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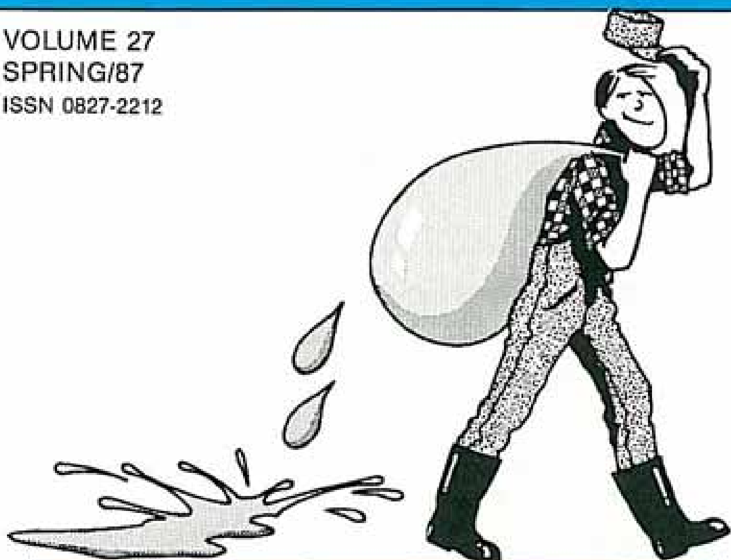


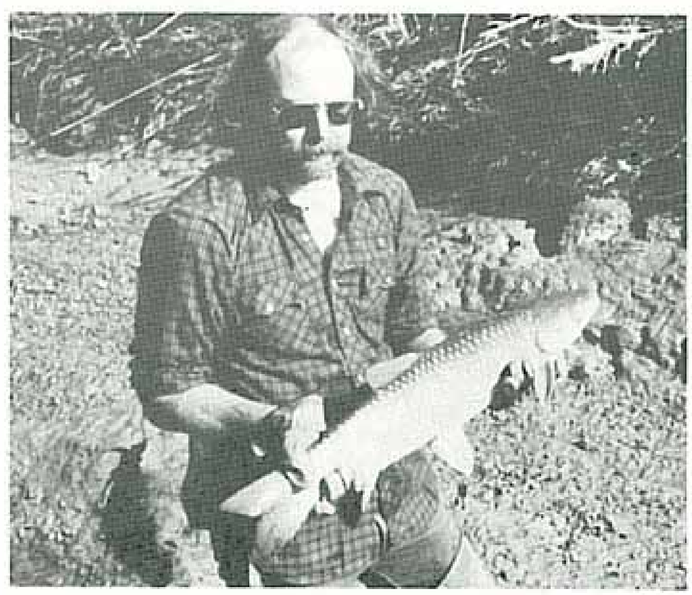
IN THIS ISSUE:

TRIPLOID GRASS CARP

The New Weapon in the Aquatic Weed Battle

Science and irrigation districts in the United States have combined forces to develop a new living weapon that is proving quite successful in controlling many species of aquatic macrophytes. The triploid grass carp [Clemopharyngodon edella (Cov) Blake] is a herbivorous fish and is capable of removing dense plant biomass even in large flowing canals. At a recent annual meeting of the Aquatic Plant Society held in Boise, Idaho five presentations were made regarding the use of the grass carp for controlling aquatic weeds in California, Colorado, Oregon and Washington.

Our canals, like most other aquatic habitats in Alberta, are very conducive to the lush growth of many aquatic plants. In spite of many canals only recently being rehabilitated, large aquatic weed growths are appearing in some reaches much to the concern of maintenance staff. The control of these growths is imperative in order to avoid downstream water shortages. Conventional methods of control are mechanical or chemical. Both methods are very costly and have definite limitations. The use of a plant eating sterile fish, particularly the triploid grass carp, offers an attractive biological alternative.



Dr. Randal Stocker holding triploid grass carp.

