



Surface Water and Groundwater Resources of Christchurch City and Selwyn District:

A searchable meta-database for finding information

Summer Scholarship Report

WCFM Report 2013-001

REPORT: WCFM Report 2013-001

TITLE: **Surface Water and Groundwater Resources of Christchurch City and Selwyn District:** A searchable meta-database for finding information
This report describes how the database was created and provides a guide to its operation.

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DATE: **18 February, 2013**

Executive Summary

A meta-database of information on the surface and groundwater resources of Christchurch City and Selwyn District has been created, in response to concerns that information on these freshwater resources is currently dispersed and difficult to find. This meta-database can now be used by the community to find out about papers, reports and official communications regarding the water resources of Christchurch and Selwyn District, learn where the documents are held in hardcopy or online, and in some cases access the document or its data directly via the database.

The database includes over 750 references; mainly university research theses and reports, technical reports, scientific papers, official communications, and relevant policy and strategy documents. All information has been checked for objectivity and relevance, before being collated into “search groups” and linked to keywords to enable the database to be searched. A brief summary of content is provided for each reference.

The meta-database is hosted on the Waterways Centre’s website (www.waterways.ac.nz), and can be searched by entering either a key subject word or a document type.

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Section 1 Introduction

1.1 Background

Over the last 50 years much information has been compiled, researched and published regarding the surface and groundwater resources of Christchurch City and Selwyn District. However, the documents are dispersed and the information hard to access and utilise. The Waterways Centre for Freshwater Management became aware of concerns raised by the community, regarding their difficulties finding and using such information to inform their opinions and actions relating to water resource issues in Canterbury. In November 2012, a student summer research project was funded to bring together this information in a meta-database of information that would remain accessible to the public.

Another motivation for the project was the realisation that, if this information and data is not collated into one place, much of the older documents will be lost in academic, regulatory, and personal archives and even the awareness of the data existence will be lost. Thus this database was designed to direct both readily accessible information, and that which is harder or more time-consuming to find; for the latter direct access to the reference has been provided where possible.

1.2 Geographical Coverage

The database incorporates resources relating to both the Selwyn District and Christchurch City geographical areas. There was some difficulty determining the exact geographical boundaries of the Selwyn District. Two major catchments; the Waimakariri River and the Rakaia River catchments, lie immediately to the north and south of the Selwyn District catchment respectively (Figure 1), and are connected to it by means of groundwater systems. Therefore some Waimakariri and Rakaia catchment documents have been included in the database where relevant. The Christchurch City boundary, on the other hand, was relatively easy to define (Figure 2). It includes Banks Peninsula and follows the territorial boundary of the city.

1.3 Constructing the Meta-Database

Experience with the construction of another Waterways Centre meta-database (on River Mouths) was used as a starting point for this database, but with some significant design improvements to improve content and function. For example, keeping referencing styles consistent, grouping documents to enable searching and adding keywords, and including a short overview or summary of the content of the report. However, to avoid copyright complications, no abstracts from the articles are included in the database.



Figure 1. Map of the Selwyn District Boundary (courtesy Selwyn District Council)

