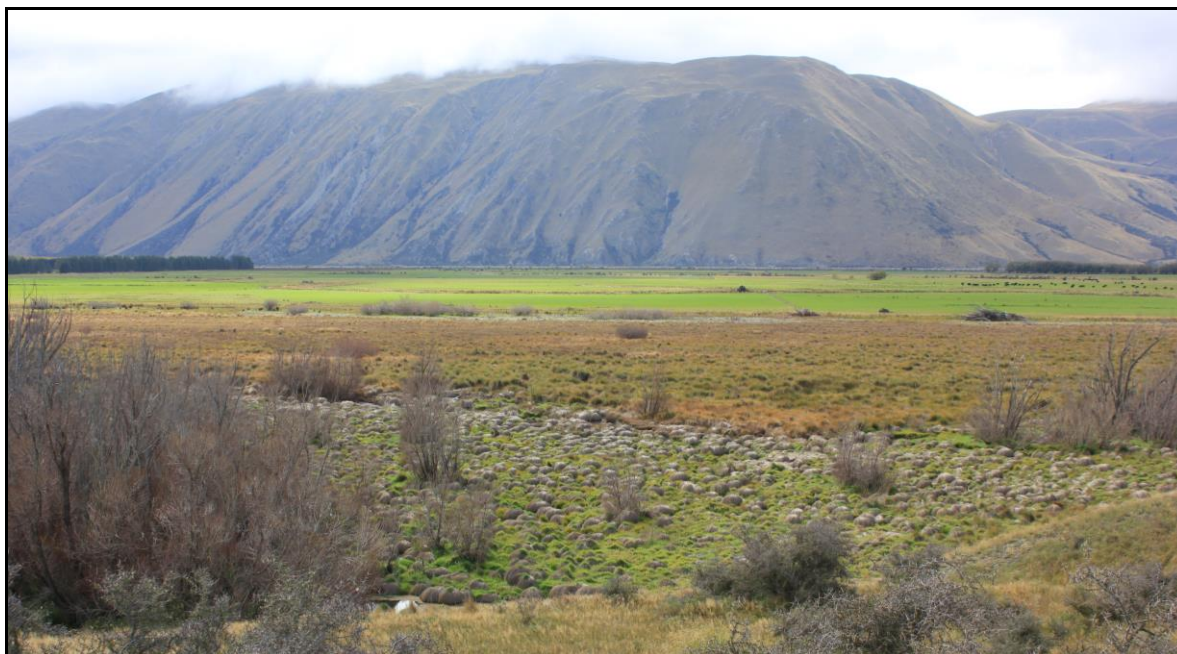
This SNA is located on the floodplain of the Rangitata River, where the lower reaches of Scour Stream flow across the river flats. Permission for access for a ground survey was denied by the landowner. However, parts of this area are visible from Rangitata Gorge Road and the vegetation boundaries are visible on aerial photographs. This SNA encompasses an area of wetland vegetation and is part of a larger wetland, the other part of which is listed as SNA 795.

The SNA lies on recent alluvial deposits (gravel and silt) from the Rangitata River. It is within Hakatere Ecological District (McEwen, 1987) and the K4.1c Land Environment, within which indigenous vegetation is regarded as 'at risk' (Walker *et al*, 2006). Seepage/flush wetlands are regarded as an 'originally rare' ecosystem, in which indigenous vegetation is listed by Holdaway *et al* (2012) as 'endangered'.

Plant Communities:

As far as can be determined from roadside views the wetland appears to be dominated bog rush, pukio (*Carex secta*) and other sedges. Red tussock (*Chionochloa rubra*) is present at the wetland margins. A substantial area is dominated by a dense tall stand of crack willow* (*Salix fragilis*). These trees are mostly dead having presumably been recently treated with herbicide. Vegetation grades, at the margins, to pasture grasses.

