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Nine x 7 Years of Innovative Extension Agricultural Engineering in Ontario Since 1948

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Abstract

125 Engineers have worked for the Agricultural Engineering Service (AES) over 64 years since 1948, including authors Ogilvie (1954-1963), Kains (1969-2000) and Fraser (1980-). Delivery methods have changed from the early days of one-on-one farm visits, telephone calls on party lines, hand-written overheads and kodachrome slides…to fewer focused meetings with innovative farmers and early adopters, smartphones, tablet and laptop computers, texts, email, PowerPoints, webinars and apps. But the message has remained constant: help solve complex agricultural engineering problems, using the best available engineering principles in a rapidly changing world, while keeping an eye on safety, cost/benefit and the environment. AES staff work with innovators and early adopters and continue leading today with innovative designs, methods and procedures on an ever-expanding list of topics. This paper chronicles nine distinct seven year periods shaping the Ontario agricultural landscape.

Keywords. Agricultural engineering history, extension engineer

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Introduction

There have been many names for the group of Engineers and the Department or Ministry of the Ontario government they worked for, but in this paper Agricultural Engineering Service (AES) and Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) will be used.

125 Engineers have worked for the AES over 64 years since 1948, including authors Ogilvie (1954-1963), Kains (1969-2000) and Fraser (1980-). Delivery methods have changed from the early days of one-on-one farm visits, telephone calls on party lines, hand-written overheads and kodachrome slides…to fewer focused meetings with innovative farmers and early adopters, smartphones, tablet and laptop computers, texts, email, PowerPoints, webinars and apps. But the message has remained constant: help solve complex agricultural engineering problems for a wide range of clients, using the best available engineering principles in a rapidly changing world, while keeping an eye on safety, cost/benefit and the environment.

One needs to understand historical changes in rural Ontario to put things in perspective. After World War II, rural demographics changed (Figure 1). Farmers fled the countryside for urban areas and, while total rural population increased, those who lived on farms dropped dramatically, a trend that continues. In 1951, farm population was more than 50% of the total rural population, shrinking to **under 10% today**. Demographic shifts helped drive changes requiring engineering problem solving. Farms consolidated into larger more efficient, specialized operations, but that created other challenges; increased field mechanization and monoculture created drainage, compaction, and soil erosion challenges; increased barn sizes created structural, ventilation, manure, mechanization, fire-safety and labour challenges; and rural-urban tensions arose from increased odour, noise, dust, flies and other nuisances.

