

Women in Calgary Geotechnique

Amy Rentz, Sarah Verwey, Lillian Landry-Paré & Heinrich Heinz
Thurber Engineering Ltd., Calgary, Alberta, Canada



ABSTRACT

The history of geotechnique in Calgary goes back some 60 years and includes contributions from many individuals. For various reasons, many of these people, particularly women, have not been well recognized for their contributions. In a previous paper presented at GeoRegina in 2014, the heritage and foundation engineering aspects of the development of geotechnique in Calgary were presented, including details about some of the pioneers of geotechnique in the city, with focus on the founding members of the Calgary Geotechnical Society. Some general information was also presented on major projects developed in the city in the 1970s and 1980s. In conjunction with the ongoing efforts by the Canadian Geotechnical Society's Heritage Committee, which is in the process of researching and writing the history of women in Canadian geotechnique, this paper will focus on the lives and contributions of leading women in Calgary. One main goal of this paper is to record and recognize some of the women who have paved the way for others and who have made significant contributions in our field. The paper includes a set of vignettes on some of Calgary's leading women in geotechnical engineering and geoscience fields.

RÉSUMÉ

L'histoire de la géotechnique dans la région de Calgary remonte à une soixantaine d'années et a bénéficié de l'apport de nombreux professionnels. Pour différentes raisons, plusieurs de ces professionnels n'ont pas été reconnus à leur juste valeur pour leur contribution à l'industrie, en particulier les femmes ingénieures. Dans un article présenté à la conférence GéoRégina en 2014, les fondements du développement de la géotechnique à Calgary ainsi que son héritage ont été présentés, incluant des précisions sur quelques-uns des pionniers du domaine dans la ville, avec un accent sur les membres fondateurs de la Société de Géotechnique de Calgary. Quelques projets majeurs ayant marqué Calgary dans les années 70 et 80 ont également été présentés de façon générale. Dans le cadre de recherches entamées par le Comité Héritage de la Société Canadienne de Géotechnique sur les femmes en géotechnique au Canada, le présent article porte une attention particulière aux carrières et aux vies d'ingénieures éminentes de Calgary. L'objectif premier de cet article est de rendre compte et de reconnaître quelques-unes des femmes ayant ouvert la voie aux futures générations et ayant contribuées de façon significative au développement de la discipline à Calgary en présentant un portrait de ces ingénieures.

1 INTRODUCTION

A previous paper presented four years ago at GeoRegina addressed heritage and some engineering aspects of the development of geotechnique in Calgary (Heinz et al. 2014). Details about some of the geotechnical pioneers in the city, who were active in the 1950s and 1960s, were also presented. The contributions of women who left their mark in Calgary were not mentioned at the time, mostly because women started to play a role in local geotechnique in the 1970s, as described below.

This paper examines the history of some of the women in Calgary geotechnique, with the intent to have their contributions and personal experiences recorded and recognized. Except for the "pioneers" who arrived in Calgary in the early 1970s, all women mentioned here have been members of the Executive of the Calgary Geotechnical Society (CyGS). The women featured in this paper are only a small sample of those who have contributed to Calgary geotechnique over the years and is not a complete list.

As anyone who tries to summarize the history of a group knows, the task is both wide and deep, and discovering the full story is challenging. Therefore, we apologize for any omissions or inaccuracies.

2 WOMEN IN GEOSCIENCES

2.1 Early Calgary Women Geoscientists

During the pre-1950s period, when geotechnique-related fields such as soil mechanics and geological engineering were under development in Canada, there is no documented record of women contributors (Leonoff 1994; CGS 2016). This was not the case in other sectors, where Canadian geologists like Drs. Alice Wilson and Grace Anne Stewart were fighting the odds in what was then seen as a man's world (Drs. Wilson and Stewart have entries in Wikipedia, and their early experiences have been documented in the thesis by O'Donnell 2000).