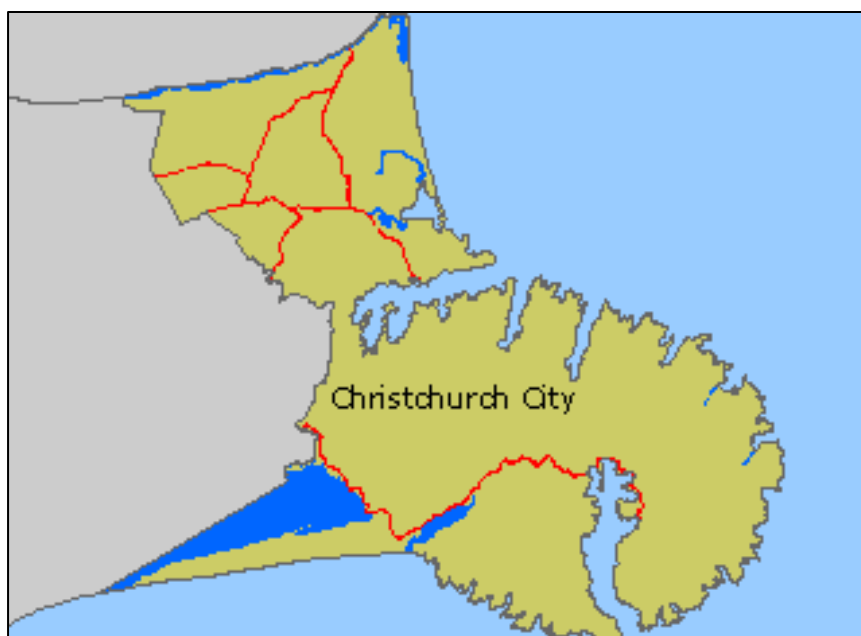


Figure 2. Map of Christchurch City Boundary (Statistics New Zealand, 2006)

Section 2 Methodology

2.1 The Software - EndNote X3

The meta-database was constructed using EndNote X3 referencing software to enter in the details of the documents, and the summaries and key words. EndNote X3 is designed specifically for creating libraries on special topics, with a range of different referencing styles. It offers the flexibility to create a style which will specifically suit a particular project and is used predominantly for large research projects to store all relevant reference information. EndNote X3 also has the ability to hold a large volume of information (up to 100,000 references) as well as enabling the user to categorise information into a range of specific groups.

Although initially EndNoteX3 is a daunting piece of software, the help manual includes creating personalised categories, finding duplicate records, creating an output style and also unique referencing types. It has a number of useful tools, including search function which can be linked to the online database display to enable a keyword search.

At the conclusion of the data compilation, EndNote X3 was combined with web engine software to create a database which is publically accessible online at www.waterways.ac.nz

2.2 Data Sources

One of the primary tasks of this project was to find the source information in a logical, systematic way, to ensure that useful references where not missed and that time wasn't wasted on accessing the same reference more than once. The scope of information and the places in which key information could be found was extensive, so a list of key places in which relevant material could be held was compiled. The list included (but was ultimately not limited to);

- Avon-Heathcote Estuary Ihutai Trust
- Central Plains Water Limited Website
- CERA – Christchurch Earthquake Recovery Authority
- Christchurch City Council
- Christchurch City Libraries
- Department and Staff from both Canterbury University and Lincoln University
- Department of Conservation
- Environment Canterbury online publications library
- Lincoln planning Review
- Lincoln University Library Database and Repository
- Lincoln University Research Archive
- Ministry for the Environment
- Ngai Tahu (Te Runanga O Ngai Tahu)
- The National Institute of Water and Atmospheric Research (NIWA) online Library
- Selwyn District Council
- The Styx-Purakaunui: Waterways, Wetlands and Surface Water Website
- The University of Canterbury Library Database and Repository

- Water Rights Trust
- Waterways Centre for Freshwater Management
- WET - Waihora Ellesmere Trust

It must be noted that, while every attempt was made to produce a complete database, due to time and resource constraints, it is possible that not all relevant information is included. Any such omissions can be brought to the attention of Waterways Centre by contacting them with details of the reference and it will be added to the database.

2.2.1 Municipal Libraries

The online 'search' system and a variety of keywords were used to locate known references in the Christchurch City Libraries, and an additional 50 resources were located by the librarians, even though many of the Aotearoa New Zealand items were being stored in a storage facility off site due to the earthquakes. Many historical resources, such as the North Canterbury Catchment Board Reports, were accessed this way. Christchurch City Libraries also requested books from the Research Room Collection, which they made available, including some invaluable historical resources dating as far back as the 19th century.

2.2.2 University Libraries

Both online and hard copy resources were located through the Lincoln University and University of Canterbury library systems. A number of invaluable historical resources were also found via the MacMillan Brown library at the University of Canterbury.

2.2.3 Government and CRI Websites

Environment Canterbury's website contained a wealth of information on the water resources of Christchurch and the Selwyn District. Environment Canterbury Technical Reports in particular provide data-rich information on a broad range of water resource management issues. The websites of both Christchurch City Council and the Selwyn District Council were also searched for key council reports and documents. The Selwyn District Council website was especially useful to locate information about the Central Plains Water Enhancement Scheme. The DOC (Department of Conservation) website also yielded valuable reports.