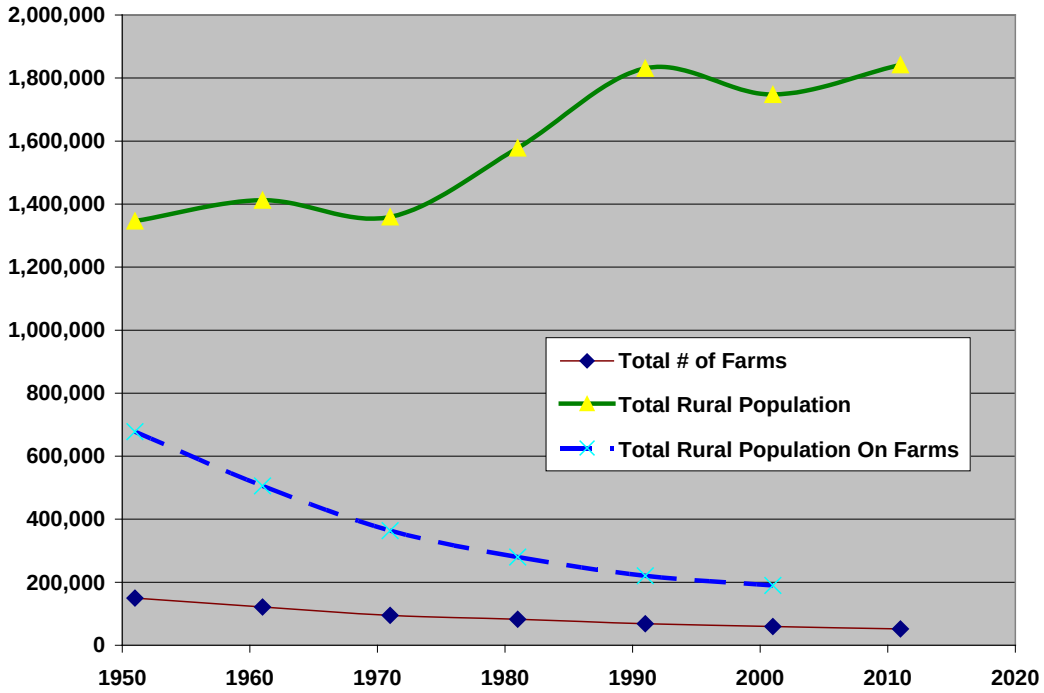

Figure 1. Trends in rural population and total farms in Ontario 1951-2011 (OMAFRA, 2012)

In 1957, a study on technology adoption of farm practices theorized there were five groups of psychographic profiles (Iowa State College, 1957). *Innovators* made up about 2.5% of a given population; *early adopters* 13.5%; *early majority* 34%, *later majority* 34%, and *laggards* 16%. It is the first two groups that AES staff have mainly worked with, learned from, and extended information to others. Innovators and early adopters are willing to learn, take a chance and be leaders, not always sure where a new piece of equipment, technology or practice might lead.

1948-1954

There is debate over the birth of the AES. Bob Kelly was hired as *fieldman* September 1948 by the Kemptville Agricultural School 'for two months preparing farm drainage plans in SE Ontario'. However, Ralph Gregg, hired February 1, 1950 is generally recognized as hired 'first' to teach 4H and farm machinery clubs from his Guelph office. 'Real' horse power was being replaced by tractors and local Agricultural Representatives recognized farm families needed training on machinery operation, maintenance and safety. Ralph was an agricultural mechanization graduate from the Ontario Agricultural College (OAC) at Guelph, an option in the Bachelor of Science in Agriculture course started in 1946, with the first graduates in 1948.

A 1952 report (Report of Committee on Farm Engineering, 1952) stated '*more information and leadership should be available to farmers on economy and efficiency of new farm buildings… we suggest farm building plans be secured from the U.S. and Canadian sources…with a view to selecting a few basic plans for Ontario.'* The Canadian Farm Building Plan Service (CFBPS) was launched in 1953, and the first Ontario pole barn was designed by Jack Pos of OAC that same year. *'Pos succeeded in having a demonstration single story pole barn built…on a farm at Parker, near Guelph….the forerunner for the early pole barn designs published by the Canadian Farm Building Plan Service'* (Turnbull, 1989). This building technique continues to this day.

Hank Bellman, hired 1952, reported farmers started asking about farm buildings and this was *'extra important in summer of '53 by a tornado that swept western Ontario, Watford to Ilderton area'* (Bellman, 1974). The devastating Sarnia tornado (Wikipedia, 2012) May 21, 1953 carved a path of destruction resulting in five killed, 48 injured and financial losses of $15 million. John Ogilvie, hired 1954, reported *'During the flood on the Holland Marsh after Hurricane 'Hazel', in October 1954, the Agricultural Engineering Extension Specialists acted…to organize and supervise the forces of the tractor manufacturers behind a tractor cleanup program* (Ogilvie, 1962*.'* These examples reflect how engineers responded to catastrophes and safety concerns, a characteristic that followed the AES throughout their history through fires, ice storms, floods, droughts, snow collapses, coroner inquests, etc.

During this period, for the first time in history, non-farmers living in rural areas outnumbered farmers (Figure 1), although many had a farm connection through family or work. The number of farms continued to drop, although their size increased. Engineers working for the AES, included Ian Balsillie, John Clark, Keith Clarke, Hank Ford, Ralph Gregg, Bob Kelly, Don Knapp, Larry Donaghue, Bert Moggach, John Ogilvie, John Turnbull and Hal Wright.

1955-1961

Until 1956, the AES was directed mainly from the engineering department at the Ontario Agricultural College (OAC) at Guelph, although staff was paid by the Ontario Department of Agriculture (ODA). In 1956, the Drainage Division of OAC stopped providing surveys and plans, a service they had provided since 1906. There was huge demand for subsurface field drainage, and AES staff found they could not keep up with demand. In Niagara alone, 200 drainage plans were developed during this time. Drainage contractors were in short supply and there was even a report of 'bribery with $50' to get a contractor out to drain a farm!

