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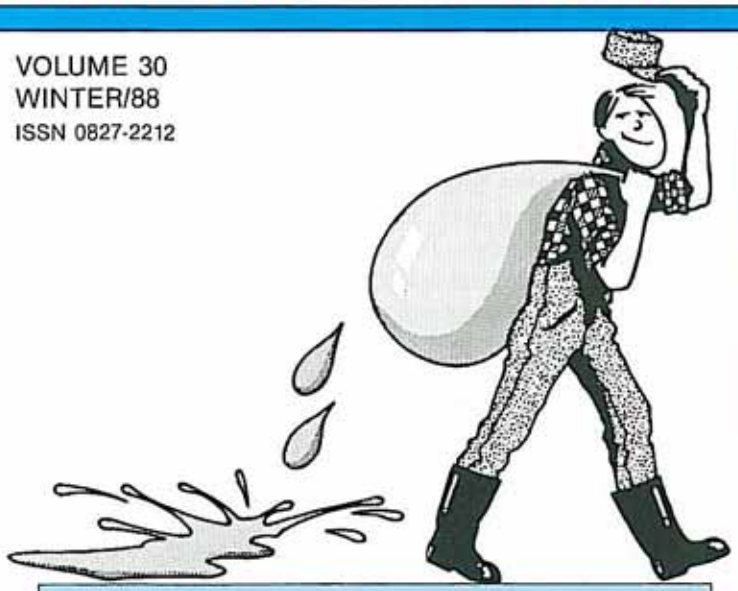


IN THIS ISSUE:

CANAL ROTOVATION

Will Tillage Control Aquatic Plant Populations?

Have you seen anyone rototilling the bed of a canal lately? You may have if you frequented the Taber or Bow River Irrigation Districts this past fall. No, they are not going to plant rice, but hope to decrease the heavy aquatic plant growth.

The theory behind this experiment by the Evaluation & Management Section of the Project Planning Branch, in conjunction with Dr. Jack Allan of Canada Agriculture, is to see if detrimental effects can be imposed on tubers and roots of various aquatic plants by exposing them to more oxygen and severe freezing temperatures. Most of the older irrigation supply canals in southern Alberta have an accumulation of decaying organic matter and silt that has been deposited over the many years of use. This rich, anaerobic layer extends from the surface of the canal bed down to a depth of 35-45 cm and offers an excellent substrate for tubers of Richardson pondweed (Potamogeton richardsonii); Sago pondweed (P. pectinatus); giant pondweed (P. vaginatus); the flat-stemmed pondweed (P. zosteriformis); the narrow-leaved water-plantain (Alisma gramineum); and the over-wintering crowns of the green and northern water milfoil (Myriophyllum verticillatum and M. exalbescens). These are the seven most common

Although it doesn't look it now, this reach of canal is badly infested with aquatic weeds.

problem aquatic weeds in our irrigation canals. The canal bed is saturated with water and seems to be protected from freezing and desiccation by the heavy organic mat of decaying vegetation from the previous summer's vegetative growth. This heavy layer of decaying vegetation also creates a (very strongly) oxygen starved (anaerobic) mud layer that may be involved in the dormancy mechanism of the underground tubers.

The rotovation experiment was designed to study the effect of exposing this rich organic mud layer to desiccation and/or freezing. By tilling the canal bed, the organic insulating mat was disrupted and the canal bed hydrosoil stirred up to allow for fall drying and subsequent freezing during the winter months. The overwintering tubers and crowns should be disrupted and moved to the surface for exposure to the sun and freezing air. And lastly, the anaerobic conditions in the hydrosoil to the depth of 20-30 cm will be disrupted and oxygen introduced to the exposed tubers and crowns.

A total of five test sections were tilled. The tillage was done by using garden tillers with both spike and flat blade attachments. Tillage depths varied between 150 mm and 300 mm and each plot averaged approximately 20 m in length. Frost tubes were also installed with one installed in the tilled area and one in the control section.

Three problems encountered when tilling the canal beds were: large rocks, ponded water, or soft and muddy conditions. Even though the water had been turned out of the St. Mary River Irrigation District Main Canal for almost a month, too much water remained ponded to do any experimental tilling. A hydraulic tiller on a boomtruck would solve the soft bed problem and allow tilling in shallow water.

