the WATER HAULER'S BULLETIN

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A MESSAGE FROM THE ASSOCIATE MINISTER OF ALBERTA AGRICULTURE, THE HONOURABLE SHIRLEY McCLELLAN

An old adage states that you can't fully understand or appreciate the present without knowing a little of the past. In looking through some of the past issues of the Water Hauler's Bulletin, I soon discovered that from its inception in the fall of 1980, this publication has been dedicated to the needs of those actually involved in the management and operation of Alberta's irrigation districts.

TENTH ANNIVERSARY ISSUE

The Water Hauler's Bulletin is the only publication in the country dedicated solely to the purpose of keeping irrigation distribution operators aware and informed.

It is my understanding that the first issue was distributed to less than 50 readers. Today's publication has a circulation of over 600, including subscribers in several countries throughout the world. The Water Hauler's Bulletin has certainly progressed in appearance in its ten years, from its dull type-set printing in the early issues to its new format of late. The main thrust of the Bulletin on which it was founded continues today, emphasizing the philosophy that ideas and technology should be discussed and exchanged. Most concepts that seem simple and insignificant to one, often have significant worth to others.

On behalf of the irrigation branch staff, I wish to convey their thanks and appreciation to all those that have contributed articles or suggestions over the past ten years. It is extremely vital that you, as either contributors and readers, continue to support the production of the bulletin as we enter into our second publishing decade. The ever-growing concerns and issues of water management, sustainable development and the overall well-being of the environment will undoubtedly demand an expanded focus of irrigation interests to be highlighted in the Water Hauler's Bulletin.

Shirley McClellan, M.L.A.
Associate Minister of Agriculture

OVERSHOT GATE DISCHARGE CHARACTERISTICS STUDY

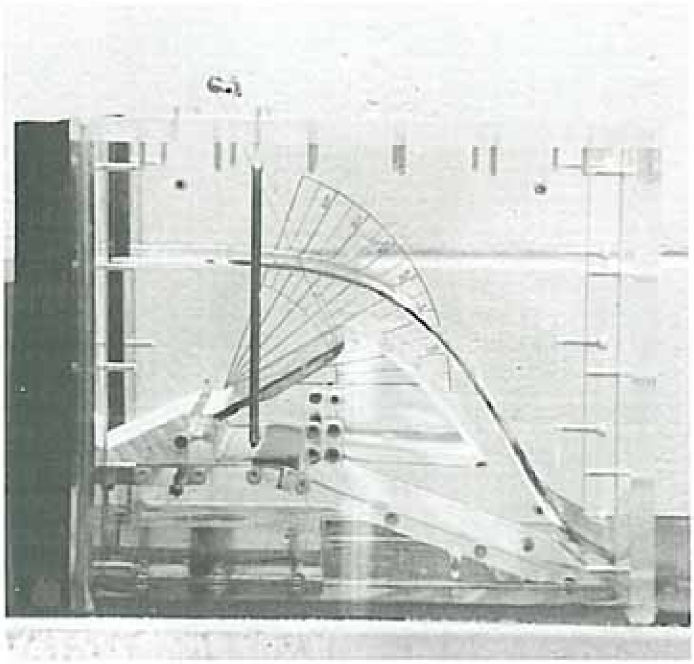
Some Very Interesting Results

The overshot gate is used extensively as an upstream level control device in southern Alberta's irrigation distribution systems. The gates are suited to automation and at drop structures can be used for accurate flow measurement. However, the movable gate changes from a broad-crested weir when full down to a sharp-crested weir when in the full up position. The intent of the Farming For the Future study, undertaken by MPE Engineering Ltd. at the Lethbridge Community College hydraulics laboratory, was to model the overshot gate and determine the discharge coefficient at all gate positions.

Jozef Prozniak, P. Eng., president of MPE says, "The overshot gate model was constructed to a 1:30 geometric scale based on an existing overshot gate structure. The gate structure was based on geometric similitude with the Ducks Unlimited Enchant drain structure and fitted with a 2:1 sill. Two additional gates and sills were fitted into the model structure; a gate with a 1:1 sill was modelled after the Monarch branch check structure in the Lethbridge Northern Irrigation District and a gate with a blunt sill was based on the Ducks Unlimited 12 Mile Coulee outlet structure." The study was conducted in accordance with the Froude criterion, he adds.