Before 1959, engineers were agricultural mechanization graduates from OAC. In 1959, recognizing the need for further training, John Ogilvie entered OAC in a Masters Program in Agriculture in the Engineering department with a course program built around subjects needed to register as a Professional Engineer. Five others followed, all approved by the Association of Professional Engineers of Ontario (APEO) to use the title *P.Eng.* All subsequent staff were engineers, the first Ralph Clayton in 1959. Many former and current AES staff continued to complete graduate work during their service. The AES structure is unlike that of the US Cooperative extension in that there is no direct connection between University and AES staff.

In the earlier years the AES emphasized one-on-one service to farmers, but then *'increasing workload dictated changing the emphasis to 'extension' in the teaching and promotion of sound engineering principles to farmers, contractors and suppliers'* (Bellman, 1994). The need for specialization became apparent. A few specialists were; Keith Clarke, Fruit and Vegetable Storage Engineering, Vineland; Bob Milne, Dairy Cattle Housing Engineering, Woodstock; and Hank Bellman, Silo Storage Engineering, Walkerton.

In a 1962 report, AES Specialist John Ogilvie reported, *'During the period 1955-1960, more plans became available through the Canadian Farm Building Plan Service. Some…developed by Extension Service personnel'* (Ogilvie, 1962). Ogilvie reported how AES staff refined their techniques to save time by switching to the stadia method for surveying; by using aerial photos to assist in drainage designs - an almost GIS method we're familiar with today and during a time when aerial photos were not widely available. The ozalid process was adopted for preparing drainage plans, white print machines were purchased, walkie-talkies were used for drainage surveying and the innovative McBee™ filing method was used for the thousands of drainage plans in county offices. This in a time when photocopiers, fax machines, computers, databases, internet, email and cell phones were 25-40 years into the future.

Foreshadowing statements in the Ogilvie report included:

- *'Tile drainage contractors encounter difficulty with obtaining outlets…they then request the advice of the Extension Engineering Specialist'* (this often became a mediation effort between neighbours, an expertise future AES staff would use in nuisance mediation efforts)
- *'Construction companies specializing in farm buildings have entered the field'* (AES staff were instrumental in the formation of the Canadian Farm Building Association in 1980, still representing the farm building industry today)
- *'In the past, car tours and bus tours were common and a good way of spreading new ideas and disease'* (Engineers led hundreds of tours over the years, and were involved in creating and following biosecurity measures to minimize the spread of disease).
- *'The future of the AES should be to…..assemble, interpret and extend agricultural engineering information to people engaged in, or serving agriculture.'*

In 1958, AES engineers visited Michigan counterparts and were convinced a *'clear-span roof system using gable or single-slope wood trusses made good sense in terms of engineering and economics'* (Turnbull, 1989). This spurred interest in Ontario and the first Michigan-type glued-and-nailed plywood gusset, 40 ft, single-W gable roof truss was designed for a one story layer barn at Highgate. This was the birth of farm building trusses, revolutionizing farm buildings.

New engineers working during this time frame included Tom Brown, Ed Brubaker, Ralph Clayton, Bill Hamilton, Ross Milne, Bob Milne, Paul Musial, Howard Nodwell, Don Presant, Norm Sinclair and Vern Spencer.

1962-1968

In his 1961-1962 annual report, E.I McLoughry, Director of Extension Liaison (McLoughry, 1962) listed new developments worked on and promoted by AES staff. Among them:

- *'An interest in grain driers is becoming apparent in the corn belt of southwestern Ontario. These machines are commercially available at an operating cost of 2¢ to 4¢ per bushel.'*
- *'Interest is apparent in utilizing slatted floors for manure removal in pig pens. The manure can be allowed to flow by gravity to a storage tank, or removed by an auger or gutter cleaner'*
- '*Single story dairy barns are gaining considerable attention over the conventional two-storey barn, with calves being housed at one end, or in a separate building.'*
- *'Increased interest in harvesting fruits mechanically has led to investigation of the use of shakers to harvest (sour) cherries.'*
- *'602 new buildings designed; 567 buildings and stables remodeled; 307 ventilation problems; 88 materials handling systems designed'*
- *'The dairy products surplus is causing some dairymen to branch into beef, hog or poultry…'*