It is hoped that the disruption of the insulating organic mat; the exposure of tubers and crowns to sun (desiccation) and freezing air temperatures; and the oxygenation of the canal hydrosoil will all contribute to the winter killing of rooted aquatic weeds that reproduce by over-wintering tubers, crowns and dormant apical buds. Preliminary results from this experiment will be published in the Water Hauler's Bulletin in late 1988. ■

FLAX-STRAW & ROCK DROPS

Using Nature's Own Material to Harness Her.

In 1980 the Bow River Irrigation District, in conjunction with UMA Engineering Ltd., began experimenting with rocks and flax-straw to see if they could come up with a design for a low cost drop structure. This type of structure was not proposed for use in channels continuously running water but more for periodic drainage works. Of immediate concern at the time were Drains #64 & 81. These channels were eroding badly and had steep sides causing cattlemen concern for their cattle that must cross and water in the drains.

The proposed rehabilitation was submitted to Irrigation Council and approved in May of 1980. However, Council noted that although they had approved the use of these types of structures, the project was experimental in nature and that follow-up inspections and evaluations were to be made.

Jack Ganesh, P. Eng., Section Head of Evaluation & Management in Alberta Agriculture, is monitoring the sites on a yearly basis since their construction in 1982-83. He files this report prepared after his 1987 fall inspection and has included some background for our readers.

"The flax-straw drops installed in the drain were constructed as follows: Flax-straw bales were stacked in a manner to form a chute with a depressed bowl for a stilling basin. Over the bales, black poly filter x was laid (poly filter x is a perforated polyethylene membrane). The poly filter x and flax-straw bales were held in place with welded wire mesh and one metre long steel pins driven in the ground between bales. Sometime after the original construction, large rocks (100 mm to 600 mm) were placed on top of the wire.

In my 1987 inspection, with representatives from both the District and UMA we found that all the flax-straw had rotted away and vanished. The filter x, steel pins, wire mesh and rocks were still in place. A luxuriant growth of grass was present where once the straw had been. The membrane filter and the rocks have continued to provide protection to the earth below. The erosion will remain in check as long as the poly filter is present to stop the soil from washing out.

Originally five rock drops were installed in 1982 in Drain 64 Hays. Of these, two were vertical drops, made by containing rocks in a vertical shape by use of steel posts and welded wire mesh. These two vertical drops kept on washing out the earth at the abutments until

Erosion occurring prior to installation of the rock drops.

the shape of the drops were changed. The vertical "sill" was depressed in the centre to allow all the flow to go down the centre. With the water not reaching the abutments now, it has not washed them out. The chute drops have worked very well.

After the first two years all five structures started to show a buildup of silt upstream. However, they were too far apart to allow for a more uniform distribution of this material. The District then installed four more intermediate chute shaped rock drops.

Rock drop in Drain 64 Hays has stopped erosion - excellent regrowth of vegetation occurring.

Our 1987 inspection revealed that all nine structures are functioning well and that a considerable buildup of silt has occurred. Vegetation is starting to grow back. This is a complete reversal of the process that was occurring in the coulee prior to the installation of the rock drops."

Ganesh says he expects the rock drops to hold up but has some reservations about the remaining poly filter x material in the flax-straw structures if additional rock is not imported and placed soon.

If these lower cost structures will continue to perform efficiently with little maintenance, after all, isn't this what leading-edge irrigation technology is all about.

For more information please contact Mr. Jack Ganesh, P. Eng., Project Planning Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta, T1J 4C7. Telephone (403) 381-5164.■

KARMEX UPDATE

The 1986 winter edition of the Water Hauler's Bulletin, reported on the use of Karmex in an experimental trial section of the SMRID Main Canal. It was hoped Karmex, a soil sterilant, would control aquatic plants such as Richardson Pondweed (Potamogeton richardsonii), Sago Pondweed (Polamogeton pectinatus) and Giant Pondweed (Potamogeton vaginatus) for up to three years. However, upon inspection after the water was turned out for the 1987 season, little or no positive results could be seen. In fact, the aquatic weed infestations, which were only found in the first 3 or 4 kilometres downstream of Stafford Reservoir, have now become established in the canal as far as the Horsefly Check, a distance of 40 plus kilometres.