Grass carp sterility trials are taking place in the U.S.D.A. Irrigation Desert Research Section in California. "In the 1985, 86 trials," states Dr. Randal Stocker, "no evidence of fertility in the female triploid grass carp was evident. However, in the 1987 trial just completed, one female did produce eggs. These eggs were mixed with milt from a male though no embryo development occurred." Dr. Stocker feels that the eggs may have been too old and over ripe. Male carp in the 1986 study produced sperm in small numbers (1/10 the normal sperm count) but must be deemed fertile. More trials are scheduled in 1988.

The method of sterilizing the grass carp in the California Desert Research Station is simple yet very effective. The eggs are stripped from the female and mixed with the milt of the male. They are then subjected to a high pressure shock 3636 kg for 1-2 minutes. This high pressure shock prevents the chromosomes from separating. As further insurance that every fish to be released in a canal is triploid, a blood test is taken and analysed.

The diploid grass carp was used in the three year northern Colorado study (1984, 85, 86). This fish is fertile but no reproduction was evident. Fish were stocked in the canal in mid May to late June at varying stocking rates. It was found that when fish were stocked at 25 kg per surface acre of water, the plant biomass was not controlled. At 70 kg the fish soon depleted the entire canal of vegetation and began to move downstream in search of an adequate food supply. A stocking rate of 50 kg per acre controlled aquatic weeds and kept fish scattered throughout the canal.

The grass carp can withstand great water temperature variations. Again in the Colorado study, fish were subjected to extreme water temperature variations ranging from 0° to 25°C. The fish were wintered in deepened sections of the canal or holding ponds. An average of 97% of the fish were recovered each year. The fish withstood the stress of being netted and handled for weighing and measuring with no apparent ill effects.

Weight gains and losses were recorded in the spring and fall. Fish stocked in the first year recorded a 100% gain in body weight and lost 4% over winter. In the second year, the fish gained 70% in weight and a 45% increase at the end of the third summer. At the end of three years, Joan Thullen of Denver stated that "the average grass carp had increased in weight by 343% and in length by 55%." Grass carp have been known to reach an age of 15 years and weights of 10 kg or more. As with most fish species, the older the fish, the less it will grow.

The feeding habits of the triploid grass carp are not like those of the common carp. The common carp grubs in the bottom sediment of the canal or lake to obtain food. Water turbidity is increased dramatically because of this activity. However, the grass carp is a nibbler; biting off and feeding on parts of a plant.

The grass carp is a voracious feeder,

however, the amount eaten is dependent upon water temperature. At water temperatures below 10°C food intake is low, however, at temperatures above 13°C, feeding greatly increases. They are non-specific feeders, eating many species of emergent and submerged aquatic plants.

Movement of the triploid grass carp in irrigation canals has been monitored by using electronic tracking equipment. Dr. Stocker sated that "Triploid grass carp tend to move upstream initially after having been stocked in flowing canals. In long sections of canals with abundant plant biomass, grass carp may remain in specific areas within the section, not necessarily moving throughout the available space."

The grass carp, which originates from China, have been used for centuries as a food source and for weed eradication. They have been successfully introduced in the southern United States as an alternative to aquatic plant herbicides and costly mechanical weed removal techniques.

The time is quickly approaching when we, in Canada, may want to evaluate the effectiveness of the triploid grass carp in our own canal systems. From the papers presented, one could have every expectation that this triploid fish could be as effective in controlling aquatic plant species as it is in the northern states.

A canal aquatic weed plan would have to be developed and approved by the federal and provincial agencies and include pre and post introduction evaluation methods that would identify fertility, feeding habits, growth rates, fish movement, stocking densities, biomass reduction, and such environmental concerns as disease, effects on native fish, waterfowl and other biological concerns.