A fixed flow was introduced into the flume and measured using a calibrated broad-crested weir and a velocity probe. Once a flow rate had been established, the upstream flow level in the channel and the elevation of the end of the gate were recorded with the gate in the zero degree position. The gate was then moved to the next position and the procedure was repeated up to 60 degrees in 10 degree increments. The flow in the flume was then adjusted to a new discharge, measured, and the test was repeated.

Data from over sixty trials was collected with the gate geometry and/or discharge rate varying from trial to trial. All data was compared with the results predicted by earlier studies of both broad-crested (Smith, 1985 and Bos et al., 1984) and sharp-crested weirs (Brater and King, 1976).



1:30 Geometric scale model of an overshot gate used in study.

The assumption that the overshot gate in the zero degree position behaves as a broad-crested weir appears to be valid, says Prozniak. The transition away from the broad-crested characteristics appears to occur quite rapidly as the gate moves out of the zero degree position, with the discharge coefficients in the 5 and 10 degree positions differing significantly from those predicted for the broad-crested weir. For a gate in the 5 degree position exhibits discharges anywhere from 10 to 20 percent higher than those predicted by the broad-crested weir formulae. Similarly, for a gate in the 10 degree position, discharges are generally 15 to 25 percent higher," he adds.

Comparison of the test data with characteristics predicted by the sharp-crested weir relations compliments the results from the broad-crested weir analysis. As expected, the zero degree position is not well represented by a sharp-crested weir relation.

MPE's study found generally, in the zero degree position, the gate discharge is from 20 to 45 percent less than would have been predicted by any sharp-crested weir relation. Again, a transition in the 5 to 10 degree gate position seems to be evident. In the 5 degree position, actual discharges are within 14 percent of those predicted by the sharp-crested weir relation and in the 10 degree position this reduces to within 7 percent.

Above 10 degrees, the overshot gate coefficient is well within the bounds of coefficients for sharp-crested weirs as derived by previous studies.

In the study, MPE found that from 10 to 30 degrees, the discharge coefficient tends to increase. In the 20 to 30 degree gate positions, the discharge coefficient tends to be close to a maximum and subsequently decreases by 4 to 8 percent as the gate moves from the 30 to 60 degree positions.

The transition in the characteristics appears to be fairly independent of gate geometry and sill type, says Prozniak. A similar transition from broad-crested to sharp-crested weir characteristics in the 5 to 10 degree range was also evident for both gate 2 and gate 3 and the 1:1 sill.

In summary, the MPE study determined that the overshot gate behaves as a broad-crested weir in the 0 to 5 degree positions. From 5 to 10 degrees the gate transitions from broad-crested to sharp-crested weir behaviour. In the 10 to 60 degree positions the gate behaves as a sharp-crested weir. The effects of sill geometry and gate aspect ratio on discharge are evident, but do not appear significant.

For more information please contact Jozef Prozniak, P. Eng., MPE Engineering Ltd., 261 - 31 Street North, Lethbridge, Alberta T1H 3Z4. Telephone (403) 329-3442. ■

"DUCKBILL" MAY FILL THE BILL!

Long-crested weirs are not new to water management and have been used in many different applications in various countries throughout the world. One such weir is the "duckbill". Unlike weirs, such as the Cipoletti or broad-crested which are used mainly for water flow measurement, the duckbill weir is used to control water surface elevation.

The concept of a duckbill weir is relatively simple. It provides more weir length than is possible with a typical weir, which is normally perpendicular to the canal's centre line. More weir length is obtained by shaping it in the form of a duckbill, thus, the origin of the name duckbill weir. The additional weir length makes it possible to pass a designed flow rate in a canal with smaller changes in head. From an operation's point of view, this means that large changes in flow rate over the duckbill weir will result in smaller changes in head and small changes in flow into a lateral or a farm turnout upstream of the weir.

The St. Mary River Irrigation District (SMRID) has put the duckbill weir to use on the Six-Mile sublateral's rehabilitation project. The Six-Mile lateral which is approximately 1 m/s concrete-lined canal, heads up four relatively short pipelines which were recently installed by the district. Immediately downstream of each pipeline turnout, a duckbill weir has been installed.

Ron Renwick, SMRID district engineer designed the weirs for this project. He says that design steps involve: considering maximum allowable water height, minimum and maximum weir head, and finally arriving at the required weir length. He also states that the angles defining the configuration of the weir are important for proper hydraulic performance. "On concrete laterals with a capacity of less than 1 m^3/s, these angles require that total weir length be somewhat less than optimum. Consequently a compromise between weir angles and total length is required," he says.

