

**Drafting an Archival Blueprint for Engineering in Manitoba: Developing a
Thematic Guide to Engineering Records**

by

Brett Lougheed

**A Thesis
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In Partial Fulfillment of the Degree of Requirements
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Of

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Abstract

The engineering profession in Manitoba has a long and storied history. Despite this fact, the dearth of historical work devoted to engineering in Manitoba is evident when examining the literature on this subject. One possible major reason for this gap in the literature is that the records documenting Manitoba's engineering history are not easily accessible by researchers. Engineering records related to Manitoba are voluminous and located throughout numerous public and private archival repositories in Manitoba and elsewhere. Also, many descriptions of engineering records, especially in the private sector, do not adhere to archival standards. The proper description of engineering records according to archival standards across archival repositories in Manitoba alone is an admirable but very ambitious goal. Since the implementation of comprehensive descriptive programs is very time consuming, the creation of a research tool focused on engineering records, a thematic guide to the records of engineering in Manitoba, would prove quite useful in the interim. A thematic guide would aim to identify the principal engineering records in Manitoba in major institutions and stimulate research into the history of the engineering profession in this province.

This thesis is a first, and hopefully formative, contribution to the efforts required to create such a thematic guide for Manitoba engineering archives. The creation of an actual guide is itself a major project beyond the scope of this thesis. The opening chapter discusses the rationale behind sound archival description in archival theory and practice, and extends that discussion to the purposes and creation of this particular type of descriptive tool. The second chapter analyzes several existing models of thematic guides in an attempt to determine the best style and format for the creation of a thematic guide

for engineering. It will then outline the suggested format of the engineering guide based on these critiques and provide direction to significant components of the proposed guide's content in an extensive list of major bodies of engineering records located in the largest public archives in Manitoba and in a cross-section of leading private engineering firms in the province. This list illustrates the vast volume and variety of records that a thematic guide would map. The final chapter is devoted to an historical overview of engineering in Manitoba. This provides the essential context for comprehending both the choice of engineering in Manitoba as a subject for a thematic guide and the records that document it. A thematic guide to engineering records would draw heavily on this historical information. The thesis concludes with recommendations for the future development of engineering archives in Manitoba through collaborative efforts between engineers and archivists.

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Brett Loughheed
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Introduction

The development of the province of Manitoba has been highly dependent upon the prowess of engineers. The practice of engineering takes place in both the public and private spheres. Engineers play vital roles in all three levels of government in Manitoba, in educational institutions, private engineering firms, as well as in other private enterprises. The University of Manitoba's Faculty of Engineering educates some of the best and brightest engineering minds in the country. There are very few aspects of Manitoban society that are not affected by engineering.

The engineering profession produces a great number of records in a wide variety of media during its day-to-day operations. These records not only detail the activities of Manitoban engineers, but also important aspects of the development of Manitoba as a province and the engineering profession within the province. The archivist is often responsible for the appraisal, acquisition, preservation, arrangement, and description of engineering records produced under the aegis of all three levels of government for future administrative, legal, or scholarly research. Private engineering enterprises often designate individuals within their organizations to carry out archival functions for their records and retain the records for future perusal and to ensure the firms' accountability. The private sector has not always been able to efficiently archive the records it creates since it does not usually have or make attempts to obtain archival expertise.

Owing to the large amount of records that engineering activities produce and their dispersal across a number of public and private repositories in Manitoba, it is difficult to gain knowledge of the quantity of these records, where these records are located, what they contain, and the context of their creation. Many engineers in Manitoba, although

fiercely proud of their profession, are unaware of the rich history of engineering in this province documented in engineering records and in the context of their creation. At the same time there is little understanding among academics and the general public of the key role and many contributions of engineers to Manitoba's development. Manitobans, including engineers, have little understanding of the impact of engineering on the history of the province and of the processes and issues shaping the professionalization of engineering in Manitoba. There is a dearth of historical work on engineering in Manitoba.

In order to alleviate this situation and fill the gap in the literature on Manitoba's engineering heritage, researchers must be made aware of the content and location of the records that document this history. The compilation of these records into a subject or thematic guide would provide a useful tool for researchers and archivists by decreasing the amount of time required to locate specific records within a vast amount of archival collections, and decrease the time the archivist must devote to identifying and retrieving these records. A guide to engineering records in Manitoba would also allow for improved administrative efficiency throughout the Manitoban engineering community. The guide would provide engineers with an understanding of the content and context of engineering records in Manitoba, as well as a sense of their locality. This would ease many managerial decisions, such as matters affecting legal and ethical accountability.

This thesis will discuss the benefits of archival description and descriptive products, such as thematic guides, to a wide variety of users. It is the goal of this thesis to lay the groundwork for an engineering records guide. The thesis will outline the style, structure, and content of a proposed guide to the engineering records located in public

and private record repositories so that the historical, archival, and engineering communities, as well as the general public, become more aware of the valuable resources these records provide for future research uses, administrative efficiency, and organizational accountability. The value of such a subject-based research tool would yield benefits for many segments of the population. Also, a thematic guide would stimulate interest in the history of engineering while more comprehensive descriptive programs in engineering firms were being developed. It may also signify the beginning of a strong relationship between engineers and archivists.

The thesis will begin with a review of the archival literature relating to the principal objectives of contemporary archival description, such as the protection of the integrity of the records and the efficient retrieval of records, and will discuss how archival description based on sound theoretical principles affects the proper creation of an efficient thematic guide. Several archival organizations have taken differing approaches to description. Chapter one will examine these varying approaches. For example, the majority of Canadian archivists describe their records at the fonds level. American archivists utilize record groups in the description of government records, while several other archival institutions, especially in the Australian archival community, are now using the series system as the basis for descriptive work. It is important to implement descriptive systems that adhere to the principle of provenance so that the integrity of the record is protected by the inclusion of contextual information about the records' provenance or origin. In order to further the benefits afforded by basic description techniques based on provenance, subject or thematic guides can also be valuable tools in

archival description systems. The benefits of such guides in supplementing provenance-based primary descriptions of records will be examined in chapter one.

Following this theoretical framework for archival description and the creation of thematic guides, the thesis will analyze the format and content of such a guide to archival engineering records in Manitoba. Chapter two will attempt to fill the existing gap in the archival literature relating to thematic guides with an extensive discussion of this type of descriptive product for engineering. This chapter will explore the possibility of linking the descriptions of government and private-sector engineering archival records in Manitoba through the Internet in order to make them more readily understandable and accessible through an automated on-line thematic guide. Several existing models will be analyzed and critiqued in order to determine the most efficient design for a guide to engineering records located in repositories across Manitoba. An appendix to this chapter will also provide some semblance of what the guide's content might be by listing the fonds and series relating to engineering in many of Manitoba's largest archival repositories and the records of a cross-section of some of the province's leading private engineering firms. The descriptions of these records according to archival standards would be the basis for a guide to engineering records in Manitoba.

The following chapter discusses another feature of the thematic guide's content, the historical introduction. Chapter three will provide an introductory overview of engineering history in Manitoba, which could serve as the basis for the historical introduction to a proposed engineering thematic guide. It will also provide some valuable contextual information for comprehending the records that result from the functions of the engineering profession in Manitoba. This information feeds both provenance-based

descriptive systems and subject-oriented descriptions provided in a thematic guide. The chapter will consist of an historical account of the engineering profession in Manitoba, from its origins in the nineteenth century to today. Prominent Manitoban firms and enterprises, government agencies, and educational institutions involved in the development of engineering in the province will all be detailed in this chapter. Also included in this portion of the thesis will be an examination of some of the most prominent projects completed by these organizations, such as the Red River Floodway, through the various specializations within the Manitoban engineering community.

The conclusion of the thesis will discuss how engineering records which cannot be accommodated within their official archival mandates, mainly those of private-sector engineering firms, might be better served by the creation of an engineering history centre where these archives, and related museum artefacts and publications, might be housed. Archival professionals employed by this centre could be responsible for compiling and maintaining an engineering records thematic guide since archivists in repositories around Manitoba and across the nation likely do not have the time or the funding to do so. The conclusion will attempt to outline the roles of engineering and archival professionals in developing a better archival approach to the appraisal, conservation, arrangement, description, and provision of access to engineering records in the future.

One goal of this thesis is to outline the various key methods of archival description and the benefits that each method provides so that a best practice for the engineering profession might be formulated. Through the compilation of standardized primary descriptions into a thorough, user-friendly, subject-based descriptive end-product, it is hoped that the records of Manitoba's engineering heritage may be made

more readily accessible. A guide to the archival records of engineering in Manitoba would be of great value to a wide variety of people, as well as archivists and engineers.

This thesis will demonstrate how the creation of such a thematic guide could lead to more far-reaching implications for the engineering community through improved cooperation with archivists.

Chapter 1: Theoretical Overview of Archival Description

Introduction

Records arrive on the doorsteps of archival institutions everyday, often in differing states of disarray. One of the roles performed by the archivist is to employ descriptive techniques in order to gain some semblance of intellectual and physical control over their holdings. The techniques applied by the archival profession are numerous and vary according to a number of factors, including institution and geography. For instance, the descriptive standard utilized by a majority of Canadian archival institutions is the fonds-level description. Archivists in the United States have been closely allied with the record group for government records as the basic unit of description, while Australian archivists have developed a descriptive system that employs the series as its foundation. This chapter will examine archival literature to explain why archivists perform description. It will then analyze various methods used to perform this important archival task. It will then focus on the benefits and desirable characteristics of a distinctive type of descriptive tool, the thematic or subject guide, which can be used to supplement existing archival descriptions, regardless of the overall descriptive system used.

Descriptive systems, whether organized around fonds, record groups, or series, are rightly based on provenance or contextual information about the creators and creation of the records, not the subject matter content of the documents. A thematic guide, however, as one aspect of an overall descriptive system, highlights the subject matter in a body of records of varying provenance that relate to a common theme, such as engineering. One purpose of chapter one is to show how the provenance and subject

orientations work together to make a thematic guide a valuable feature of descriptive work in archives. By examining the nature of a thematic guide in relation to the evolution and variety of approaches to descriptive work, it is hoped that a foundation can be laid in sound archival theory for a thematic guide for Manitoba's engineering archival records.

The Provenancial Approach to Archival Description

Archival materials are so voluminous, even in one repository, that they require description to assist archivists and researchers to gain access to information in them. This description must reflect the provenance or context in which the records were created so that their value as evidence of the people, institutions, and actions that created them and/or are documented in them can be best understood. This contextual description makes any information in the records more useful because it is more intelligible when understood in this context. According to Canadian archival educator Luciana Duranti, archival description is the process of writing about archival material. While archivists have defined the term description in innumerable ways over the years, Duranti identified three consistent elements in these definitions. They are:

(1) a process of analysis identification and organization; (2) purposes of control, retrieval and access; and (3) a final product which illustrates archival material, its provenancial and documentary context, its interrelationships and the ways it can be identified and used.¹

The history of archival description is a history of increasing commitment to provenance-based descriptive systems. Provenance is the archival principle that states that the

¹ Luciana Duranti, "Origin and Development of the Concept of Archival Description," *Archivaria* 35 (Spring 1993), 48.

descriptions of records must always correctly identify their creators and that the body of records of one creator must never be physically interspersed with those of others.

Until the late-nineteenth century in Europe, and not until the mid-twentieth century in North America, archival records were not always physically and intellectually maintained in accordance with provenance. They were often arranged by the archivists and researchers' subject matter interests and described according to the subject content of individual documents. By the late-nineteenth century, European archivists were coming to a consensus that the provenance-based approach was preferable. The rising volume of records arriving in archives made subject arrangement and description increasingly impractical and growing awareness of the importance of protecting the records status as evidence, by clearly linking records to their creators, led most archivists to favour the provenance approach.²

Arising from their commitment to provenance, archivists since the nineteenth century have attempted to apply this concept in organizing and describing records. Their aim is to define the body of records that can be said to be created by a given individual(s) or organization(s). The debate over the "proper" implementation of a provenance-based descriptive system has been a longstanding feature of archival discussion. The debate has given rise to three basic ways of implementing provenance – the fonds, the record group, and the series. These approaches have underpinned the arrangement and description of records in archives around the world throughout the twentieth century. They are important to examine here for their implications for the development of a thematic guide for engineering records in Manitoba, as a guide would adapt aspects of these approaches.

² Tom Nesmith, "Archival Studies in English-speaking Canada and the North American Rediscovery of Provenance," in Tom Nesmith, ed. *Canadian Archival Studies and the Rediscovery of Provenance* (Metuchen, N.J., & London: Scarecrow Press, 1993), 1-3.

Implementation of Provenance-Based Archival Description

Fonds

The fonds concept has important French roots. In the 1840s, the French government made the first major national policy commitment in Europe to arranging and describing records in relation to their provenance. All records with a common provenance were considered to be a fonds d'archives. Debates across the nineteenth century in Europe about more precise formulation and implementation of the fonds concept reached a consensus view around the work of Dutch archivists Muller, Feith, and Fruin at the turn of the twentieth century. Their 1898 *Manual for the Arrangement and Description of Archives* defines a fonds, or "archieff" in Dutch, as "the whole of the written documents, drawings and printed matter, officially received or produced by an administrative body or one of its officials, in so far as these documents were intended to remain in the custody of that body or that official."³

In Great Britain, application of the fonds concept resulted in the "archive group." In 1922 the influential British archivist, Sir Hilary Jenkinson of the Public Record Office, defined the "archive group" as, "The archives resulting from the work of an Administration which was an organic whole, complete in itself, capable of dealing independently, without any added or external authority, with every side

³ S. Muller, J.A. Feith, and R. Fruin. *Manual for the Arrangement and Description of Archives*. Translation of the 2d ed. by Arthur H. Leavitt. With a New Foreword by Ken Munden (New York: H.W. Wilson Co., 1968), 13.

of any business which could normally be presented to it.”⁴ The archival records of the British government were organized by “archive group.” When Americans and Canadians adopted the fonds concept in the mid-twentieth century, they questioned the “archive group” approach to institutional records. They adopted the “record group” concept.

Record Group

The explosion in the volume of records created by the rapidly expanding mid-twentieth-century state prompted archivists at the United States National Archives and Records Administration to question the archive group because the massive amount of records which would belong to one such group were virtually unmanageable. They also thought that a fonds or archive group creator as defined by Jenkinson rarely existed in such independence and thus was impractical as a focal point for the application of provenance. And they thought that if such entities were to be identified anyway, they would create a volume of records so large in the modern state that it could not be described or otherwise managed in a practical way. Jenkinson, after all, was dealing mainly with medieval and pre-modern state records. In 1941, the Archivist of the United States, Dr. R.D.W. Connor, announced that the record group concept would be used at the new American National Archives. The record group was defined as “a major archival unit established somewhat arbitrarily with a due regard for provenance and to the desirability of making the unit of convenient size and character for the work of

⁴ Hilary Jenkinson, *A Manual of Archive Administration* (Oxford: The Clarendon Press, 1922; second edition, 1937; reprinted London: Percy Lund, Humphries, 1966), 103.

arrangement and description and for the publication of inventories.”⁵ Rather than combine all records originating from a very large and independent, thus very high level, administrative agency into one huge group, the US Archives carved out smaller more manageable groups of records from the body of records created by individual government agencies. Archivists were still concerned to identify the provenance of these groups, but critics felt this was not done adequately.

Australian archivist Peter Scott led the critics in the 1960s by charging that the record group obscured the application of provenance. Scott wrote that records which were transferred to archives were not always transferred by their actual creator. Some series, or record filing systems (i.e., the basic framework within which records were controlled), were made by more than one agency, as functions were often transferred among them in the complex administration of the mid-twentieth-century state. Record series moved with these changes from one agency to another. Thus, more than one agency filed records on a given series. Sometimes series were split apart and moved to one or more new agencies in the course of administrative evolution. Yet in the record group scheme, a series was attached to one record group only. In other words, as with the fonds and archives group systems, a record could have only one creator. It could belong to only one record group, often that of the last agency to handle the records and transfer them to the archives. This led Scott to believe that if the provenance of a record group was simply the agency that transferred the records to an archives, ignoring the records’ previous custodians and creators, the full picture of the provenance of the records would be obscured, and valuable knowledge of the administrative context in which the records

⁵ Terry Cook, “What is Past is Prologue: A History of Archival Ideas Since 1898, and the Future Paradigm Shift,” *Archivaria* 43 (Spring 1997), 26-28; Mario D. Fenyo, “The Record Group Concept: A Critique,” *American Archivist* 29, no. 2 (April 1966), 233.

were created could be lost.⁶ Echoing Scott's critique, in the early 1990s, the then National Archives of Canada, which had adopted the record group for Canadian government records in the 1950s, condemned the record group for violating provenance by the "mingling of theory and convenience."⁷

Record groups were often created subjectively by archivists according to size and convenience, a practice that directly contradicted provenance. Record groups may have differed in size "depending on the administrative convenience for archives in assigning equitable workloads to its staff, controlling stack space, or even producing publications."⁸ Archivists in Canada adopted this procedure from the Americans who increasingly established record groups, and, consequently, their descriptive inventories, in an arbitrary fashion. One reason for the relative irregularity in the creation of record groups is the various conflicting definitions of the record group put forth throughout the years.⁹

Terry Cook identified one other source of confusion concerning the record group. Archivists at the US Archives identified normal, general, and collective record groups. Normal record groups pertained to the records of the major organizational units, general record groups were to relate to an agency's overarching body, while a collective record group was to include the usually smaller bodies of records that may have dealt with a similar topic or activity, but had no actual administrative relationships and no shared

⁶ Peter J. Scott, "The Record Group Concept: A Case for Abandonment," *American Archivist* 29, no. 4 (October 1966).

⁷ Bruce Wilson, "Report of the Government Archives Division Descriptive Standards Implementation Working Group," National Archives of Canada, May 1993, 11.

⁸ Terry Cook, "The Concept of the Archival Fonds: Theory, Description, and Provenance in the Post-Custodial Era," in Terry Eastwood, ed. *The Archival Fonds: From Theory to Practice* (Bureau of Canadian Archivists, 1992), 52.

⁹ Both Terry Cook and Peter Scott viewed the many contrasting definitions of the record group as a major cause of archivists' eventual unease with the concept. Cook said one of the problems with the record group concept is "centrifugal and centripetal rationales defining record group structures differently" See his "The Concept of the Archival Fonds," 51. Scott wrote, "... there is also a fundamental problem in the lack of satisfactory and consistent interpretation of the concept of the record group." See his "The Record Group Concept," 497.

record-keeping systems, or series, and thus no common provenance.¹⁰ These variations on the record group concept only added to the critics' doubts about its faithfulness to provenance.

The record group approach simply does not reflect well the ever-changing, hierarchical, complex organizations of the twentieth century. Provenancial difficulties for record groups arose when separate or independent agencies were reorganized or merged with other departments. The records of these agencies were often then amalgamated into a single record group, which obscured the provenance of the records created by the originating agencies. The record group concept is unable to accommodate the records produced by today's complex bureaucracies.¹¹

When description is done according to the record group concept, the inventories or finding aids that are produced are less than adequate for user access. Record groups are often represented as static entities, when the exact opposite is true. Inventories, prior to automation, were difficult to update. Therefore, several series may have been identified and described as the entirety of a record group, and published as such in an inventory, when in actuality, several other series may have later become a part of that same record group. Many of these inventories were consequently out of date. These inventories presented the relationships among the series of a record group as mono-hierarchical, where there is an assumed simple one-to-one relationship between the record and its creator.¹² The series that comprise record groups are, in fact, always

¹⁰ Cook, "The Concept of the Archival Fonds," 49-50.

¹¹ Ibid., 50-52.

¹² Max J. Evans, "Authority Control: An Alternative to the Record Group Concept," *American Archivist* 49, no. 3 (Summer 1986), 251-255.

changing due to administrative alterations and accessions; therefore, the relationships among series are fluid and dynamic rather than unchanging as represented by inventories.

For all of these reasons, the dominant stream of thought throughout the archival community in more recent years has supported abandoning the record group concept and sought alternatives that more closely adhere to provenance. Some have adopted the third prominent system of organizing and describing archives – the series system.

Series

One of the founders of the series system, Peter Scott, recognized that previous archival descriptive systems were based on the mono-hierarchical business structure. Scott developed the series system to allow for multiple relationships between the records and their immediate creator(s) to be represented. The series system is now in general use in Australian archives. Terry Cook has called Peter Scott “the founder of the “postcustodial” revolution in archival thinking.”¹³ Cook explained:

Scott’s essential contribution was to break through (rather than simply modify) not just the descriptive strait-jacket of the ... record group, but the whole mindset of the ‘physicality’ of archives upon which most archival thinking ... had implicitly been based.¹⁴

Scott said a series is “a group of record items, which ... result from the same accumulation or filing process and are of similar physical shape and informational content.”¹⁵ Thanks in large part to the work of Scott, the definition of the series has evolved over the years to include much more than record-keeping procedures and the shape and structure of the record. Series are now represented by the functions of the

¹³ Cook, “What is Past is Prologue,” 39.

¹⁴ Ibid.

¹⁵ Scott, 498.

records and their provenance. The Working Group on Descriptive Standards in Canada defined the series in the mid-1980s as follows:

File units or records within a fonds arranged in accordance with a filing system (alphabetical, numerical, chronological, or a combination of these), or maintained as a unit because they relate to a particular function or subject, result from the same activity, have a particular form, or because of some other relationship arising out of their creation or arising out of their respect and use.¹⁶

Scott was among the first to see that the physicality of the records had little significance compared to the contextual relationships between records and between records and their creators. Archivists had often taken on a largely custodial role in simply housing records as they arrived, and even storing them in the physical order in which they were thought to have been in their offices of origin. Scott's series system gave archivists a far more active role beyond the guardianship of the custodial one. Archivists now had to do extensive research into the complex history of the records in order to lay out their varied and evolving provenance.

This context includes histories of the agencies or individuals that created or controlled the series, as well as previous or subsequent series that were functionally similar, or contained similar information.¹⁷ Scott also deemed the series' original record-keeping history to be a pertinent detail of these narratives. The series descriptions would then be linked to this administrative context. Scott referred to this design as the context-control system. Series would be linked to their creators, while these creator organizations or individuals would be linked with one another, as well as with their predecessors and

¹⁶ Wilson, 8.