Survey of indigenous fauna was not possible. However, it is likely that the wetland provides important habitat for birds and native fish. Streams in this area provide spawning habitat for salmon.



lower part of the wetland (SNA 795), dead willow trees visible in foreground

Notable Flora, Fauna and Habitats:

Notable features of this SNA are the presence of indigenous vegetation in an 'originally rare' (nationally endangered) ecosystem, within an 'at risk' land environment, and the size of the wetland complex.

Notable Plant and Animal Pests:

Assessment of plant and animal pests was not possible. Clearly visible is the large infestation of crack willow, though it appears that this has been recently treated.

Boundaries (buffering, fencing, adjoining plant communities and habitats):

The boundaries of this SNAs has been drawn to include the main areas of wetland vegetation, as determined from aerial photographs. Ground survey would be required to confirm the accuracy of these proposed boundaries.

ASSESSMENT AGAINST DISTRICT PLAN CRITERIA:

Primary Criteria	Rank	Notes
Representativeness	M/H	Indigenous vegetation which is representative of that originally present in the ecological district, and typical of that remaining in the ecological district.
Rarity	H	Indigenous vegetation within an 'at risk' land environment and part of a 'nationally endangered' ecosystem.
Diversity and pattern	?	Plant species diversity could not be accurately assessed.
Distinctiveness/special features	?	Likely to provide favourable habitat for birds and fish.
Other Criteria		
Size/shape	M/H	Relatively large area of indigenous vegetation at this altitude.
Connectivity	M	Lies close to the open bed of the Rangitata River (SNA 772).
Long-term Sustainability	?	Unclear.

ASSESSMENT AGAINST REGIONAL POLICY STATEMENT CRITERIA:

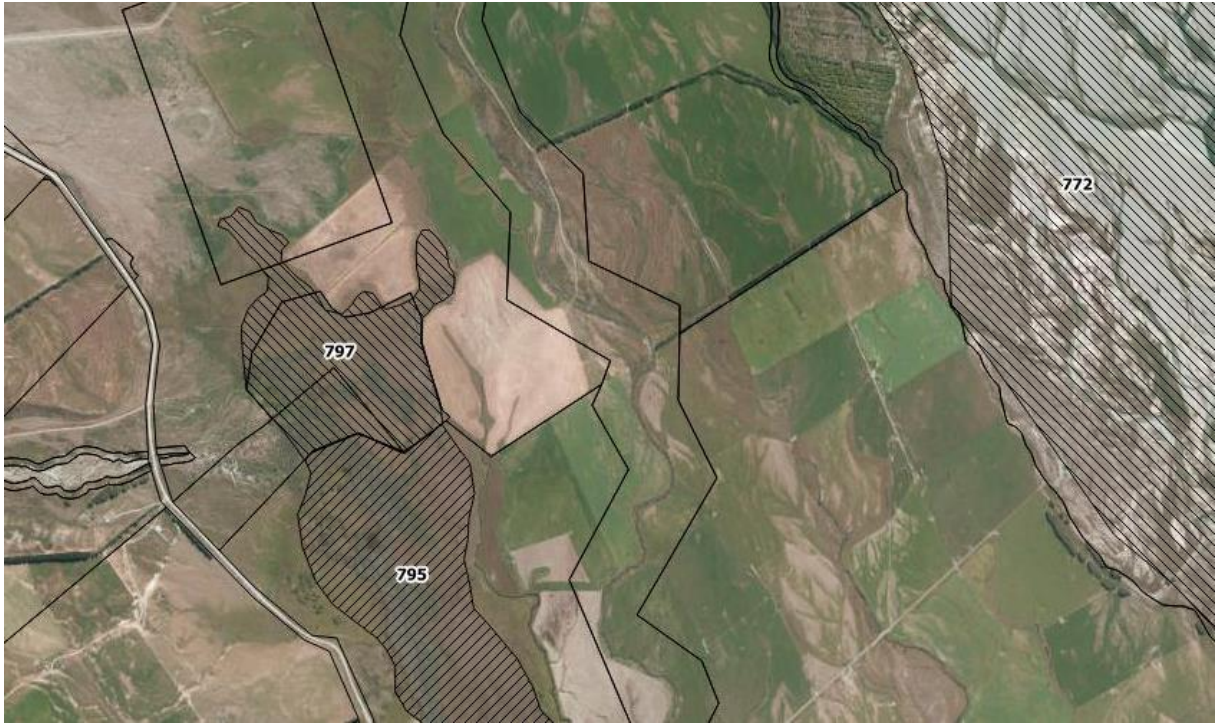
Criteria	Yes/No	Comments
Representativeness	Yes	Indigenous vegetation that is representative and typical/characteristic of the natural diversity of the ecological district. A large example of its type in the ecological district.
Rarity/Distinctiveness	Yes	Indigenous vegetation within an originally rare ecosystem.
Diversity and Pattern	?	Unclear.
Ecological Context	Yes	A wetland which plays an important hydrological role in the natural functioning of a river.

