the
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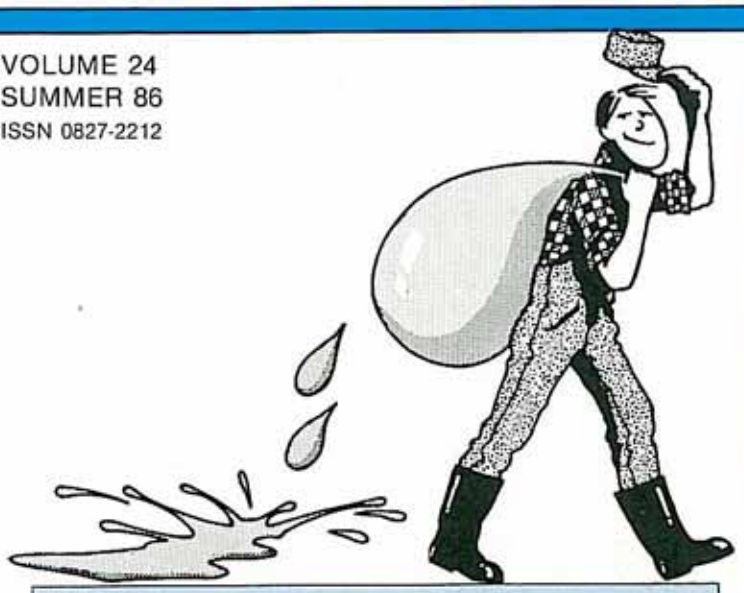

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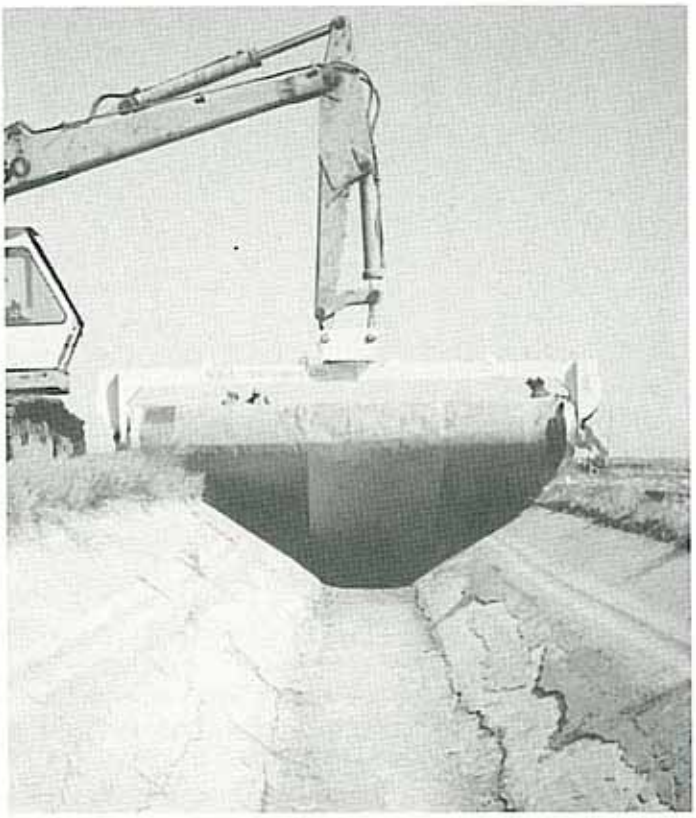
SURROGATE LINER

Aqua Liner Canada Thinks There is a Better Way

The problem facing the Bow River Irrigation District is how to repair their worst sections of cracked, unreinforced concrete slip-form lined canals. First thoughts were to remove the old liner completely, and replace it with a new reinforced concrete liner, however, this is very expensive, and would probably not be eligible again for cost sharing under the Irrigation Capital Works program. Then came the idea of placing a flexible liner inside the existing channel.

The District selected "Aqua Liner" for a trial section of 640 lineal metres. Aqua Liner is a reinforced bituminous geomembrane material which has been used as an exposed canal liner in the Western Irrigation District with some degree of success.

It has a polyester reinforced mat saturated with bitumen, and a layer of crushed slate embedded as a protective top coat. The length of each roll is 70 m, with a width of 5 m and weighs approximately 1820 kg.



Aqua Liner being rolled out over the badly cracked and broken concrete lined channel.

The bed of the existing concrete channel was cleared of any debris such as silt and pieces of broken concrete. Any large cracks or displaced concrete was smoothed with concrete grout to remove the sharp rough edges that might penetrate the Aqua material.