¹⁷ In his "Linchpin Imperilled: The Functional Interpretation of Series and the Principle of Respect des Fonds," *Archivaria* 42 (Fall 1996), 126-132, Dan Zeleny advocates that series be based upon functional origin and not on documentary form. He correctly observed that the principle of original order is easily obscured if series are accumulated based on physical or intellectual features. In turn, the evidential value of the series would be diminished.

successors. Scott claimed that the series system was able to link records with their administrative context much more accurately than other methods of applying provenance as long as the archivist respected the integrity of the series and fully recorded its context.¹⁸

Current Canadian Practice

Archivists outside Australia paid little immediate attention to Scott's work. The American and Canadian National Archives continued to employ the record group for government records. And much of Canadian archival description was poorly done and not provenance-based. By the 1980s, when Canadian archivists finally began to address this problem, they opted for the fonds concept as the basis for archival description, on the recommendation of the Bureau of Canadian Archivists' Working Group on Archival Descriptive Standards. In coming to this decision, the working group did not give serious consideration to the series system.¹⁹

The Canadian *Rules for Archival Description*, or RAD, which appeared in 1990 and was the child of the working group's efforts, is based on the fonds concept. RAD provides standard rules for describing records in Canadian archives. It has been widely adopted in Canada. The fonds concept and RAD received a major boost in the mid-1990s when the National Archives of Canada decided to abandon the record group for government records in favour of the fonds and RAD.²⁰

¹⁸ Scott, 497-502. To view an example of a series description created at the National Archives of Australia, visit: National Archives of Australia, "Primary Description of Series A10287," <http://naa12.naa.gov.au/scripts/SeriesDetail.asp?M=0&B=A10287> (April 8, 2005).

¹⁹ Wilson, 10-12.

²⁰ Ibid., 10-13.

The primary goal of RAD is the standardized description of each fonds in an archives. RAD strives to do so through a top/down or general-to-specific multi-level description of the fonds and its component parts. Multi-level description, as developed in RAD, has four principles. The first is that description should proceed from the general to the specific. For example, fonds-level description should be completed prior to the description of the fonds' component parts at the various "levels" of description, or its series, files, or individual documents. This practice aims to allow users to understand the context of the creation of the fonds at all levels through the representation of its part-to-whole relationships.

The second principle is that the information given in each description should be relevant to the particular level of the fonds being described. Information pertinent to an item should not be included in the fonds- or series-level descriptions. The third principle states that descriptions at all levels should be linked together in a hierarchy so that users can easily comprehend the intellectual structure of the fonds and the context of its creation. Finally, to avoid redundancy, the final principle calls for any information in a higher-level description not to be repeated in a lower level description. Many Canadian archivists believe that when these principles are combined with standardized descriptive elements, the provenancial and documentary context of the fonds will become apparent to the user.²¹

Users were to be the primary benefactors of RAD-compliant descriptions. Users would more easily be able to determine what material would benefit their needs. Wendy Duff and Marlene van Ballegooie wrote, "Because a *RAD*-compliant description provides

²¹ Heather MacNeil, "The Context is All: Describing a Fonds and its Parts in Accordance with the *Rules for Archival Description*," in Eastwood, ed. *The Archival Fonds*, 213-217.

users with specific information on a variety of elements, researchers are able to focus on what they want, such as the context of creation or the type of media.”²² The advent of “Archives Canada,” where RAD-compliant descriptions from archival institutions all across Canada are compiled in a searchable on-line database, has made this information widely available to researchers.²³ Keith Stotyn claimed the concept also enables archivists to maintain intellectual control over the records, even when the creating agency, a records centre, or the archives may physically retain portions of the fonds at any given time.²⁴

RAD was instrumental in a shift in the Canadian archival community away from the old forms of description, namely subject arrangement and indexing and file listings, which were the heart of traditional Canadian descriptive practice. RAD, with its strong focus on provenance, forced Canadian archival institutions to abandon their practice of providing subject access to their records via subject-term indexes in their descriptions. Although users and archivists gained from improved provenancial documentation within archival descriptions, it thus came at some expense to subject access.

The goal of the Descriptive Standards Working Group was to establish a nationally recognized definition of the fonds in order to implement the concept in archives around the country. The working group was not entirely successful in its attempt. The utilization of the fonds as the basic unit of description was not without its

²² Wendy M. Duff and Marlene van Ballegoie. *RAD Revealed: A Basic Primer on the Rules for Archival Description* (Ottawa: Canadian Council of Archives, 2001), 2.

²³ To view a fonds level description completed according to RAD featured on the Archives Canada website, visit: Canadian Council of Archives, “Archives Canada – CAIN No. 182333,” <[http://www.archivescanada.ca/english/search/ItemDisplay.asp?sessionKey=1113182235063_206_191_57_199&l=0&v=0&lvl=1&coll=1&rt=1&itm=182333&rsn=S_WWWpda0hijeT&all=1&dt=AW+\"engineerin g\"&spi=->](http://www.archivescanada.ca/english/search/ItemDisplay.asp?sessionKey=1113182235063_206_191_57_199&l=0&v=0&lvl=1&coll=1&rt=1&itm=182333&rsn=S_WWWpda0hijeT&all=1&dt=AW+\)> (April 10, 2005).

²⁴ Keith Stotyn, “Are Fonds Describable? Or To Write It, First You Have to Find It,” unpublished paper delivered to ACA Annual Conference, September 1992, 3.

detractors within the archival community.²⁵ It was one thing to define and prefer the fonds concept to other approaches, but the matter of how to implement it in practice remained to be addressed. When description is done according to RAD, archivists begin by identifying a creator of records, out of many possible records creators, to be the primary creator of the fonds, and then they associate records with the one fonds to which they can belong. When Terry Cook examined this approach in the early 1990s he concluded that the selection of fonds creators and their records tended to be quite arbitrary. Picking one fonds for records to be linked with obscured the multiple provenance of many institutional records, in particular. Cook was drawn to Scott's series approach as the best way to implement the fonds concept. Rather than start with the selection of the fonds creator, Cook, following Scott, said that archivists should implement provenance by asking who created a given series. This tactic would result in the identification of the often multiple creators of series. It would also make it possible to link all creators with all the series they created. The latter, in effect, would be the fonds for a given creator. The fonds thus emerges from the contextual research into the provenance or history of the records, rather than from the selection of its creator prior to that fuller provenancial analysis. Cook thus advocated the fonds concept approach to

²⁵ Canadian archivist Keith Stotyn, although not against the fonds-level concept himself, has relayed some of the fears of other archivists when attempting to describe fonds. Stotyn wrote, "It is in the attempt to establish loci of authority and the attempt to link the records of functionally independent agencies to those loci that archivists often conclude that identifying and describing fonds is difficult, if not impossible, and that the fonds is not 'real', that it does not circumscribe tangible groups of records. Firstly, they note that organizational relationships are notoriously volatile ... Secondly, the traditional approach ultimately provides no archival rationale for assigning the "fonds level" at any particular point in an organizational hierarchy, except for a persistent prejudice against a low level of placement." ("Are Fonds Describable," 5.) He goes on to write, "When, more usually, the fonds is located at a high division of an organization (say, at a Ministry, Division or Faculty level), it often identifies a corporate body which does not, itself, create records ... Again the traditional approach, in emphasizing lines of authority in an organization, ignores the actual performance of functions and creation of records by agencies within it." ("Are Fonds Describable," 6).

description, but not as it was presented in the *Rules for Archival Description*. Cook's vision of the fonds adhered more closely to the Australian series system.

The assumed Weberian mono-hierarchical business structure, whereby records were thought to be produced by a single, large creator is a now outdated concept and has been replaced by one that recognizes that multiple creators often create records. Creator organizations, and their hierarchical branches, are constantly manipulating the data within the records and experiencing numerous changes to their functional mandates. Many archivists believe that this means we are in a post-custodial age in archiving, when it is not enough to provide physical custody of records, but a more complex understanding of the history or provenance of the records is also needed. Today, as Terry Cook has observed, "the curatorship of physical objects will define the profession much less than will an understanding of the conceptual interrelationships between creating structures, their animating functions, and the resulting records."²⁶

Cook has identified the key flaw of the traditional fonds approach to description, as represented in the Canadian RAD standards. Today, multiple agencies or individuals often create records. Records cannot be simply assigned to one particular fonds anymore. Fonds-level descriptions can try to compensate for this by pointing in a general way to other agencies that are associated with a set of records, but it is clear from the RAD-style fonds descriptions that are produced that this is a very limited linkage. These fonds descriptions rarely contain anything more than a list of series titles and seldom explain those series' histories or make evident their links to multiple creators. In fact, Canadian archival institutions, especially the larger ones, rarely even create series descriptions given the focus in RAD on the top/down, general to specific, overall description of a

²⁶ Cook, "The Concept of the Archival Fonds," 63-64.

fonds. And when these archives do so, series are again usually simply linked to one overarching fonds. While the fonds concept may still be able to accurately depict the simpler provenance of a private person's records, it is unable to do so for modern institutional records. The provenance of modern institutional records, the creation of today's complex, intermingling, multi-hierarchical structures, is best represented by the series system of description, which allows for the records to be associated with multiple creators.

Following Scott and Cook, Bob Krawczyk of the Archives of Ontario advocated a series-based descriptive system in the mid-1990s that reflects the first implementation of the system in a major Canadian archives. Krawczyk wrote, "According to a fonds-based arrangement, the records must be placed in a single fonds although nothing in their history of creation, accumulation, or transfer to the archives would suggest that that is the best means of representing their provenance."²⁷ According to Krawczyk, modern administrations were no longer compatible with the traditional mono-hierarchical structural view of the fonds. Special guidelines had to be created later in order to cope with multi-provenance series. Krawczyk wrote, with a focus on government records:

First, the arrangement of government records into mutually exclusive fonds ... is not logical. It may be *possible* in some circumstances, but there is little in the context of creation of the records themselves to recommend it. Second, whereas the division of records into fonds is an outcome of attempts to rigourously observe the principle of provenance, but arrangement into fonds raises insoluble problems in achieving that goal, perhaps it is time to consider alternatives.²⁸

While most Canadian archivists continue to describe records utilizing the fonds concept as the basic unit of description, many have begun to heed the advice of

²⁷ Bob Krawczyk, "Cross-Reference Heaven: The Abandonment of the Fonds as the Primary Level of Arrangement for Ontario Government Records," *Archivaria* 48 (Fall 1999), 144.

²⁸ *Ibid.*, 145.

Krawczyk and the practices of the Archives of Ontario and “consider alternatives”. The alternative is the series system whereby the series is the primary level of arrangement and description and the administrative and historical context behind the creation of the series is represented in the relationships among the series, their creator(s), and the function(s) leading to their creation. This critique of the fonds concept did not gain much credence in the Canadian archival community until Krawczyk and the Archives of Ontario demonstrated the practicality of implementing a series-based descriptive system.²⁹ The series could practically and efficiently serve as the basis of descriptive programs in Canadian archives. Other Canadian archives are following this path originally set out in Australia in the 1960s. In the early 2000s, the provincial archives of Manitoba and Saskatchewan adopted the series system for the arrangement and description of their government records.

The product of any descriptive system is a research guide or finding aid designed to improve user access to records. A thematic guide is a type of finding aid that should utilize series-level descriptions in its construction. A provenance-based guide consisting of a collection of descriptions of all the records for a particular theme such as engineering in Manitoba would be of much value. As will be outlined more fully in the next chapter, the proposed thematic guide to the engineering records in Manitoba would be strongly rooted in the provenance of the described collections and would utilize series-level descriptions. Since the fonds remains the most recognized standard in Canadian archives for the arrangement and description of records, the proposed engineering thematic guide would link the series-level descriptions to the fonds of which they are a component part

²⁹ To view an example of a series description at the Archives of Ontario, visit: Archives of Ontario, “Series Description: RG 47-69 - Community Information Services Correspondence Files,” <http://www.archives.gov.on.ca/english/about/sample.htm> (April 8, 2005)

in order to preserve the provenance of the records. In those institutions, such as the Archives of Manitoba and the City of Winnipeg Archives, where the fonds system is not currently in use, the series descriptions would still be linked to the records' creators and to any descriptive systems or tools in the records' home repositories that may strengthen the provenance of the records.

Benefits of Archival Description

No matter what form archival description takes, its benefits to both users and archivists are numerous. Description allows the archivist to impose a measure of administrative control over the records in their holdings. The information contained in these descriptions allows archivists to efficiently manage their repositories and assists in the performance of most other archival functions. Documentation of records proves useful even prior to the transfer of records to an archival institution. David Bearman pointed out that documentation of the "organizational, functional and systemic context of records creation ... will be useful for administrative control purposes such as assignment of responsibilities, establishment of contacts, determination of records disposition and negotiation of transfers during the pre-archival life cycle of the records."³⁰

Archival documentation may assist the archivist in performing his or her appraisal duties. Information pertaining to the transactions that gave rise to records, or what David Bearman termed the "documentation of documentation," is the data pool that archivists draw from when appraising records for their historical or monetary value.³¹ Description is also critical in assisting the archivist with such functions as acquisition, accessioning,

³⁰ David Bearman, "Documenting Documentation," *Archivaria* 34 (Summer 1992), 39-40.

³¹ *Ibid.*, 45.

records scheduling, retrieval, and providing access to the records. As the Bureau of Canadian Archivists' Working Group on Archival Descriptive Standards stated in its report Toward Descriptive Standards, "... it is clear that description plays a crucial role in an archives' traditional mandate to acquire, preserve, and make available historically significant records"³² Luciana Duranti went so far as to claim that archival description has never been an archival function, just a process that assists in the performance of the only true archival functions: preservation of the physical, moral, and intellectual characteristics of records, and communication of the evidence within, and the transactions giving rise to, archival documents.³³

One other benefit that the archivist realizes from adequate archival description is that it frees up time for other archival tasks that might have otherwise been spent on helping researchers to find records. Descriptive tools allow researchers to search for materials in a more independent fashion. Adequate description might answer most of the questions users might ask, as well as provide pointers to the location of various relevant records. If more richly contextual provenance-based descriptions were done, researchers would be less dependent on the idiosyncratic nature of a particular archivist's personal knowledge of the holdings. As David Bearman wrote in 1992, "One failure of the standards of description currently employed is that only those with extensive experience in archives understand how to translate a question about information content into the name of the organization or person around whom a fonds [or record group or series]

³² Bureau of Canadian Archivists – Working Group on Archival Descriptive Standards. *Toward Descriptive Standards: Report and Recommendations of the Canadian Working Group on Archival Descriptive Standards* (Ottawa: Bureau of Canadian Archivists, 1986), 9.

³³ Duranti, 52-53.

would be created.”³⁴ Bearman claimed that this oversight, in those now outdated archival standards such as RAD, could be alleviated by archivists creating readily-accessible documentation containing data on functions, form of material, subject content, and the creator(s) of the records.

While the principle of provenance must remain an integral part of all archival description, sometimes users require types of information relating to the records other than information regarding the records’ creators and functions. Subject-oriented descriptive tools, such as thematic guides, provide ancillary benefits that provenance cannot always supply. Archivists have recognized that the desire for subject access to records among users is growing, a fact evidenced by the proliferation of thematic guides in institutions around the world. Archivists have also learned that that can only be done well within the provenance structure. If the records for a subject like engineering were presented without their accompanying contextual information, namely their provenance, users would not be able to fully comprehend the records that they were researching and the records would lose their evidential value. Users would also find it difficult to locate all the relevant records for a complex theme like engineering since the relevance of some engineering records is only evident within the records’ provenance. Provenance can still, and should, be applied in a thematic guide so that the descriptions of records of a given theme, and their contextual histories, are compiled together in a simple, yet comprehensive research tool.

The demand for subject access and the construction of thematic guides has proven that archival description is increasingly becoming a tool for users rather than archivists. Archivist Victoria Lemieux once wrote, “While archival description initially sought to

³⁴ Bearman, “Documenting Documentation,” 44.

impart information about archival sources to archivists, it now has evolved into a function aimed at providing tools for researchers."³⁵ The most obvious benefit of description to the user is that it improves the user's access to records. Archival description should assist the researcher in locating documents relevant to his or her research. If the structure, content, and context of the records are described in sufficient detail, researchers should be able to conduct their work more efficiently by reading descriptions and determining what records they need to examine without wasting time on irrelevant documents. Proper documentation can not only provide some insight into what records exist, but can also shed some light on what records do not exist and why they do not exist.³⁶

In addition to presenting the user with some insight into the content of a body of records, description yields significant information on a body of records that users must take into account to fully comprehend the records they are analyzing. Luciana Duranti has claimed that the primary purpose for conducting description in Europe and North America is becoming the illumination of provenancial and contextual relationships.³⁷ Archival description should explain these relationships to the user as well as the functions and activities of the creator(s) that gave rise to the records.³⁸ It is the job of the archivist to present users with a view of the records, through their descriptions, that illuminates the evidential nature of the records. Focusing on the functions and information systems that produced the records often does this.³⁹ American archivist Sharon Gibbs Thibodeau has observed that users view archival descriptions that are made accessible to the public as

³⁵ Victoria Lemieux, "RADical Surgery: A Case Study in Using RAD to Produce a Thematic Guide," *Archivaria* 39 (Spring 1995), 52.

³⁶ Bearman, "Documenting Documentation," 44.

³⁷ Duranti, 51.

³⁸ Lemieux, 56.

³⁹ Bearman, "Documenting Documentation," 41.

valuable resources. Consequently, the worth of archival institutions, archivists, and archival descriptive practices may also be recognized by a grateful society: Thibodeau writes, "A strong, professional arrangement and description program is an investment in the archival future in more ways than one."⁴⁰

To summarize, Luciana Duranti has provided a brief historical synopsis of the purpose of description. She writes:

... the purpose of description has gone from creating surrogates of the documents and providing an account of the holdings to serving society's perpetual memory and providing evidence of the existence of the records, from guiding scholarly research and determining the most useful arrangement of records to revealing the intellectual order of [physically] disordered or meaninglessly ordered material; and finally, from aiding the archivist in conducting research for the scholar to guiding any kind of user in his/her independent research through illuminating the contextual relationships and the inner history of the records.⁴¹

Products of Archival Description

Finding Aids

Duranti has also outlined the historical evolution of the products that result from archival description. She says, "The products of description have gone from analytical repertories and lists to guides and calendars, and from inventories by physical and intellectual form (or theme) to structural inventories."⁴² She might well now include the web-based formats for series and fonds systems of description. The most common term for the product of a descriptive program is the finding aid. Jennifer Edgecombe has defined finding aids as "the descriptive media (such as registers, guides, inventories and

⁴⁰ Sharon Gibbs Thibodeau, "Archival Arrangement and Description," in James Gregory Bradsher, ed. *Managing Archives and Archival Institutions* (Chicago: The University of Chicago Press, 1989), 77.

⁴¹ Duranti, 52.

⁴² Ibid.

indexes) that establish physical and intellectual control over the holdings of an archives and make it possible to retrieve particular records or information from these archives.”⁴³

Finding aids present the information recorded in the description of the records, including their structure, context, and content, to the user in an easily accessible format and often supplement this information with other informative tools such as indexes. Most finding aids make contextual information about the records their centrepiece. They usually do not and cannot contain much information about the subject content of a particular body of records. They do so even less well for a larger grouping of records, such as the holdings of an entire archival institution. This is a limitation that thematic guides can address, but within an overall contextual, provenance-based approach.

Thematic Guides

The majority of research requests are subject based, leading one to believe that many users would prefer subject access if given the choice. Most researchers seem interested in knowing about a subject of interest, and not so much about the context of the creation (or provenance) of the records, except when that can help them pursue a subject interest. Archivists and researchers are able to deduce subjects from the provenancial information provided in most finding aids because they understand that agency functions determine the subjects of the records.⁴⁴ The records of the National Ballet of Canada are, after all, about ballet. However, the average user is usually unable to perform that deduction when it becomes far more complicated than this simple example. The records

⁴³ Jennifer Edgecombe, “Finding Aids,” in Judith Ellis, ed. *Keeping Archives*, 2d ed. (Port Melbourne, Victoria, Australia: D.W. Thorpe, 1993), 248.

⁴⁴ Richard H. Lytle, “Intellectual Access to Archives: I. Provenance and Context Indexing Methods of Subject Retrieval,” *American Archivist* 43, no. 1 (Winter 1980), 70.

of the federal immigration program, for example, are scattered among several agencies of the Canadian government that have been responsible for that function, starting after 1867 with the Department of Agriculture! A researcher may feel puzzled by this and even uncomfortable about asking the archivist for assistance. The archivist often has to act as a mediator between the records, the finding aids, and the user. American archivist Jackie Dooley has pointed out that as research becomes increasingly interdisciplinary, even experts in their chosen fields require subject access on occasion.⁴⁵ Consequently, archives are always concerned about providing subject access to the records in their holdings, even if they stress contextual information in most descriptive tools.

Dooley went on to claim that subject access to records is not only desirable, but also necessary. She explained that many archivists have believed that subject access was unnecessary, as long as provenancial access to the records was available. Archivists tended to take this position because it was impossible to examine the subject content of the millions of documents in an archival repository and because one could learn much about the likely subject content of a given collection by studying its provenance.⁴⁶ Dooley put forth the opinion that the archival community should abandon this stance and adopt a new one that allows for improved subject access to records. She wrote:

Archivists should confirm their professional consensus that it is necessary to provide subject access to materials in order to supplement existing access by provenance, recognizing that subject access includes not only generic topics but also specific named persons, organizations, places, and events, as well as time, place, form of material, occupation, and function.⁴⁷

One tool for dealing with researchers' requests for subject access is the thematic guide. The Bureau of Canadian Archivists' Working Group on Archival Descriptive

⁴⁵ Jackie M. Dooley, "Subject Indexing in Context," *American Archivist* 55, no. 2 (Spring 1992), 351.

⁴⁶ Dooley, 345.

⁴⁷ *Ibid.*, 353.