Useful CRI (Crown Research Institute) websites included those of NIWA (National Institute of Water and Atmospheric Research) and Landcare Research.

2.2.4 Waterways Centre Institutional Knowledge

An email was sent out to the Waterways Centre for Freshwater Management's Joint Working Group; approximately 50 academic staff at Lincoln and Canterbury universities with water-related research interests and teaching. They were invited to submit references for their relevant publications and these publication lists were used to ensure that research and resources not previously found by other search methods were included in the database. This was most effective at locating 'grey literature' (less formal reports and publications with raw data), which if not brought forward for a wider audience can easily slip through the cracks of academia. This is often incredibly useful for determining patterns and trends over time.

Joint Working Group members also shared their knowledge of old government reports and publications that were not in the public arena.

2.3 Reference Types

Overall, a range of reference types were included in the database and these included:

- Book Sections
- Books
- Conference Proceedings
- Council Pamphlets
- Council Policies, Plans and Strategies
- Council Reports
- Data sets
- Dissertations and Theses
- Journal Articles
- PowerPoint presentations
- Student Summer Scholarship Project Reports
- Technical Reports
- Selected unpublished reports and documents

A decision had to be made regarding what level and type of information should be included to ensure academic robustness and that the quality of the information included was high. Any resource with useful raw data for future research and assessment was included in the database, as this is the type of information that is likely to be lost if not made accessible. The types of information that were often excluded were;

- Protocols and methods documents (e.g., Aquifer Test Guidelines) unless they contained raw data specific to the project regions.
- Undergraduate project reports except for summer student scholarship project reports, where normally the student must have completed their undergraduate degree and have committed to postgraduate study.
- Section 42a (RMA Consent) reports (initially), although the intention was to reconsider at a later stage.
- Meeting minutes from the Canterbury Water Management Strategy Zone Committees, but the final reports (i.e. the Zone Implementation Plans – ZIPs) have been included. Note that the meeting minutes can be easily located via a general internet search.
- Submissions on water-related regional plans, due to the bias in many of them. For recent plan changes, these submissions can be found via the internet, or by contacting the relevant council.

- Council memos and Statements of Evidence, unless they contained robust technical or raw data.
- PowerPoint Presentations, unless the research report was unavailable and the raw data could be useful for future projects.

2.3.1 Checking for Objectivity and Relevance

References were screened before being added to the database for both objectivity and their relevance to the database. Objectivity was considered important. It was necessary to provide reliable and factual information on the region's water resources, ensuring that the database is of a high quality and that bias does not diminish the credibility of the database.

Determining whether a reference was relevant was more complicated, and an inclusive, as opposed to exclusive, approach was taken. Some of the more problematic references included;

- Those pertaining to near-coastal environments such as estuaries and lagoons. These were included, but those pertaining to specific coastal processes and marine fauna off the coast were excluded, other than for Lyttleton and Akaroa Harbours.
- References on tsunamis, which were excluded except where there was discussion of the influence that such an event would have on the waterways of Christchurch City and Selwyn District.

2.4 Accessing the Reference Material via the Database

It would be preferable, of course, that all information identified in the database should be available online and the document or a direct link to the document, provided. However, this is not possible in many cases, due to copyright considerations or practical limitations and instead the user will need to contact the institution or individual that holds the documents. For example, some of the Christchurch City Library resources are archived, and are not on the shelf of any library. Communication with the library is required to set a time to view these, to protect their historical value. Likewise for some unpublished reports held by university staff, the staff member will need to be contacted (and details of the contact are provided). Further, copies of a small number of the references which have proved very hard to find and access, but for which copyright issues are not a problem, are kept in a file at the Waterways Centre. The database user will need to contact the Waterways Centre, who can provide access for private study. One such example is raw data collected from the groundwater monitoring wells surrounding the Burwood Landfill; users are directed to the contact the Waterways Centre for access.

Therefore information has been included to help users identify the reference they need, assess whether it is actually what they are looking for, and access the information itself.