The large heavy rolls of liner were lifted and rolled in place by means of a hydraulic hoe. 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 metal strips and Hilti fasteners. The end flap from the previous roll was overlapped and heat sealed to the new roll.

The District was planning to install flapper valves, to relieve any hydraulic pressures that might develop between the two liners, however, they have now decided to wait and see if any problems occur.

The friction coefficient (n) for the Manning's velocity equation generally used in uncracked concrete lined channels is $n = 0.014$. The addition of the Aqua Liner may increase the n factor by 10% according to Dr. David Manz, P. Eng. of the University of Calgary. Actual metering of this trial section will be undertaken sometime this summer, when flows are reaching full supply level.

Installation of the Aqua Liner took only two days.

Cost for supplying and installing this 640 lineal metres of Aqua Liner was $58,000.00 which translates to about $18.00 per square metre. For more information please contact Mr. Jake Friesen, Manager, Bow River Irrigation District, (403) 654-2111■

FALL IRRIGATION

Fall Irrigation Has Its Pros and Cons

Fall irrigation is a management practice whereby water is applied in the fall to rebuild soil moisture conditions for the following crop growing season. Even though the practice of fall irrigation is generally supported and promoted, it is seldom used by irrigation farmers. This limited use is based on problems generally associated with fall irrigation.

(1) Wet soils are slow in warming up, consequently, high soil moisture conditions and low soil temperatures may delay seed germination and plant growth in the spring.
(2) Delay in spring field work due to high soil moisture conditions.
(3) Possible leaching of nutrients.
(4) Reduced benefit from off-season precipitation.
(5) The inconvenience of farming around low lying areas that tend to collect water from spring run-off.

Those people who do fall irrigate, do it for a number of different reasons.

(1) Rebuilding of soil moisture reserves after harvest for the following crop growing season, particularly the lower half of the root zone.
(2) Early seeding, better seed germination and seedling development, when adequate soil moisture is available for plant use.
(3) Fall irrigation improves soil moisture conditions for fall tillage.
(4) Extends the use of available labor and existing equipment over a larger area.
(5) Leaching of salts for salinity control.
(6) Reducing winter kill of alfalfa by maintaining adequate soil moisture conditions before freeze-up.

Irrigation districts that allow fall irrigation to take place generally experience delays in major construction or maintenance work on canals or laterals until water in the distribution system is turned off. If fall irrigation is limited or not allowed, some of this construction work may take place early in September, when reasonable fall working conditions still exist. Secondly, fall irrigation is an inefficient way of supplying water to only a small percentage of the irrigation farmers. Thirdly, fall irrigation limits the amount of water which can be stored or conserved by the irrigation district for the following irrigation season.

Knowing the problems and benefits associated with fall irrigation, we soon can see that it is not a simple process whereby water is diverted from the main distribution system to the farmer and then on to the land. Rather, it is a complex operation involving management decisions by both the irrigation farmer and irrigation districts.

Management on the irrigation farmers' part needs to take into consideration the following:

(1) The amount of water to be applied in the fall varies with time, manpower available and soil moisture conditions after harvest.

(2) The crop to be grown - since water management practices vary according to the crop to be grown, some of the crop water requirement may be satisfied through fall irrigation.

(3) Fall tillage operations vs. the amount of water applied for fall irrigation - combining a light application of water and minimum fall tillage, one can expect to receive maximum benefit from fall and winter precipitation. (In the Lethbridge area, we would expect to benefit from 62 mm of moisture 5 out of 10 years).