Why didn't this very effective chemical work? In order for Karmex to become effective, the chemical must become fixed in the soil. For reasons unknown, this did not happen. Maybe the heavy snowfall in November, right after the chemical was applied and the resulting melt from the warm weather in November through March, kept the chemical in suspension. Other possibilities are: the SMRID could not drain the weed infested reach of canal completely or the dead and decaying plant biomass may have prevented the chemical spray from binding in the soil. In any case, success was very very minimal at best. No further tests using Karmex are planned in this canal.■

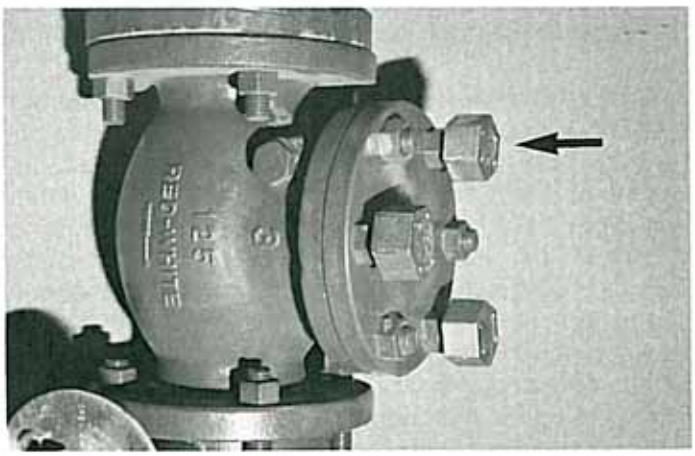
CAP IT — BURY IT — FORGET IT

New Method of Providing Cathodic Protection to Buried Steel Fittings.

Of upmost interest to an irrigation district is the protection of their buried steel fittings from corrosion. The most obvious economic contribution to good maintenance is to keep all susceptible fittings fully protected.

A new unique method of providing protection (Protecto Caps) was recently evaluated by the Department of Chemical Engineering & Applied Chemistry at the University of Toronto. What are Protecto Caps? Protecto Caps are zinc alloy nut-like anodes which are wrenched on the threaded ends of the external bolts of the fitting. By firmly attaching Protecto Caps, studies showed the nuts, bolts and the adjacent flanges of the buried fittings were assured long term protection from galvanic corrosion.

What degree of protection from corrosion do these Protecto Caps provide? The answer to this question depends on several factors. Number one being soil resistivity. Some soils are much more corrosive than others, therefore, the degree of protection provided by the zinc anode caps varies accordingly. Second, the size of the fitting being protected is a factor. For example, a large fitting with only 2 caps on it would only be protected for a short period of time as the anode cap would be destroyed by galvanic action quite quickly. Although increasing the number of zinc caps placed on a fitting would not necessarily increase the degree of protection conferred to the steel, increasing the number of caps does greatly increase the length of time it is protected. Third, the coating of the fitting itself is also a factor in determining whether additional corrosion protection is required and how much. If the fitting is initially galvanized or epoxy coated then maybe only the nuts and bolts are subjected to corrosion and need protection. Very often the bolts holding the fittings together are the first to fail and, in this case, the Protecto Caps would assure long term protection against corrosion.



Protecto Caps attached to fitting.

Tests and information resulting from research done by the International Lead/Zinc Institute show the life expectancy of 90 gram Protecto Caps installed on a buried 150 mm ductile iron 90° bend with average coating can be determined as follows:

Soil Resistivity (Ohm-Cm)	2 Caps (years)	6 Caps (years)	12 Caps (years)
1000 (corrosive)	5	20	35
2000	7	30	50
3000	10	40	65
4000	12	55	90
5000	16	70	110
6000	20	85	140
7000 (passive)	25	95	165

From the above statistics it is noted that even in the most corrosive soils, protection can be significantly prolonged just by adding more anodes to the buried fittings.

Protecto Caps may also be used on fittings that are submerged in a corrosive environment such as water with a high salt content. All of the tests, by the University of Toronto, were done by immersing the fittings in a salt solution for up to 1100 hours. It was shown that the zinc anode caps conferred excellent cathodic protection to iron mechanical joint fittings and gland ring assemblies.

What about costs and sizes available? Protecto Caps are available in sizes ranging from 11 mm to 19 mm in the 90 gram weight and 23 mm to 26 mm in weights up to 400 grams. Approximate cost for the 90 gram anode is $2.00 each and a similar size in a 180 gram weight is $2.50 each. Cost will vary according to size and weight requested.