This last point was huge. In 1970, supply management commenced in the dairy sector, which 40+ years later (now) is in danger of being disbanded because of international trade negotiations. Dairy supply management (and later for poultry) altered work of the AES. Dairy farmers prospered and farms expanded; herds became more housed versus pastured; long term haylage/silage feed storage was important; the ability to spend capital on buildings, manure storages, equipment, etc. improved. AES work expanded because windowless livestock buildings became more common to improve ventilation and heat loss; and the widespread adoption of liquid manure, not only for dairy, but for swine, beef and even caged layers.

In April 1967, OMAFRA's Capital Grants Program was born. It *'encouraged the construction of well Engineered drainage systems, ponds and farmsteads.'* (Brubaker, 1968). It encouraged subsurface field drainage and poured $ millions into the farm community. It also coincided with the 1968 introduction of plastic drainage tile *'being observed to determine if it will perform as well as clay tile and stand up under Ontario conditions*' (Brubaker, 1968). It has lasted almost 50 years! The program's success led AES staff to be involved in future programs, notably The Ontario Soil Conservation and Environmental Protection Assistance Program (OSCEPAP), 1983-1988. This $25.5 million program assisted producers in controlling soil erosion and protecting water resources. Engineers advised and designed grassed waterways, drop inlet structures, floodwater storages, permanent manure storages, etc, then inspected to ensure structures were properly installed. This mix of regulatory work with extension created conflict in the minds of some staff. However, work on this program led AES staff into erosion control contractor schools, manure storage design and the still evolving computer software on storage sizing (MSTOR) and nutrient management planning on field application (NMAN). Engineers collected liquid manure samples to '*determine the fertilizer value to…eventually indicate the amount of money that can be spent on storage facilities'* (Brubaker, 1966)

Figure 1 shows rural non-farm population actually dropped between 1962-68, possibly reflecting moves to urban areas in search of higher paying jobs. Those living on farms continued to drop as did the total number of farms. There were few 'new' hires to the AES, including Norm Bird, Mart Kirik, Gord Tobey and Martin Wrubleski. However, from 1964 to 1968, several technicians were hired to assist the AES. Technicians throughout the AES history included; Sam Bradshaw, John Cerven, Ralph Elliott, Don Gaunt, Don Holmes, Bud Kelly, Ludwig Kern, Harold McKnight and Glen Stinson.

1969-1975

This period was influenced by a shift in demographics (Figure 1). By 1969, first Baby-Boomers born after World War II had entered the workforce and started families. Many opted to settle in rural areas and commute to city jobs. At the same time, WW II veterans, many born between 1915 to 1925 era reached early retirement. Many of them also opted to retire in rural areas. Figure 1 shows a spike in rural population. Farms and farmers' numbers continued to drop.

There was growth in 'intensive' livestock operations by standards of the day, and complaints about nuisance odours from swine barns and the new 'liquid manure storages'. In 1970, separation siting of Ontario livestock facilities was introduced with *'A Suggested Code of Practice (ASCOP)'* (The Department of Energy and Resources Management and The Ontario Department of Agriculture and Food, 1970). It recommended fixed minimum separation distances between livestock barns and neighbouring houses and other incompatible uses. While ASCOP contained a framework for the establishment and expansion of livestock facilities, it provided little protection for farms from encroachment by non-farm land uses.

The ASCOP was revolutionary. It introduced the Animal Unit system to 'indicate the relationship among various animal and poultry species of different ages in terms of their potential to cause a pollution problem through the production of wastes'. It introduced the Certificate of Compliance, which livestock farmers were 'encouraged to apply for from the Air Management Branch, Department of Energy and Resources Management before commencing construction'. It outlined recommended fixed setbacks for livestock facilities from dwellings and other properties, how much long term manure storage was needed, how much acreage would be necessary to spread manure upon, and how to till the manure into the soil. This 'voluntary' document soon took on a 'mandatory' status before building permits were issued. This put AES staff in an awkward position between extension and regulation. In a historical report, (Wrubleski, 2002) stated, *'…the Code of Practice work in intensive livestock operations was a mixing of quasi-regulatory matters with consultation….(it) was an evolutionary phase, and it took some years to realize the conflict and separate the functions.'*

The *'Canada Animal Manure Management Guide'* (Agriculture Canada, 1974) was revolutionary at the time with its purpose of *'focusing attention on those practices that provide a reasonable yet environmentally sound basis for manure management'.* This document had much input from AES staff and was a forerunner to, and formed the basis of the revolutionary NMAN computer program for nutrient management.