Notable women geoscientists who spent a significant part of their careers in Calgary include Drs. Helen Belyea (1913-1986) and Diane Loranger (1920-2004). Dr. Belyea spent 35 years with the Geological Survey of Canada (GSC) in Calgary and authored over 30 scientific publications, including *The Story of The Mountains in Banff National Park* (Belyea 1960). Dr. Loranger started her career as a field geologist with Imperial Oil in 1940, but quickly progressed to supervisory positions, later becoming an international consultant (Kelland 2016).

It is perhaps worth noting that Drs. Wilson, Stewart, Belyea, and Loranger fall in the category of high-achievers, as described by O'Donnell (2000). Not only were they

highly capable technically, but they were physically fit and ready to engage in rugged field work, which was not seen by many in their time as an appropriate job for women.

2.2 Women in Calgary Geotechnique

Anna Burwash's paper on Women in Geotechnical Engineering (1997) describes the early involvement of women in Canadian geotechnique and identifies, from Burwash's perspective, some of the world events and trends in the 1950s and 1960s that may have led to the increase in women's enrollment in post-secondary studies and pursuing careers in science and engineering.

This landmark paper was part of a special heritage edition of Geotechnical News, produced for the CGS Golden Jubilee Conference in Ottawa in 1997 (this special volume is available in the Canadian Geotechnical Virtual Archives). The paper included a small sample of female contributors, with only two Calgary women featured namely Ms. Burwash herself and Ms. Sue Aitken (Evison), both also featured in this paper. Burwash (1997) did not specifically address the entrance of women to Calgary geotechnique which occurred in the early 1970s, when many highly skilled engineers and geoscientists were attracted to Calgary to study the technological and economic feasibility of constructing crude oil and gas pipelines from Alaska and northern Canada to Alberta. Anna Burwash and Gretchen Minning, both with previous experience in northern work, and whose profiles are presented below, were part of this contingent.

A notable group active in Calgary in the 1970s boom was Northern Engineering Services Company Ltd. (NESCL), a consortium of engineering firms which remained active until 1977, at which time projects routed along the Mackenzie Valley were placed on hold as a result of the Berger Inquiry (Heinz et al. 2014). A major player in NESCL was R.M. Hardy and Associates Ltd. (Hardy), a firm which went through several mergers and acquisitions over the years and is currently known as Wood Group. NESCL and Hardy are mentioned subsequently in this paper.

The following sections provide a brief look at the careers, contributions, and personal experiences of some of the leading women in Calgary geotechnique. The divisions by decade below, from the 1960s to the 1990s, represent the time frame when these notable women first entered the profession.

3 VIGNETTES

3.1 1960s Women

Anna Burwash

Anna Burwash, born in Maryland, earned a B.Sc. in Civil Engineering from Carnegie Mellon University in Pittsburgh, Pennsylvania, and was the lone female civil engineering student in the 1968 graduating class.

Following graduation, she moved to Toronto to launch her career in geotechnical engineering; becoming a Canadian citizen in 1974. Securing an engineering job

proved difficult, but after a time, she landed a position with a consulting firm in Fredericton, working under two University of New Brunswick (UNB) professors. This experience led her to a position at the Muskeg Research Institute at UNB from 1970 to 1973 in applied research studies in muskeg and permafrost.



Figure 1. Anna Burwash in 1999, at the ASCE National Convention in Charlotte, NC where she received the Can-Am Civil Engineering Amity Award.

In 1973, Ms. Burwash transitioned back to consulting, first with Geocon Ltd. in New Brunswick, then making the move to Hardy in Calgary in 1976. During her time at Hardy, she worked closely with Dr. Jack Clark whom she considers a mentor. She notes that Hardy was the first company she worked for with other female geotechnical professionals, including Gretchen Minning, Glynnis Horel, and Olivia Makowecki (all featured in this paper).