2.4.1 Providing Additional Publication Information

Although the referencing style in EndNoteX3 used was based on APA, this was modified to include key information such as URL's, ISBN and DOI's to assist in locating a reference (refer Appendix 1 for the modified APA output style utilised for this database). This was achieved by editing the bibliography template in EndNoteX3 so that it suited the project aims.

URL links were included, while noting that they will alter over time (a concern for upkeep of the database), as they play an important role in accessing a reference for as long as they are current. Most URL's will provide a linked page when they change, so the information can often still be located.

ISBN numbers were also included, even though these numbers are not as useful for locating publications as many believe. They are, however, unique to a publication, unlike ISSN numbers which relate to a journal or series. ISSN numbers were excluded.

To ensure that database users could relocate the more obscure (e.g., dating as far back as 1879!) but still valuable documents, the library's where they were found, along with their call numbers, were included. The exception was for the Christchurch City Libraries, where due to earthquake damage and the temporary nature of the current library facilities, the call numbers will be changing in the near future. A quick search of the Christchurch City Library Catalogue or getting in contact with the librarians will instead be required.

2.4.2 Resource Summaries

To help users confirm (or otherwise) that they have indeed found the information they are seeking, a short summary of the content of each reference and how it relates to the database has been written. These summaries are often only a few sentences long, but are used instead of the document's abstracts to avoid copyright complications. Emphasis has been placed on relevance to the Christchurch City and Selwyn District waterways resources.

2.5 Facilitating Searches

2.5.1. Allocating References to Categories

To assist with searching and accessibility, the database has been grouped according to key themes and characteristics. There are approximately 40 categories, within 6 main groups (Figure 3). References can appear in more than one category where appropriate.

2.5.2. Keywords

Upon entering each reference source into the database a list of keywords were also entered to enable a search function to be set up. These keywords are not an extensive list of search terms, but provide more flexibility than using just the categories (Figure 3) to find a particular reference. For example for the following reference:

Dalmer, E. B. (1971). The Waimakariri River as a Water Resource: A report presented to the North Canterbury Catchment Board on 2 October, 1970 (The North Canterbury Catchment Board Report). Christchurch: The North Canterbury Catchment Board. Accessible at: University of Canterbury Library: TC 522 .W13 .D148 copy 2.

The following keywords were also entered into the database:

- Waimakariri
- surface water
- Waimakariri River
- North Canterbury Catchment Board
- rainfall levels
- precipitation
- discharges
- discharge quantities
- low flows
- abstraction
- water takes
- irrigation
- river use
- infiltration
- pollution
- river characteristics
- flow data
- river classification
- recreation
- fish
- wildlife
- industrial waste
- water rights

Each reference had a different number of keywords, depending on the nature, length and relevance of the document.

Figure 3. Waterways Christchurch City and Selwyn District Database Categories

Subject: All References	Resource Type	Surface Water	Groundwater	Selwyn	Christchurch
Algae	All Technical Reports	Surface Water	Groundwater	All Selwyn Surface and Groundwater Resources	All Christchurch Surface and Groundwater Resources
All Christchurch City and Selwyn District Water Resource Information	Christchurch Drainage Board	Technical Reports	Technical Reports		
Bacteria Concentrations	Ellesmere Lands Drainage Board	Water Quality	Water Quality	Burnham	Avon River
Canterbury Earthquakes				Central Plains Water Irrigation	Avon-Heathcote Estuary (Ihutai)
Canterbury Rivers and Streams	North Canterbury Catchment Board	Water Quantity	Water Quantity	Drinking Water	Banks Peninsula
Canterbury Water Management Strategy				Halswell River	Christchurch-West Melton Groundwater Zone
Climate Change	Strategies and Plans			Lake Ellesmere/Te Waihora	Drinking Water
Ecology	Thesis/Dissertations			Lake Forsyth/Wairewa	Heathcote River
Fish				Lincoln	Port Hills
Floods				Rakaia Catchment	Styx River
Historical Surface and Groundwater				Selwyn River	Waimakariri River and Catchment
Irrigation					Woolston Cut
Lakes					
Land Use Change					
Ngai Tahu					
Recreation					
Stormwater					
Surface-Groundwater Interface					
Wastewater					
Water Allocation					
Waterway Restoration					
Wetlands					

Section 3 Operating the Database

3.1 Finding the Database

The database is accessible via the Waterways Centre for Freshwater Management website: http://www.waterways.ac.nz/Research_database/Database.shtml. The database is available free to the public.