Even the most stable coating system for fittings will suffer some deterioration with time. This should, from the standpoint of economics and maintenance, be considered, and maybe a number of Protecto Caps be installed as cheap insurance.

For further information please contact Mr. Grant Hunter, 1708 - 31 Street S.W., Calgary, Alberta, T3C 1N1. Business telephone (403) 240-2100 or residence telephone (403) 246-4341. ■

COMPUTERS AS A TOOL IN THE MANAGEMENT OF AGRICULTURAL LAND DATA

A Decentralized Systems Approach

In October 1984, the Planning and Development Sector of Alberta Agriculture initiated a comprehensive review of computer system functional requirements with a mandate to assess current needs and methods of addressing those needs. The Agricultural Land Information System (AgLIS) concept was developed with the primary objective of providing a common method of handling agricultural land data for the Sector. Six functional requirements were identified: Planimetric and Thematic Mapping, Engineering Design and Drafting, Data Analysis and Modelling, Presentation Graphics, Project Management, and Database Management.

A formal implementation plan for AgLIS was prepared (October 1985 to January 1986) using a phased decentralized system approach. The objective of Phase I (April 1986 to March 1987) was to put in place two primary systems for the support of the planimetric and thematic mapping and the engineering design and drafting functions within the Sector. One system is located at the Alberta Agriculture headquarters building in Edmonton, and the other system is located at the Planning and Development Sector offices at the Agriculture Centre in Lethbridge.

Each primary system consists of an IBM PC/AT with one 1.2Mb floppy disk drive, one 30Mb hard disk drive, and one 70Mb hard disk drive. Peripherals include a Calcomp 1043 GT 8 pen drum D/E size plotter, a Calcomp 9100 digitizing table (with 36" x 48" active area), and a CIPHER Series 9000 Magnetic Tape Subsystem. Software includes the GeoBased Systems STRINGS(TM) Geographic Decision Support System (for planimetric and thematic mapping) and AutoCAD (for engineering design and drafting) from AutoDesk Inc.

Typical thematic and planimetric mapping applications include thematic inventories (e.g. Saline/Wetland), Level II Land Classification Reports, and 3D Modelling (e.g. contours). Multi-township thematic map production that typically took up to 3 months to complete in a manual environment has been completed in approximately 3 weeks using the GeoBased Systems STRINGS(TM) software. Typical engineering design and drafting applications include profiles/cross-sections and orthographic drawings.

AgLIS Computer System in Lethbridge.

The objective of Phase II (April 1987 to March 1988) was to place secondary systems in Irrigation Branch offices (Brooks, Medicine Hat, and Taber) and the central data processing work area in the local Sector office to support all AgLIS functional requirements.

Each secondary system consists of an IBM PC/AT with a 1.2Mb floppy disk drive and a 30MB hard disk drive. Peripherals include a HP7475A 6 pen A/B size plotter and a KURTA digitizing tablet (with 11" x 12" active area). Software includes AutoCAD (to support engineering design and drafting), Freelance Plus (to support presentation graphics), LOTUS 123 (to support data analysis and modelling), and Knowledgeman (to support database management).

The decentralized systems approach has provided an effective solution for the management of agricultural land data. Problems with this approach do exist, but the benefits outweigh the problems.

For further information, contact Mr. Pat McIlhargey, Information Systems Analyst, Project Planning Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta, T1J 4C7. Telephone (403) 381-5170.■

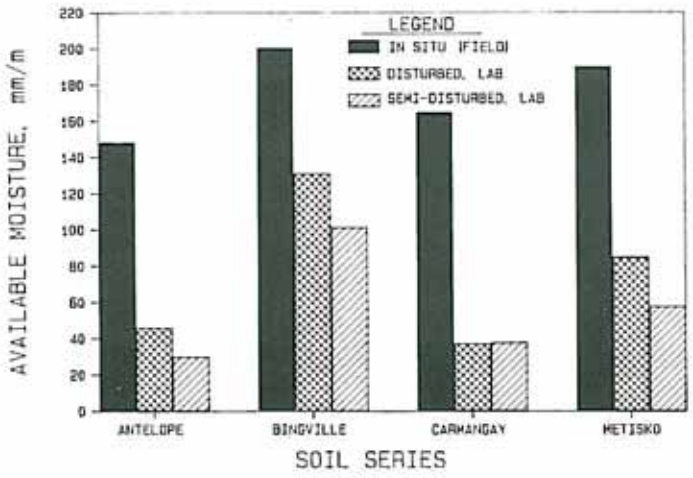
MOISTURE RETENTION TESTS IN SANDY SOILS

Field Method Proves The Best.