Standards identified several distinguishing characteristics of thematic guides. Thematic guides are often “produced by well-funded public archives, are disseminated for external use, detail other finding aids, and concentrate on the main data elements.”⁴⁸ They are also different from other types of finding aids in that they are “focused on a particular audience and are evaluative in nature.”⁴⁹ It is important to note that these were simply guidelines. No standards have ever been developed for the creation of thematic guides.

Thematic guides are normally geared to the repository level of description, that is they compile some or all of the descriptions within a single repository pertaining to a given subject or theme. A guide is normally comprised of a preface, an explanatory introduction, and a listing of related records.⁵⁰ Another common feature of thematic guides is an index to the descriptions, which aids the user greatly in locating information relevant to his or her topic.⁵¹ Adequate contextual information would have to be extractable from these primary descriptions and either linked to or become a part of the entries to allow the user to fully comprehend the information contained in the guide. This information has been referred to as “secondary description.”⁵² The guide should convey this information about the records in a way that facilitates its use.⁵³ Some archivists believe that the descriptive entries in a thematic guide do not have to adhere completely to descriptive standards, as long as the contextual information for the entries is prominently displayed.⁵⁴

⁴⁸ Bureau of Canadian Archivists – Working Group on Archival Descriptive Standards, 44.

⁴⁹ Lemieux, 52.

⁵⁰ Bureau of Canadian Archivists – Working Group on Archival Descriptive Standards, 60-62.

⁵¹ Lytle, 73.

⁵² Lemieux, 56.

⁵³ Thibodeau, 76.

⁵⁴ Lemieux, 67.

Several authors have identified a few difficulties with thematic guides. Some archivists have complained that the cost of doing such specialized guides for a certain subject area keeps their number and quality low. These guides may thus serve only a few types of researchers and not all that well. Compilers of inter-institutional thematic guides often run into problems since the primary descriptions at numerous archival institutions are not necessarily standardized and consequently can differ greatly.⁵⁵ Some note that the cost and difficulty of updating thematic guides means they are out of date often before they are even made available.⁵⁶

While little can be done to improve funding for thematic guides or the standardization of description across all archival repositories without major alterations to local, national, or international archival policy, automation holds the key to keeping thematic guides current. Information can now be entered into a database, where data can be easily added, altered, or deleted, keeping the information current for the needs of researchers. Jackie Dooley foresaw an inter-institutional automated thematic guide that would be regularly updated in a consistent manner and benefit users all over the world. She wrote:

Shared databases provide archivists the opportunity to build a universal 'subject guide' covering all repositories and all subject areas – a guide that would be increasingly up to date, not immediately obsolete. If such a guide is to be effective, however, the data must be consistent, or retrieval will be haphazard.⁵⁷

⁵⁵ Ibid., 59.

⁵⁶ Mary Jo Pugh, "The Illusion of Omniscience: Subject Access and the Reference Archivist," *American Archivist* 45, no. 1 (Winter 1982), 38.

⁵⁷ Dooley, 346.

Conclusion

The function of archival description, in all its many formats, is beneficial to both users and administrators. Each approach to description, whether based on the record group, fonds, or series, has its pros and cons. The process of description, and its associated contextual documentation rooted in provenance, is an essential archival task allowing archival repositories to maintain control over their holdings and provide users with accurate and comprehensive views of the records. The many and varied products of archival description only add to the benefits experienced by users and administrators. One such product, the thematic guide, is a valuable descriptive tool that provides ancillary benefits to primary descriptions and allows for improved subject access to the records. The engineering profession has a keen interest in accessing the records that result from the numerous functions it performs. A guide to engineering records, founded on the descriptive principles discussed in this chapter, will provide this desired access to engineering professionals, and any other interested users. The next chapter will discuss the style, structure, and format of an engineering thematic guide.

Chapter 2: Toward a Thematic Guide to the Records of Engineering in Manitoba

Introduction

When one is presented with an overview of Manitoba's engineering legacy,¹ one is awakened to the value of the records that document this long and distinguished history. Documents detailing the history of engineering in this province are located throughout public and private repositories in Manitoba.² Many of these records are described in one form or another but access to these descriptions is mostly obtained by visiting the institutions in which the records are held. The creation and promotion of a thematic guide, based on the archival principles of description described in the previous chapter, to the records of engineering located in all record repositories in Manitoba, and possibly across the nation, would assist in promoting the value of these records to a larger audience. Through the study of these records, many more users may become aware of the contributions engineers have made to Manitoban society as a result of the accelerated production of historical works on the subject.

Design of a Thematic Guide to the Records of Engineering in Manitoba

The leading nations in developing descriptive archival standards are Australia and Canada. This suggests that these countries' descriptive practices for thematic guides are worth particular attention. That said, unlike the standards set out for general descriptive

¹ See chapter three of this thesis for an historical overview of engineering in Manitoba.

² For a listing of the fonds and series pertaining to engineering in Manitoba's most prominent public and private archival repositories see Appendix A of this thesis. The records of several engineering associations, including the Association of Professional Engineers and Geoscientists of the Province of Manitoba, are currently not a processed collection within any archival repository and are noticeably absent from this listing. Once they were acquired, processed, and described by an archival repository, the thematic guide would undoubtedly be altered for their inclusion.

systems in Canada, Australia, and internationally through the International Council on Archives, there are no formal widely accepted standards as such for preparing thematic guides.³ Each archives fashions these guides according to its own needs and internal standards. The national archives in each of these two countries are looked to by their compatriots to show leadership in the design, development, and implementation of these standards. Therefore, when attempting to formulate the best practice for compiling a thematic guide it makes sense to analyze examples that have been produced by these institutions.

It is essential in today's ever-changing archival scene to create thematic guides that are automated. Web-based thematic guides will allow the guide's facilitators to more easily maintain, alter, and update information as it becomes available. Automated thematic guides also provide the option of keyword search capability, which can further refine a research pursuit. The volume of records received by archives continues to grow at an extraordinary rate so online thematic guides are necessary to ensure that the information contained therein remains current. The Internet also makes it much easier to reach a very wide audience. The national archival institutions mentioned above provide thematic or subject guides on their websites. The thematic guides created by Library and Archives Canada and the National Archives of Australia are typical of the format and strengths and weaknesses of others.⁴

³ There is a substantial gap in the literature relating to thematic guides, a fact that lends support for the subject of this thesis.

⁴ For other examples of online thematic guides see the American National Archives and Records Administration, "Research Room – Research by Selected Topic." <http://www.archives.gov/research_room/getting_started/research_by_topic.html> (February 2, 2005), and The National Archives, United Kingdom, "The Catalogue – Research Guides: A to Z." <<http://www.catalogue.nationalarchives.gov.uk/researchguidesindex.asp>> (February 2, 2005).

Library and Archives Canada

Thematic guides have been afforded a significant presence on the website of Library and Archives Canada (LAC).⁵ The site features a single guide that has been published by LAC in a hard copy format but that has also been made available to users in an electronic form. The website also features a number of unpublished thematic guides relating to useful or popular topics that provide access to the Archives' collections. The "Thematic Guides" home page makes reference to the fact that these unpublished guides contain descriptions that are not representative of the totality of LAC's collections and that website administrators are making efforts to ensure the data is up to date. The page states, "Please note that these research guides are not complete descriptions of our holdings. They are intended only as a starting point for research and will be updated regularly."⁶ The practice of constantly updating the information in a thematic guide should be adopted by anyone creating such a resource.

The published thematic guide on the website of Library and Archives Canada features government records relating to Aboriginal Peoples.⁷ This guide consists of a main page with links to an overview of Aboriginal history in Canada, an inventory of the most pertinent collection in the Archives' holdings, in this case the records of the Department of Indian Affairs, file- and item-level descriptions, and unprocessed accessions. There are also links to descriptions and inventories of documents pertaining

⁵ Library and Archives Canada, "Homepage," December 18, 2004. <<http://www.collectionscanada.ca/>> (December 18, 2004).

⁶ Library and Archives Canada, "ArchiviaNet: On-line Research Tool - Thematic Guides," May 27, 2002. <http://www.collectionscanada.ca/archivianet/020120_e.html> (December 18, 2004).

⁷ Library and Archives Canada, "Aboriginal Peoples: Guide to the Records of the Government of Canada." <http://www.collectionscanada.ca/archivianet/0201200109_e.html> (December 18, 2004).

to more specific topics within the larger, more generalized subject of Aboriginal Peoples, such as "Métis Scrip Records", "Treaties and Agreements", and "Bands and Agencies."

Library and Archives Canada's online published thematic guide, "Aboriginal Peoples – Guide to the Records of the Government of Canada," is inconsistent but user friendly. Each topic or inventory is prefaced with a historical introduction, providing the necessary contextual background to the records. For example, prior to the inventory of Record Group 10 (Indian Affairs), an administrative history of the Department of Indian Affairs provides some context to the creation of the records. Administrative histories allow the user to gain a much broader comprehension of the records by providing information on the functions that gave rise to the creation of the records. If the user knows which branch or agency of the department carries out the functions related to their area of interest, he or she can narrow their focus on those agencies or branches and the descriptions of the records that they create. These descriptions are usually represented at the series or sub-series level. In this way, in fact, a provenance-oriented approach to research dovetails with a subject-oriented approach. A well-designed thematic guide enables the two to work together in order to draw upon the advantages of both.

The Aboriginal records guide is easily navigable owing to its clear, descriptive directions. The guide not only identifies relevant records and their location codes but also provides instructions that direct users to other research tools, such as finding aids, which may yield more results. The record listings are thorough and include links to LAC's searchable collections database, ArchiviaNet, but the inventories are unfortunately quite varied and inconsistent in terms of their level of description.

The previously unpublished thematic guides on Library and Archives Canada's website are divided into three categories: "Specific and General References," "Research Strategies and Advice," and "Overview." Each type of guide differs in its function and in how the records are presented to the user. The thematic guides that fall under the category of "Specific and General References" are intended to provide the user with the precise location codes for the records so that they may request these documents at a later date. Those guides classified in the category of "Research Strategies and Advice" are intended to provide the user with suggestions on how best to carry out research on a particular topic and how to utilize the relevant records. The thematic guides designated as "Overview" provide users with more generalized descriptions of archival material.⁸

An example of a thematic guide that provides "Specific and General References" is the guide to the records relating to the Grosse-Île Quarantine Station in Quebec.⁹ These types of guides begin with a contextual historical overview of the topic prior to providing a listing of the precise references to the relevant archival material. This particular example separates the archival references into government records and private records. This guide goes on to provide a listing of sources pertinent to the subject located in archival institutions other than Library and Archives Canada. It then concludes with a bibliography of the sources utilized in the creation of the guide.

The guide to the records of the Grosse-Île Quarantine Station is the most comprehensive example of guides categorized as "Specific and General References." The structure of the guide is representative of the other eighteen examples in this

⁸ Library and Archives Canada, "ArchiviaNet: On-line Research Tool - Thematic Guides - Unpublished Guides," April 1, 2004. <http://www.collectionscanada.ca/archivianet/02012002_e.html> (December 18, 2004).

⁹ Library and Archives Canada, "Grosse-Île Quarantine Station (Quebec)," September 2000. <http://www.collectionscanada.ca/archivianet/02012002/0201200206_e.html> (December 18, 2004).

category. They are unfortunately consistent in their inconsistency. The archival references to government records all include the collection number and a brief description of the collections' scope and content and the administrative history of the creating department as they relate to the subject. Varying series-, file-, and item-level descriptions follow this collection synopsis. The private records references include a collection title and number and little else. There is minimal description of the related private records, including a nominal amount of file- and item-level references.

These types of guides would be much improved if links were made from the listing of these references to standardized fonds or series descriptions in a searchable database of the institution's holdings, as employed by LAC's published online thematic guide to Aboriginal Peoples. Some consistency in the level of description would alleviate considerable confusion in the compilation of these guides. On the positive side, this guide attempts to be somewhat inter-institutional by providing a listing of topical records in other archives, although it too is inconsistent in the level of reference information it provides. Links to the websites of these other institutions and their descriptions would have proven to be a valuable asset.

Library and Archives Canada has created two examples of thematic guides that intend to provide users with research strategies and advice. These are the guides related to federal-provincial conferences and the federal Department of Public Works. The guide to the records of federal-provincial conferences consists of a history, research strategies, specific and general references to government records, and a bibliography relating to this particular subject.¹⁰ The history of the topic provides the essential context necessary for

¹⁰ Library and Archives Canada, "Federal-Provincial Conferences," September 2000.
<http://www.collectionscanada.ca/archivianet/02012002/0201200212_e.html> (December 18, 2004).

user comprehension of the records. The section on "Research Strategies and Advice" was repetitive as it listed many of the references found in the "Specific and General References" section in paragraph form. The section did, however, offer useful administrative histories of the records' creating offices and how they relate to the theme of the guide.

The research strategies and advice contained in the guide did provide some valuable insight into how best to utilize the records listed in the guide and how to access relevant records that were not a part of the guide. Specifically, the guide offered information on material in other archives besides LAC, hints on how to search LAC's ArchiviaNet database, information on the structure and functions of administrative bodies that gave rise to the creation of the records, and explanations as to why a pertinent set of records may not be able to be made available to the public. The archival references are once again inconsistent in the level of description but are primarily at the file and item level. There are also no links from the listings to the ArchiviaNet database.

The guide to the records of the Department of Public Works¹¹ also attempts to provide users with research strategies and advice but utilizes a structure different from the previous example to do so. Rather than separating the research strategies and advice from the listing of archival references, like the guide to the records of federal-provincial conferences does, the guide to the records of the Department of Public Works lists the relevant series and then immediately provides advice on the best strategies for accessing and using these records. This method was employed by LAC since the records of the Department of Public Works were voluminous, complex, and poorly inventoried. This

¹¹ Library and Archives Canada, "Records of the Department of Public Works (RG 11)," December 2000. <http://www.collectionscanada.ca/archivianet/02012002/0201200203_e.html> (December 18, 2004).

guide was created with the intent of explaining the complexities in the provenance and original order of the collection at a series level and is unique in that it organizes the relevant series according to function. The guide lists the main series related to the subject, the series that could be consulted regarding a Public Work in a specific location, miscellaneous series, and series regarding other functions. This guide also provides information on other printed sources that would be beneficial to the researcher. The descriptions, although brief, are more consistent than other examples on the LAC website since the records are uniformly listed at the series level. Links to the Archivianet database are once again absent.

LAC's unpublished thematic guides that have been categorized as "Overview" are intended to provide users with a general description of the records relating to a particular topic. One example of this type of guide is the one detailing the records of "Canadian Immigration Since Confederation and the Department of External Affairs."¹² This guide is divided into three sections, two of which are historical and administrative summaries of the Department of External Affairs and the department's relation to Canadian immigration since 1867. The third section is a listing of the records of this department as they relate to the guide's subject matter. The guide concludes by providing a list of a number of other thematic finding aids that may prove useful in the research of the topic.

The description of these records begins with a general overview of the scope and content of the Department of External Affairs collections and its component series relating to immigration. The guide goes on to provide a description of the scope and content of each relevant series and sub-series and also provides advice on how the user

¹² Library and Archives Canada, "Canadian Immigration Since Confederation and the Department of External Affairs," September 2000.
<http://www.collectionscanada.ca/archivianet/02012002/0201200202_e.html> (December 18, 2004).

can best access and utilize the records in the series. This guide then divides the larger, overarching theme of immigration into a number of smaller sub-topics and lists the series within the Department of External Affairs collection that document them. The aspiration of this guide is simply to provide an overview of a particular collection as it pertains to a particular subject. Therefore, it unfortunately does not contain any links to LAC's searchable collections database, which would provide the user with more specific information about the records. This particular guide seems to provide more than a general description of the records in other ways, specifically by dividing the larger theme into more manageable topics and by supplying the user with a list of other useful research tools relating to the given theme.

Another example of a thematic guide classified as an "Overview" is the one entitled "Immigration Instructions: A Chart of Circulars, Directives, and Operations Memoranda, 1909-1978."¹³ This guide, unlike the previous example, is not much more than a general description of the records described in its title. The guide lists the series of circulars, directives, and operations memoranda relating to immigration procedures and provides reference numbers at the file level for pertinent documents. The guide also briefly describes the complexities of comprehending each series and provides advice on how to access and utilize the relative archival material within each series. Although this guide provides reference numbers it does not mention what collection the material is drawn from, nor does it include any administrative history of the creating office or historical introduction to the topic. The researcher is left wondering why the records

¹³ Library and Archives Canada, "Immigration Instructions: A Chart of Circulars, Directives, and Operations Memoranda, 1909-1978," September 2000.
<http://www.collectionscanada.ca/archivianet/02012002/0201200221_e.html> (December 18, 2004).

listed in the guide are relevant to its theme. This guide would have truly benefited from links to ArchivariaNet.

National Archives of Australia

The thematic guides produced by the National Archives of Australia are the best examples from which to draw upon when attempting to formulate the most effective structure for a guide to the records of engineering in Manitoba. The National Archives of Australia has created a number of excellent thematic guides and has made them available on its website.¹⁴ Each guide is consistent in its format and at its level of description. Unfortunately, none of these thematic guides are fully automated. If the user wanted more information on the records featured in the guides they would have to consult the National Archives' online catalogues of archival materials, RecordSearch and PhotoSearch. Nonetheless, an analysis of the thematic guides produced by the National Archives of Australia yields a consistent format that clearly and efficiently presents the records of a particular subject to interested users.

Each guide begins with an extensive introduction including a description of the National Archives, its mandate, its holdings, its reference services and products, and its website. The introduction then details the thematic guide, including its purpose and structure. Also included in the introduction is information on how to access records, the National Archives' online database of its holdings, the descriptions that comprise the guide, and other tidbits that users might find useful, such as how to properly cite the records, the cost for reproducing archival material, and advice on how to locate further

¹⁴ National Archives of Australia, "National Archives Shop – Research Guides."
<https://shop.naa.gov.au/browse_cat.php?cat=42> (December 18, 2004).

information on the subject. A descriptive introduction such as this informs the user about the contents and structure of the guide and provides some context behind the creation of the guide, which allows the user to more fully comprehend the records contained therein. It also provides the researcher with information on how best to use the guide to reach his or her desired research goals prior to being inundated with the listing of the records.

The thematic guides created by the National Archives of Australia are organized according to topics that archivists have deemed to be of value or interest to scholars and the general public. Each chapter of the guide lists the descriptions of records related to a particular topic within a larger theme. The records descriptions are all at the series level and appear as they are found in the holdings' databases, RecordSearch and PhotoSearch. The guide is a compilation of these series descriptions and a number of relevant files or items, although, as noted in the introduction, owing to the large volume of relevant records, some peripheral files or items may have been omitted. The user is urged to complement the findings in the guide with his or her own examination of RecordSearch and PhotoSearch, using the chapter titles and subdivision headings as keyword searches.¹⁵

As mentioned, the record descriptions in the guides are all at the series level. On occasion, the entirety of a series may not be relevant to the chosen subject. That is why Australian archivists are in the time-consuming process of adding file- and item-level descriptions to their catalogues. The series descriptions in the thematic guides may include information on pertinent files or items within a given series but this feature is not exclusive to all entries. The guide does, however, attempt to provide strategies on how to

¹⁵ Pam Oliver, *Allies, Enemies and Trading Partners – Records on Australia and the Japanese*. (Commonwealth of Australia, 2004), 7.

<http://www.naa.gov.au/publications/research_guides/pdf/Trading_Partners.pdf> (December 18, 2004).

identify additional files or items, including asking reference staff for assistance and examining other descriptive end-products.

Each descriptive entry includes information on the series' content and function. The descriptions begin with the series title, reference number, and date range of the material. They also include the name of the material's creating body or bodies and the dates during which they were responsible for carrying out the functions that produced the records. Each creating body is assigned a unique identifier that can be used in RecordSearch to acquire more information on that particular creator. Following this information is a note on the extent or volume of the series and where the records are specifically located within the National Archives of Australia's numerous record centres. A brief description of the series, including its scope and content, follows before concluding with any pertinent item- or file-level data. Any file- or item-level descriptive information usually includes the title, date(s), reference number, and content description. If a descriptive entry is repeated in varying chapters of a guide, repetitive segments may be omitted from subsequent entries.

The thematic guides created by the National Archives of Australia are excellent examples of a subject-based guide that is concisely descriptive, user-friendly, and adheres to archival theory. These Australian thematic guides share the best elements of the guides created by Library and Archives Canada and go beyond them to design research tools that promote subject access to a set of valuable and interesting records and present them in a well-structured format that is easy to use. The design, style, and structure of the guide to the records of engineering in Manitoba should be largely founded on the work of the National Archives of Australia.

Thematic Guide to Engineering Records in Manitoba

Prior to creating a thematic guide, it is essential to design the style, structure, and content of such a descriptive product. The style and structure of a thematic guide to engineering records in Manitoba would be largely based on the thematic guides produced by the National Archives of Australia, but with two unique additions. The first addition would be that the guide would be inter-institutional, encompassing many of the archival repositories in the public and private sectors of this province. The second is that the guide would be automated and housed on the Internet, containing links to the pertinent archival descriptions of the different institutions. This would ensure that the information contained in the guide could be updated and corrected when necessary, as well as provide access to the records to a global audience.

Like the thematic guides produced by the National Archives of Australia and many of those created by Library and Archives Canada, the first element of a thematic guide to engineering in Manitoba would be an extensive, historical preface and/or introduction to the chosen subject and to the guide itself. The preface might outline the reasons why a guide to the engineering records of Manitoba would be beneficial to scholarly researchers, to the general public, and to the engineering and archival communities. It might also describe the steps taken in compiling the guide and would acknowledge those people and organizations involved in its creation. It might also make

mention of the types of records one might encounter in the guide and the record-keeping issues associated with them.¹⁶

The introduction would provide the context behind the creation of engineering records. This context would be supplied by an extensive historical overview of the engineering profession in Manitoba, as detailed in the third chapter of this thesis, which would allow the user to gain an understanding of the value and significance of the listing of records that would follow. An extensive historical overview would be an essential component of an engineering thematic guide owing to the lack of engineering history available elsewhere. This overview would provide the broadest possible context required for the large volume of records that would compose a province-wide guide such as this. The introduction would continue with a thorough discussion of the thematic guide itself, including its purpose and structure and advice on how to utilize the thematic guide to its full potential in order to achieve the desired research results. The advice might include tips on how to locate relevant files or items within a given series, or identify other research tools or sources that might yield further results. It is imperative that the introduction be written clearly and concisely so users will not be confused by its approach and discouraged from further searching.