It is anticipated that the database will be updated as more resources are published. If individuals or organisations have information that they wish to include in the resource, they should contact the Waterways Centre for Freshwater Management's administrator.

3.2 Searching the Database

Both keyword search and category groups are provided to help locate references. It is recommended that the category groups be checked initially to see if an appropriate category is provided for their topic before trying a keyword search.

When using the keyword search, it is best to keep to singular words or simple combinations. It may be necessary to try different word combination. For example; waterway restoration, riparian buffer zone, riparian vegetation are all word combinations used in the keyword search, but relate to the same topic.

A list of documents will be created once a category is opened or a keyword search carried out (Figure 4). Each resource has a 'short resource summary' which can be viewed by clicking 'Show'. For those resources with URL links the database user can link to the database by clicking 'More Information'.

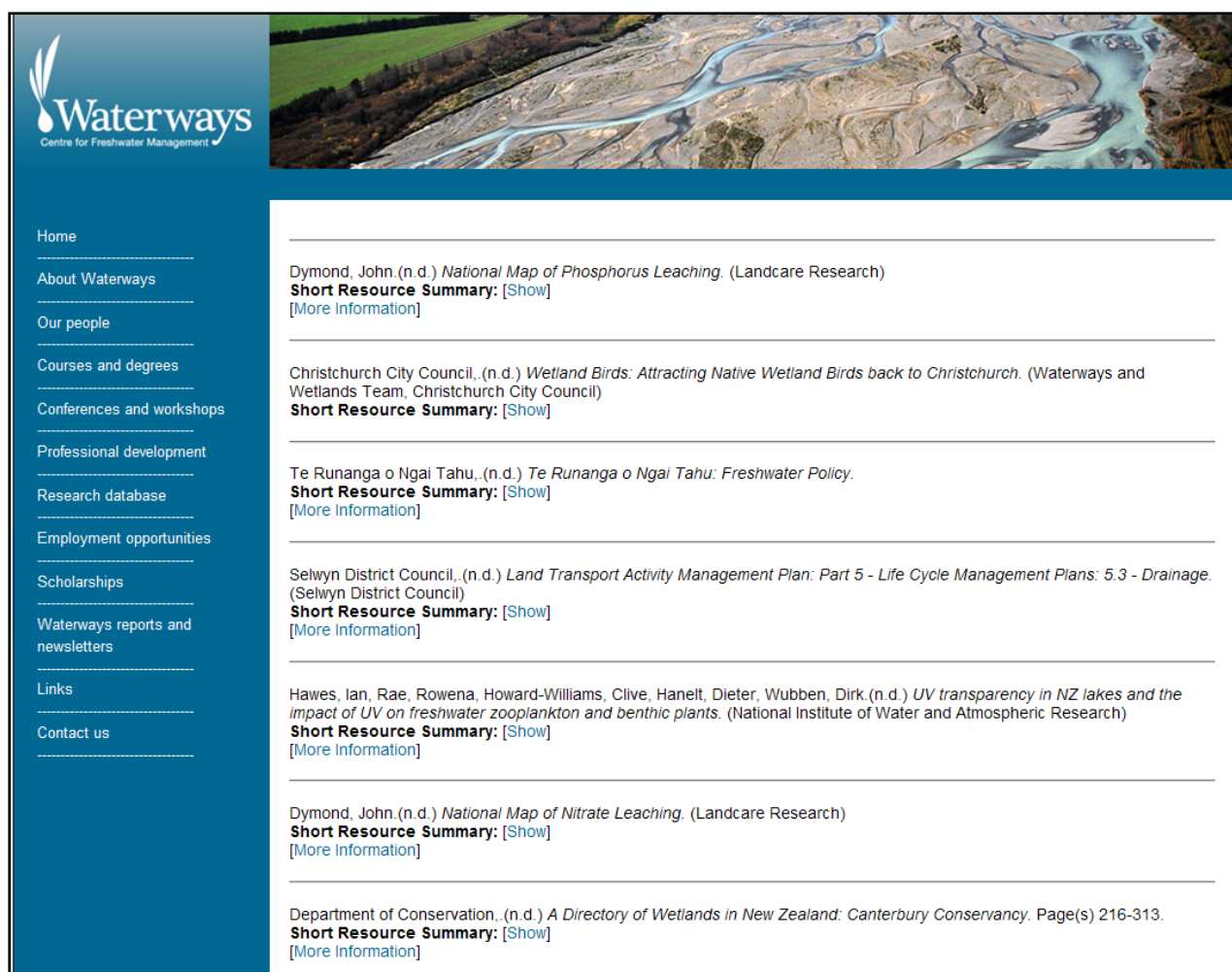


Figure 4. Database reference list example.

Section 4 Discussion & Recommendations

There were a number of challenges encountered when creating this database for the water resources of Christchurch City and the Selwyn District. These are discussed below to provide guidance to other similar data access projects, and as an assessment of the limitations of this project.

4.1 Locating Old Government Reports

Unfortunately, locating reports by government departments which no longer exist (such as DSIR, Ministry of Works and the Ellesmere Lands Drainage Board) proved to be an incredibly challenging task. Some of this type of information will still be missing from this database.

Further exploration of the National Library Archive and CRI library systems, particularly that of NIWA (current contact: Hannah Russell) is recommended. Another possible repository of useful water resource information is the Banks Peninsula Conservation Trust (current contact: Rachel Barker).

4.2 Earthquake Disruptions to Library Services.

For those references not available in electronic format, the disruptions caused by the 2010 and 2011 Christchurch Earthquakes poses some problems. In the summer of 2012/2013 when this database was being compiled, the central library at the University of Canterbury was undergoing repairs and was shut for the summer. Resources were still available but had to be accessed via other libraries.