An interest and aptitude for the management side of organizations led Ms. Burwash to establish her own management consulting firm in 1980, A.L. Burwash Consulting Ltd.; her largest project being a technology transfer study for application in peat dewatering, undertaken for the National Research Council of Canada (NRCC). During this time, she also earned a Professional Development Degree in Engineering from the University of Wisconsin (distance education), adding this achievement in 1981.

In 1987, Ms. Burwash moved back to Toronto and away from geotechnical engineering, pursuing work in government. She found the skills and values developed during her engineering career, such as critical reasoning and the value of prudent review processes, to be pertinent and readily transferable to these later roles.

Throughout her geotechnical career, Ms. Burwash was heavily involved in numerous technical societies and committees. Her involvement in these groups paved the way for future women, with her being the first female board member of the CGS (Atlantic Regional Director 1973 to 1976), and possibly the first female CGS member, as well as the first female member of the NRCC Associate Committee on Geotechnical Research.

When asked about being a woman in a male-dominated profession, Ms. Burwash notes that she focused on getting the work done and striving to be an effective member of the team. Her advice to university students and those entering the workforce is to get involved with technical and

professional groups and build connections with those in the profession.

Gretchen Minning

For over five decades, Gretchen Minning has been a practicing geologist in Canada. During this time, she has worked in both government and industry, and currently runs her own consulting firm, G.V.M Geological Consultants Ltd. (G.V.M.). Her career has taken her across Canada to the Yukon, Northwest Territories, northern Alberta, the western Arctic Islands, northern Ontario, and Labrador.



Figure 2. Gretchen Minning at her home office in Calgary (2018) – photo by M. Darragh.

Ms. Minning earned a bachelor's degree in Geology from Lawrence University in Appleton, Wisconsin in 1965 and a master's degree from the University of Washington, Seattle in 1967, where she was the sole female student in her program. Unlike the majority of her classmates, Ms. Minning did not want to pursue a Ph.D. or a career in academia. Instead, she took on a government position as part of the Terrain Sciences Group at the GSC, working as one of two females in the Group. She worked for the GSC in both Ottawa and Calgary from 1967 to 1973. Ms. Minning then moved to the private sector and joined NESCL mentioned previously, a consortium of engineering companies in pursuit of a permit for a pipeline from Alaska to Alberta. She then joined Hardy in 1977. Most of her early work experiences required remote field work where field teams slept in tents and often traversed the region in helicopters and small airplanes. During her time at Hardy, Ms. Minning worked with other female geotechnical professionals including Anna Burwash and Olivia Makowecki (both featured in this paper), although she was often the only female on her field expeditions.

In 1980, Ms. Minning started her own consulting firm, G.V.M., and has now been a private consultant for 37 years, contributing to government organizations, engineering and environmental companies, as well as the energy and natural resource sectors. The majority of her work comprises detailed terrain mapping using LiDAR and stereo air photos and identification of areas of geotechnical concern. In addition to her consulting work, Ms. Minning has been an active member of the CyGS and the Geological Association of Canada and is a licensed

member of both the Association of Professional Engineers and Geoscientists of Alberta (APEGA) and Engineers and Geoscientists of British Columbia (EGBC, formerly APEGBC). She was awarded the Calgary Geotechnical Society Award in 2018.

When Ms. Minning is not pursuing her geological interests, she is busy golfing and hiking or travelling with her husband Dr. David Morrow, also a geologist.

Despite once being told that she would never get a job in geology because she was a woman, Gretchen Minning has proved that she can be a successful geologist and an undoubtedly valuable member of the geological field. She wants to encourage young geologists and engineers to *'work hard and competently on every job'* that comes their way and to *'remember that not everyone can be a manager or committee chairperson, but workers will always be needed.'*

3.2 1970s Women

Sue Aitken

S.E. (Sue) Aitken (Evison) has been a practicing geotechnical engineer for over thirty years. During her career, she became proficient at numerical modelling, particularly seepage assessments, and developed an interest in dams and tailings management.