Sandy soils in southern Alberta are considered less suitable for irrigation development than finer textured soils due to limited available moisture storage capacity, low levels of natural fertility and susceptibility to wind erosion. Existing land classification standards in Alberta specify that soils having an available moisture storage capacity of less than 80 mm per metre are severely limited for irrigation development.

A combination of field and laboratory procedures was used to study the moisture retention characteristics of four coarse-textured soil series which occur extensively in southern Alberta. The implications of these findings on existing land classification standards for irrigation suitability in Alberta were also addressed.

In situ field capacity moisture content (FC) was found to be substantially higher in these sandy soils than estimates based on conventional laboratory methods. Results compare favourably to similar tests conducted on coarse-textured soils in North Dakota and confirm the need to use laboratory-based estimates of field capacity with extreme caution. Laboratory estimates of the permanent wilting point (WP), on the other hand, are generally considered more reliable since very little change in soil water content occurs at higher tension values. Plant available water content was consistently underestimated when laboratory estimates of field capacity moisture content were considered.



Comparison of methods for estimating plant available moisture in coarse-textured soils.

Plant available moisture retention capacity was found to be adequate for irrigation development in all four soils, including soils classified as Orthic Regosols developed on dune sand (Antelope soils). Detailed fractionation of the sand fraction, however, revealed that the sand within most of the soils consisted of medium to very fine sand, the particle sizes most susceptible to wind erosion.

A conservative approach to expanded irrigation development of extremely sandy soils is recommended to prevent depletion of these particularly vulnerable resources. Modification of existing land classification standards is presently not warranted, however, a conditional land class might be considered provided irrigated land use could be restricted to perennial forages or pasture. Management practices must also be adopted to minimize further deterioration of moderately sandy soils currently being irrigated and to avoid canal maintenance problems periodically experienced by some irrigation districts.

Taber's Northeast Fincastle Lateral - sandy soil blown in from southern Alberta's strong westerly winds.

For more information please contact Mr. Rod Bennett, Research Section, Land Classification Branch, Alberta Agriculture, Agriculture Centre, Lethbridge, Alberta, T1J 4C7. Telephone (403) 381-5174.■

SALINITY MAPS OF IRRIGATION DISTRICTS UNDERWAY

How much saline/waterlogged land is there within Alberta's irrigation districts? Where is it? How severe is it? And how does it compare to salinity on adjacent drylands?

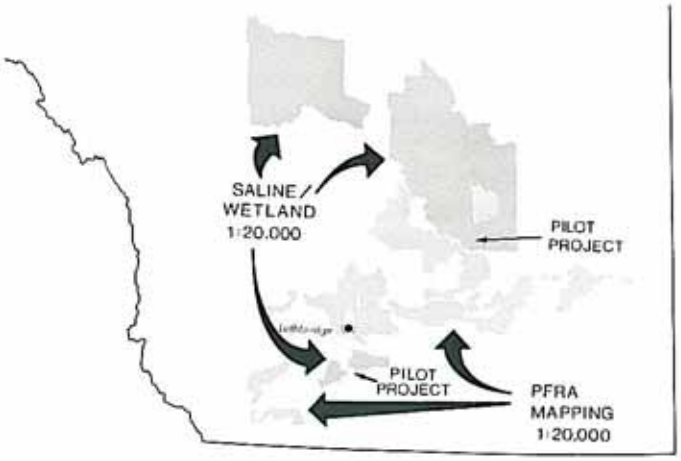
Alberta's irrigation districts have been systematically mapped for salinity and waterlogging since the early 1980's, using conventional air photography. The results have not been widely distributed, however. Now, in order to publicize this much-needed information, the Irrigation and Resource Management Division of Alberta Agriculture is producing a series of maps.

Affected area information has been collected under two separate terms of reference. Some of the districts [Eastern Irrigation District (EID), Magrath Irrigation District (MID), Raymond Irrigation District (RID), and Western Irrigation District (WID)] were mapped under level III soil irrigability guidelines and included soil testing for verification. Saline/Wetland (S/W) maps at 1:20,000 scale were produced from this information. The remaining districts were mapped by PFRA using visual mapping only, without soil sample verification. These maps were also produced at 1:20,000 scale though the information is less accurate. Both types of maps document moderate and severe levels of salinity/waterlogging.