In a confidential paper on the advancements of contributions of agricultural engineering to Ontario agriculture, (Calver, 1972) George Calver, Program Supervisor of the AES, stated; *New initiatives which the Department of Agriculture and Food might consider…taking further initiatives in pollution control, building standards, tile drainage inspection, drainage contractor licensing, provision of main drain by adopting the administration of The Drainage Act and in machinery supervisory work…'* All of these suggestions came to pass and continue to affect the work of AES staff to this day.

The AES led farmers into the computer age with the *Comsolve Program,* which assisted farmers mainly on management decisions for barn ventilation design, tractor selection, and truss design. In his 1973-1974 report Ed Brubaker reported 401 *Comsolve* 'runs' (Brubaker, 1974).

This was the most prolific hiring period in AES history. New hires included: Jim Arnold, Vic Biliski, Ken Boyd, George Garland, Harry Huffman, Frank Kains, Ken Mullen, Jim Myslik, George Penfold, Glen Slater, Bob Stone and Jim Weeden.

1976-1982

Rural non-farm population continued to grow and farms consolidated and specialized further. It was boom time in Ontario agriculture, at least during the first half of this time frame, despite historically high interest rates of up to 9%. Swine barns, machinery storages and liquid manure storages were going up everywhere. This came to a crashing end when interest rates peaked even higher at over 20% in 1981. Farm foreclosures became commonplace.

The 1979 oil crisis caused increases in oil prices and awakened farmers to be interested in energy conservation and production. In his 1980 annual report (Brubaker, 1980), Ed Brubaker, Supervisor, AES stated, '*Requests for information on energy conservation and alternate energy sources are increasing significantly….because of increasing costs….projects presently underway include passive solar heating for livestock structures, grain drying and farm shops. One farmer has installed a commercial wind generator and surplus power is fed into the Ontario Hydro system…other farmers are contemplating production of Alcohol as an engine fuel…there is very modest activity in methane production.'* These words mirror ones we hear 30 years later.

'Computer programs continue to grow as an important extension tool for the Engineers' (Brubaker, 1978). These words seem prophetic with laptops, tablets, smartphones today, but this was only a year after Bill Gates dropped out of Harvard to devote all his time to a little company called *Microsoft™.* It was reported that *'Hands on access to a (computer) terminal in their (Engineer's) own office would increase the usage of these (Comsolve) programs* (Brubaker, 1981). Ken Boyd, Supervisor, AES, in his first annual report stated, *'It is hoped that every engineer will very shortly have hands-on access to a micro-computer'* (Boyd, 1982).

Because drainage machine operators were trained by OMAFRA staff, licensed by the Ministry, and becoming very proficient with new equipment for determining grades and proper installation, the AES dropped this work altogether around 1982, moving to the next innovation.

In January 1976, the *Agricultural Code of Practice (ACOP)* (OMAF *et al*, 1976) provided a two-way method to separating livestock/poultry barns from non-compatible uses and vice-versa. It introduced the term Livestock Unit and created a sliding scale for separation distances, since fixed distances were too restrictive, or too lenient, depending on the size and type of farm. ACOP introduced for the first time the *Minimum Distance Separation (MDS)* formulas. MDS I determined minimum separation distances between proposed new development and existing livestock facilities and/or permanent manure storages, while MDS II determined minimum separation distances between proposed new or enlarged livestock facilities and/or permanent manure storages and other existing or approved development. MDS is envied around the world by many jurisdictions in its approach to orderly livestock growth and planning. An estimated 25,000 Ontario livestock barns have been MDS-sited.

New hires included: Harold Cuthbertson, Ron Fleming, Hugh Fraser, Don Hilborn, Harold House, John Johnson, Ron MacDonald, Pat Plue and Helmut Spieser.