Likewise the Christchurch City Libraries were operating out of their temporary Tuam and Peterborough premises. A number of the relevant references were being kept offsite, so that information needed to be requested prior to arriving at the library. Some of the references were unfortunately totally unavailable in a yellow-stickered building. These may be available from mid-2013. A list of those references which are likely to be relevant, but have not been able to consulted yet, is given in Appendix 3.

4.3 Document Size & Duplication

Some of the online information resources in the database are large documents, and may take some time (or impossible to download through some internet connections). In particular, these include reports on the Central Plains Water Enhancement Scheme, which are accessible from Selwyn District Council.

Given the size of this database, it was easy to find resources in more than one place and to miss the fact that they had already been included in the database. However, there is a 'find duplicate records' function in Endnote which can locate such duplication.

4.4 Updating and Maintaining the Database

The amount of information available on Christchurch City and Selwyn District water resources is large and constantly increasing. A meta-database such as this may never be “complete” , and given the time constraints of this project it is very likely that some key references sources have been unintentionally omitted. Appendix 3 includes some references which are yet to be published, which can be incorporated when the database is next reviewed and updated.

A regular review of the database to add new references and information, and to check linkages and functionality, is recommended. This should be undertaken every 3 years.

Acknowledgments

Thank you to Mr Joffre Horlor, Systems Programmer at the University of Canterbury, for making the meta-database operational and providing comment and feedback throughout the project. Thanks also to Theresa Buller and Rosemary O’Neil from the Christchurch City Libraries for their help locating an extensive list of resources, and bringing other relevant material forward. This, despite earthquake-associated disruptions which meant many of the Aotearoa New Zealand items were stored in a storage facility off site. Thank you to Dr Hugh Thorpe for direction to old Ministry of Works reports, and to the University of Canterbury Engineering and Physical Sciences Library’s Endnote librarian, Alison Johnston.