To date, efforts have concentrated on reducing the original 1:20,000 mapping information to 1:50,000 or 1:100,000 scale. This has involved manual reduction and hand-drafting in a pilot project within the EID, and a pilot computer project within the MID and RID.

A key question is how the extent and location of affected lands under irrigation compares with that of adjacent dryland. Final maps will show those quarters assessed for irrigation and those that are not irrigated. Affected lands mapped in both areas will be tabulated separately.

Given the mapping period involved (1980-present), differences may exist between map representation and current conditions. These affected area maps will provide a valuable reference point, however, and should assist in evaluating and updating changes in salinity over time. This includes documenting the general improvement in salinity often associated with improved irrigation management and canal rehabilitation.



Mapping procedure and pilot project areas within the irrigation districts of Alberta.

Before a map is sent to print, irrigation districts are being given the opportunity to review the manuscript. The primary intent of this project is to produce maps that will be a resource to the district, but may be of value to other land-use interests as well. In the EID, for example, wildlife habitat is an important resource.

Preliminary tabulations of affected area are available for three districts - EID, RID and MID. Indications are that from 14-26% of irrigated lands are affected by salinity/waterlogging. From 2-17% of adjacent drylands are similarly affected. Within the EID, for example, 20% of irrigated lands are affected. Adjacent drylands are about 10% saline. This high incidence of adjacent dryland salinity suggests that much of the salinity within the district may be "natural" or associated with cultivation practices.

Overall mapping plans include the completion of final manuscripts for all districts by the summer of 1988. Individual district maps will be printed and released as resources permit.

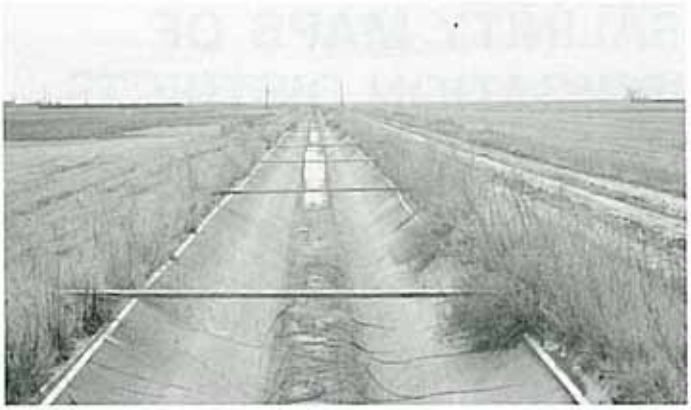
Further information on this project can be obtained by contacting either Brook Harker (381-5516), Frank Hecker (381-5174), or Art Potvin (381-5170). ■

UPDATE: AQUA LINER

After two irrigation seasons, the Bow River Irrigation District is happy with the performance of Aqua Liner in their 640 lineal metre trial section. As readers may recall, the flexible surrogate liner was rolled out on the inside of a badly cracked unreinforced concrete lined channel. Once in place, the liner was fastened to the top of the existing concrete by means of galvanized metal strips and Hilti fasteners every 150 mm. The liner was anchored transversely at the start of every roll by the same methods.

The District had planned to install flapper valves, to relieve any hydraulic pressures that may develop between the two liners. However, none occurred and it is now apparent that the sun's rays have heated the bitumen compound sufficiently to bond the bituminous geomembrane to the old concrete liner.

Mr. Jake Friesen, Manager, reports that the liner is holding up very well and has needed little attention. If a repair is required, district personnel simply bond a patch on by heating both surfaces with an open flame torch. Friesen says he would like to install more if the original $18.00 per square metre price tag was to drop substantially.



2 x 8's laid across lateral to allow side roll sprinkler to cross.

In conversation with Mr. Leo Boychuk of Aqua Liners (Canada) Ltd., he stated that "the price per square metre installed has dropped to $14.00 per square metre. This has come about because of us being able to get more efficient in container shipping methods from Holland."■

WATER HAULER'S BULLETIN SUCCESS

Communicate your resourcefulness by having an article published in the Bulletin. Its success depends upon your help in obtaining and submitting new and useful ideas.

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) 381-5164, Lethbridge.

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