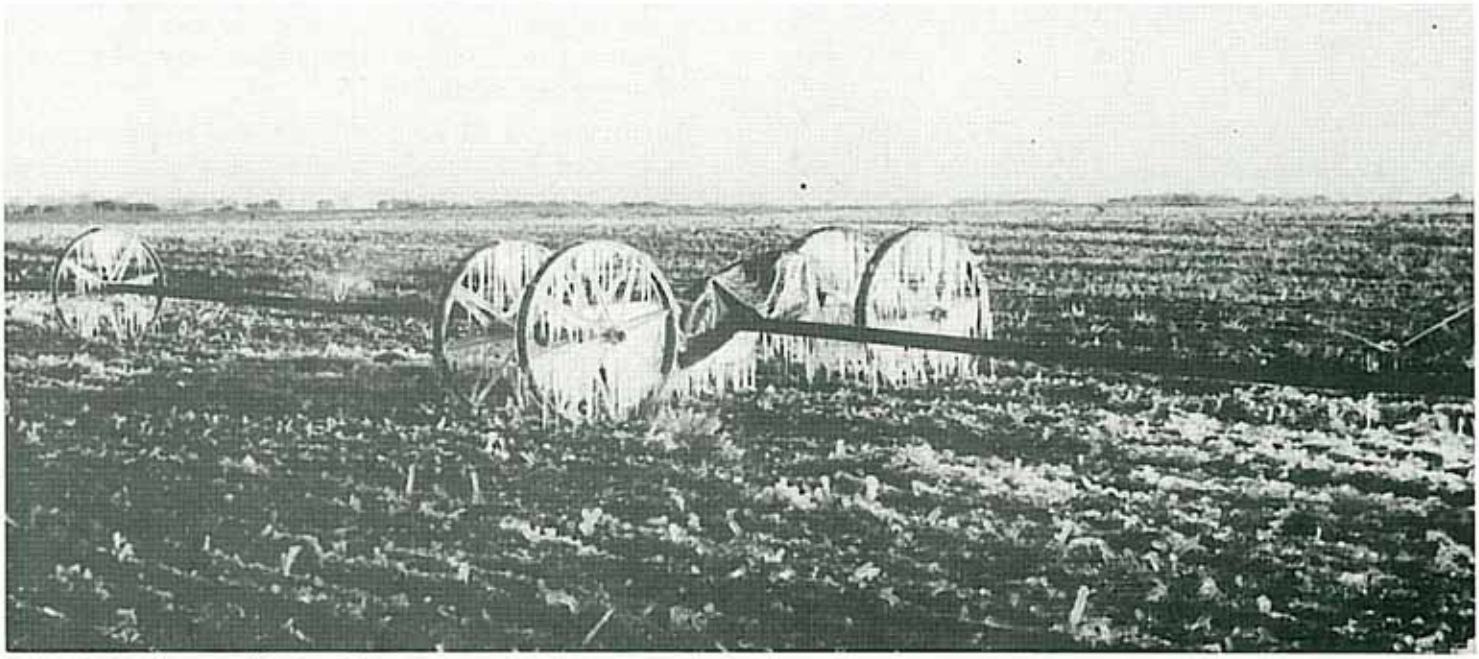
Conversely, a heavy application of water in the fall and several cultivations or plowing will leave the surface black, reducing the amount of snow trapped and increases snow melt run-off. Leaving the surface of the soil black, increases evaporation, causing the soil surface to dry quicker and allowing field work to start sooner.

Management on the irrigation districts' part needs to take into consideration the water supply situation and the amount of soil moisture remaining after the crop growing season. Based on average precipitation records, the irrigation districts must make a decision whether or not enough water is available in the fall for irrigation to take place. If sufficient water is available, then to what extent can fall irrigation take place?

The practice of fall irrigation is one that does not need to take place on the same piece of land year after year, but rather every second or third year, alternating with other fields. By alternating fields to be fall irrigated, the irrigation districts can reduce the overall amount of water which needs to be diverted from its reservoirs, saving the water for next year's crop.

Fall irrigation is not without cost to either the irrigation farmer or irrigation district.

From this we can see that fall irrigation is not a simple yes or no decision by either the irrigation district or the irrigation farmer, but rather, a complex management decision of both parties, whereby the various climatic, soils, and water supply factors need to be taken into consideration ■