Final Consideration (of other matters: Section D, page B-19 of Timaru District Plan):

This area appears to have been set aside from farm development and possibly protected and managed (?). It has limited potential for further development, due to poor drainage. Vegetation is affected by a plant pest (crack willow), though this infestation appears to have been recently controlled.

Discussion:

If the above assessment is accurate, this site meets the Timaru District Plan and Canterbury Regional Policy Statement criteria for a significant natural area. Important values are the presence of wetland vegetation within an acutely threatened land environment.



SNA 797, presumed extent

References Cited

- Cox, S.C; Barrell, D.J.A (compilers). 2007. Geology of the Aoraki area. *Institute of Geological and Nuclear Sciences 1:250,000 geological map 15*. Institute of Geological and Nuclear Sciences Limited, Lower Hutt.
- de Lange, P.J; Rolfe, J.R; Champion, P.D; Courtney, S.P; Heenan, P.B; Barkla, J.W; Cameron, E.K; Norton, D.A; Hitchmough, R.A. 2012. *Conservation status of New Zealand indigenous vascular plants, 2012*. Department of Conservation, Wellington, New Zealand. 70p.
- Harding, M.A. 2002. Mesopotamia Pastoral Lease vegetation survey. *Unpublished Report*, Department of Conservation.
- Hitchmough, R.; Anderson, P.; Barr, B.; Monks, J.; Lettink, M.; Reardon, J.; Tocher, M.; Whitaker, T. 2013. Conservation status of New Zealand reptiles, 2012. *New Zealand Threat Classification Series 2*. Department of Conservation, Wellington. 16p.
- Holdaway, R.J.; Wiser, S.K.; Williams, P.A. 2012. Status assessment of New Zealand's naturally uncommon ecosystems. *Conservation Biology*, 2012.
- Leathwick, J; Wilson, G; Rutledge, D; Wardle, P; Morgan, F; Johnston, K; McLeod, M; Kirkpatrick, R. 2003. *Land Environments of New Zealand*. David Bateman Ltd.
- McEwen, WM (editor). 1987. Ecological regions and districts of New Zealand, third revised edition (Sheet 4). *New Zealand Biological Resources Centre Publication No. 5*. Department of Conservation, Wellington, 1987.
- Robertson, HA; Dowding, JE; Elliot, GP; Hitchmough, RA; Miskelly, CM; O'Donnell, CFJ; Powlesland, RG; Sagar, PM; Scofield, RP; Taylor, GA. 2012. Conservation status of New Zealand birds, 2012. *New Zealand Threat Classification Series 4*. Department of Conservation, Wellington.
- Walker, S.; Price, R.; Rutledge, D.; Stephens, R.T.T.; Lee, W.G. 2006. Recent loss of indigenous cover in New Zealand. *NZ Journal of Ecology* 30: 169-177.