1983-1989

It was during this period the engineers were split into five groups across the Province, reporting to the head engineer at each of the Colleges of Agricultural Technology at Alfred, Kemptville, Centralia, New Liskeard and Ridgetown. It was challenging because of reduced communication between staff, different priorities regionally, and AES staff was the only 'extension-type' staff that dealt directly with farmers in the College system. There was a misconception among upper management that AES staff spent all of their time in one-on-one type work, which was furthest from the truth. Staff created and taught courses to contractors in drainage, building design,

erosion control, ventilation, and gave hundreds of presentations to groups of all kinds, and worked with innovators and early adopters as they always had done.

In 1961, there were 88,000 acres of corn and soybeans in Ontario. By 1981, it was 350,000 acres. A new term ‘cash cropper’ was coined, signifying farmers exclusively growing field crops. Most raised no livestock and most of the land they farmed received little to no added organic materials such as livestock manure or incorporated sod crops. Much of the land was planted with corn year after year with no rotation of other crops. It became apparent by the early 1980’s these cropping practices were causing severe soil erosion problems. A study conducted by the Ontario Institute of Pedology in cooperation with OMAFRA estimated total annual erosion costs in lost crop yield, soil nutrients and pesticides was $68 million (Driver and Wall, 1982). Most of the losses were in southwestern Ontario where most of the field crops were grown.

In response to the study, OMAFRA introduced the Ontario Soil Conservation and Environmental Protection Assistance Program (OSCEPAP), which provided funding to producers for controlling soil erosion and protecting water resources through the installation of new manure storages. The program ran 1983 to 1988, and influenced work by many in the AES. Staff became experts rather quickly in the design and installation of soil erosion control structures such as grassed waterways, drop inlet structures, water and sediment control basins, and in the sizing and design of manure storages. The AES provided on-farm advice to thousands of farmers, put together schools for contractors, and wrote dozens of factsheets on these topics.

Another development during this time was the advent of personal computers in every AES staff member’s office. The first stand alone computers in offices were *Megatels* in 1981, followed by the *Orion DY-4* about 1983. Engineers were the first staff to receive ‘personal computers’, often with the envy of other staff! These computers assisted on the design of ventilation system sizing, drainage runoff calculations for erosion control structures and manure storage sizing.

Innovations during this time frame included; an open-front dairy heifer barn designed by Bob Stone, hired 1969, that was hugely popular with dairy farmers both inside and outside Ontario; the first naturally ventilated swine barn designed by Norm Bird, hired 1961, which spurred hundreds of similar barns and variations by Frank Kains, hired 1969, and Yves Choiniere, hired 1984; manure storage sizing computer software by Ron Fleming, hired 1976, the prequel to the current MSTOR software; NVENT software by Harry Huffman, hired 1971, and Harold House, hired 1981, design and troubleshooting software that was ahead of its time; and the first on-farm anaerobic digesters used primarily for odour control, not energy production, designed by Ron MacDonald, hired 1981, Steve Clarke, hired 1983, and Helmut Spieser, hired 1977.

In 1988, legislation passed called the *Farm Practices Protection Act (FPPA).* Although its wide-ranging effects were not felt by AES staff initially, it ultimately impacted all staff in the convening years. The intention of the legislation was to protect farmers from frivolous nuisance complaints, and promote better relationships in the countryside.

New hires included Luc Brunet, Yves Choiniere, Steve Clarke and Mike Toombs.

1990-1996

February 28, 1990 is etched in the memories of every AES staff member working that day. With no warning, careers of all changed forever. One by one, 27 engineers and 7 technicians across the Province were summoned to several locations. Some were told they had retained their jobs, others were let go. When the dust settled, 8 engineers and no technicians remained, although four engineers were eventually hired back, having to reapply in competition with other staff let go for new positions. Everyone was in shock. There were no particular reasons given, as no other group in OMAFRA was affected, but a recent sizeable pay increase in 1989 for engineers

across government may have had an influence in the decision. The following year was a difficult one not only for those who remained, but for those who lost their jobs and had to find other employment. Engineers who remained, focused on newly minted specialties and carried on.