Ms. Aitken was born and raised in New Zealand (NZ) where she obtained a B.Sc. in mathematics from the University of Otago in 1975. Due to the prevalent view at the time that the only career options for females were teaching or nursing, she pursued a teaching opportunity in Christchurch for a couple of years. There she became interested in engineering after joining a network of skiers, a number of whom were engineers.

Encouraged and supported by her uncle Norman Hardie, a civil engineer and famous mountaineer, she completed her bachelor's degree in Civil Engineering at the University of Canterbury in 1978, where she was one of three women in her graduating class of over 100.

Upon graduation, Ms. Aitken applied for a position at the Christchurch City sewer department. Despite having all the credentials required for the job, she recalls the interviewers having a sense of disbelief that a female was prepared to enter the sewer system. Instead, she opted to work for a young, dynamic boutique consultancy, Halliday O'Loughlin & Taylor; a firm that invited the idea of having a female engineer, at a time when others did not.

In 1979 Ms. Aitken left NZ and moved to Alberta where she worked for a precast fabrication and construction company in Edmonton, before briefly leaving the workforce in 1981 to raise her two daughters. She remained invested in geotechnique during this time, undertaking a part-time M.Sc. in Geotechnical Engineering at the University of Alberta. She made her return to engineering consulting in 1988, working for several firms over the years including Thurber Engineering Ltd. in Edmonton, and Hardy, Klohn Crippen Berger (KCB), and Jacques Whitford (now Stantec) in Calgary. During this time, she was involved with several key projects in western Canada including the McKnight Boulevard sewer system rehabilitation project (in Calgary), and the Bennett Dam Sinkhole Investigation

project (in British Columbia), along with initiating KCB's presence in Fort McMurray. Ms. Aitken returned to NZ in late 2003. She now works for Beca Ltd., an engineering consulting firm, where her primary interest is in promoting dewatered tailings management.



Figure 3. Sue Aitken (2018).

During her time in Alberta, Ms. Aitken was actively involved with the CyGS, holding various positions in their Executive in the early 1990s. She was the Southern Alberta Regional Director for CGS and was one of the first women awarded the Stermac Award in 1997. She was also active in other societies including the Consulting Engineers of Alberta, the Tunnelling Association of Canada, the North American Society for Trenchless Technology, and the Canadian Dam Association. In 2000, Ms. Aitken became the first woman to be elected president of APEGA and was identified by Alberta Venture as one of the Top 50 Most Influential Albertans in 2001. Also in 2001, she chaired the Government of Alberta Commission on Parental Leave and all their recommendations were accepted and passed into law.

In addition to her many professional achievements, Ms. Aitken is also an accomplished golfer and skier, winning the national junior women's golf title in NZ, and was a former ski patroller at the Lake Louise Ski Resort. Her personal and professional successes are a testament to her determination and refusal to accept any barriers that may have come her way. Although, she does recall a 'prickly start' being a woman in the industry, she was able to succeed throughout her career by living by her mantra '*what are the physics?*', words of wisdom from Angela Kupper, a fellow student at the time.

Olivia Makowecki

Olivia B. Makowecki graduated in Civil Engineering from the University of Alberta in 1974. She then joined Hardy in Calgary and remained with the firm until retiring from the profession in the early 1990s. During her career, Ms. Makowecki worked extensively on foundation engineering projects, particularly in downtown Calgary, under Messrs. Wally Semchuk, Neil Burgess, and Dr. Jack Clark. It should be noted that the authors were unable to interview her for this paper.

Glynnis Horel

Glynnis Horel is a practicing geological engineer based on Salt Spring Island, BC. She earned a B.Sc. in Geological Engineering from the University of British Columbia in 1975 and a M.Eng. in Civil Engineering-Geotechnical from the University of Alberta in 1984. During her career, she worked for the Yukon government as well as a number of consulting firms in British Columbia and Calgary, including Hardy. Her work has focused on road construction, design, and maintenance as well as the effects of land use activities on terrain hazards and hydrogeological processes. She was an active member of the CGS for many years and was the first female president of the Association of Professional Engineers of Yukon Territory, from whom she was awarded the designation, Fellow of Engineers Canada in 2010. She was also the recipient of the Professional Services Award from EGBC in 2007. It should be noted that the authors were unable to interview her for this paper.