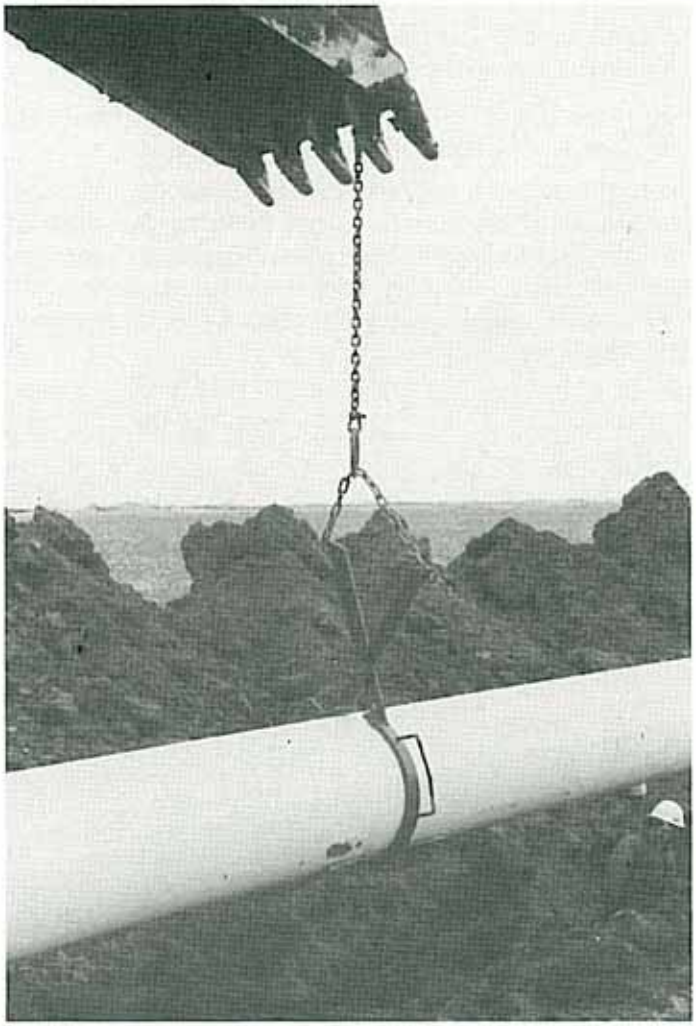
Fall irrigation is not without problems.

THE SCISSORS CLAMP

New Method For Lifting PVC Pipe

Like sliced bread, the idea was so obvious everyone should have thought of it. Yet, it was the ingenuity of the Taber Irrigation District employees, in their own shop, that have designed and made a unique PVC pipe lifting device.

Although PVC pipe cannot be classified as one of the heavyweights, manually lifting 6 m lengths of 450 mm diameter PVC pipe is not easy. Pipe of this size is neither fish nor fowl, meaning they are too heavy for brute strength to handle safely, and yet it's just not worth the bother to sling, lift, and place them in a trench by hydraulic hoe. Too often, heavy pipe is rolled and partially dropped into the trench. In cold weather, this can cause structural damage to the pipe, or worse yet, land on some unsuspecting pipelayer.



Rubber belting on inside of clamps protect pipe from damage.

The more "mature men" of the District, with the sore backs, i.e. R. Lloyd, J. Sparks, and T. Nawolski built the first scissor-like lifting clamps this past spring. Since then, they have produced them for every 50 mm diameter pipe size from 350 mm through 600 mm.

For more information on how to build your own PVC lifting device, please contact Ron Lloyd at (403) 223-2148■

GRAVEL ARMOUR UNDER STUDY

Spring Inventory Leaves A Lot Unanswered

During the Spring of 1986 a gravel armour study was undertaken by the Evaluation and Management Section of the Project Planning Branch. This study was initiated because of concerns over the installation of gravel armour on 2:1 side slopes. The main emphasis was to determine the severity of sloughing and siltation in the gravel lined sections of rehabilitated canals.

Approximately 180 km of armour lined canals were inventorized. The majority of these canals had only run water for one season and will, therefore, be observed again this fall.

For each of the canals inventoried, a form was made out, listing the design criteria and any other particulars of the canal. The criteria included; the name of the canal, the design capacity, bed width, bed grade, canal velocity, side slopes, gradation of gravel armour, type of lining if any, and the total length of the project.

Sloughing of the armour was broken into three categories. First was a total complete sloughing of the bank, with the slide occurring from top to bottom. Second was a partial slough, where only part of the bank had moved (usually the toe). The third category was drainage flow over the bank, causing the armour material to slide or erode down the bank.

Section of canal where armour was directly placed on liner. Note: Sloughing — Investigations Continue.

Silt build up on the bed and sides of the canals was also monitored with the silt build up having to be a minimum of 15 cm in depth before it was classified as a problem.

The following is a table showing the results of the study.

	TOTAL LENGTH	% SLOUGHING	% SILTATION
Total Canals Inspected	178 km	4.00%	20.40%
3:1 Side Slopes	55 km	1.00%	24.70%
2:1 & 2½:1 Side Slopes	122 km	5:30%	19.50%
Less Than 5.0 m³/s	37 km	0.70%	1.17%
Greater Than 5.0 m³/s	140 km	4.82%	25.50%
Velocities Less Than 0.61 m/s	30 km	1.52%	5.70%
Velocities From 0.61 - 0.76 m/s	89 km	5.00%	24.20%
Velocities Over 0.76 m/s	59 km	3.60%	22.00%
With Gravel On Liner	22 km	2.22%	9.68%
With Gravel & Earth On Liner	37 km	0.56%	29.00%

From the table, a number of interesting trends have appeared.