Duckbill weir installed on SMRID Six-Mile Lateral.

Another concern which Renwick had was the potential of weeds and debris clogging the weir. The solution to this was to build the weir with a removable nose piece which would allow flushing when needed. The weirs used by SMRID were constructed of metal and attached to the concrete using Hilti hammer bolts and then sealed at the bottom to improve hydraulic performance at low flow conditions.

The complete duckbill weir, including installation costs, was less than $1000 on a canal with a 1 m^3/s capacity. According to Renwick, the duckbill weir has performed well on the smaller concrete-lined canals.

The integration of the design of a turnout with the duckbill weir can result in a turnout that is relatively insensitive to changes in the canal flow. This results in more stable flows to the water user, reducing the labor required to control water. If turnouts and check structures do not have to be adjusted each time there is a change in flow rate, it will take less time and labor to operate the system, he concludes.

For more information please contact Ron Renwick, District Engineer, St. Mary River Irrigation District, P. O. Box 278, Lethbridge, Alberta T1J 3Y7. Telephone (403) 328-4401. ■

ALBERTA AGRICULTURE AND THE GIS

The transition from manual drafting to electronic systems takes time and is not without difficulty. The electronic drafting age began for Alberta Agriculture in Lethbridge in the fall of 1985 with the purchase of its first microcomputer for a Geographic Information System (GIS). But before we get ahead of ourselves, first let's explain what a GIS is, says Ron Elder, head of the department's drafting services unit in Lethbridge.

In order to understand what a GIS is, a person needs to know what spatial data refers to. Spatial data can be summed up as any piece of information, whether it is a line, a point or a polygon, that is geographically referenced to a real world location either by Universal Transverse Nercator Projection Coordinate (UTM) latitude/longitude, legal land location, etc. In layman's terms a GIS is a system that handles and processes spatial data. The system has the ability to process geographically referenced data graphically and in tabular form, store this information, perform analysis on it and give results in map and/or report form.

Several packages were considered and it was decided that the best package suited for an agricultural/irrigation application would be Geo/SQL®. This package was developed by Software Support Ltd. in Edmonton which is an Alberta company with a sister office in Calgary.

The Geo/SQL® software uses the AutoCAD® software as it's graphics engine, says Elder. In this way, all maps are digitized and displayed in AutoCAD®. The Geo/SQL® software stores all spatial information in a proprietary database specific to the Geo/SQL® software. All attribute data, which is information related to a graphical entity, is stored in the relational database, RBASE®. In this way, by linking attribute information to a graphical entity we can give any map feature intelligence, thus creating smart maps, he adds.

In the past, Alberta Agriculture stored all irrigation information on hard copy map and report form. The maps were hand drafted using 1:20 000 orthophoto bases and reproduced in blueprint form. The irrigation information was stored in a vast array of reports and documents with one of the main sources being the irrigation capital works (ICW) reports. If a request came in asking for the total length of a certain type of pipe used in an irrigation district, a technologist would pull numerous reports and drawings and after much investigation and manipulation

Ron Elder at one of the Department's GIS stations.

a length would be computed and submitted. With the Geo/SQL® system a length can be computed within seconds and a map highlighting the pipe segments can be provided just as quickly.

The Raymond Irrigation District was chosen as a pilot project because of the types of ICW projects in the district, the complexity of the distribution system and the overall medium size of the district as compared to the other twelve districts. To start the project, the complete distribution system and drainage courses were digitized into AutoCAD® from the 1:20 000 distribution system plans. Next, the turnouts and pumping stations were located and digitized onto the maps using turnout and pumping station symbols. At this point the project was ready for the keying of attribute data. The various sections of Alberta Agriculture were polled as to what type of information they would like kept in the mapping database. After much discussion it was decided that information would be kept on the following:

1. Distribution System	Linear Information
2. Turnouts	Point Information
3. Lift or Pumping Stations	Point Information
4. Spillways	Point Information
5. Tailouts	Point Information
6. Reservoirs	Polygonal Information

Each of the above topics became its own table in the database and contains information about each graphic entity specific to that subject. The data that is being kept for these tables has some overlap. Information that is common to all tables would be: legal land location, ICW and ICW addendum numbers. Design capacity and lateral name are common to all tables with the exception of reservoirs.