The current standard primary object of archival description in Canada is the fonds. Thus most thematic guides in Canada list fonds-level descriptive entries. A thematic guide to the engineering records in Manitoba may benefit from a deviation from this course and list descriptions at the series level. Since fonds-level descriptions are meant to provide an overview of the entire collection, many of these descriptions do not

¹⁶ This information might include the formats and media of engineering records, the kinds of information contained in each, and the specific issues facing each type, such as their retention schedules, public accountabilities, client confidentiality, as well as access, technology, and storage issues.

immediately make it known why some collections are relevant to the topic of engineering. Series descriptions are based on the functions carried out by their creators. Engineering may be one of those functions, or an aspect of another function, so a series-level description would provide more detailed information on the records relating to those pertinent functions.

For example, if one was presented with a fonds-level description of all of the records of the entire provincial Department of Agriculture in the Archives of Manitoba, it would not make much mention, if any, of this body's relevance to the topic of engineering. It may make mention of the series that comprise the fonds in the scope and content note, and one may be able to estimate which series might be related to engineering, but there would be a sense of uncertainty in doing so and the research process would be needlessly more time consuming as the user would have to go to the archives or ask an archivist to definitively determine the series' relevance to the topic. However, if one is presented with series-level descriptions of the records of the Department of Agriculture, one would notice that one particular series is the records of the Technical Services and Training Branch and that within the scope and content note for this series, the Engineering Section Office Files were a component.

While it is true that creating a thematic guide containing series-level descriptions would be more time consuming since many of the series descriptions would have to be created from scratch as this is currently not the standard in Canada, the benefits to users and archivists would supersede this fact. Thematic guides are supposed to provide users with subject access to archival material. If they are presented with a list of provenancial-based fonds-level descriptions that are inexplicably related to the subject of engineering,

the users really have not gained anything from this research tool and they will continue to inundate archivists with questions about how the fonds-level descriptions are relevant to the subject query. Thematic guides featuring fonds-level descriptions only do not provide researchers and archivists with the self-sufficient subject access to archival material that they so desire.

In order to sustain the part-to-whole, or series-to-fonds, relationship that archivists, especially in Canada, find vital to the maintenance of the integrity of the records, links from the series descriptions to the fonds-level RAD (*Rules for Archival Description*) descriptions should be established. These links would illuminate the contextual “ambience” surrounding the series descriptions. Many fonds-level descriptions from a number of Manitoban archival institutions already exist online in a searchable database entitled Archives Canada.¹⁷ The series descriptions could be linked to their related online fonds-level entries located at Archives Canada. Archives Canada entries would have to be created for those fonds-level descriptions that did not currently exist on the website.

Rather than organizing the guide according to topics that have been subjectively chosen as the most interesting or valuable, as has been the practice of the National Archives of Australia, a thematic guide to the records of engineering in Manitoba would be better served by organizing the records according to institution. The topic of engineering is so broad and interwoven that the majority of the series descriptions would be constantly repeating themselves in each research topic or section of the guide. An institutionally-organized thematic guide would alleviate this situation.

¹⁷ Canadian Council of Archives, “Archives Canada: Canadian Archival Information Network Homepage.” <<http://www.archivescanada.ca/>> (January 22, 2005).

Following the thematic guide's preface and introduction, an index to the listing of the record descriptions contained in the guide would prove to be a useful structural and navigational tool. The index should be representative of the structure of the guide. Therefore, the index would contain a listing of the institutions that house archival records. The institutions would be divided among public archival repositories and private engineering firms. It would be useful to further separate the collections of public archives into government records, private records, and any specialty media collections, as is the practice of these institutions. Following the institution's name and, if need be, section would be the fonds or collection titles of which the series of records pertaining to engineering in Manitoba are a part. Beneath the fonds or collection title would be a listing of the relevant series. Although this guide will not feature fonds-level descriptions prominently, it may be beneficial to include the fonds or collection title of which relevant series are a component part within the index in order to provide the users with some reference as to the provenance of the series.

In order to provide some institutional context to the series listings, a link from the institution's heading within the index to a page describing the institution, its history, mandate, and holdings would be valuable. This page could either be something created by the writers of the thematic guide or it could be the institution's home page, where other valuable links could then be followed. This information provides the user with contextual material on why the institution is collecting and housing archival documents relating to engineering. This page(s) could also contain important information on the institution's reference and access policies in case a user wanted to visit the archives and investigate the records in-depth.

Links from the series listings on the index pages could then be made to the actual series-level descriptions. Each series description would be consistent and largely conform to the Canadian *Rules for Archival Description*. Descriptive data fields would include the series title, reference number, date range, and extent or volume of material. A provenance field would describe the creators of the records and the dates in which they were responsible for their creation. A scope and content note would describe the material that comprises the entirety of the series but would also include information on the series' relevance to the topic of engineering in Manitoba. If certain files or items within the series are known to be specifically related to the theme of the guide, they may be listed following the scope and content note. Other RAD entries such as restrictions on access and notes on arrangement would also prove to be valuable contextual information for fully comprehending the records.

Links to descriptions of the series' associated fonds from a field identifying the fonds would provide further contextual information including the fonds' administrative history or biographical sketch, acquisition information, and whether or not there are other accruals to the fonds expected. Also, for ease of reference, a field identifying the repository that houses the series would be included. In addition, if electronic file listings of the records exist in the records' home institution's website, links to these file listings from the descriptions would be beneficial by allowing the user to view descriptions of the records at a file level and determine their exact location for future perusal at the institution. This feature would save the user and the reference archivist time in

determining what records might be relevant and determine their exact locations for retrieval.¹⁸

The descriptions of archival material provided by private engineering firms do not conform to archival standards. Archivists would have to work with engineers and administrators in developing fonds- and series-level descriptions of their holdings to maintain consistency for inclusion in the guide. The fonds-level entries could then either be included in Archives Canada, or a separate private engineering searchable database could be established for the province of Manitoba. If other provinces and other countries followed suit, descriptions of engineering records from institutions around the world could be linked together and shared with engineers, archivists, and other interested parties on a global scale.

The entire thematic guide could feature keyword search capability. A search engine could be displayed on a side bar menu. The user would enter certain keywords, such as names, places, or events, into the search engine and the engine would search the entire guide, including the introduction and all descriptive entries for pages that featured these keywords. A list of pages featuring those keywords would then be displayed including links to the pages themselves. The user would then click on these links to view the pages featuring their chosen keywords. This keyword search capability would add another layer of subject access to the thematic guide and would further assist the researcher in pursuing his or her query. The records in such a guide would still be organized by institution to give the user a broad overview of the records and their host

¹⁸ For an example of the envisioned style and format for a series description in a thematic guide to engineering records in Manitoba see Appendix B of this thesis.

institutions. Keyword search capability would only serve to provide the user with a tool to further narrow his or her research query.

The thematic guide could also link up to any existing local, national, or even international engineering historical sources on the Internet, or could add links to such resources when they became available, if they were relevant to the topic of engineering in Manitoba. These sources might include a bibliographical listing of engineering histories as well as links to engineering related museums and artefacts, such as the Manitoba Electrical Museum & Education Centre created by Manitoba Hydro.¹⁹ Some individual or organization might be commissioned to create such a bibliographic listing for the province of Manitoba for inclusion in the thematic guide. These additions would make the thematic guide to the records of engineering in Manitoba a sort of “one-stop” source for research into this valuable, yet historically neglected topic.

Conclusion

A thematic guide to the records of engineering in Manitoba would be a worthwhile venture among archivists and engineers. The guide would promote the records that document the rich engineering legacy in Manitoba to a much wider audience that increasingly demands subject access to archival material. It would also stimulate research into the history of the engineering profession in Manitoba. This chapter has outlined the format of what a thematic guide to the engineering records of Manitoba might look like, as well as provided a listing of appropriate records located in numerous archival facilities in Manitoba that might appear in such a guide. The creation of a

¹⁹ Manitoba Hydro, “Manitoba Electrical Museum & Education Centre.”
<http://www.hydro.mb.ca/about_us/electrical_museum.shtml> (February 20, 2005).

thematic guide as described in this chapter may take years to fully develop but each stage of the guide would be useful to a number of users. Therefore, the thematic guide would likely appear in stages. As each component of the guide was completed, it would be added to existing components on the Internet until the guide was completely developed.

The next chapter of this thesis will continue to focus on the content of a thematic guide to engineering records in Manitoba by examining an integral component of any thematic guide, the historical overview of the chosen subject. The inclusion of an historical overview of the engineering profession in Manitoba in a thematic guide, as detailed in chapter three, would prove to be an invaluable introduction to the guide. It would provide users with a solid contextual base for the comprehension of the records featured therein through descriptions of the primary functions of the engineering profession in this province and by detailing significant events and topics.

Chapter 3: A Historical Overview of Engineering in Manitoba

Introduction

Manitoba has a rich engineering tradition that dates back several centuries. This chapter outlines the province's engineering history in order to provide some contextual information about engineering records in Manitoba. One cannot expect to fully understand the value and significance of a body of records without first examining the context of their creation. This historical overview of the engineering profession in Manitoba could be utilized as an introduction to a thematic guide relating to the subject, as outlined in the previous chapter. It is hoped that this broad history of engineering in Manitoba will be able to provide a more comprehensive understanding of the engineering records in the province and demonstrate the value of including descriptions of these records in a thematic guide.

It is important to remain cognizant of the fact that this chapter is an overview of a much more intensive historical subject. Many details or topics may have been omitted or given only a passing glance for this reason. The overview is intended to offer a basic foundation of contextual information for the comprehension of engineering records and to survey a few key events and topics that may be of interest to users. It should also be noted that this overview is only a draft of what might appear in an engineering thematic guide and could be altered or revised as necessary. In fact, the introductory historical overview of an engineering thematic guide would have to be constantly altered, revised, or updated to incorporate new technologies, people, events, topics, legislation, and

organizations as they appeared on the Manitoban engineering scene. A web-based thematic guide would allow for such changes to be made with relative ease.

The chapter begins with a discussion of the origins of the engineering profession in the province, the struggles of engineers to achieve their desired level of professionalism, and the education of engineers in Manitoba. Discussion of the important contributions engineers have made to the development of the province's public and private sectors will follow. These contributions include advancements in the fields of civil engineering (transportation, water and sewerage, solid waste disposal, structures, highways, dams, flood protection), electrical engineering (electricity generation and distribution, telecommunications), mechanical engineering (transportation, aerospace), agricultural engineering (food production and processing), mining and petroleum engineering (metals, oils, industrial minerals production), and the consulting engineering industry in Manitoba.

Origins of the Engineering Profession in Manitoba

The roots of the engineering profession in the province of Manitoba date back to the eighteenth century and the fierce competition for furs between the Hudson's Bay Company and the North-West Company. Each company displayed engineering prowess in its attempt to gain an advantage over the other in trading. This competition led to improvements in the design and fortification of forts, as well as better transportation networks in Manitoba, including the advent of York boats, steamships, the Red River cart, and relatively comfortable roads and waterways freed of obstructions due to extensive survey work. These engineering innovations were the result of the two

organizations' desire for material gain but they opened up Manitoba to trade and spurred the province on to further development.¹

Professionalization

Although engineering innovations were instrumental in transforming Manitoba into a thriving, modern territory by the nineteenth century, the majority of the people responsible for the province's development did not consider engineering to be a professional vocation. In fact, by 1851, only thirty-five men in Canada referred to themselves as engineers.² Many of these men were of British or American descent but were instrumental in developing a distinctively Canadian technical style that borrowed from both the British and American traditions.

When the Canadian Pacific Railway was completed, the number of engineers in Canada dramatically increased and the movement for the creation of a professional organization for engineers began to take hold.³ Canadian engineers felt underappreciated and taken advantage of by their unscrupulous employers.⁴ The Canadian Society of Civil Engineers (CSCE) was established in Montreal in 1887⁵ in an attempt to guard against unethical work practices and to improve the public's perception of engineers, which had

¹ For further discussions on engineering innovation brought about by the fur trade, see C.R. Young, H.A. Innis, and J.H. Dales. *Engineering and Society with Special Reference to Canada*. (Toronto: University of Toronto Press, 1946), 298-303; and, K.M. Cameron. *Public Works in Canada under the Department of Public Works*. (Ottawa: King's Printer, 1939), 8-10.

² J. Rodney Millard, *The Master Spirit of the Age: Canadian Engineers and the Politics of Professionalism, 1887-1922* (Toronto: University of Toronto Press, 1988), 6-7.

³ Millard, 28.

⁴ Norman R. Ball, "Mind, Heart and Vision": *Professional Engineering in Canada 1887 to 1987* (Ottawa: National Museum of Science and Technology, National Museums of Canada, in cooperation with the Engineering Centennial Board, 1987, 1988), 19.

⁵ Millard, 3.

been sullied by irresponsible and unqualified people who referred to themselves as engineers.⁶

Manitoba became the first jurisdiction in the world to pass legislation intended to professionalize and standardize the engineering profession. In 1896, the provincial government hurriedly passed a bill put forth by the provincial committee of the CSCE that called for the incorporation of a self-governing licensing and regulatory society, the right to restrict use of the term "civil engineer", and the provision of access to any provincial engineering works.⁷ However, the bill was passed without any penalty clause and attempts at amending the legislation were postponed following the passage of licensing laws in other provinces. Since the bill did not allow for repercussions of any kind, unfortunately it amounted to nothing more than a "mild registration law."⁸

Areas outside of the Montreal base of the CSCE began to clamour against a lack of representation within the organization. Consequently, regional branches of the CSCE were established throughout Canada, including one in Manitoba.⁹ In 1917, the CSCE underwent further changes, most notably the adoption of a new name. The Engineering Institute of Canada (EIC) retained many of the CSCE's original objectives, including sharing knowledge among members, the development and maintenance of engineering standards, and the promotion of the profession to the public. The regional branches were assigned responsibility for the function of promotion, a designation that further decentralized the organization.¹⁰

⁶ Ibid., 9.

⁷ Ibid., 70-71.

⁸ Ibid., 77.

⁹ Ibid., 83.

¹⁰ Ibid., 88.

The Manitoba branch of the EIC immediately set out to establish wage control policies. The branch's members pledged not to accept any work that paid less than an agreed upon sum and the branch negotiated with large corporations to ensure these salary demands would be met.¹¹ Despite the relative financial prosperity enjoyed by Manitoban engineers, they joined with their professional brethren in stepping up efforts to establish restrictive licensing legislation in Canada. It was hoped that this legislation would regulate competition and improve the status of engineers by discriminating against those who were unqualified, consequently removing them from the labour pool, which in turn would increase the salaries of those who were qualified.¹² Licensing was also intended to alleviate overcrowding created by an abundance of engineering professionals.¹³

By 1920, most provinces, including Manitoba, had passed licensing legislation for the engineering profession, which successfully closed off the profession to unqualified outsiders.¹⁴ As J. Rodney Millard puts it, "... no one could practise engineering, or use the title 'Professional Engineer,' unless he were a member of the local provincial association."¹⁵ The Engineering Institute of Canada established an Association of Professional Engineers in Manitoba.¹⁶ This organization was designed to provide guidance to practising engineers, promote the profession in the province and across the

¹¹ These tactics proved to be very beneficial to Manitoba EIC branch members as they were paid at a higher rate than their American counterparts and were also paid, on average, \$1000 more than civil engineers elsewhere in Canada. Ibid., 120.

¹² Ibid., 122-123.

¹³ This problem was compounded by immigrant workers and recent university graduates, who were competing for the limited amount of work. Ibid., 10.

¹⁴ Ibid., 140.

¹⁵ Ibid., 144.

¹⁶ D.A. Ross, "History of Engineering," in *The Engineer and the Public*. (Winnipeg: Manitoba Association for Adult Education, 1937), 7-8.

nation, serve as a think-tank for Manitoban engineers, and to pressure government into establishing engineering standards in the interest of public safety.¹⁷

Engineering Education

Engineers received very little technical education prior to the 1880s. The men employed in this profession depended upon the practical knowledge they had acquired from their British or American mentors. By the 1880s, engineers in Canada began receiving formal university education in a small number of Canadian universities that emphasized the scientific aspects of engineering over its practical teachings.¹⁸ Historian David F. Noble attributed this shift in the focus of engineering education to “the engineering educators’ quest for academic respectability and the increasing complexity of engineering problems, which defied the traditional cut-and-try approach.”¹⁹ The province of Manitoba soon recognized the need to establish a university degree program in engineering to confer a level of professionalism and integrity, based in sound scientific research and investigation, on its young graduates.

In 1907, following a successful request by the University Council to the provincial government to increase funding, civil and electrical engineering courses were first offered at the University of Manitoba and the Engineering Department was established. The University added courses in mechanical engineering prior to the

¹⁷ George A. DePauw, “*Works, Technology and Ethics*”: *Pioneering in Highway Bridges for the Province of Manitoba and the Engineering Profession* (Winnipeg: George A. DePauw, 1993), 97.

¹⁸ Millard, 7-8.

¹⁹ David F. Noble, *America by Design: Science, Technology, and the Rise of Corporate Capitalism* (New York: Alfred A. Knopf, Inc., 1977), 26.

formation of the Faculty of Engineering in 1921.²⁰ The University offered degrees in Agricultural Engineering and Geological Engineering in the following decades.²¹

Today, the Faculty of Engineering at the University of Manitoba offers degrees in Biosystems Engineering, Civil Engineering, Electrical and Computer Engineering, and Mechanical and Manufacturing Engineering.²² Through its many titular incarnations and curriculum alterations, the Faculty has continued to provide graduates who have made major contributions to the profession.

Transportation

Railways

Some of the earliest and most significant engineering works in Canada were transportation projects. In Manitoba, these primarily consisted of the design and construction of railways. According to Millard, "The railways were the foremost achievement of nineteenth-century Canadian engineering."²³ Governments hailed railways as "engines of change to promote settlement, foster economic development, and encourage political unification."²⁴

The burgeoning wheat trade in the west precipitated much of Manitoba's railway design and construction. The Canadian government was fearful that Winnipeg and Manitoba would fall under the influence of the Americans, who were making advances

²⁰ A.J. Carlson, "Seventy-Five Years of Engineering Education in Manitoba," in University of Manitoba Faculty of Engineering, *75th Anniversary: 1907-1982 ... and Engineering for Tomorrow* (Winnipeg: University of Manitoba, 1982), 7-9.

²¹ Carlson, 13.

²² *University of Manitoba 2004-2005 Registration Guide* (Winnipeg: University of Manitoba, 2004).

²³ Millard, 4-5.

²⁴ Norman R. Ball, ed., *Building Canada: A History of Public Works* (Toronto: University of Toronto Press, 1988), 88.

northward.²⁵ The Canadian Pacific, Canadian National, and Canadian Northern Railways successfully incorporated Manitoba into a nation-wide, publicly owned rail network and temporarily halted the American sphere of influence in the province and protected the lucrative grain market. In addition to these publicly owned transcontinental railways, private operations began to infiltrate the province.²⁶ The railway boom began to level off following the end of the First World War but some companies continued to build in Manitoba, particularly in the province's northern regions. Following the Second World War, railway construction began to decline. In Manitoba, most railways designed and constructed after 1945 were minor routes designed to provide access to resources.²⁷

Engineers played a large part in the advancement of railway technology in Manitoba. Engineers increased train speeds and improved hauling capacities through such innovations as double-tracking heavier lines and implementing gentle grades and curves.²⁸ Their work allowed for the creation of an efficient, nation-wide transportation network that had major economic and social repercussions for Manitoba. Southern Manitoba experienced unprecedented immigration in the early 1900s. Settlements appeared all over the province and its population soared. Manitoba became one of the largest wheat producing regions in the world as agriculture became the province's principal industry. As a result, society began to recognize the achievements of engineers and the profession began to rise in prominence. The number of engineers in Manitoba and across Canada began to swell, especially in the public sector.

²⁵ Young, Innis, and Dales, 305-306.

²⁶ For example, the American-owned Great Northern Railway operated a network around Winnipeg. Ball, *Building Canada*, 94-96.

²⁷ *Ibid.*, 98.

²⁸ *Ibid.*, 105-109.

Urban Mass Transit

Manitoba experienced tremendous population growth, especially in its urban centres, in the nineteenth and twentieth centuries. Engineers were charged with the task of developing new modes of transport for moving large quantities of people to and from various locations within the city. Since horses were slow and unable to work at their optimum efficiency in the winter, horse-drawn streetcars were eventually replaced by electric tramways.²⁹

Electric tramways proved to be a faster and cheaper mode of transport and were soon being utilized in both Winnipeg and Brandon.³⁰ Engineers and shop workers with the Winnipeg Electric Railway Company were able to build and modify their own streetcars from the Company's shop. They designed unique equipment for the streetcars, such as double windows, defrosters, scrapers, and ploughs, for the purpose of providing uninterrupted tramway use in the winter.³¹ By the 1950s, electric tramways could not easily navigate through the congested traffic routes created by increasing use of automobiles, so they were replaced with buses, which were more flexible in their movements and cheaper to maintain.³² Engineers have overcome many challenges specific to this region, such as the province's harsh climate and topography, in developing this essential service for many Manitobans.

²⁹ Ibid., 62.

³⁰ Ibid., 63-64.

³¹ Ibid., 70.

³² Ibid., 76.