First, it appears from this initial inspection that canals with 3:1 side slopes tend to stay in place much better than canals with 2:1 slopes, but they have a higher tendency towards siltation. Second, the canals with low velocities had less sloughing and less siltation. Third, canals having a capacity of less than 5.0 m³/s tended to have very little sloughing and very little siltation. The fourth trend, which appeared, was, canals with gravel armour installed directly on a lining material sloughed more than canals with earth and gravel on the liner. The lined canals with earth and then overlayed with gravel tended to have more silt build up than canals with only gravel on the liner.

In conclusion, the canals studied tended to be in good condition with siltation being the major problem. The Project Planning Branch will continue to evaluate these canals■

THE RIGHT AMOUNT

A New Film Release

"The Right Amount", a new Alberta Agriculture film, outlines the requirement of irrigating properly and efficiently to produce top quality crops and at the same time maximize yields.

The film addresses some of the management problems associated with irrigating incorrectly. Problems such as salinity, water ponding, soil erosion, equipment problems and water tables are looked at.

"The Right Amount" explains the importance of monitoring on a regular basis soil moisture levels throughout the root zone at several different locations in the field. The film outlines various methods available for measuring soil moisture in the field.

"The Right Amount" is available on a free-loan basis from Alberta Agriculture, Film Library, (403) 427-2127, 7000 - 113 Street, Edmonton, Alberta, T6H 5T6■

U19 - NOT A SUBMARINE

A Possible Solution To Canal Bank Erosion

The Lethbridge Northern Irrigation District became increasingly concerned over the progressively worsening bank erosion taking place in their Picture Butte Lateral. Flow velocities in the channel were relatively low, somewhere in the range of 0.76 m/s. Investigations eliminated wave action, but soon centered around the high water fluctuations occurring in the canal during the irrigation season. It was found that these high fluctuations of water levels or "sudden drawdowns" as they are called, created a pumping action of the unprotected material fines in the banks, causing material to slough.

Typical Section of Picture Butte Lateral prior to rehabilitation.

First thoughts were to, just place gravel armour on the unprotected banks. But District Engineers felt that because of the high drawdowns, there would be little gained by directly placing gravel armour on the slopes as the material fines would still be pumped. It was at this point that the District decided to try a geotextile on the slopes and then place gravel armour on top of the 100% polyester material. The geotextile they chose was Nilex U19 having a thickness of 1.5 mm. The District chose to use a geotextile because this material is strong, provides soil reinforcement, allows water to filter through it and yet holds material fines so they do not separate.

During rehabilitation, the canal slopes were trimmed back to a 2.5:1 slope. The geotextile was then laid from the toe of the slope up to the top of the bank and keyed into the bank. The material was not placed in the canal bed. Gravel armour was then placed directly on top of the geotextile to a depth of 175 mm.

Gravel Armour was dumped directly on U19 Geotextile. A Geotextile will not control seepage.

The cost of the U19 material ran approximately $1.10/m². The District feel they have a cost effective solution to a very complexing problem. An assessment of this rehabilitated reach of canal will be made after the water is turned out in the fall■

HOW MUCH SALINE/ WATERLOGGED LAND IS THERE?

How much saline/waterlogged land is there in Alberta's irrigation districts? That's a question that is often asked with varying results. Ranges of from 10 - 30% are frequently quoted - but many acreage estimates include large tracts of dryland, are based on extrapolation from limited data, or are pure guestimates.