Information unique to the various tables are: length, purpose, type of construction and lateral material type for the distribution system, turnout and delivery type for the turnouts, reservoir name, reservoir area and live storage of the reservoir for the reservoirs table.

Once the database information had been keyed, some preliminary testing of the database began. The data was put through some query and analysis work and was found to be accurate and functional. For example, some types of queries performed were: laterals with a flow capacity greater than 0.25 m^3/s, pipelines, and completed ICW projects, etc.

For the background map information, it was decided that the new provincial 1:20 000 mapping series of digital basemaps would be used. The basemaps were purchased from the land information services division of Alberta Forestry, Lands and Wildlife. Basemaps covering 85% of all the irrigation districts were acquired. The nine basemaps, required to provide coverage for the Raymond Irrigation District, were converted to AutoCAD® form and loaded into the GIS database. Loading this information into the database allows the operator the ability to build complete mapsheet and irrigation information in one step using the same process.

Now that first step of the pilot project is complete, says Elder, other forms of information can be entered into the system. These can include other coverages such as: land classification information, soils surveys, crop coverages, irrigation district rolls, parcel ownership, and financial records, etc. This leaves the future of the irrigation facilities management database open and unlimited, he adds.

In the next few years, Art Potvin, technical services section head of the land evaluation and reclamation branch, wishes to complete the basic geographic information system for the remaining twelve districts. He notes that some districts already have a GIS system in place, thus the department would like to exchange information and avoid duplication of data entry.

For further information please contact Ronald Elder, Head, Drafting Services Unit, Land Evaluation and Reclamation Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5906. ■

MONITORING PROGRAM FOR REHABILITATED PROJECTS

Irrigation Council has initiated a program to monitor and evaluate the present status of all works which have been funded by the Irrigation Expansion and Rehabilitation Program. The irrigation branch of Alberta Agriculture will be tasked with carrying out the program.

Field inspections to evaluate the condition of canals and their linings, control structures, and pipeline inlet and exit structures will be done on a district by district basis. All districts were consulted to establish relevant criteria to be used in the evaluation.

Details especially noted will include:

1. Erosion/siltation of channel banks and bottom.
2. Erosion/siltation in proximity to structures.
3. Concrete cracking, spalling exposure of reinforcement.
4. Deterioration of exposed liners.
5. Evidence of buried liner failure — seepage.
6. Corrosion of metal structure components.
7. Physical integrity of structures.
8. Damage caused from livestock or burrowing animals.
9. Vegetation problems/weed infestation.
10. Observable design deficiencies.

Over 800 projects have been completed since major rehabilitation commenced in 1969. Field inspections can only be carried out during times when water is out of the canals. Therefore it is estimated that the project will take at least two to three years to complete. Written and pictorial reports will be prepared for Irrigation Council as well as for each individual district.

It is anticipated that this program will help identify levels of maintenance and design limitations on all cost shared rehabilitated projects completed to date.

For further information please contact Zafar Iqbal, Planning Engineer, Irrigation Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta T1J 4C7. Telephone (403) 381-5713. ■

NEW WEED SCREEN

Gets the job done at the least expense

Design and build a better type of self-cleaning weed screen for pipeline inlets and water managers will hold your name in honor for years to come. This was not the motive of the Bow River Irrigation District's Steve Topping, P. Eng. and technologist Dave Brandley when they decided to design and build a simple rotating weed screen for an aquatic weed-choked pipeline inlet structure.

Few commercial units for the removal of weeds in front of small pipeline inlets are available that districts can afford. Manufacturers cannot spread the cost of designing, tooling and marketing a few pieces of specialized weed removal equipment for a very small market sector and still sell at prices districts can afford.

However, excellent components for building such equipment such as conveyor belts, pumps, nozzles and power units are available. Many of these commercially available components are marketed for the conveyance of industrial and food products. What Topping and Brandley did was adopt some of these products into their screen.

The moving parts are constructed of modern thermoplastics. The revolving conveyor belt and sprockets are very strong and can withstand exposure to cold winter temperatures (−40°C). The one problem of using the plastic belts is providing protection from damaging ultraviolet light. A cheap plywood cover is providing this protection.