Roads and Highways

Prior to the twentieth century, roads in Manitoba were designed and constructed haphazardly. Manitoba's climate and geography made construction difficult. Insufficient funding as well as a shortage of qualified labour only served to exacerbate the situation. Rural communities demanded better roads for hauling materials. Legislation passed in the Manitoba Parliament in the early 1900s called for the government to institute a program of road construction in all municipalities. These roads were to meet certain engineering standards, such as grading and drainage specifications, and were to be regularly maintained to ensure their quality for years to come. With increased government funding and the proliferation of literature on the subject in engineering journals, municipal engineers and road superintendents became increasingly adept at building better roads.³³

To boost tourism, the government established a program of paving Manitoba's roads and highways to improve the quality of the province's thoroughfares. Engineers conducted extensive research into construction materials and recommended paving roads with either asphalt or concrete. The use of asphalt and concrete in urban areas and on Manitoba's highways successfully produced smooth and durable roads on which vehicles could comfortably travel greater distances in shorter time periods.

As the number of automobiles in Manitoba continued to rise in the 1920s, engineers began to design roads and highways specifically for vehicular travel rather than adapting existing roads for their use. Road and highway engineers soon became principally involved with improving the alignment, visibility, and grades of main traffic

³³ Ibid., 38.

arteries to ensure traffic flowed smoothly.³⁴ Engineers had to cope with some uniquely Manitoban factors when constructing roads and highways, especially the province's harsh winter climate.³⁵

During the Depression, roads leading to natural resources were constructed to initiate industrial growth. As industries grew and diversified and the province's population continued to expand, the stress on the existing road and highway systems became apparent.³⁶ The provincial government undertook a massive redesign, reconstruction, and expansion of the provincial trunk highway system in an effort to improve the quality of the roads and highways in Manitoba. Engineers undertook extensive research into a number of factors including the physical condition of existing structures, current and future traffic trends, the various industries of Manitoba and the interconnection of rural and urban market centres, as well as the economic trends of the province.³⁷ Engineers had to determine what type of road or highway suited the economic, social, and geographic characteristics of a specific region.³⁸ All highways were constructed according to a set of design standards³⁹ and were to be maintained on a regular basis to ensure their long-term stability and efficiency.

The Trans-Canada Highway was perhaps the crowning achievement of highway engineers in this country. When completed in 1961, the Trans-Canada Highway was the

³⁴ Ball, "Mind, Heart and Vision," 79.

³⁵ Engineers designed roads with high grades so that the snow would drift over the roads and not pile up and obstruct traffic. These designs were supplemented with an extensive snow-ploughing program. See Geo. Collins. "Manitoba Equipment Chosen to Cope With Severe Weather," *Engineering and Contract Record* 61, no. 10 (October 1948), 80.

³⁶ Manitoba Department of Public Works – Highways Branch. *Manitoba Highways – Planning For Tomorrow: An Engineering Study of Long Range Needs on the Provincial Trunk Highway System*. (Winnipeg: 1960), 23.

³⁷ *Ibid.*, 20.

³⁸ *Ibid.*, 27-29.

³⁹ *Ibid.*, 34.

longest stretch of paved road in the world⁴⁰ and was constructed to uniform engineering standards of right-of-way, curvature, gradient, sight distance, pavement, shoulders, and bridges.⁴¹ Engineers were able to overcome the many challenges that this project posed, many of which were similar to those experienced during the construction of the transcontinental railways, through numerous ingenious innovations.⁴²

The efforts of engineers in the creation, development, and maintenance of Manitoba's roads and highways have been instrumental in the formulation of the social and economic characteristics of this province. An interconnected system of highways and roads, designed to specific engineering standards, decreased travel time and made automobile travel more pleasurable. Rural isolation became a thing of the past as these areas became linked with urban centres. Trade intensified as goods were transferred easily, and at a quicker rate, from rural areas of production to the large urban markets. Roads and highways also provided access to previously inaccessible regions of the province, many of which contained valuable natural resources. The direct result of this improved access to resources was that the province experienced considerable industrial growth.

⁴⁰ Ibid., 24.

⁴¹ Ball, *"Mind, Heart and Vision,"* 111.

⁴² In Manitoba, one challenge that faced engineers was the gumbo clay soil in many areas of the province. This soil was thought to be unsuitable for the construction of a highway due to its instability. Since this type of soil was quite prevalent in Manitoba, engineers did not have the option of building the highway around areas featuring this soil. Engineers conducted soil surveys to determine the load capacity of these types of soils and added bituminous material to the soil in order to make it water-proof. By doing so, they successfully devised a method of using the soil as a base in the construction of the highway and its embankments. See G.B. Williams, "Trans-Canada Highway in Manitoba," *Engineering and Contract Record* 54, no. 2 (January 8, 1941), 10.

Waterworks, Sewerage, and Solid Waste Disposal

Waterworks

For many years, Manitobans depended upon ground water and wells to provide them with a safe water supply for washing and drinking, as well as for fire protection and public health concerns. As the province experienced tremendous population growth due to immigration in the 1800s, these water sources became too polluted to act as a reliable supply of potable water for the city of Winnipeg.⁴³ Winnipeg was forced to install a system of waterworks for its citizens and originally utilized a network of artesian wells as the system's source.⁴⁴

The city hired consulting engineers to work with municipal officials in examining a number of factors, including supply characteristics, elevation, climate, soil, frost, and population growth, prior to constructing the waterworks distribution system. The city accepted a number of recommendations by engineers during the construction of the system. For example, leaky wooden pipes were replaced with cast-iron pipes that could withstand considerably more water pressure without buckling. Pumping equipment steadily improved as a number of designs became increasingly powerful, light-weight, and reliable. These innovations increased performance and decreased operating costs. As a result, cash-strapped rural areas were able to implement efficient waterworks systems as well.⁴⁵

By the early 1900s, it became apparent that Winnipeg's artesian well system would no longer be able to provide a steady supply of clean water for the city. Excessive

⁴³ Ball, *Building Canada*, 195-196.

⁴⁴ For a more in-depth discussion of the waterworks function of the Winnipeg City Engineering Department, as well as the other functions of the department, see the author's unpublished paper "An Administrative History of the City of Winnipeg Engineering Department, 1874-1971," March 2003.

⁴⁵ Ball, *Building Canada*, 204-206

pumping lowered well levels below those of the rivers. Consequently, the city was susceptible to extended outbreaks of disease. The water supply was also deemed to be too hard for domestic and industrial purposes and the pressure was considered to be insufficient for fire protection needs.⁴⁶ The city responded by commissioning a number of studies and surveys to find a source of water that could provide Winnipeg with a constant supply of clean, potable water to accommodate its burgeoning population. Shoal Lake, located east of Winnipeg, was eventually chosen by a number of engineering professionals as a viable source owing to its "inexhaustible supply, excellent water quality, and gravity."⁴⁷

Engineers designed an extensive distribution system consisting of a diversion dyke and channel that directed the water from Shoal Lake to an intake where it traveled along a hundred miles of a newly constructed covered aqueduct to the city of Winnipeg. The Winnipeg Aqueduct was laid with a constant down-grade to allow gravity to propel the water along this section of the line.⁴⁸ From there, the water traveled through a tunnel under the Red River and through a few miles of cast-iron piping to a reservoir where it was then distributed throughout the city and to its adjoining municipalities. Engineers made provision for the addition of a storage reservoir, pumping stations, and another branch aqueduct to ensure a continuous supply of clean water to Winnipeg and its surrounding districts for years to come.⁴⁹

⁴⁶ Harold Shand, "Organization and Operation of the Greater Winnipeg Water District," *American Water Works Association - Journal* 47, no. 1 (January 1955), 15.

⁴⁷ Ball, *Building Canada*, 214.

⁴⁸ Norman R. Ball expressed the significance of the Winnipeg Aqueduct for the City and the engineering profession in Manitoba when he wrote, "The Winnipeg Aqueduct ... marked the beginning of Winnipeg's long tradition of bold and imaginative public works engineering." Ball, *Mind, Heart and Vision*, "85.

⁴⁹ Ball, *Building Canada*, 214.

Over the years, not only has the capacity and efficiency of the city's water supply system improved, but so has the quality of the water. Chlorine, ammonia, and fluoride were added to the water supply to further sterilize the water. Other chemical compounds have been utilized to combat algae and odour in reservoirs and improve the taste and smell of the water.⁵⁰ The city's residential, commercial, institutional, industrial, and emergency needs have been satisfactorily met by the efforts of engineers in the design, construction, and maintenance of Winnipeg's water distribution network.

Inadequate government funding and the lack of decent sources of water near these communities hindered the water supply situation in rural areas. Through increased government funding, most Manitoban communities now feature adequate water supply and treatment facilities. Engineers have conducted a number of studies on how to further improve the water supply situation in southwestern Manitoba.⁵¹ In northern Manitoba, the extremely cold temperatures hampered water distribution. Engineers devised methods to improve the apportionment of water in these communities utilizing a combination of techniques involving heating the water and providing continuous circulation.⁵²

⁵⁰ Ibid., 215.

⁵¹ Engineers recommended increasing the flow of the Souris River and its tributaries through the construction of dams on the river. Unfortunately, the topography of the area proved to be a detriment to the construction of dams of sufficient size. Engineers also recommended the construction of an extensive network of pipelines and canals for the distribution of water, drawn from the Pembina and Assiniboine Rivers, for domestic and industrial purposes. Studies were also conducted to determine ways in which the rate of decline in the groundwater level of the Greater Winnipeg aquifer, a rich source of water for industry, could be naturally abated or artificially reversed. See N. Mudry, "The Future and Manitoba's Water Resources," *Engineering Journal* 48, no. 10 (October 1965), 37.

⁵² Ball, *Building Canada*, 216-217.

Sewerage

As urban centres expanded in the late-nineteenth century, the disposal of sewage became an unsightly and potentially deadly problem. Waste was often buried in the ground or dumped in rivers and streams. As a result, river cities such as Winnipeg were transformed into unhealthy cesspools. Consulting engineers were quite vocal in their support of the implementation of sanitary measures in Canadian cities.⁵³

By the 1880s, most of the wealthier sections of Winnipeg had been connected with sewers but city officials refused to provide sewer connections to Winnipeg's less privileged citizens for many years owing to the latter's lack of political influence. This stance was abandoned in 1904 when health officials compiled comprehensive death statistics for the city of Winnipeg and linked many of these deaths and illnesses to a typhoid epidemic caused by a lack of sewer connections.⁵⁴ Finally, in 1905, legislation was passed requiring the construction of public sewers in downtown Winnipeg's business section under the supervision of sanitary engineers.⁵⁵ By 1916, Winnipeg had 335 miles of connected sewers.⁵⁶ Unfortunately, after passing through ineffective grates or strainers, the effluent from these sewers emptied into the Red and Assiniboine Rivers, polluting them as early as 1910.⁵⁷

By the mid-1930s, low river flows exacerbated the pollution problem of the Red and Assiniboine Rivers. The city of Winnipeg and its adjacent municipalities could no longer ignore the situation and decided to undertake a program of sewerage expansion

⁵³ Ibid., 224-225.

⁵⁴ Ibid., 230-231.

⁵⁵ Ibid., 231-232.

⁵⁶ Ibid., 236.

⁵⁷ This practice was considered to be a viable sewage disposal and treatment plan in the early-twentieth century since it was believed that the waste would deteriorate within the fresh water naturally. Ibid., 225.

and sewage treatment to combat the growing problem. Engineers conducted extensive research and designed a collector system and sewage treatment plant for the city and its surrounding areas.⁵⁸ The treatment plant originally provided only primary sewage treatment, but the city's engineers made provision in their designs for secondary treatment in the future.⁵⁹

The merits of the Winnipeg sewerage system and its sanitary engineers were tested in 1950 as the waters of the Red River flooded the city. City engineers worked to pump storm water out of the sewers. When the flooding of sewers did occur, or when the threat of flooding was imminent, engineers were instrumental in the lessening of the flow into basements, in preventing water mains from being contaminated with sewage, and in providing recommendations to prevent future incidents.⁶⁰ The city's engineers were chiefly responsible for minimizing the effects of a potentially catastrophic situation.

Perhaps in an attempt to make up for the inauspicious beginnings of the city's construction of sewerage systems, Winnipeg became one of the leading cities in Canada in per capita sewerage expenditures. The city established separate sewer systems in certain areas for its expanding population so that these areas could be more effectively served.⁶¹ The city also expanded its existing facilities and constructed an additional treatment plant with the capability of performing secondary treatment on sewage.

⁵⁸ Ibid., 238.

⁵⁹ For a discussion of the City of Winnipeg's sewage collector system and treatment plant, see W.M. Scott and J.A. MacGillivray, "Ten Years' Operation of the Greater Winnipeg Sewage-Treatment Plant," *Water and Sewage* 85, no. 10 (October 1947), 60-63.

⁶⁰ For a discussion of the work of engineers in the maintenance of the City of Winnipeg's sewerage system during the flood of 1950, see W.L. Wardrop. "City of Winnipeg Sewerage System and the Manitoba Flood," *Municipal Utilities* 88, no. 9 (September 1950), 51, 82, 84, 86, 88, 90; and William D. Hurst. "Winnipeg's Flood Emergency Organization," *American Water Works Association - Journal* 42, no. 12 (December 1950), 1101-1106.

⁶¹ N.S. Bubbis, "The Greater Winnipeg Sanitation District and River Pollution Abatement," *Engineering Journal* 43, no. 6 (June 1960), 68.

Most areas in Manitoba are now equipped with adequate sewerage systems. Engineers recognized the need for increased dilution flows in Manitoba's rivers and streams to combat the practice of discharging sewage effluent into sources of water, which some treatment plants continue to this day. Engineers have increased the water flow of many of Manitoba's lakes and rivers through the construction of dams, reservoirs, and diversion projects. Although these structures were built primarily for flood protection, they also serve to increase water flows, which assist in the dilution of the sewage in Manitoba's waters.⁶² This is but one example of the challenges to waterworks and sewerage engineers often posed by the climatic and geographic conditions of the province.

Solid Waste Disposal

The industrialization of Manitoba led to a dramatic increase in the amount of solid wastes that society produced. City and municipal officials were faced with the new challenge of how to collect and dispose of this material. The production of waste continued unabated and by the mid-1950s open dumps and incinerators were beyond their capacities and producing obnoxious odours. Sanitary landfills, as designed by public works engineers, served to alleviate these conditions.⁶³

Sanitary landfills were similar to open dumps in that they were simply large excavations intended for the disposal of waste, with clean soil used to cover the garbage every day, which was then compacted by bulldozers. This practice limited the smells emanating from the landfills. Engineers conducted surveys of potential sites and

⁶² Mudry, 38-39.

⁶³ Ball, *Building Canada*, 245-248.

examined any environmental concerns, particularly their drainage potential to ensure there would be no risk of groundwater contamination. In addition to their work in ensuring the safety of landfill sites, engineers also assisted in attempting to make these facilities more aesthetically pleasing and otherwise beneficial to the community. When sites were filled, engineers often converted them into parks or recreational facilities.⁶⁴ The design and implementation of an adequate system of waste collection and disposal is an excellent example of the ways in which engineers have improved health and safety conditions for Manitobans.

Civil Engineering Structures

Prior to the specialization of the engineering profession, most engineers referred to themselves as civil engineers. They were hired by governments and private corporations to plan, design, and erect structures to benefit society in a variety of ways. These structures were often bridges, locks, or dams, which were constructed primarily to assist Manitobans in traversing the province's many waterways. Manitoba's civil engineers have also contributed to a number of measures to ensure the safety and well-being of its population. Perhaps the greatest achievement in this respect is the work civil engineers have accomplished in flood control.

Buildings

Engineers have been quite influential in the design, erection, and maintenance of many of Manitoba's buildings. Not only have engineers been employed in the erection of

⁶⁴ Kilcona Park in Winnipeg was constructed in such a fashion. Ibid., 248-250.

many industrial, commercial, and domestic structures, but all three levels of government have utilized engineers in the design of public buildings, often to convey a certain political message.⁶⁵ Engineers were often responsible for the implementation of various functional and stylistic features of buildings, such as fire protection and prevention measures.⁶⁶ Engineers have continued to adapt their building designs and construction techniques to an ever-changing world. They have done so by examining the current and future trends of the industry, not only the technological advancements, but also the social, economic, and environmental factors involved.

Bridges, Locks, and Dams

Before the advent of the railroad, bridges were designed and constructed with very little engineering knowledge. These early "civil engineers" designed wooden trusses based on intuition rather than technical or scientific understanding. This practice was adequate until railroads increased the loads on bridges and these designs and materials were abandoned.⁶⁷ While some rural areas continued to use wooden bridges for local traffic needs, iron became the material of choice before it too was replaced by steel.⁶⁸ Steel was considered stronger and more economical than iron.⁶⁹

Concrete was another material that grew in popularity among engineers, partly because it was an economical choice, but primarily owing to its "precision, permanence,

⁶⁵ Ibid., 262.

⁶⁶ Ibid., 272. One type of building that required extensive engineering assistance was the airport. For a discussion of the role engineers have played in the development of airports in this country, see Ibid., 286-309.

⁶⁷ Ibid., 8-9.

⁶⁸ Ibid., 13.

⁶⁹ Ibid., 17.

and sophistication.”⁷⁰ As concrete’s use increased and its benefits became more apparent, older timber bridges built across the province’s rivers, lakes, and streams were replaced with concrete designs.⁷¹ By the mid-1920s, Manitoba featured 680 concrete structures compared to 160 timber structures and only forty steel structures.⁷²

The fact that most of the bridges constructed in Manitoba prior to 1920 still exist today is a testament to the strength and durability of these materials and the engineering prowess of those who designed and built them. Paul Schioler, former Assistant Engineer with Winnipeg’s City Engineer’s Department, described the city’s bridge engineering policy at the turn of the twentieth century as responsible and based more on practical structural than aesthetic qualities.⁷³ The city has continued with this policy of fiscal responsibility, emphasizing substance over style, in its bridge engineering.

Engineers also designed and constructed a number of locks and dams in an effort to provide water for agricultural and domestic needs in rural areas and to improve the navigational routes of the province’s waterways. In the second half of the nineteenth century, steamships sailed up and down the Red and Assiniboine Rivers and were a vital mode of transport for passengers and freight. When water levels were low, this manner of transportation was potentially dangerous since the bottoms of the ships would occasionally strike the craggy river beds. Engineers erected dams and locks to divert water from the rivers’ tributaries and increase the water levels of the rivers during periods when they were low.

⁷⁰ Ball, *Mind, Heart and Vision*, 53.

⁷¹ DePauw, 34.

⁷² “Reinforced Concrete Bridges, Manitoba,” *Canadian Engineer* 36, no. 16 (April 15, 1924), 435.

⁷³ Paul Schioler, “Winnipeg’s Bridges,” *Canadian Engineer* (January 19, 1911), 202.

For example, the route from Winnipeg north to Lake Winnipeg proved to be a difficult one for steamships to navigate since the St. Andrews' Rapids decreased the river level considerably. Engineers employed by the federal Department of Public Works recommended the construction of a Camere dam in St. Andrews, which raised the water levels in this region by nearly twenty feet over the rapids and minimized any obstructions to the flow of water so that steamships could safely deliver their cargo to settlements around Lake Winnipeg. A navigation lock was constructed to permit the passage of vessels past the dam.⁷⁴ The St. Andrew's Lock and Dam was the first of its kind in North America and was one of the province's greatest engineering achievements.⁷⁵

Flood Control

The Manitoba government's neglect of flood control measures came to a crashing halt in 1950 when Winnipeg experienced one of its worst floods on record. Despite the city's best efforts in sandbagging and temporary dyke construction, the waters of the Red River inundated the city that spring. Following extensive relief and rehabilitation periods, the provincial government began to recognize the unnecessary risk to human life that floods posed and took steps to develop a policy of flood control.

⁷⁴ Canadian Society for Civil Engineering, Prairie Region, *St. Andrew's Lock and Dam, 1900-1910* (Winnipeg: Canadian Society for Civil Engineering, Prairie Region, 1990), 1-4.

⁷⁵ The Canadian Society for Civil Engineering recognized the benefits that the St. Andrew's Lock and Dam provided for the province of Manitoba, as well as the engineering prowess of those who designed and built it, when the organization named it a Historic Civil Engineering Site in Manitoba. (The only other one it has designated is the tramway at Grand Rapids, the first rail-line in the west.). St. Andrew's Lock and Dam had a number of unique engineering features but the dam itself was recognized as the most unique. The lower portion of the dam was fixed and permanent but the top thirteen feet was removable so that the main channel would be cleared and the water level could be lowered for the winter. A removable dam such as this prevented flooding from ice jams, which would occur if a permanent dam was constructed in its stead. At the time of construction, this removable dam was the only one of its kind in North America. By 1990, there were only two other removable dams in the world that operated on such a grand scale. The lock is the only one in Canada west of Sault Ste. Marie, Ontario. *Ibid.*, 3.

Following exhaustive research into past floods, engineers designed a number of flood-control proposals to supplement the city's system of boulevard dykes to protect Winnipeg and its immediate surroundings from a massive flood.⁷⁶ Experts recommended excavating a twenty-six mile long ditch east of Winnipeg in order to divert any overflow from the Red River around the city. They also recommended constructing a seventeen mile long diversion channel from Portage la Prairie to Lake Manitoba that would divert floodwater from the Assiniboine River elsewhere before it met the Red River in Winnipeg. Another recommendation was for the construction of a reservoir dam on the headwaters of the Assiniboine River at Shellmouth, Manitoba, which would provide additional protection to communities situated along the Assiniboine River.⁷⁷ Historian Robert Passfield observes that the proposals were not terribly innovative, but were "comprehensive and sound from an engineering point of view."⁷⁸ The Floodway has since been recognized as a national historic site and is revered not only for being structurally sound, but also for the forward-thinking provincial administration that insisted upon its design and construction to prevent such a tragedy from ever occurring again.⁷⁹

During construction, engineers were concerned with ascertaining the stability of the slopes of the floodway channel due to the highly fragile clay soil, the rate of flow in the channel to prevent bank erosion, and the most economical cross-section and gradient for the channel.⁸⁰ Engineers were able to overcome all of the challenges presented by

⁷⁶ Robert W. Passfield, "'Duff's Ditch': The Origins, Construction, and Impact of the Red River Floodway," *Manitoba History* 42 (Autumn/Winter, 2001-2002), 3.

⁷⁷ *Ibid.*, 4.