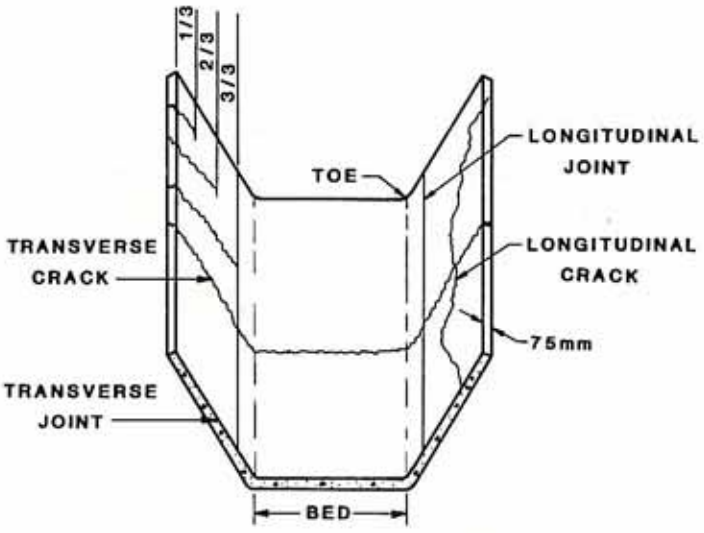
To finally resolve the issue CASM (Committee Assessing Salinity Mapping) is at work. The group has representation from Alberta Agriculture, Canada Agriculture, Alberta Environment and private industry. An inventory of existing salinity mapping studies with an initial evaluation of their relative accuracies has just been completed. This is being followed by a detailed analysis of major salinity mapping and will result in final affected acreage figures for all irrigation districts. For more information on CASM, its objectives and activities contact Brook Harker, Drainage Branch at (403) 381-5159 or Frank Hecker, Land Classification Branch at (403) 381-5174■

REINFORCED CONCRETE SLIP-FORM LINING INVENTORY

Still Looking Good, Although Cracks Have Increased Significantly

The 1986 annual spring inventory into the amount of cracking taking place in wire mesh reinforced concrete slip-form lined canals has been completed and results tabulated. It was conducted on 39 km of laterals in five Irrigation Districts of Southern Alberta. All the concrete laterals inventoried have been in place at least one winter.

The results of this year's inventory proved to be very interesting when compared to those of the past five years. Overall cracking, up until this year, was held for a combined total of less than 2%, however, the 1986 inventory indicates an increase of the amount of cracks by just over 100% from the previous years total. When compared to the 1985 inventory the number of transverse cracks increased from 352 to 699 and an equal increase in longitudinal cracks from 350 to 710. The total cracking, 3.8% is approximately double the 1985 inventory, but is, however, still a small percentage of the total overall reinforced lining installed.



X - SECTION OF CONCRETE LINED DITCH

CRACKING	UNCRACKED	UP TO 5 mm	5 mm TO 40 mm	OVER 40 mm
Overall	96.20%	3.54%	0.25%	0.01%
Transverse	98.20%	1.75%	0.04%	0.01%
Longitudinal	98.00%	1.79%	0.21%	—

Some interesting facts derived from the 1986 inventory are:

(1) 1.8% of the canals have transverse cracking or approximately 1 crack every 56 lineal metres of canal.
(2) 2.0% of the canals have longitudinal cracking or approximately 1 lineal metre of crack for every 56 lineal metres of canal.
(3) There was an increase of 98.6% in transverse cracks and 102.9% increase in longitudinal cracks from the 1985 inventory.
(4) When looking downstream, 36.7% of the cracks are on the left slope; 32.8% on the right slope, 28% in the bed and 2.5% across the ditch transversely.
(5) 68.4% of the cracking is found on the ditches running east and west and 76% of these cracks are found on the north side slope.
(6) 31.6% of the cracking is found on the ditches running north and south and 68% of these cracks are found on the east side slope.
(7) With the exception of Lateral A-2 in the WID, approximately 70% of the cracking found is on the opposite side of the driving bank.
(8) Approximately 96% of the cracks were found in the ditches that have been in place for at least 4 winters.

One theory that can be advanced as to why the sudden 100% increase in cracks from 1985 to 1986 may be found in this past fall's extreme weather. Heavy rains fell through much of September and into October. The saturated pads began to freeze by mid October with the unseasonably below normal temperatures causing more severe frost action■

JACK BREWIN RETIRES

Mr. Jack Brewin has retired from the Board of Directors of the St. Mary River Irrigation District. Significant is that this man has been either a Government appointed or elected official in the Irrigation Sphere for the past 33 years. His record is unsurpassed — 1 of the original 7 members of the Advisory Board of the old Crown Corporation SMRD, spent 9 years on the original Irrigation Council of Alberta (1st farm member appointed by the Government), and has been a Director of the Alberta Irrigation Projects Association (AIPA) since 1953, with the exception when he was appointed to Irrigation Council. His accomplishments are many, but Jack feels his greatest contributions have been in lobbying government through the AIPA for: the establishment of Cost Sharing for major irrigation capital works, the centralization of the Irrigation Division in Lethbridge, an Irrigation Bridge Policy, and the Three Rivers Dam.

Why retirement after only 33 short years? "Our farm economy is such today, that the farm requires my full time attention", states Jack.

Good luck Jack! You will be sadly missed but long remembered■

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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