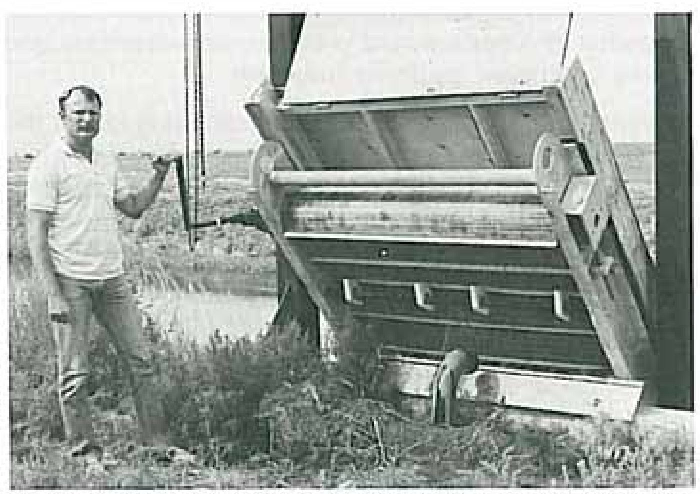
The real value of the BRID's sloped rotating weed screen lies in its simple cleaning action. As the operator hand cranks the geared drive, the endless conveyor belt rotates carrying the weeds upward and dropping them in a pile on land. Don Duncan the ditchrider in charge of the screen says, "It's been a real time saver. It saves me anywhere from 20 to 30 minutes every time I need to clean the screen. The old one required me to hand pull or brush every little bit of weed or algae off."

"I haven't had one complaint from the farmers on the pipeline since the screen has been operational," says Duncan.

The screen was built with a spray system to "water-jet" the vegetation off the screen. Topping has not yet put the nozzle system to work as the screen has been keeping clean without its use.

Topping feels the screen is about as simple as he can go yet get the job done. He wants more time to test it before automating it any further.

For further information please contact Steve Topping, P. Eng. at Bow River Irrigation District, P.O. Box 140, Vauxhall, Alberta T0K 2K0. Telephone (403) 654-2111. ■



Steve Topping demonstrates the BRID's new rotating weed screen.

NEW CHAIRMAN AND VICE-CHAIRMAN FOR IRRIGATION COUNCIL

Associate Agriculture Minister Shirley McClellan has announced the appointments of new chairman and vice-chairman of the Alberta Irrigation Council.

The new council chairman is John Weing, an irrigation farmer in the Magrath area. Weing has been a member of the Irrigation Council since December, 1989. He is a past chairman of the Magrath Irrigation District board of directors and has been a member of the Alberta Irrigation Projects Association.

The council's new vice-chairman is John Hollinda, a water user in the Eastern Irrigation District (EID) who farms near Tilley. Hollinda has been a member of the council since April, 1987. He is a past member of the EID's board of directors and past president of the Alberta Irrigation Projects Association.

"I am very pleased that John Weing and John Hollinda have accepted the appointments. These gentlemen will be great assets to the council as chairman and vice-chairman. Both are forward-looking individuals, dedicated to the improvement of irrigation farming in Alberta, and both bring valuable skills and experience to the council's deliberations," says McClellan.

In making the announcement, the associate minister emphasized her appreciation of the contribution made to irrigation in Alberta by the previous vice-chairman and acting chairman, Leighton Buckwell.

"Leighton Buckwell has done an outstanding job for the Alberta Irrigation Council, both in his capacity of vice-chairman, and in stepping in when he was most needed, to act as chairman of the council. Leighton's leadership and his very successful efforts on behalf of Alberta's irrigation farmers will be remembered with gratitude by all members of the industry. I am happy Leighton will be staying on as a member of the Irrigation Council until the fall of this year." ■

John Weing

AIPA APPOINTS NEW EXECUTIVE DIRECTOR

Stan Klassen has been appointed to the newly created executive director position for the Alberta Irrigation Projects Association. Klassen, a Saskatchewan native, has operated his own business in Lethbridge since 1970. Klassen will be responsible for all areas of activities but concentrate on public relations, public education and research. His new office is located in the SMRID building at 1210 - 36 Street North, Lethbridge, Alberta.Telephone (403) 328-4401. ■

THE WATER HAULER'S BULLETIN

Designed to provide the operation and management personnel of Irrigation Districts with items of interest in their line of work. Comments are welcome. Please contact Duncan Lloyd, editor, at Area Code (403) 381-5539, Lethbridge.
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