References

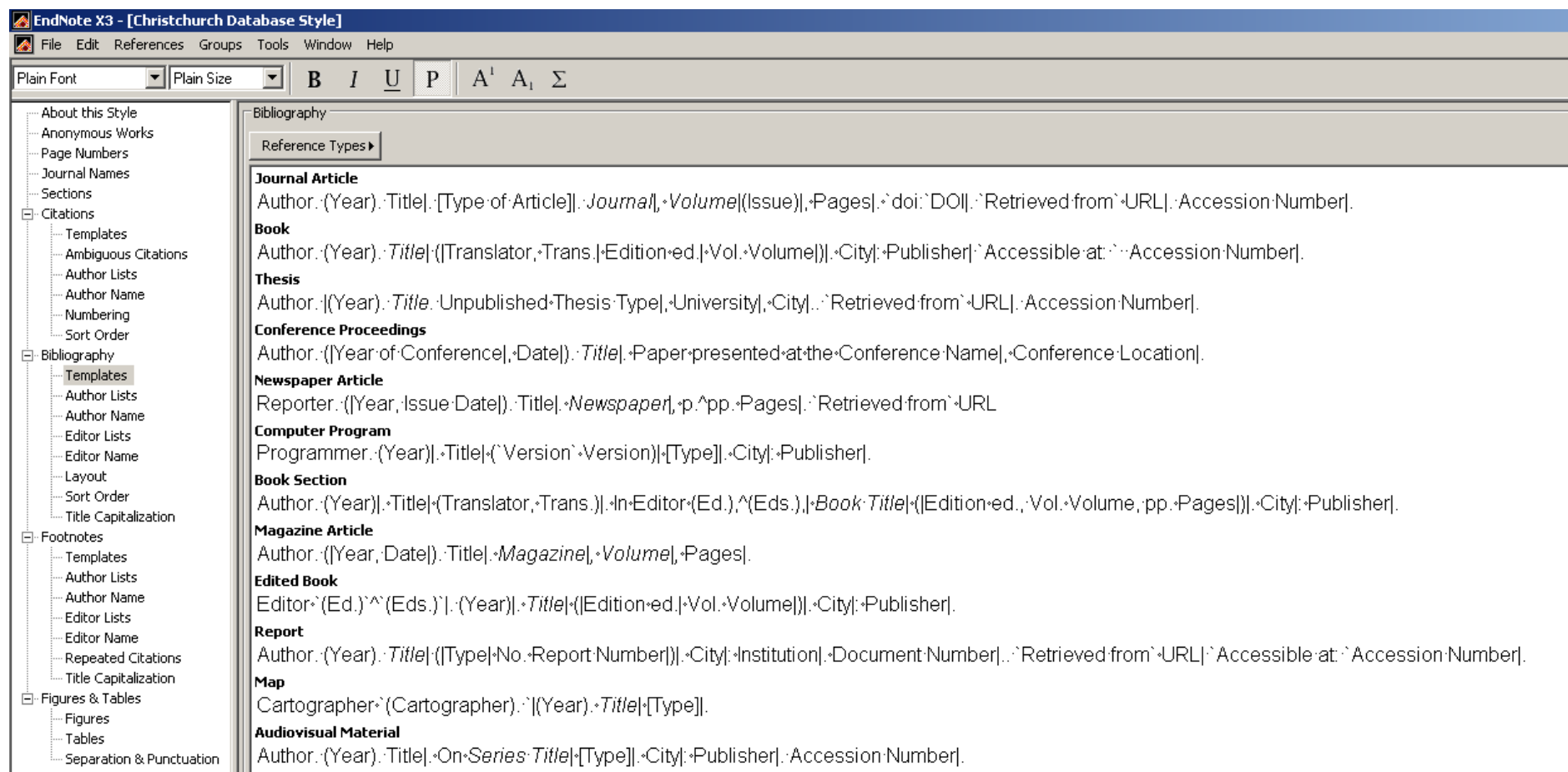
Selwyn District Council. (n.d.). *Map of Selwyn District*. Retrieved January 16, 2013, from Selwyn District Council: <http://www.selwyn.govt.nz/contact-us/map-of-selwyn-district2>

Statistics New Zealand. (2006). *Boundary Map of Christchurch City*. Retrieved January 16, 2013, from Statistics New Zealand:

<http://www.stats.govt.nz/Census/2006CensusHomePage/Boundary/BoundaryMap.aspx?id=2000060&type=ta&ParentID=1000013>

Appendix 1 Christchurch Database Style

The Database output style was based on APA 5th and modified to suit the needs of a database user.