3.3 1980s Women

Georgina Griffin

Georgina Griffin earned a B.Sc. degree (1984) and an M.Eng. (1986), both from the University of Alberta in Edmonton; her father Wayne Griffin was a Professor with the Mining Department there from 1982 to the early 1990s.



Figure 4. Georgina Griffin receives the 2017 Calgary Geotechnical Society Award, the first woman to do so, from Heinrich Heinz – photo by M. Pinheiro.

From there, Ms. Griffin pursued a career in consulting, working for a number of firms over the course of her career including UMA Engineering (now AECOM), Jacques Whitford (now Stantec), AMEC Foster Wheeler (now Wood Group), and is presently a Senior Geotechnical Engineer at Clifton Associates in Calgary. Her geotechnical experience to date comes mostly from work in the Calgary area and Southern Alberta, but also in the Arctic, working in areas such as slope stability, foundation design and analysis, dams and transportation projects, and commercial and residential developments. In addition to contributing her technical skills during her time at these organizations, she has gone out of her way to mentor junior engineers.

Ms. Griffin has also been heavily involved with the CyGS, beginning in 1994 as a Member-at-Large. She then took on the role of Treasurer from 1995 through 1999, as well as Treasurer for the 2001 CGS Conference, and was highly effective in these roles.

She has published several CGS Conference papers highlighting the impact of geotechnical conditions on the design and construction of some projects in Alberta, including dams, highways, and foundations in swelling soils. In recognition of her contributions to Calgary Geotechnique, she was awarded the 2017 CyGS Award, becoming the first woman recipient.

Outside of geotechnique, Ms. Griffin devotes her time to various volunteer activities, including with Alberta Theatre Projects and APEGA. Together with her husband Doug of 30 years, she enjoys theatre, opera, and attending the annual Calgary Comic Expo.

Dr. Cathryn Ryan

Dr. Cathryn Ryan is presently Acting Head and Professor with the Department of Geosciences at the University of Calgary (U of C). As a youth, she considered studying marine biology, brought on by her love of sailing, however, due to bleak job prospects at the time, she opted to pursue hydrogeology instead.



Figure 5. Dr. Cathryn Ryan (2017).

She attended Queen's University in Kingston, Ontario and graduated with a B.A.Sc. in Geological Engineering in 1984, then continued her education at the University of Waterloo, earning a M.Sc. in 1987 and a Ph.D. in 1994, both in Earth Sciences in the Faculty of Science.

Since obtaining her doctorate, Dr. Ryan has worked predominantly in academia. She was involved early in her career with work in Mexico City and Costa Rica (she is fluent in Spanish), and has since held research and teaching positions at one Costa Rican and two Canadian Universities.

Dr. Ryan has been with the U of C since 1997. Her current research focuses on measuring and monitoring dissolved gases in groundwater and the impacts of agricultural and oil-and-gas related activities on groundwater quality, with research sites located in Southern Alberta. She has also completed some recent work on the role of groundwater in flooding in Calgary, noting that she likes to conduct research that is meaningful to the local community.

Dr. Ryan's technical contributions are extensive, including authoring more than 60 journal publications, numerous technical reports and conference papers, as well as leading many students through graduate degree programs. She is known as a leader in her profession as well as in the community, having received two community outreach awards (2009 and 2011) from the U of C. She was the recipient of a Certificate of Appreciation from the CGS in 2001, for her work in that year's Calgary conference organizing committee.

She is an advocate for the protection of aquifers and water rights, previously holding directorship positions with several organizations that focus on water resource management in Central America and elsewhere.