⁷⁸ Ball, *Building Canada*, 163.

⁷⁹ David O'Brien, "Floodway Admired Around World," *Winnipeg Free Press* (March 7, 2005).

⁸⁰ Passfield, 5.

this project through intensive research and testing.⁸¹ The Red River Floodway, Portage Diversion Channel, and Shellmouth Dam have proven their worth to Manitobans time and time again as flood waters have consistently threatened these parts of the province. The success of the Red River Floodway spurred other communities to construct flood control works. Although many communities still experience regular flooding due to inadequate drainage and flood protection, floodways and drains were constructed with increasing frequency in rural areas to prevent the flooding of agricultural lands.⁸²

Although engineers have been involved in flood protection measures in Manitoba for many years, the Red River Floodway now represents what sound engineering practices can accomplish for emergency flood protection and prevention. Robert W. Passfield writes:

Beyond a doubt, the Red River Floodway ranks as an outstanding engineering achievement, but its significance rests not so much in its scale, construction, or the physical properties of its structures, as in its design concept, function, and socio-economic impact, as well as its symbolic importance to Canadians.

The Red River Floodway has become a national symbol of what Canadian engineers and engineering works, in the tradition of public works engineering, can achieve in defending a major region of the country against the onslaught of potentially devastating natural disasters, and of the limits of what man can achieve.⁸³

Power

When electricity arrived in North America, Canadian engineers adapted the new technology to suit their own environment.⁸⁴ Early electrical generators could not transmit

⁸¹ Ibid., 6.

⁸² Examples of these works were the Seine River Diversion along the Seine River below Ste. Anne, and the Lake Manitoba control works on the Fairford River. These two projects regulated the water levels on Lake Manitoba and prevented the flooding of valuable farmland in the area. Mudry, 36.

⁸³ Passfield, 11.

⁸⁴ Ball, *"Mind, Heart and Vision,"* 27.

direct current over large distances. Following the introduction of the alternating current induction motor and transformers to the Canadian market, power could be generated in a higher capacity and transmitted over greater distances to remote markets.⁸⁵ By utilizing this new technological advancement, local power utilities discovered they could deliver power at a cheaper rate to their subscribers by building their own generating stations and then transmitting that power to the city. Prior to the construction of any generating station, engineers first conducted studies relating to the potential site's engineering features, the economic phases of the desired market, and other sources of competing power.⁸⁶ By the 1920s, several generating stations were erected along the Winnipeg River and were transmitting power to the city of Winnipeg.

To ensure uninterrupted service for its customers, especially during winter months, Winnipeg Hydro erected a significant local engineering innovation, the Amy Street Steam Plant. The Steam Plant distributed central heating to a portion of Winnipeg's downtown core using surplus steam from the boilers employed in the hydro-electric system. This plant was unique because a cogeneration plant for electric power and centralized heating were concepts that were unheard of in this era.⁸⁷ This steam plant was such a success that by 1932, three other steam generating plants could be found in Winnipeg, heating various residential districts.⁸⁸

Buoyed by these early successes and the public's increasing demand for more power, the city, province, and private enterprise erected new hydro-electric generating stations along Manitoba's rivers. By 1945, these stations could no longer provide the

⁸⁵ Ball, *Building Canada*, 171-172.

⁸⁶ "Water Power Resources of Manitoba," *Canadian Engineer* 53, no. 21 (December 22, 1927), 554-555.

⁸⁷ Ball, "Mind, Heart and Vision," 85.

⁸⁸ G.W. Oliver, "Central Heating System of the City of Winnipeg," *Engineering Journal* 15, no. 1 (January 1932), 26.

required capacity to meet all the conditions of the river flow and load requirements.⁸⁹

Many existing hydro-electric developments were upgraded and their generating capacity and transmission lines were extended to accommodate an expanding power market that was becoming increasingly dependent upon electricity.

It was estimated that the Winnipeg River contained enough water power for a complete rural electrification system in Manitoba. Although many rural communities were connected with electricity by the 1940s, citizens demanded that the government bring power to every rural household. Following the Second World War, the Manitoba Power Commission ordered its engineering staff to conduct surveys and prepare plans for an extensive rural electrification scheme.⁹⁰ Electricity had profound economic and social impacts on Manitoba's farms. It improved the quality of life in rural areas and, subsequently, reduced the costs of production, which in turn increased farmers' incomes.

Engineers continued to seek out new options for increasing power capacity. Following the advice of their engineers, power utilities interconnected with power grids of their neighbouring provinces and states. Engineers also studied extensively the possibility of utilizing nuclear energy in Manitoba.⁹¹ Having exhausted the power supply of the Winnipeg River, power utilities turned their attention to northern Manitoba and the development of hydro-electric sites along the Nelson, Churchill, and Saskatchewan Rivers.

The Nelson River was considered a rich source of hydro-electric power but alternating current (ac) transmission systems were unable to transmit this power over the

⁸⁹ L.A. Bateman, "Long Range Hydro Planning for Manitoba," *Engineering Journal* 43, no. 10 (October 1960), 117.

⁹⁰ "Farm Electrification in Manitoba," *Engineering Journal* 26, no. 6 (June 1943), 347-348.

⁹¹ Bateman, 122.

great distance between the river and Winnipeg. Certain electrical engineering advancements increased the transmission capabilities of direct current (dc) systems and precipitated the development of several hydro-electric generating stations along the Nelson River.⁹² The flow of the Churchill River was diverted into the Nelson River to expand upon the Nelson's generating potential.

Several new Manitoba Hydro projects are in the works, including system efficiency improvements, new interconnections, and the development of several new hydro sites. Engineers have been conducting extensive research into the long-term viability of these projects, their marketability, and the effects they might have on the environment.⁹³ Engineers continue to play an integral role in the design, preparation, construction, maintenance, and expansion of power sites in Manitoba and the distribution of that power to locations all over the province.

Telecommunications

Public works engineers have been involved in the development of telecommunication networks across Manitoba for three centuries now. This work began with a survey of the province for the establishment of a telegraph line.⁹⁴ The telegraph system was replaced by the installation of telephone lines in 1905 and 1906.⁹⁵ These networks were enhanced following the Second World War when economic conditions permitted improvements to the province's telephone system and the creation of a nation-wide television network. The Canadian Broadcasting Corporation (CBC) implemented a

⁹² Ball, *Building Canada*, 186-187.

⁹³ Hilmi M. Turanli, "Preparing for the Next Generation at Manitoba Hydro," *IEEE Power Engineering Review* 22, no. 3 (March 2002), 19-20.

⁹⁴ Cameron, 51.

⁹⁵ Young, Innis, and Dales, 334.

microwave transmission system to achieve the latter. Potential sites were surveyed to determine the locations of any obstructions to the line, possible locations for access routes, and the availability and cost of power for the site. Some engineering difficulties presented themselves but were overcome in time for the completion of the network in 1958.⁹⁶ Engineers continued to expand upon and improve these communication networks through the development and application of new technology.

Natural Resources and Engineering

The province of Manitoba has experienced tremendous economic and social gains from the work of engineers. Their work has successfully diversified and expanded Manitoba's resource sector. The province was utterly dependent upon agriculture for its income but engineering advancements led to the development of new industries such as mining, pulp and paper, and oil and gas, while also improving the agriculture industry. Consequently, the standard of living of Manitobans has improved dramatically since 1870.

Agriculture

The agriculture industry grew substantially in the twentieth century as technological advancements in the storage and shipping of wheat, such as grain elevators and railways, contributed to the tremendous growth of this industry in Manitoba.⁹⁷ In

⁹⁶ The numerous sloughs in the province posed a problem for engineers during the construction of the microwave transmission system since these bodies of water deflected microwaves in unexpected directions. The erection of the massive steel microwave towers proved to be troublesome due to the instability of the prairie clay gumbo soil. Footing had to be placed several feet below the frost line and anchored to concrete piles to ensure the tower would stay erect. Ball, *"Mind, Heart and Vision,"* 119-121.

⁹⁷ *Ibid.*, *Building Canada*, 146.

addition to the increased storage capacity that concrete grain elevators provided, they also aided farmers in loading large quantities of grain into rail cars.⁹⁸ Agricultural engineering developed new milling processes that aided in the diversification of the agriculture industry.⁹⁹ Engineers designed improved farming tools through research and experimentation. Production was expanded by the arrival of machines on the farm, such as tractors, combines, and trucks, which allowed farmers to plant and harvest larger crops during Manitoba's short growing season.¹⁰⁰

Experts recognized that if Manitoba was to develop its agricultural economy, extensive irrigation throughout the province was necessary. The advancement of irrigation techniques allowed Manitobans to settle in areas with arid lands. Engineers designed a number of projects to provide water for the irrigation of thousands of acres of farmland.¹⁰¹ Consequently, much land that was previously unsuitable for agriculture now produced bountiful crops.

Mining

The mining industry experienced considerable growth in the first half of the twentieth century as geologists and engineers determined that Manitoba was rich in mineral resources, gold, iron, and copper ore, especially in its northern reaches. Engineers were instrumental in the development of this industry. They played a role in showing how many of the province's raw materials could be converted into valuable

⁹⁸ The previous system of loading grain from a flat platform was insufficient when compared with the efficiency of the elevator system and its complex system of weights and grades. Young, Innis, and Dales, 323.

⁹⁹ Ibid., 309.

¹⁰⁰ Ibid., 314.

¹⁰¹ For example, storage reservoirs were constructed on many of Manitoba's rivers and lakes and delivered water to irrigable lands through canals by gravity or with the assistance of pumps. Engineers also conducted studies on importing water through diversion dams and channels and on developing groundwater through aquifers as sources for irrigation once the reservoirs ran dry. Mudry, 37-38.

secondary industries.¹⁰² Engineers conducted extensive surveys on the potential of these secondary industries and also provided designs and specifications for their installation.

Engineering innovations, such as mechanized transport, had a dramatic effect on the growth of the mining industry in Manitoba. Motor boats and airplanes allowed prospectors year-round access to areas that were previously inaccessible. Technological advancements in drilling and hauling equipment, explosives, lighting and signalling, pumps, and stoping techniques all contributed to a transformation of the mining industry. In the early years of mining, miners were only able to extract a limited volume of high-grade rock due to their inability to go deeper into mines. These improvements allowed miners to work larger areas and profitably mine lower grade ores. Private mining operations relied on engineers to maximize their profits through their knowledge of such fields as metallurgical, chemical, mechanical, electrical, mining, geological, mineral processing, and civil engineering.¹⁰³

Pulp and Paper

In the early twentieth century, Manitoba was one of only a few provinces with a thriving pulp-and-paper industry. Engineers were partly responsible for the development of this industry as many of their innovations spurred the industry on to further growth. Engineers successfully adapted to its growing market through such innovations as

¹⁰² For example, limestone and clay shale were useful in the manufacture of Portland cement and other building materials, such as brick and tile. Phosphatic shale was used as a component of fertilizer, while the province's supply of peat was utilized in the production of fuel. Sandstone deposits were used in the development of a glass industry in Manitoba. Dr. R.C. Wallace. "Manitoba's Minerals," *Canadian Engineer* 24 (February 13, 1913), 298.

¹⁰³ Ball, *"Mind, Heart and Vision,"* 69-74.

insulation to reduce heat loss, better filters, systems that reused chemical by-products and waste, and longer lasting machinery and buildings.¹⁰⁴

Oil and Gas

The oil and gas industry in Manitoba has always been dependent upon engineering prowess. Oil was first discovered in Manitoba in 1951.¹⁰⁵ Since then, engineers have been instrumental in the growth of the oil industry in Manitoba through the design of new technologies that have improved exploration, drilling, and extraction techniques. These developments provided more efficient means of extracting and developing Manitoba's considerable oil reserves.¹⁰⁶ In 1958, engineers were successful in completing the portion of the transcontinental gas pipeline that ran through Manitoba. They were able to overcome similar difficulties experienced during the construction of Canada's transcontinental railways, including cold weather and rugged topography, to provide Manitobans with a steady supply of gas.¹⁰⁷

Consulting Engineering

Consulting engineers were rare in Canada in the first half of the twentieth century. Most Canadian engineers were employees of governments, not self-employed businessmen. It has been estimated that the proportion of Canadian engineers that were independent consultants at that time was as low as ten or fifteen percent of the total

¹⁰⁴ Ball, *Building Canada*, 75-77.

¹⁰⁵ J.N. Fox and C.D. Martiniuk, "Petroleum Investment Opportunities in Manitoba – A Geological, Engineering and Economic Perspective," *Journal of Canadian Petroleum Technology* 36, no. 1 (January 1997), 24.

¹⁰⁶ J.N. Fox and C.D. Martiniuk, "Unlocking Manitoba's Oil and Gas Potential," *Journal of Canadian Petroleum Technology* 38, no. 13 (Special Edition 1999), 48.

¹⁰⁷ Ball, *Building Canada*, 119.

profession.¹⁰⁸ As technology and industry gave rise to new public works projects that required engineering expertise, there was an increasing demand for engineers. Many of these works required engineers who understood the challenges presented by the province's harsh climate and difficult topography. A growing number of Manitoban engineers were determined to capitalize on this demand and established consulting firms throughout the province. Consequently, Manitoba experienced moderate growth in the consulting engineering industry throughout the twentieth century.¹⁰⁹

In addition to the work done on public works projects in urban and rural sectors, the agricultural and resource-based industries in the province have utilized consulting engineering firms frequently. Consulting engineering firms have provided specialized engineering services for a wide variety of projects, including structural, mechanical, and electrical engineering services in the erection and maintenance of buildings; many civil engineering works including bridges, tunnels, and dams; construction and maintenance of transportation networks such as railroads, highways, and mass transit; municipal services such as waterworks and sewerage system construction and maintenance, as well as waste disposal services; environmental studies; a number of industrial services including engineering expertise for the agriculture, oil and gas, pulp and paper, and mining and metallurgy industries; power generation and distribution schemes; flood control works; telecommunication networks; and other miscellaneous projects.¹¹⁰

¹⁰⁸ Millard, 41.

¹⁰⁹ Statistics Canada. *Architectural, Engineering and Scientific Services in Canada – 1992 and 1993*. (Ottawa: Minister of Industry, Statistics Canada, 1997), 38-39.

¹¹⁰ Consultative Committee on the Canadian Consulting Engineering Industry. *The Canadian Consulting Engineering Industry: Realizing the Potential*. (Ottawa: Department of Industry, Trade and Commerce and Regional Economic Expansion, 1982), 43-44.

The services provided by Manitoban consulting engineering firms included feasibility studies, planning, design, field services during construction, and project management.¹¹¹ Geotechnical engineering and the sale of software products, or custom-built and custom-designed systems, are services that some Manitoban consulting engineering firms have recently started to provide.¹¹² A number of consulting engineering firms in Manitoba have experienced success within the province through the provision of these services and a few firms have achieved tremendous accomplishments, not only on a local scale, but nationally and internationally as well. These proficiencies have helped to establish Manitoba as a pre-eminent locale for engineering expertise.¹¹³

Conclusion

Manitobans enjoy a high quality of life. Much of the province's prosperity can be attributed to the work of engineers. It is apparent that most aspects of life are affected by engineering. The engineers in this province have overcome tremendous difficulties presented by climate and topography, limited resources, and vast distances to design, plan, implement, and maintain works that have benefited Manitobans in numerous ways. Engineers have not only been adept at the technical aspects of projects, but they have, for the most part, been adequate in factoring in the social, economic, environmental, and political aspects of these works that are unique to this province.

¹¹¹ Ibid., 42.

¹¹² Statistics Canada, 42.

¹¹³ For histories of two consulting engineering firms that have deep Manitoba roots and have achieved great success locally, nationally, and internationally, see Alan W. Bell, *Looking Back: UMA Group – The First 75 Years* (Toronto, 1998); and W.L. Wardrop, *et al. Wardrop Engineering Inc.: The First Forty Years* (1995).

Engineering in Manitoba has always depended upon a symbiotic relationship between government and private enterprise. The strong education and employment opportunities that the three levels of government in this province have provided for engineers have allowed professionals to plan, construct, and maintain a number of advantageous public works projects for the citizens of this province. These works include systems of waterworks and sewerage, transportation and communication networks, power generation and distribution systems, building construction and maintenance, and flood control measures. Engineering has also greatly benefited several industries and the commercial sector of the province, consequently improving Manitoba's economy and providing the funding for future projects, as well as the expansion and maintenance of existing ones.

This type of historical overview of the engineering profession in this province could form the introductory component of a thematic guide to engineering records in Manitoba. This overview of the rich engineering heritage in Manitoba provides the context surrounding the creation of engineering records. These records are of considerable use and value. The subject of engineering is of much interest to a wide array of citizens and researchers. The compilation of descriptions of the records detailing the profession's history in a concise yet thorough thematic guide, as detailed in chapters two and three, and based on the theoretical underpinnings of archival description outlined in the first chapter of this thesis, would provide subject-access to this large body of records located in a number of archival repositories in the public and private sectors. The creation of this valuable research tool is really only the tip of the iceberg of what can be accomplished through improved cooperation among engineers and archivists. The

creation of a thematic guide could lead to further archival advancements in the engineering profession as a result of other cooperative ventures between engineers and archivists. The conclusion of this thesis will elaborate upon further recommendations for the future development of engineering archives in Manitoba.

Conclusion

Archivists and engineers could build upon the collaborative effort of producing a thematic guide to engineering records by developing further engineering archives in Manitoba. Engineers depend on records managers and other information professionals to help administer their organizations and the records that they produce. However, many firms do not administer their archival records well. Archivists can assist engineers in the appraisal, arrangement, description, conservation, and provision of access to archival records. This could be done in three ways: either through the efforts of consulting archivists, the hiring of in-house archivists, or in the creation of an engineering history centre. This work would be done mainly for private engineering firms, as the records of public-sector engineering activities fall within the mandates of government archives or, in the case of related activities, such as university education in engineering, within the mandates of university archives. That said, the duties of archivists at an engineering history centre, for example, should include monitoring the engineering archival work of public and university archives to see that it is done well.

There is a great need for archival work with private engineering firms. A number of private engineering firms were visited during the preparation of this thesis¹ and the author saw that their records were not always organized to their highest potential. The three major concerns faced by engineering firms in regard to the preservation of their records are the sheer volume of material they produce, apprehension about disposing of

¹ The firms visited by the author represented a cross-section of the industry in the province based on the size and scope of the firm and the functions they carry out. These firms were Crosier Kilgour & Partners Ltd., SMS Engineering Ltd., UMA Engineering Ltd., and Wardrop Engineering Inc.

records, and lack of proper storage facilities, a problem which compounds the difficulties presented by the first two concerns.

The records produced by engineering firms originate with a variety of creators in the organization. For every job undertaken an engineering firm produces a set of records. These records have a wide variety of forms, structures, and media from textual records, photographs, and cartographic material to an ever-increasing volume of electronic records. Each type of record poses unique challenges to those responsible for determining their long-term use and viability.

Due to the long-term nature of their accountability for their work, engineers are leery about disposing of any records as long as the related work is still in existence. Working with engineers, archivists can provide appraisal strategies that not only recognize and preserve those records of value for the organization, but also identify records that are of historical or legal significance. Archivists may even be able to provide engineers with this information prior to the records' creation, which may then be incorporated into records schedules by records managers. By doing so, engineering firms would no longer accidentally dispose of records that were deemed to be worthless, only to discover their value at a later date. Conversely, engineering firms would no longer feel pressure to hold on to records of little or no value, such as the records of projects that are now completed or no longer exist. This may, in turn, reduce the immense volume of records retained by engineering firms.

Many of the record inventories examined during the preparation of this thesis were not descriptive and were difficult to understand. Also, most engineering firms arrange their records according to specific projects or by a certain format or media.

Administrative records, project records, and the records of project engineers are often retained separately and administered in different record-keeping systems. Consequently, the records of a given creator, a project engineer for instance, may be divided among three separate record-keeping systems. This practice contradicts the core archival principle of provenance. If engineering records were arranged and described according to archival standards, firms would be able to maintain much more control over their holdings and improve their overall company administration. Archivists could do this work themselves or provide advice to engineers or other employees within the firm on how to arrange and describe their records.

Many archivists are equipped with knowledge of how to preserve archival material over the long term. Since many engineering firms retain records for extremely long periods of time, substantial deterioration of the records may occur. This deterioration can be exacerbated by a number of factors, including repeated improper handling of the records and inadequate storage requirements. Many of the firms consulted were forced to find alternative off-site storage owing to the large volume of records produced. While many of these firms sent semi-active or archival material to climate controlled commercial storage centres, others chose more inexpensive, yet inadequate measures, including one firm that stored records in the rickety attic of a chicken feed warehouse! Archivists would be able to provide engineers with counsel on how to preserve damaged documents and conserve others, primarily through proper storage conditions, including temperature and humidity controls.

To date, engineers have not been overly concerned with providing access to their records to the general public. While it is understandable that many of the records they

produce are confidential, are subject to privacy legislation, and, consequently, have had access to them restricted, many others do not fall under these categories. Engineers have put little effort into making these records available to the public. There are researchers, including engineering historians, who would like access to engineering records and are unaware of the rich resources available in the holdings of private firms. Archivists could work with engineers to develop a policy on access that would satisfy a firm's confidentiality concerns but also make a portion of their records available for public use. One method of providing access to archival material that is gaining in popularity is scanning records for mounting on the Internet. These images, in addition to an automated thematic guide to engineering records, would be valuable tools that would allow users to access the records at all times from any location in the world.

While archivists could provide engineers with this expertise on a contract or in-house basis, the author suggests consideration of a private engineering history centre based on an engineering archives. As explained above, the archives of such a centre would have to be limited to the private sector. It is the mandate of public archival repositories to collect and preserve the records created by governments. Since engineering is one of the major functions of civic, provincial, and federal governments, their respective public archives should acquire engineering records. An engineering history centre would provide an alternate location for the deposit of private engineering records, especially since financial constraints in the province have created a substantial decline in the acquisition of private records by public archives. There are very few private institutional or personal archival engineering materials in the public-sector archives in Manitoba.