The Farm Practices Protection Act (FPPA) affected AES staff as they were expected to deal with complaints about agricultural noise, odour and dust issues. AES staff dealt with many odour-related complaints mainly. Those that could not be solved locally ended with a hearing at the Normal Farm Practices Protection Board. 11 such hearings occurred between 1990 and 1996 at which AES staff were often subpoenaed to be expert witnesses.

In 1991, in support of the new Land Stewardship Program, AES staff produced the Agricultural Pollution Control Manual which addressed pollution risks from manure, farm stored chemicals, and waste products. The manual was widely used and was the forerunner to the 1st edition of the award-winning Environmental Farm Plan (EFP) manual published spring 1993. AES staff authored many of the EFP chapters and became technical experts on its many topic areas. The 4th edition is anticipated for 2012, again with plenty of AES direction, and writing. Since the spring of 1993 when EFP workshops were first offered to 2012, this program has reached close to 40,000 producers (Kains, 2012). Participation in EFP became a prerequisite for many government funding programs.

In 1990, OMAFRA produced the first of a series of manuals on best management practices, entitled 'BMPS: A First Look'. BMPs are proven, practical and affordable approaches to conserving soil, water and other natural resources in rural areas. There are now 23 BMP manuals in the series, virtually every one having extensive AES staff involvement in planning and writing. These colourful manuals present options for producers to choose from to meet their own particular environmental circumstances. Diverse topics included dealing with manure handling, water wells, crop production, dead animals, etc. They explained difficult topics in simple language, using pictures, tables, graphs and testimonials to get the message across. AES staff authored the majority of many of these BMP manuals. There was only one new hire during this time frame, Finbar Desir.

1997-2003

The single biggest event during this time frame that affected the work of AES staff was the Walkerton tragedy of May 2000. Through a series of technical mistakes, the Walkerton well water supply became contaminated with the highly dangerous O157:H7 strain of *E.coli*, resulting in the death of 7 residents and the sickness of about 2500 others. The public inquiry that followed included AES staff testifying. About this time, 'intensive livestock operations' were being built, especially for swine, such as 1000 to 2000 head finishing barns, or 2000 sow Segregated Early Weaning (SEW) operations. Although the Walkerton tragedy had nothing to do with swine, some rural residents speculated contamination of rural water was just around the corner if one of these 'industrial-sized' operations was built next door.

Nutrient Management Plans (NMPs) are written plans on what livestock farmers plan to do with their manure in crop production in order to grow crops sustainably, while protecting ground and surface waters. Between 1993 and 1997, Don Hilborn, hired 1978, designed a 'simple on the outside, but sophisticated on the inside' computer software program called *NManPC* to help farmers with NMPs. There have been many changes to this software (now simply called, NMAN) but it is recognized even today as the best software of its kind in the world. It is used by agricultural consultants, agribusiness, farmers, and government agencies. Municipalities asked for NMPs in this time period before they would issue building permits for livestock barns, but the rules were sporadic across Ontario. AES staff again got caught in the extension/regulation conundrum as they reviewed NMPs for Municipalities. This changed when NMPs became

mandatory for large livestock operations with the passing of the *Nutrient Management Act, 2002.* AES staff no longer reviewed NMP, but helped train others with NMAN and reviewals.

Ten years after its predecessor, the *Farm Practices Protection Act (FPPA) 1988*, the *Farming and Food Production Protection Act (FFPPA) 1998* was passed. This updated legislation increased the number of nuisance issues that farmers were protected against, as long as they were following normal farm practice. This list had been noise, odour and dust, but was increased to include light, vibration, smoke and flies. Nuisance complaints continued to occupy a lot of work for some AES staff, especially for those living in more urbanized, rural environs. During the 1997 to 2003 period, there were 28 hearings of the Normal Farm Practices Protection Board and AES staff testified at many of them.