Appendix 2 EndNoteX3 Reference Entry Example

EndNote X3 - [Ross, 1954 #445]

File Edit References Groups Tools Window Help

Reference Type: Thesis Show Empty Fields

Plain Font Plain Size B I U P A¹ A₁ Σ

Author
Ross, J. A

Year
1954

Title
The Physiography of the Selwyn River Catchment

City
Christchurch

University
Canterbury University College

Degree
Master of Arts and Honours in Geography

Number of Pages
41

Date
7 December 1954

Thesis Type
Master's Thesis

Accession Number
University of Canterbury Library: Macmillan Brown Library

Keywords
Selwyn catchment
Selwyn River
Selwyn River catchment
propositions
homogenous
physiographic history
shingle fans
river course
river path
stream erosion
geology
catchment characteristics
glaciation
moraine
landscape change
Landscape evolution

Abstract
This 1950's thesis looks at the Selwyn River Catchment, describing both its nature and origin. The geology of the area is detailed in this thesis and three theories or propositions are justified and explained by the author. These propositions include but are not limited to the proposition that until ice modified the Selwyn River valley the whole catchment could have had a homogenous physiographic history and that the Selwyn River course has been determined by shingle fans originating from other larger, nearby rivers.

Added to Library: 14/01/2013 Last Updated: 14/01/2013

Appendix 3 Resources to include as they become available

A list of resources that were unable to be reviewed when collating for the Christchurch City and Selwyn District Database over the 2012/2013 summer.

1. Published but unavailable due to earthquake damage to the Christchurch City Libraries

These are expected to be available by mid- 2013

- Water Quality & Beach Standards (2004)
628.161099383 WAT
- Our Water Resources (1985)
553.780993172 OUR
- Treatment Works [official] Opening 27th October, 1962, 10.00 A.M Programme (1962)
352.6 CHR
- Freshwaters of Canterbury (1999)
333.91009938 FRE
- From Rain Drops to River Flows (1999)
First floor stack – ask at desk. #551.48 FRO
- Proceedings of the Conference on Erosion Assessment and control in New Zealand, 1978. # 631.45 CON
- Towards a Resolution of Conflict in Water Resource Allocation: A discussion based on examination of the Rakaia River Debate (1984)
333.91009385 TOW
- Rakaia Water Use and Irrigation Development (Maidment, 1981)
Serials # 627 WAT
- An Illustrative Example of Evaluation Procedures (drainage Scheme – North Canterbury) (Norton, 1968)
Serials #338.1072 DIS
- Groundwater between the Selwyn and Rakaia Rivers, Canterbury, New Zealand (Anderson, 1994)
553.79099385 AND

- Report on Waimakariri River Flood of 27/12/57 (North Canterbury Catchment Board, 1958)
627.4 NOR
- Analysis of Potential Stormwater Quality Controls in Christchurch (Elliott, 1997)
628.161099383 ELL

2. Currently in Draft Form

Expected to be publically available by the end of 2013

- O’Sullivan, A., deVries, T. and Scouller, J. (2013). Characterising stormwater budgets and water quality runoff from green roof systems in Christchurch. Proceedings of the 8th South Pacific Stormwater Conference, New Zealand Water Association, Auckland, New Zealand, May 8-10 2013, 13 pp.
- Caruso, B., Ross, A., Shuker C. and Davies T.R.H. (2013). Flood Hydraulics and Impacts on Invasive Vegetation in a Braided River Floodplain, New Zealand. *Environment and Natural Resources Research* 3: 92-110.

3. To be included if the geographical coverage of the database is extended

- Thorpe, H. R.; Scott D.M.: “An evaluation of four soil moisture models estimating natural ground water recharge”. *Journal of Hydrology (NZ)* 38 (1). Pp 179-209. Accessible at: http://www.hydrologynz.org.nz/downloads/JoHNZ_1999_v38_2_Thorpe.pdf

(relating to Winchmore Station near Ashburton)

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