Despite her success and accolades, Dr. Ryan is humble of her achievements. She stresses the importance of assuming the best of all interactions with others and always acting with kindness. Her personal interests include outdoor activities that require her complete concentration such as skiing (back-country, cross-country, and alpine) and hiking, thus completely freeing her mind of work.

3.4 1990s Women

Dr. Jocelyn Hayley

Dr. Jocelyn Hayley (Grozic) is a Professor at the University of Calgary and is one of few females to be inducted as a Fellow of the Engineering Institute of Canada, just one of many remarkable accomplishments in her on-going career as a geotechnical engineer in academia.

Dr. Jocelyn Hayley grew up outside of Edmonton Alberta, to Don Hayley, a well-known geotechnical engineer, and her mother, a biologist. It was her interest in the intersection of nature and the use of engineering judgement that led her to pursue geotechnical engineering. Dr. Hayley completed her bachelor's degree at the University of Alberta (U of A) in 1994. Following a brief period in consulting, Dr. Hayley returned to academia and earned her Ph.D. in 1999 from the U of A under the supervision of Drs. Morgenstern and Robertson. She then spent one year as a post-doctoral fellow at the Norwegian Geotechnical Institute (NGI) in Oslo, Norway where she worked under the supervision of another notable Canadian geotechnical engineer, Dr. Suzanne Lacasse. After completing her post-doctoral fellowship at the NGI, she accepted an academic position at the University of Calgary in 2001 where she currently holds the positions of Senior Associate Dean of Research for the Schulich School of Engineering and Professor in the Department of Civil Engineering.

Dr. Hayley's research interests include gas hydrates and loose gassy soils as well as permafrost sediments. One of her most notable projects was part of the Indian National Gas Hydrate Program Expedition where she spent five weeks on a Japanese drill ship in the Indian Ocean to collect and analyze subaqueous gas-hydrate soil samples. Dr. Hayley has authored/co-authored close to 100 publications to date. She has also received well over twenty awards and distinctions for teaching, research, and service including the Women in Engineering and Geoscience Champion Award from APEGA as well as

being named one of Calgary's Top 40 under 40 by Avenue Magazine, to name a few.



Figure 6. Dr. Jocelyn Hayley (2016).

In addition to her many academic pursuits, Dr. Hayley is an active member of several societies including the CyGS (member of the Executive from 2002 to 2006) and is a champion of diversity and young professionals. In 2004, she initiated the ongoing conference series called the Canadian Young Geotechnical Engineers and Geoscientists Conference. Her continual advice to young female engineers is to *'bring their authentic self to the workplace and not to conform to implied norms.'* As well, she feels passionate that young professionals should diversify their life experiences and in doing so, will expand their own diversity of thought to call upon during their careers. When Dr. Hayley is not juggling her countless academic duties, she is likely exploring nature with her two daughters or riding her Vespa to a Martial Arts class.

To say Dr. Jocelyn Hayley is an accomplished academic and strong female presence in the geotechnical engineering field is an understatement. She has continued to excel in all aspects of her career, which makes her a true role model for young engineers both male and female.

Marcia MacLellan

Marcia MacLellan, the youngest of four children and the daughter of an engineer and a nurse, was born in Halifax, Nova Scotia and raised in Moncton, New Brunswick. She obtained her B.Sc. in Geological Engineering from Queen's University in 1990, where she was one of only two women in her graduating class in the Mineral Exploration option.

From there, she moved to Calgary and joined Klohn Leonoff Ltd. (now KCB), becoming the only female engineer in the Calgary office at that time. A few years into her career, she was joined by Sue Aitken (featured in this paper) where the pair developed a strong friendship.

Due to the limited geotechnical market in Calgary in those early years, Ms. MacLellan often worked on projects outside of western Canada, including Sudbury (Ontario), Panama, and St. Lucia, to name a few. One notable western Canada project she was involved with was the Bennett Dam Sinkhole Investigation in BC. As a result of her outstanding work on this project, she was awarded the Canadian Dam Safety Association Award for Most Promising Young Professional.