One of the most unusual weather events in the history of Canada occurred between January 4th and January 10th. The Great Ice Storm of 1998 *'was a massive combination of five smaller successive ice storms which combined to strike a relatively narrow swath of land from eastern Ontario to southern Quebec……causing massive damage to trees and electrical infrastructure, leading to widespread long-term power outages. Millions were left in the dark for periods varying from days to weeks, leading to more than 30 fatalities, a shut down of activities in large cities like Montreal and Ottawa, and an unprecedented effort in reconstruction of the power grid. The ice storm led to the largest deployment of Canadian Military personnel since the Korean War, with over 15,000 Canadian Forces personnel deployed in Ontario, Quebec and New Brunswick at the height of the crisis.'* (Wikipedia, 2012). Ten staff of the AES volunteered to go to Eastern Ontario to help out in any way they could with the farming community, among them two of the authors, Hugh Fraser and Franklin Kains. Most staff stayed up to a week, stationed at farm machinery dealerships in Glengarry and Stormont Counties. Their job was to match farmer-donated generators from unaffected areas of Ontario with farmers who had no electrical power for days to weeks on end. It was a fulfilling experience for AES staff being able to help those who needed help so desperately. Hundreds of generators arrived from all over Ontario in the relief effort. One of the largest groups of generators came from the Mennonite community near Waterloo.

This period also underwent something no AES staff member had ever experienced. There were two Ontario Public Service Employees Union (OPSEU) strikes, one in 1997, the other in 2002 and many personnel cuts to the Ministry. Although AES staff was not part of OPSEU, they had to cross picket lines for several weeks during both strikes. The strikes gave AES staff a glimpse at how divisive a strike can be on staff in the short and long term.

New hires included Robert Chambers, Jake DeBruyn, Andrew Jamieson, Kevin McKague, Rebecca Short and Dan Ward. Finally, the first female engineer to work for the AES after 50 years was Beth Burrows, hired 1998.

2004-2010

This period saw world energy prices increase dramatically, spawning interest by farmers and others in alternate forms of locally produced, green energy. The Green Energy and Green Economy Act, 2009 was created to expand Ontario's renewable energy production and create clean-energy jobs by creating a feed-in-tariff program guaranteeing financial compensation rates for energy generated from solar photovoltaic, biogas, biomass, landfill gas, and on/off shore wind and water power. The Ontario Biogas Systems Financial Assistance Program of 2008-2010 aimed to increase the number of biogas systems in Ontario, the use of byproducts in those systems and the knowledge base of stakeholders. About 25 systems were built as a result of this program and AES staff was involved in the bulk of them.

There was severe winter damage in the grape industry in 2005, and vineyard operators were anxious to install wind machines used to pull warm air down from an inversion layer high above their crop to 'warm' the crop above critical air temperatures. Hugh Fraser, hired 1980, did a four year on-farm research project to demonstrate the effectiveness of wind machines and to develop best management practices for their use. He also did noise studies because wind machines are noisy and neighbours do not like them. From 2005 to 2010, the industry grew from about 25 wind machines to 500 with an installed value of $17.5 million. Wind machines are now being installed in other tree fruit such as apples, peaches and nectarines, and saving $ millions of dollars in lost production during the late spring frosts of 2012.

As stated earlier, in 1970 *'A Suggested Code of Practice (ASCOP)'* was introduced to separate livestock barns away from neighbouring houses and other incompatible uses. This was followed by the 1976 *Agricultural Code of Practice,* then with an updated 1995 version. In 2006, an improved version was printed entitled, *Minimum Distance Separation (MDS) Formulae Implementation Guidelines'.* It provided better protection for livestock operations from encroaching uses, and provided far more information on implementation. It also introduced time-saving software for calculating setbacks, a welcome addition for Municipal employees who enforced MDS. An updated version is planned for 2013.

Staff numbers rose modestly. New hires included Richard Brunke, Colleen Fitzgerald-Hubble and Susan Motkaluk (the first two female engineering managers), Ben Hawkins, Benoit Lebeau, Dan McDonald, Jim Ritter, Terrence Sauve, Amadou Thiam, and Ping Wu.

Conclusion

Most engineers who worked for the Agricultural Engineering Service over the past 64 years would tell you it was quite a ride. The job varied daily, one was able to work with innovators and early adopters of every stripe, and at the end of the day one felt like they had made a difference. It is unclear what the future holds. Farming has become much more complicated with more regulation, rules, and tight margins. Regardless what the future holds, engineers working for the AES will continue to help clients (farmers, commodity groups, agribusiness, internal and external government staff and others) solve complex agricultural engineering problems, using the best available engineering principles in a rapidly changing world, while keeping an eye on safety, cost/benefit and the environment.

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