An excellent model to follow for the development of an engineering history centre in Manitoba is the Center for History of Physics at College Park, Maryland established by the American Institute of Physics.² The purpose of the Center is "to preserve and make known the history of modern physics and allied fields."³ It does so through documentation programs, educational programs, reference services for a wide array of users, and its library and archives. A centre devoted to engineering history could raise the profile of the subject in this province in much the same way. The Center for History of Physics is funded by its parent organization and through grants from government, corporate, and individual sources, and especially by a consortium of investors called the Friends of the Center for History of Physics. A similar funding scheme for an engineering history centre could be developed in Manitoba. The majority of funding would come from private sources and professional engineering corporations and associations. It might be possible to receive some government funding, both directly and indirectly through tax credits for firms that make records available to the public. An ideal location for such a centre would be the campus of the University of Manitoba, where the Faculty of Engineering (and other faculties) might well be interested in using the centre's resources for educational purposes. The university's Smart Park, which is constantly developing such university/community ventures, might also be interested in providing a location for a centre.

² American Institute of Physics, "Center for History of Physics Homepage," 2005.

<<http://www.aip.org/history/>> (January 17, 2005). For another model of an engineering history centre that is not quite as inclusive (and consequently perhaps more financially viable) as the above example, see the website of the Institute of Electrical and Electronics Engineers, Inc. (IEEE) History Center ("IEEE History Center," January 24, 2005, <http://www.ieee.org/organizations/history_center/> (February 19, 2005).).

³ American Institute of Physics, "The Center for History of Physics."
<<http://www.aip.org/history/ctrbro.htm>> (January 17, 2005).

Many information professionals, primarily historians and archivists, have developed a number of documentation programs at the Center for History of Physics. These programs are intended to provide strategies on how the subject of physics might best be recorded in a systematic fashion. Advice is given to scholars, scientists, and institutions on how to accurately and efficiently document their functions and activities. An engineering history centre would provide a central location for private institutions to inquire about and obtain such records management and archival advice and services. Archivists working at an engineering history centre could provide archival strategies for the management of the records of firms affiliated with it from the moment of the records creation to their transfer to the centre for long-term preservation.

The educational programs developed by the Center for History of Physics are some of the institution's primary means of making the records of physics more accessible to the public. They explain the heritage of physics to the scientific community and, perhaps more importantly, to the general public as well through historical publications and exhibits. An engineering history centre could similarly institute educational programs in Manitoba high schools, universities, and community colleges, not only through the methods mentioned above but also through more interactive activities that make learning a much more dynamic experience. The exhibition of artefacts and documents in an on-site engineering museum would be one interesting way to educate visitors about the history of the profession in this province through an approach that is more conducive to learning, especially for younger minds.

The key element of the Center for History of Physics, as it would also be in an engineering history centre, is the reference service provided by its library and archives.

The materials in the Niels Bohr Library of the Center for History of Physics consist of books, journals, archival manuscripts and photographs, oral history interviews and their transcripts, and other material dealing with the global history of physics and related fields. The archives has an established mandate which directs it to acquire collections only when it is the most suitable repository. Otherwise the archives provides advice on where the records would most appropriately be housed. The archives within an engineering history centre would similarly not acquire any collections that were within the mandates of other archival repositories and would also be able to assist potential donors in locating the proper place for their records.

The archives within an engineering history centre, just like the Niels Bohr Library archives, would acquire engineering records of all formats, including textual records, photographs, cartographic material, audio recordings, and graphic materials. They would be housed under climate controlled conditions and arranged and described according to archival standards. Access would be provided to all users as long as all confidentiality concerns by the donor and the terms of any relevant legislation were satisfied. Access would be enhanced by in-house research tools, such as finding aids, and an extensive automated website that would be comparable to that of the Center for History of Physics.

On the Center for History of Physics website, the bibliographic information for the books and journals in the Niels Bohr Library are all available on-line in a searchable database. The finding aids to the collections have all been digitized and made available on the web, as have oral history interviews. Also, the Center for History of Physics has compiled an on-line catalogue of their photographic holdings, as well as the International Catalog of Archival Sources, a database featuring indexed information about physics-

related archival material in repositories around the globe. An engineering history centre would strive to duplicate all of these achievements and could surpass them through other means such as virtual exhibitions of digitized material. As one can see from this thesis, an indexed on-line catalogue to descriptions of engineering-related material in Manitoba, with the potential to link to other national and international on-line holdings is a distinct possibility. The website for an engineering history centre in Manitoba would be the perfect host for the thematic guide to the records of engineering described in this thesis. The centre could provide the necessary funding to hire archival professionals to create and update such a guide. An alternate host for the guide could be the Association of Professional Engineers and Geoscientists of the Province of Manitoba,⁴ which might be approached to fund it.

An engineering history centre in Manitoba would undoubtedly require substantial funding. The engineering profession would likely have to provide much of it. Given such costs, it might also consider alternatives that could achieve some of the same results at less cost. One possible option is the creation of an engineering archives program at an established public archives, such as the Archives of Manitoba. With appropriate funding from the engineering profession, the archives might be willing to provide services to engineering firms in the province. This partnership option would be more limited in scope and thus less desirable in some ways than an independent engineering history centre. It might also be difficult for the Archives of Manitoba or any other possible public archives partner in the province to permit one group in the community to obtain what may seem to others as preferential treatment.

⁴ Association of Professional Engineers and Geoscientists of the Province of Manitoba, "Homepage." <<http://www.apegm.mb.ca/>> (February 19, 2005).

Engineers require archival expertise in order to ensure the long-term historical, legal, and administrative value of their records. A thematic guide to engineering records in Manitoba can form the stepping stone to a relationship between archivists and engineers that could lead to important broader projects such as a Manitoba engineering history centre.

Appendix A – Listing of Engineering Records in Public and Private Archival Repositories¹

- **Public Archives**

- *Archives of Manitoba – Winnipeg, MB*

- *Government Records*

- **Agriculture**

- **Minister**

- Office Files, 1886, 1950 – (AG 0002A)

- **Deputy Minister**

- Office Files, 1895-1896, 1918 – (AG 0004)

- **Technical Services and Training**

- Engineering Section Office Files, 1980 – (AG 0329)

- **Energy and Mines**

- **Minister**

- Office Files, 1980 – (EM 0049)

- **Deputy Minister**

- Office Files, n.d., 1979 – (EM 0050)

- **Mining Engineering**

- Office Files, 1931 – (EM 0029)

- **Mines and Natural Resources**

- **Minister**

- Office Files, 1928 – (NR 0001)

- **Deputy Minister**

- Office Files, 1881 – (NR 0005)

- **Executive Council**

- **Office of the Premier**

- Office Files, 1877 – (EC 0016)

- **Government Services**

- **Minister**

- Office Files, 1878 – (GS 0123)

- **Deputy Minister**

- Office Files, 1892 – (GS 0082A)

¹ This appendix is not a complete listing of the records of engineering in Manitoba. Many more records exist in other repositories across Manitoba and the rest of Canada. It is representative of the records located in institutions visited by the author during the preparation of this thesis and represents an accurate cross-section of public and private archival repositories featuring engineering records. This listing, including collection dates and reference numbers, is limited by the descriptions located in the repositories as of 2003. All information in this appendix has been drawn from those descriptions.

- **Design**
 - Investigative Reports, 1972 – (GS 0102)
 - Plans and Shop Drawings (GS 0100)
- **Highways**
 - **Deputy Minister**
 - Office Files, 1914 – (HT 0135, HT 0242)
 - **Western Association of Canadian Highways Officials**
 - Minutes, 1929-1972 (HT 0026)
 - Proceedings, 1968 – (HT 0088)
- **Industry and Commerce**
 - **Minister**
 - Office Files, 1960 – (ITT 0001)
 - **Deputy Minister**
 - Office Files, 1962 – (ITT 0011)
 - **Central Registry**
 - Company Files, 1948 – (ITT 0002)
 - Industry Files, 1946 – (ITT 0004)
 - Prospect Files, 1959 – (ITT 0003)
- **Northern Affairs**
 - **Minister**
 - Office Files, 1973 – (NA 0036)
 - **Engineering and Construction**
 - Office Files, 1967-1978 (NA 0034)
- **Public Works**
 - **Highways**
 - Office Files, 1870-1962 (A 0045)
 - **Operations**
 - Building Operations Files, 1973 – (GS 0043)
 - **Project Management**
 - Architecture Engineering Investigative Reports, 1972 – (GS 0102)
 - **Provincial Architect**
 - Project Plans and Specifications, 1905-1977 (A 0078)
- **Treasury Department**
 - **Provincial Treasurer**
 - Office Files, 1873-1911, 1922 – (I 0088)
- **Urban Affairs**
 - **Minister**
 - Office Files, 1977 – (UA 0002)
 - **Deputy Minister**
 - Office Files, 1936 – (UA 0001)
- **Manitoba Housing and Renewal Corporation**
 - **General Manager**

- Office Files, 1960-1983 (MHR 0026)
 - **Corporate Secretary**
 - Office Files, 1971 – (MHR 0052)
- **Manitoba Telephone System**
 - **Network Services – Network Engineering**
 - Network Plans Files, 1918 – (MTS 0161)
- **Manitoba Hydro**
 - **General Counsel and Corporate Secretary**
 - Executive Meeting Minutes, 1953 – (MH 0026)
 - **Public Affairs**
 - Predecessor Corporate Records, 1880-1961 (MH 0035)
- *Private Records*
 - **Doupe Family Papers; n.d., 1829-1982; 55 cm. of textual records (P320-P324, P827)**
 - Manitoba Land Surveyors Correspondence and Research; n.d., 1932-1942; 4 cm. of textual records (P322)
 - Legal and Professional Papers; 1858-1952; 9 cm. of textual records (P322, P324)
 - **Francis E. Collinson Collection; 1892-1945; 5 scrapbooks – 1 album, ca. 1155 photographs – 122 postcards – 4 sketches – 34 maps – 2 aerial photographs – 2 certificates (P5960-P5964)**
 - **Matthew George Collins Collection; 1876-1999, predominant 1876-1937; 2 cm. of textual records, 5 newspaper clippings (P6007, D315 f.3)**
 - **Gary Albert Filmon Collection; n.d., 1980-1988; 61 feet of textual records; Restricted Access (9-1233, 1988-70)**
 - **Gordon L. Shanks Collection; 1972; 11 pages of textual records (MG9 A61-1)**
 - **John Leslie Charles Collection; 1978; 429 pages of textual records (MG9 A109)**
 - **George Arthur Bayne Collection; 1869-1914; 1 inch of textual records (MG11 A20)**
 - **Arthur J. Merrill Collection; 1912-1929; 4 cm. of textual records (MG11 E9)**
 - **William Charles O'Keefe Collection; 1867-1931; 4 inches of textual records (MG8 B30)**
 - **Thomas Russ Deacon Collection; 1895-1955; 2 inches of textual records (MG14 B1)**
 - **H.H. Bayfield Collection; 1915; 64 pages of textual records (MG1 B24)**

- **Harry William Armstrong Collection; 1937; 3 pages of textual records (MG11 A33)**
- **John Watter Harris Collection; 1868-1922; 5 inches of textual records (MG14 C74)**
- **Henry Norland Ruttan Collection; 1863-1909; 10 inches of textual records (MG14 C52)**
- **Thomas Clarkson Scoble Collection; 1866-1900; 10 inches of textual records, 120 feet of microfilm (MG14 C44, M167-168)**
- **Manitoba Water Well Association Collection; 1958-1983; (P387)**
- **Mining Corporation of Canada Collection; ca. 1917-1925; 20 inches of textual records (P3558-P3561)**
- **Refrigeration Service Engineers Society Collection; 1944-1993; 4' 2 1/2" of textual records (P5022-P5025, D311 f.3, P5671)**
- **Winnipeg Construction Association Collection; 1904-1939; 9 inches of textual records; (MG10 A22)**
- **Vulcan Iron Works Collection; 1944-1949; 2.5 cm. of textual records (MG11 O46)**
- **Winnipeg Central Heating Company Limited Collection; 1930-1967, 1979; 5 inches of textual records (MG11 C51)**
- **Professional Engineers' Wives Association Collection; 1940-1996; 0.91 m. of textual records – photographs (P5886-P5892)**
- **Canada – Department of Public Works Collection; 1848-1891; 3 feet of textual records (MG4 D12)**
- **Winnipeg and Hudson's Bay Railway and Steamship Co. Collection; ca. 1886-1887; 6 pages of textual records (MG11 A21)**
 - Engineers Reports, ca. 1882
- **Port Nelson Collection; 1909-1914; 5 inches of textual records (MG11 A29)**
 - Reports of Chief Engineer, 15 February 1913
- **Last Spike Manitoba Northern Railway Collection (MG16 C6-4)**

▪ ***Hudson's Bay Company Archives***

- **Hudson's Bay Company Architectural Drawings; 1880-1913, 1971; 3600+ maps, plans, and architectural drawings**
- **Records of the Hudson's Bay Company Fur Trade Department, 1910-1960**
 - **Ships' Logs; 1926-1937; 22.5 cm. of textual records (RG3 Series 6)**

- Logs of *Nascope*, 1933-1937 (RG3 Series 6B)
 - **Personnel Records; 1910-1933; 25 cm. of textual records (RG3 Series 11)**
 - Fur Trade Directories (RG3 Series 11B)
 - **Labrador District Office Records; 1911-1921, 1935-1937; 5 cm. of textual records (RG3 Series 19)**
 - Log of *Fort Garry*, 1936-1937 (RG3 Series 19C)
 - **Ships Logs; 1938-1958; 7.5 cm. of textual records (RG3 Series 48)**
 - Hudson's Bay and James Bay (RG3 Series 48B)
 - **Abstracts of Ships Logs; 1935-1957; 15 cm. of textual records (RG3 Series 49)**
 - Engineers (RG3 Series 49B)
 - Masters and Engineers (RG3 Series 49C)
 - **Mackenzie River Transport Government Reports; 1938-1950; 6 cm. of textual records (RG3 Series 57)**
 - **Miscellaneous Transport Division Records; 1912-1957; 12 cm. of textual records (RG3 Series 66)**
 - Miscellaneous (RG3 Series 66 C)
- **Biographical Sketches, 1849-1968**
- ***Graphic Materials***
 - **George Coutts Graphic Material Collection; 1931-1933; 3 film reels**
 - **Boundary Commission Graphic Material Series; 1872-1874; 273 photographs: albumen (C6)**
 - **Henry W. Meindl Graphic Material Collection; 1912-1917; 270 photographs: b&w (C67)**
 - **Manitoba Natural Resources Graphic Material Series; 1949-1950; Series III; 56 photographs: b&w (C74)**
 - **Thomas Russ Deacon Graphic Material Series; 27 photographs and postcards**
 - **Drainage Graphic Material Collection; 28 photographs**
 - **Public Works / Drainage Graphic Material Collection; 8 photographs**
 - **Highways Department Graphic Material Collection; ca. 1914-1960; prints, negatives, glass slides**
- ***City of Winnipeg Archives – Winnipeg, MB***
 - ***Engineer's Annual Reports; 1898-1915; 20 cm. of textual records***
 - ***Letters to Council, 1874-1968***
 - ***Council Minutes, 1897-1980***

- *Minutes of the Council of the Metropolitan Corporation of Greater Winnipeg, 1961-1971*
- *By-laws, 1899-1993*
- *Planning, Property & Development*
 - Land and Development Services, 1940-1948 (1997 06 27)
 - Environmental Planning, 1939, 1962
- *Public Works*
 - Bridge engineering studies - 1966, 1984-1985; Restricted Access (1999 02 11)
- *Streets and Transportation*
 - Capital Works projects
- *Operations – Waterworks, Waste and Disposal*
 - Water and Waste Department, Engineering Division, 1993-1995 (2000 05 19)
 - Water and Waste – Engineering Branch, 1986-2001 (2001 06 27)
 - Water and Waste Department – Engineering Division, 1965-1995 (2000 05 15)
 - Water and Waste / Engineering; 1995-1996; Restricted Access (1999 12 10)
 - Water and Waste / Engineering; 1994; Restricted Access (1999 06 28)
 - Water and Waste/ Engineering; 1979-1998; Restricted Access (1999 01 20)
 - Water and Waste / Engineering; 1975-1998; Restricted Access (1998 12 01)
 - Water and Waste Department – Administration and Engineering; 1992; Confidential (1997 02 07)
 - Waterworks, Waste and Disposal Department; 1991; Confidential; (1995 09 11)
 - Waterworks, Waste and Disposal Department; 1959-1964; Confidential (1989 03 06)
 - James Avenue Pumping Station, Waterworks and Waste Department, 1902-1980
- *W.D. Hurst, City Engineer, Engineering Department*
 - 1898-1987 (1996 01 25)
 - 1898-1915 (1995 07 06)
 - 1875-1973 (1987 02 10)
 - Restricted Access (1985 10 08)
- *Archives of the Flood of '97*
 - Emergency Preparedness and Coordination Committee, 1997-1998
 - Mayor and Council – Engineering flood reports, 1997-1998
 - Archival Flood Records, 1941-1984

○ *Library and Archives Canada – Ottawa, ON*

- *Canadian Council of Professional Engineers fonds, 1936-1982; 7 microfilm reels: negative and positive, 1 videocassette, 1 medal: bronze*
- *Canadian Engineering Heritage Record fonds, [ca.1900-1979]; 2.82 m of textual records, 943 photographs*
- *Engineering Institute of Canada fonds, 1860-1994; 48.5 m of textual records, 420 photographs, 26 medals, 2 pins, 1 seal die, 10 audio cassettes, 1 painting*

○ *Library and Archives Canada – Government Archives Division – Winnipeg, MB*

- *Department of Indian and Northern Affairs (RG 10)*
 - Manitoba Regional Office, Regional Office Registry Files; 1885-1973; 40.8 m. of textual records
 - Engineering Project Files of the Manitoba Regional Office; 1978-1982; 10.5 m. of textual records
- *Department of Public Works (RG11)*
 - Winnipeg District Office; 1899-1970; 20.4 m. of textual records
 - Winnipeg District Office; 1960-1979; 27.6 m. of textual records
 - Winnipeg District Office, Project Files; 1967-1979; 14.3 m. of textual records
 - Harbours and Rivers Engineering Branch, Shannon Files, and Development Engineering Branch, Registry Files; 1893-1973; 20.4 m. of textual records
 - Winnipeg Central Records Office – Building Plans; 1974-1985; 3.6 m. of textual records
 - Western Region, Manitoba, Property Administration, Central Registry Project Files; 1971-1978; 2.1 m. of textual records
 - Indian Schools Program Files; 1967-1979; 3.3 m. of textual records
- *Department of Transport (RG12)*
 - Canadian Air Transportation Administration, Office of the Regional Director, Central Region, Winnipeg, Manitoba; 1944-1975; 3 m. of textual records
- *Department of National Defence (RG24)*
 - Air Command Headquarters – Central Registry Files; 1981-1993; 1.2 m. of textual records
 - Air Command Headquarters, Central Registry Files; 1974-1980; 1.5 m. of textual records

- Air Command Headquarters, Central Registry Files; 1975-1987; 7.2 m. of textual records
- Central Registry Files of the Department of Defence, Air Command Headquarters; 1988-1991; textual records
- Air Command Headquarters, Deputy Chief of Staff – Military Engineering Files (DCOS-MILE); 1966-1977; 0.9 m. of textual records
- Air Defence Command and Air Transport Command; 1970-1975; 3.3 m. of textual records
- ***Department of Labour (RG27)***
 - Operational Records of Central Region, Winnipeg Regional Office; 1976-1985; 7 m. of textual records
- ***Department of National Health and Welfare (RG29)***
 - Public Health Engineering Division, Western Region, Central Registry Files; 1940-1969; 1.8 m. of textual records
- ***Geological Survey of Canada (RG45)***
 - Ground Water Resources Reports, Prairie Provinces, 1936-1954; 1.8 m. of textual records
- ***National Harbours Board (RG66)***
 - Port Churchill, Manitoba; 1916-1977; 24.9 m. of textual records
 - Surveyors' Notebooks, 1928-1962
 - Daily Journals of Engineers, 1928-1972
- ***Defence Construction Limited (RG83)***
 - Office of Regional Branch Director, Prairies and Northwest Territories; 1965-1975; 5.1 m. of textual records
- ***Regional Economic Expansion (RG124)***
 - REE, PFRA Survey and Construction Field Books; 1959-1980; 3.6 m. of textual records
 - PFRA Field Books; 1950-1961; 1.5 m. of textual records
- ***Canadian National Railways (RG30)***
 - Surveys and Miscellaneous Railway Operating Procedures Manuals of Canadian Northern Railway and Grand Trunk Pacific Railway, Townsite Plans; 1897-1945; 0.3 m. of textual records and cartographic material
 - Engineer's Office, Western Region, Winnipeg, Manitoba, Registry Files; 1950-1970; 31.5 m. of textual records
- ***Canadian National Railways Land Records***
 - Railway and Townsite Map and Plan Registers; 1889-1960; 17 ledgers
 - Townsite Plan Files; 1903-1948; ~1000 blueprints and plans
 - Survey Department Townsite Files, 1902-1959
- ***Grand Trunk Pacific Railway Cartographic Series***
 - 6996 maps, plans, blueprints, and drawings; 1903-1930

○ ***Parks Canada Prairie and Northern Regional Office – Winnipeg, MB***

▪ ***Drawings***

• **Riding Mountain National Park; 1924-2002**

- Standard Drawings
 - Residences
 - Campground Structures: Kitchen Shelters, Showers, Toilet Buildings, Privies
 - Campground Furniture
 - Back-Country Cabins, Garages, Service Buildings, Field Trailers
 - Trailer Park Services
 - Amphitheatres, Rear Projection Buildings
 - Towers, Lookouts, Cupolas
 - Park Gates, Texas Gates
 - Landscaping
 - Sewers and Related Works
 - Monuments (Historic and Survey) – Cairns
 - Miscellaneous Standard Drawings
- Record Survey; Extant As-Found
- Master Planning
- Concept
- Preliminary
- Working Drawings, Construction
- As-Built, As-Constructed
- Maintenance