Her involvement in the Bennett Dam project would lead her to join the Canadian Dam Association (CDA), where she was on the organizing committee for the 2005 and 2014 CDA conferences in Calgary and Banff. She was also on the organizing committee for the 2001 CGS conference in Calgary and became involved with the CyGS in 2004 as a member of the Executive through to 2014. From 2009 to 2011, she was the Southern Alberta Regional Director on the CGS Board of Directors and represented the CGS on the Board of the Canadian Society of Civil Engineers during that time.

During her geotechnical career, Ms. MacLellan's presence was felt through her active participation in technical organizations as well as her mentorship during her time at KCB. Her travels to other KCB offices and remote projects promoted strong bonds with her colleagues, which she feels was important to her success. She notes that she didn't mind being one of few females in her workplace but did experience challenges in the way men and women communicate. She feels that the industry would benefit greatly from more diversity in the workplace. She credits her upbringing in the Maritimes and the strong field program at Queen's University for her *'grit'*, a trait she considers valuable to be successful in geotechnical engineering, regardless of gender.



Figure 7. Marcia MacLellan (2012).

Ms. MacLellan chose to leave the profession in 2014, and now devotes her time to permaculture garden design, where she employs some of the skills and knowledge developed during her geotechnical career with the goal to bring sustainable ecosystems to life.

Lara Percival

Lara Percival is a practicing consulting engineer for Tetra Tech Inc. (Tetra Tech) in Calgary, with over 25 years of project management and geotechnical engineering experience. During her career, she has traversed the globe, working in Alberta, British Columbia, the Yukon, and the Middle East.

Ms. Percival, daughter of a mining engineer (father), was born and raised in the Yukon and later moved to Vancouver, BC to obtain a bachelor's degree in Civil Engineering and a Master of Engineering from the University of British Columbia in 1991 and 1992. Following her graduation in 1992, Ms. Percival worked for several

consulting firms including Golder Associates Ltd. in Vancouver, EBA Engineering Consultants Ltd. (now Tetra Tech), and Jacques Whitford and Associates Ltd. (now Stantec) in Calgary. During this time, she was involved in numerous retaining wall designs, commercial and residential developments as well as the Little Bow Dam project southeast of Calgary, to name a few. Ms. Percival was also involved with the CyGS as a member of the Executive from 2001 to 2004. In 2004, Ms. Percival left consulting and worked as a technical recruiter for a brief stint but realized that her true professional interest was in engineering. She then moved to Doha, Qatar with her husband in 2005 where she worked as a project manager for AECOM (formerly Cansult Maunsell/AECOM and Cansult Ltd.). During this time, she worked in project management for mega municipal development projects including luxury malls and a large port project. She returned to Calgary with her family in 2013 and joined Tetra Tech as a geotechnical project manager and then as a geotechnical team lead. When Ms. Percival is not focused on her professional development, she enjoys working on her acreage and spending time with her daughter and husband.



Figure 8. Lara Percival (2018).

During her career, Ms. Percival has not experienced any barriers being a female in a male-dominated industry, although she attributes this to her ability to advocate for herself and working with very supportive mentors and managers. Her advice for young female engineers is to *'recognize that you bring a different and valuable perspective to the workplace, and always strive to do what you enjoy.'*

3.5 The 2000s to Present

The number of women pursuing careers in science, technology, engineering, and math has grown substantially in recent years. Women in Calgary geotechnique are no exception, having a larger presence in the workplace and more involvement in technical societies than ever before.

The more recent (post 2000) contributions of women to the CyGS, as members of the Executive, is summarized below. Note that the contributions of the women whose profiles appear above are not repeated here.

Anupama Amaratunga

- Student Rep. 2005 – 2006

Angela Beattie

- Venue Coordinator 2004 – 2008, 2009 – 2014; Member-at-Large 2008 – 2009, 2014 – 2015

Catherine Fear

- Member-at-Large 2001 – 2004, 2007 – 2010; Co-Chair 2004 – 2005; Chair 2005 – 2006; Past Chair 2006 to 2007

Melissa Hernandez

- Member-at-Large 2016 – 2017

Alena James

- Member-at-Large 2004 – 2007

Sarah Khosravani

- Student Rep. 2010 – 2012

Aditi Khurana

- Venue Co-ordinator since 2017

Justyna Kos-Fairless

- Treasurer 2004 – 2008; Co-Chair 2008 – 2009; Chair 2009 – 2010; Past Chair 2010 – 2011; Member-at-Large 2011 – 2014

Magalie Levasseur

- Announcements 2004 – 2006

Leanne McLaren

- Member-at-Large 2015 – 2016; Venue Co-ordinator 2016 – 2017; Southern Alberta Regional Director since 2017

Bhamisha Ramdharry

- Treasurer 2009 – 2010; Co-Chair 2010 – 2011; Chair 2011 – 2012; Past Chair 2012 – 2013; Member-at-Large 2013 – 2015

4 CLOSING REMARKS

The objective of this paper was to profile the lives and contributions of leading women in the geotechnical engineering and geoscience fields in Calgary. This paper builds on the efforts being completed by the CGS Heritage Committee, who are researching and writing the history of women in Canadian geotechnique.

One of the goals of this paper was to document the range of experiences that these women have had across different decades (1960s to 2000s). While some of the women experienced one challenge or another as a result of being a female in a male-dominated industry, they were able to succeed by working competently and by being themselves.

It is the work and determination of the leading women profiled above that have paved the way for others and will hopefully influence the industry in a positive manner for future female geotechnical engineers and geoscientists.

5 ACKNOWLEDGEMENTS

The authors would like to thank Anna Burwash, Gretchen Minning, Sue Aitken, Georgina Griffin, Dr. Cathryn Ryan, Dr. Jocelyn Hayley, Marcia MacLellan, and Lara Percival for their contributions as well as their willingness to be open and honest about their experiences as female geotechnical engineers or geoscientists. Their stories are equally inspiring as they are eye-opening for the female authors who are currently working to become established in their own careers.

The authors would also like to thank Dr. Suzanne Powell (Thurber, Victoria) for her support in this effort and the CGS Heritage Committee for their efforts on profiling women at the national level and encouraging the authors to expand on the efforts in the Calgary area.

REFERENCES

- Belyea, H.R. 1960. The Story of the Mountains, Banff National Park. *Geological Survey of Canada, Department of Mines and Technical Surveys*, Ottawa, Canada.
- Burwash, A.L. 1997. Breaking New Ground – Women in Geotechnical Engineering. *Geotechnical News*, Special Issue: 69-73.
- Canadian Geotechnical Society (CGS). 2016. A brief history of the Canadian Geotechnical Society. Available from the Canadian Geotechnical Virtual Archives at <https://www.cgs.ca/index.php?lang=en>. [accessed April, 2018].
- Heinz, H.K., Pinheiro, M. and Wong, T.T. 2014. Geotechnique in Calgary – A 60-year Retrospective, *In Proc. of 67th Canadian Geotechnical Conference*, Regina, SK, Canada.
- Kelland, R. 2016. Claiming their Ground – Three Pioneering Alberta Women in their Professions. *RETROactive, Blog of Historic Resources Management Branch of Alberta Culture and Tourism*. October 19, 2016.
- Leonoff, C.E. 1994. *A Dedicated Team – Klohn Leonoff Consulting Engineers, 1951-1991*. Klohn Leonoff Ltd., Richmond, BC, Canada.
- O'Donnell, C.N. 2000. *Alberta Women in the Field, Geoscientists in the Resources Industry, Government Research, and Academia, 1914-1999*. Ph.D. thesis, Department of Education, The University of Toronto, Toronto, ON, Canada.