• **Manitoba South**

- **Lower Fort Garry National Historic Site; 1911-2002**
 - Record Survey; Extant As-Found
 - Master Planning
 - Concept
 - Preliminary
 - Working Drawings, Construction
 - As-Built, As-Constructed
 - Maintenance
- **Riel House National Historic Site; 1969-1997**
 - Record Survey; Extant As-Found
 - Working Drawings, Construction
 - As-Built, As-Constructed
- **St. Andrew's Rectory and Church National Historic Site; 1979-1992**
 - Record Survey; Extant As-Found
 - Concept
 - Working Drawings, Construction
 - Maintenance

- **The Forks National Historic Site; 1984-2001**
 - Record Survey; Extant As-Found
 - Preliminary
 - Working Drawings, Construction
 - Maintenance
- **Neubergthal National Historic Site; 1997**
 - Record Survey; Extant As-Found
- **Inglis Elevators National Historic Site; 2000**
 - Record Survey; Extant As-Found
- **Manitoba General – Various; 1964-2002**
 - Record Survey; Extant As-Found
 - Concept
 - Preliminary
 - Working Drawings, Construction
 - As-Built, As-Constructed
- **Manitoba North National Historic Sites**
 - **Churchill; 1975-2000**
 - Record Survey; Extant As-Found
 - Working Drawings, Construction
 - **Cape Merry; 1980-1998**
 - Record Survey; Extant As-Found
 - Concept
 - Working Drawings, Construction
 - **Prince of Wales Fort; 1958-2002**
 - Record Survey; Extant As-Found
 - Working Drawings, Construction
 - **Sloop's Cove; 1977-1999**
 - Record Survey; Extant As-Found
 - **York Factory; 1971-1998**
 - Record Survey; Extant As-Found
 - Preliminary
 - Working Drawings, Construction
 - As-Built, As-Constructed
- ***Specifications***
 - **Riding Mountain National Park; 1954-2001**
 - **Lower Fort Garry National Historic Site; 1969-2000**
 - **Manitoba North National Historic Sites (includes Churchill, Cape Merry, and Sloop's Cove); 1988-1996**
 - **Riel House National Historic Site; 1977-1987**
 - **St. Andrew's Rectory and Church National Historic Site; 1984**
 - **The Forks National Historic Site**
 - **York Factory National Historic Site; 1990**
 - **Regional Office Facilities; 1978-1995**
- ***Reports and Studies***
 - **General Reports and Studies; 1965-1997**

- **Regional Office Facilities; 1972-1989**
- **Riding Mountain National Park; 1960-2002**
- **Lower Fort Garry National Historic Site; 1967-1983**
- **Neubergthal National Historic Site; 1997**
- **Riel House National Historic Site; 1973-1978**
- **St. Andrew's Rectory National Historic Site; 1979-1983**
- **York Factory National Historic Site; 1983-2002**
- ***Technical and Maintenance Manuals***
 - **Riding Mountain National Park**
 - "Maintenance Stores Building Solar DHW Retrofit", Master Plumbing and Heating Co., Winnipeg
 - "East Gate Landscape", A&E Services Landscape Arch. Section, 1989
 - "Wasagaming Water Tower Upgrading, Insulating, and Heating: Product Specifications and Suppliers, 1988
 - **Lower Fort Garry National Historic Site**
 - "AER-O-FLO Sewage Treatment Plant", CLOW Corporation
 - "Food and Audio Equipment", Quality Food Equipment Centre Ltd., Winnipeg
 - "Warehouse Building Maintenance Manual" (Draft)
 - **Riel House National Historic Site**
 - "Riel House Technical and Maintenance Manual", Geremia Blackie Cibinel, Architects, 1991
 - **St. Andrew's Rectory and Church National Historic Site**
 - "St. Andrew's Rectory Landscape Technical and Maintenance Manual"
 - **York Factory National Historic Site**
 - "1990 Staff Housing Maintenance and Operations Manual"
- ***Parks Canada – Prairie and Northern Region - Architectural and Engineering Services Technical Library***
 - Landscape
 - Technology – General
 - Engineering – Civil Engineering – General
 - Signage
 - Hydraulic Engineering
 - Environment Technology – Sanitary Engineering
 - Highway Engineering – Roads and Pavements
 - Bridge Engineering
 - Building Construction
 - Mechanical Engineering and Machinery
 - Electrical Engineering – Electronics – Nuclear Engineering
 - Motor Vehicles – Aeronautics – Astronautics
 - Chemical Technology

- Manufacturers
 - Handicrafts
 - Home Economics
- ***University of Manitoba Archives & Special Collections –
Winnipeg, MB***
- ***University Records***
- **Office of the President, 1907-1983 (UA 20)**
 - **Office of the President, 1954-1999 (UA 29)**
 - **Faculty of Agricultural and Food Sciences (UA 21)**
 - Dean's Office, 1966-1979
 - Associate Dean's Office, 1960-1982
 - Canadian International Development Association (Zambia) Files, 1979-1983
 - Department of Agricultural Engineering; 1945-1985; 0.9 m. of textual records
 - Department of Plant Science, 1968
 - Department of Animal Science, 1954-1979
 - Department of Entomology, 1969
 - **Libraries, 1908-1988 (UA 9)**
 - **General Faculty Council; 1901-1965; 0.61 m. of textual records (UA 12)**
 - **Continuing Education Division, 1981-1984 (UA 23)**
 - **Faculty of Arts, 1966-1967 (UA 27)**
 - **Faculty of Engineering; 1942-1945; 5 cm. of textual records (UA SC 40)**
 - **Unprocessed Material**
 - **Office of the President**
 - A.95-55, 1992-1995
 - A.93-44, 1982-1991
 - A.91-58, 1971-1976
 - A.93-36, 1981-1988
 - **Vice President Academic**
 - A.97-07, 1993
 - A.94-05, 1991
 - A.93-06, 1989
 - A.91-55, 1988
 - A.91-02, 1986-1987
 - A.90-15, 1984-1986
 - A.89-06, 1983-1985
 - A.88-10, 1979-1984
 - **Vice President Administration**
 - A.97-50, 1989

- A.84-32, 1977-1982
 - **Associate Vice President Operations**
 - A.91-39, 1988
 - **Vice Provost Student Affairs**
 - A.96-46, 1993
 - **Director of Student Affairs**
 - A.93-36, 1984
 - **Office of Space Management**
 - A.92-29, 1968-1975
 - **Transport Institute**
 - A.96-12, 1985-1986
 - **Archives & Special Collections**
 - A.94-34
 - **Professor Shanks – Agricultural Engineering**
 - A.81-16
 - **Biosystems Engineering**
 - A.97-54
 - **Faculty of Engineering**
 - A.03-81
- **University Publications**
 - **Faculty of Engineering, 1912-1996**
 - **Faculty of Agriculture, n.d., 1978**
 - **Continuing Education Division, 1961**
 - **Alumni Association, 1880-1930**
 - **Faculty Association, 1924-1937**
 - **Office of the Registrar, 1917**
 - **Calendars, 1907-2001**
 - **International Symposium on Large Engineering Systems, 1976**
 - ***Brown and Gold Yearbook, 1915-1975***
- ***Manuscript Collections***
 - **John W. Dorsey Collection; 1910-1920; 0.5 cm. of textual records (MSS 82)**
 - **Andrew Taylor Collection (MSS 108, MC1)**
 - Bachelor of Science (Civil Engineering)
 - Municipal Engineer
 - Army Records
 - Royal Canadian Engineers
 - Consulting
 - **Red River Floodway Collection; 1962-1972; 0.8 m. of textual records (MSS 60)**
 - **Winnipeg Tribune Collection (MSS 24)**
 - Engineers, 1949-1974
 - Engineers, 1975-1980

- Agricultural Engineers
- American Society for Heating, Refrigeration and Air Conditioning Engineers
- Association of Consulting Engineers
- Canadian Medical and Biological Engineering Society, 1972
- Canadian Society of Safety Engineering, 1979
- Engineering Institute of Canada, 1949-1978
- Unions – Operating Engineers, 1964-1980
- Army – Canada – Royal Canadian Engineer Corps
- University of Manitoba – Faculty of Engineering, 1976-1980
- Winnipeg – Engineering Department, 1949-1971
- Engineered Homes Ltd., 1977-1980
- Pritchard Engineering Co. Ltd., 1969-1975
- Pydee Engineering Co. Ltd., 1979
- W.L. Wardrop and Associates, 1964-1980
- **W.H. Hunt Collection**
 - **Textual Records**
 - Textual Records, 1877-1939
 - Engineering, 1912-1973
 - Militia, 1906-1970
 - Personal, 1908-1981
 - Daily Diaries and Field Books, 1913-1974
 - Estate Book, 1930-1974
 - **Library**
 - University and Career, 1849-1967
 - Personal, 1881-1964
 - **Maps and Plans**
 - Large Map Book; 234 maps and plans; 1899-1966
 - Small Map Book; 58 maps and plans; 1907-1940
 - Map Box; 35 maps and plans; 1873-1970
 - Rolled Maps and Plans; 138 maps and plans; 1870-1974
 - **Certificates and Photographs**
 - Certificates; 9 items; 1916-1929, 1965-1972
 - Photographs; 7 photographs, b&w; 1908-1913, 1939-1951
 - Aerial Photographs and Tin Box

▪ ***Photograph Collections***

- **Andrew Taylor Photograph Collection (PC 110)**

- **Red River Floodway Photograph Collection, 1962-1963 (PC 78)**
 - **Winnipeg Tribune Photograph Collection**
 - Canadian Society of Safety Engineering, 1979
 - Engineers, 1949-1974
 - Pritchard Engineering Co. Ltd., 1969-1975
 - Unions – Operating Engineers, 1964-1980
 - **Faculty of Agriculture Photograph Collection; 1900-1980; 95 photographs and nine negatives (PC 17)**
 - **Department of Civil Engineering Photograph Collection; n.d., 1912-1923; 1 photo album: 15 photographs (PC 66)**
 - **Department of Electrical and Computer Engineering Lantern Slide Collection; ca. 1900-1950; 1478 slides (PC 164)**
-
- **Record Holdings of Private Firms**
 - ***Wardrop Engineering Inc. – Winnipeg, MB***
 - ***Daily Company Records***
 - **Correspondence**
 - Letters, memos, faxes, transit documents
 - **Design records**
 - Sketches, calculations, rough notes
 - **Proposals and Reports**
 - ***Bound Documents***
 - **Proposals**
 - **Reports**
 - **Specifications and contracts**
 - ***Staff Records***
 - **General correspondence**
 - Letters, memos, faxes
 - **Design**
 - Rough notes, calculations, drawings, requests
 - **Report preparation**
 - ***Drawings***
 - ***Photographs***
 - ***UMA Engineering Ltd. – Winnipeg, MB***
 - ***Planning***

- *Preliminary Work*
- *Design Services*
- *Office and General Supervision*
- *Resident Engineering*
- *Legal Surveys*
- *Soils and Material Testing*
- *Project Management*
- *Record Drawings*
- *Re-design or Specification Recoverables*
- *Annual Report*
- *Microfilm*
- *Crosier Kilgour & Partners Ltd. – Winnipeg, MB*
 - *Textual Records*
 - *Drawings*
- *SMS Engineering Ltd. – Winnipeg, MB*
 - *Drawings*
 - *Tender drawings*
 - *Originals, reproductions, prints*
 - *Record drawings*
 - *Originals, reproductions, prints, mark-ups*
 - *Drawings of existing buildings*
 - *Specifications*
 - *Textual Records*
 - *Correspondence*
 - *Design Files*
 - *Shop Drawings*
 - *Contract Administration Files*
 - *Electronic Records*
 - *Tender Drawings*
 - *Record Drawings*
 - *Specifications*
 - *Reports*

Records Holdings of Crown Corporations

○ *Manitoba Hydro – Winnipeg, MB*

- *Board of Directors*
- *President and Chief Executive Officer*
 - **Aboriginal Relations**
 - **Public Affairs**
 - Progress Footage
 - Managers Office Files
 - Supervisory, Creative Services Files
- *General Counsel and Corporate Secretary*
 - Office Files
 - Contract Files
- *Finance and Administration and Chief Financial Officer*
 - **Gas Supply and Services Division**
- *Customer Service and Marketing*
 - **Industrial and Commercial Solutions Division**
 - **Consumer Marketing and Sales Division**
 - Load Forecasting Files
- *Transmission and Distribution*
 - **Transmission and Distribution**
 - Research and Development Files
 - **Transmission Planning and Design**
 - Property Acquisition Files
 - Property Drawings
 - Legal Survey Projects
 - Proposals Files
 - **Transmission Construction and Line Maintenance**
 - Planning Review Committee – Meeting Files
 - **Transmission System Operations**
 - **Distribution Planning and Design**
 - **Distribution Construction**
 - **Apparatus Maintenance Divisions**
- *Power Supply*
 - **Power Planning and Development**
 - **HVDC**
 - **Generation North**
 - **Generation South**
 - **Engineering Services**

- **Power Sales and Operation**
 - Environment Review Committee – Meeting Files
 - Hydraulic Planning and Development Files
 - Power Resource System Planning Files
- ***Photographs***
 - **Public Relations Division**
- ***Archival Records***
 - **Predecessor Corporate Records**
 - **Distribution Technical Services**

Appendix B – Example of a Descriptive Entry in a Thematic Guide to Engineering Records in Manitoba

Repository: University of Manitoba Archives & Special Collections¹

Fonds: Andrew Taylor fonds²

Series: Royal Canadian Engineers files

Series Identifier: xyz³

Extent: 0.6 m of textual records

Provenance: Andrew Taylor created the records in this series during his tenure with the Royal Canadian Engineers from 1946 until 1952. Taylor was originally posted to the Directorate of Engineering Development in Ottawa from 1946 until 1950 when he took a year-long educational sabbatical. Taylor returned to this post in 1950 until 1952. During this tenure, Taylor was appointed to the Canadian Committee of the International Geographic Union in 1947 and the Soil and Snow Mechanics Committee of the National Research Council in 1949. Taylor held these posts until his sabbatical in 1950. Upon his return in 1951, Taylor was a member of the Snow, Ice and Permafrost Research Establishment until his retirement from the Army in 1952.

Scope and Content: Series consists of correspondence, research notes, and drafts relating to Taylor's career as an engineer with the Royal Canadian Engineers, specifically relating to Taylor's involvement with the Directorate of Engineer Development, the Snow and Soil Mechanics lab, and the Snow, Ice and Permafrost Research Establishment.

Restrictions on Access: There are no restrictions on access to this material.

Arrangement: Series is one of eighteen organized according to function.

Relevant Files or Items: Entire series is relevant to the theme.⁴

Electronic Finding Aid: File listing available.⁵

¹ This field would feature a link to a page describing the institution, including its history, mandate, holdings, and possibly its reference and access policies. The page would have to be created by the writers of the thematic guide or the field could link to the institution's homepage if it provided the required information.

² This field would feature a link to the fonds-level description in Archives Canada, if it existed, featuring an administrative history or biographical sketch, descriptive information for the whole of the collection, and other pertinent contextual information regarding the fonds and its relation to its component series.

³ It is imperative to ensure that this value is unique to each series in each fonds.

⁴ If a few specific files or items within that series are the only relevant material within the series, their titles, dates, and brief notes on their content may be listed here.

⁵ This field would feature a link to the online file listing of the material featured on the records' home institution's website if a listing was available. If not, a statement to that effect would be included.

Bibliography

Archival Descriptions and Primary Sources:

Archives of Manitoba

Government Records

- Agriculture "
- Energy and Mines
- Executive Council
- Government Services
- Highways
- Industry and Commerce
- Manitoba Housing and Renewal Corporation
- Manitoba Hydro
- Manitoba Telephone System
- Mines and Natural Resources
- Northern Affairs
- Public Works
- Treasury Department
- Urban Affairs

Private Records

- Harry William Armstrong Collection
- H.H. Bayfield Collection
- George Arthur Bayne Collection
- Canada – Department of Public Works Collection
- John Leslie Charles Collection
- Matthew George Collins Collection
- Francis E. Collinson Collection
- Thomas Russ Deacon Collection
- Doupe Family Papers
- Gary Albert Filmon Collection
- John Watter Harris Collection
- Last Spike Manitoba Northern Railway Collection
- Manitoba Water Well Association Collection
- Arthur J. Merrill Collection
- Mining Corporation of Canada Collection
- William Charles O'Keefe Collection
- Port Nelson Collection
- Professional Engineers' Wives Association Collection
- Refrigeration Service Engineers Society Collection

- Henry Norland Ruttan Collection
- Thomas Clarkson Scoble Collection
- Gordon L. Shanks Collection
- Vulcan Iron Works Collection
- Winnipeg and Hudson's Bay Railway and Steamship Co. Collection
- Winnipeg Central Heating Company Limited Collection
- Winnipeg Construction Association Collection

Hudson's Bay Company Archives

- Biographical Sketches, 1849-1968
- Hudson's Bay Company Architectural Drawings
- Records of the Hudson's Bay Company Fur Trade Department, 1910-1960

Graphic Materials

- Boundary Commission Graphic Material Series
- George Coutts Graphic Material Collection
- Thomas Russ Deacon Graphic Material Series
- Drainage Graphic Material Collection
- Highways Department Graphic Material Collection
- Manitoba Natural Resources Graphic Material Series
- Henry W. Meindl Graphic Material Collection
- Public Works / Drainage Graphic Material Collection

City of Winnipeg Archives

- Archives of the Flood of '97
- By-laws, 1899-1993
- Council Minutes, 1897-1980
- Engineer's Annual Reports, 1898-1915
- W.D. Hurst, City Engineer, Engineering Department
- Letters to Council, 1874-1968
- Minutes of the Council of the Metropolitan Corporation of Greater Winnipeg, 1961-1971
- Operations – Waterworks, Waste and Disposal
- Planning, Property & Development
- Public Works
- Streets and Transportation

Crosier Kilgour & Partners Ltd.

- Drawings
- Textual Records

Library and Archives Canada

- Canadian Council of Professional Engineers fonds
- Canadian Engineering Heritage Record fonds
- Engineering Institute of Canada fonds

Library and Archives Canada – Government Archives Division, Winnipeg, MB

- Canadian National Railways Collection
- Canadian National Railways Land Records Collection
- Defence Construction Limited Collection
- Department of Indian and Northern Affairs Collection
- Department of Labour Collection
- Department of National Defence Collection
- Department of National Health and Welfare Collection
- Department of Public Works Collection
- Department of Transport Collection
- Geological Survey of Canada Collection
- Grand Trunk Pacific Railway Cartographic Series
- National Harbours Board Collection
- Regional Economic Expansion Collection

Manitoba Hydro

- *Board of Directors*
- *President and Chief Executive Officer*
 - Aboriginal Relations
 - Public Affairs
 - Progress Footage
 - Managers Office Files
 - Supervisory, Creative Services Files
- *General Counsel and Corporate Secretary*
 - Office Files
 - Contract Files
- *Finance and Administration and Chief Financial Officer*
 - Gas Supply and Services Division

- *Customer Service and Marketing*
 - Industrial and Commercial Solutions Division
 - Consumer Marketing and Sales Division
 - Load Forecasting Files
- *Transmission and Distribution*
 - Transmission and Distribution
 - Research and Development Files
 - Transmission Planning and Design
 - Property Acquisition Files
 - Property Drawings
 - Legal Survey Projects
 - Proposals Files
 - Transmission Construction and Line Maintenance
 - Planning Review Committee – Meeting Files
 - Transmission System Operations
 - Distribution Planning and Design
 - Distribution Construction
 - Apparatus Maintenance Divisions
- *Power Supply*
 - Power Planning and Development
 - HVDC
 - Generation North
 - Generation South
 - Engineering Services
 - Power Sales and Operation
 - Environment Review Committee – Meeting Files
 - Hydraulic Planning and Development Files
 - Power Resource System Planning Files
- *Photographs*
 - Public Relations Division
- *Archival Records*
 - Predecessor Corporate Records
 - Distribution Technical Services

Parks Canada Prairie and Northern Regional Office

- Drawings
- Parks Canada – Prairie and Northern Region - Architectural and Engineering Services Technical Library
- Reports and Studies
- Specifications
- Technical and Maintenance Manuals

SMS Engineering Ltd.

- *Drawings*
 - Tender drawings
 - Record drawings
 - Drawings of existing buildings
- *Specifications*
- *Textual Records*
 - Correspondence
 - Design Files
 - Shop Drawings
 - Contract Administration Files
- *Electronic Records*
 - Tender Drawings
 - Record Drawings
 - Specifications
- *Reports*

UMA Engineering Ltd.

- Annual Reports
- Design Services
- Legal Surveys
- Microfilm
- Office and General Supervision
- Planning
- Preliminary Work
- Project Management
- Record Drawings
- Redesign or Specification Recoverables
- Resident Engineering
- Soils and Material Testing

University of Manitoba Archives & Special Collections*University Records*

- Continuing Education Division fonds
- Faculty of Agricultural and Food Sciences fonds

- Faculty of Arts fonds
- Faculty of Engineering fonds
- General Faculty Council fonds
- Libraries fonds
- Office of the President fonds (UA 20)
- Office of the President fonds (UA 29)
- University Publications
- Unprocessed Material

Manuscript Collections

- John W. Dorsey fonds
- W.H. Hunt fonds
- Red River Floodway fonds
- Andrew Taylor fonds
- *Winnipeg Tribune* fonds

Photograph Collections

- Department of Civil Engineering Photograph Collection
- Department of Electrical and Computer Engineering Lantern Slide Collection
- Faculty of Agriculture Photograph Collection
- Red River Floodway Photograph Collection
- Andrew Taylor Photograph Collection
- *Winnipeg Tribune* Photograph Collection

Wardrop Engineering Inc.

- *Bound Documents*
 - Proposals
 - Reports
 - Specifications and contracts
- *Daily Company Records*
 - Correspondence
 - Design records
 - Proposals and Reports
- *Drawings*
- *Photographs*
- *Staff Records*
 - Design
 - General correspondence
 - Report preparation

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Ball, Norman R., ed. *Building Canada: A History of Public Works*. Toronto: University of Toronto Press, 1988.

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