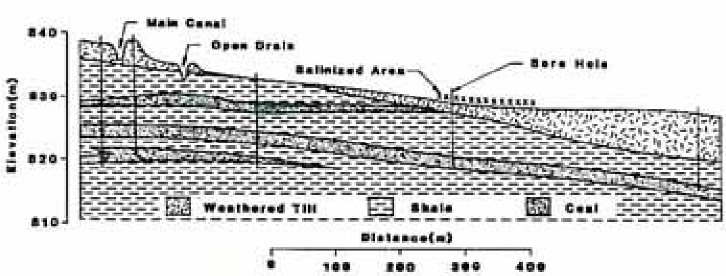
Relatively few biological controls of pests have been found which man has been able to use effectively, however, scientists working with irrigation people, have found an effective biological herbicide in the form of the Triploid Grass Carp. ■

CANAL SEEPAGE AND GROUNDWATER

Not Often Distinguishable

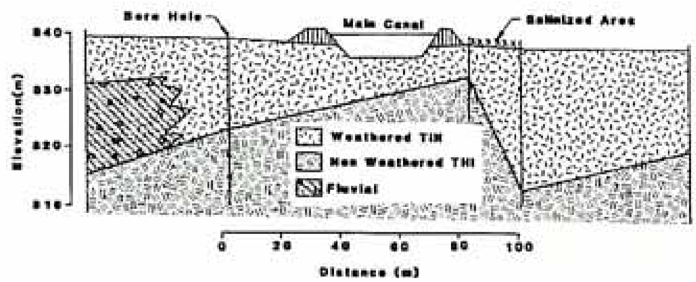
The Drainage Branch of Alberta Agriculture has studied the causes of soil salinization and the effectiveness of various canal seepage control mechanisms. These studies, which have been conducted in many of the Irrigation Districts, have shown the importance of understanding the groundwater flow characteristics adjacent to canals. Knowing whether a salinized/waterlogged area results from canal seepage or a combination of seepage and natural groundwater discharge has a direct bearing on which type of seepage control method should be used. If the groundwater conditions are not adequately understood, the effectiveness of the often costly seepage conrol measures may be jeopardized. In addition, seepage control systems can be severely damaged by groundwater pressures.

The relationship between soil salinization, canal seepage and natural groundwater discharge is exemplified by investigations conducted at the two areas within the Horsefly basin south of Taber. This basin, which is about 14,000 acres (5800 ha), extends from Horsefly Lake in the north to the SMRID main canal in the south. It is estimated that 30% of this basin is affected by salinity or waterlogging.



In the above example, natural groundwater flow is the major cause of soil salinization downslope of the SMRID main canal. Hydrogeologic investigations indicate that bedrock is shallow throughout the affected area and the invert of the canal is often located in bedrock. A detailed groundwater investigation showed that natural groundwater flow occurs in coal layers in the bedrock. In areas where the bedrock has been eroded, this water discharges at ground surface causing soil salinization. This type of bedrock controlled salinization is common throughout southern Alberta.

An open drain installed downslope of the canal in the 1950's, while perhaps controlling the relatively small amount of canal seepage, has had no effect upon the overall salinity problem which exists downslope of the canal. A proper groundwater investigation conducted prior to construction of the drain would have shown this. In order to be effective, a single deep interceptor drain would need to be excessively deep. Although not investigated, canal lining would likely be at risk of severe damage because natural groundwater discharges into the canal.



The above example shows canal seepage to be the cause of downslope salinity. Hydrogeologic investigations showed that bedrock is at depths of over 30 m. The dominant geologic material is glacial till of which the upper 10 to 15 m is weathered. Groundwater investigations indicate that canal seepage water flows through the canal bank as well as through the weathered till and discharges at the affected area, thus causing soil salinization.

Computer modelling of the canal seepage has shown that an interceptor drain placed at or below canal invert will intercept all canal seepage water. A shallow interceptor drain was installed in the weathered till at this site. Monitoring has shown that the drain is effective at intercepting the canal seepage water and reducing the water table in the affected area. Lining of the canal in this area would also be effective.

These two examples point out the importance of identifying and understanding the groundwater flow during any canal seepage investigation. Both of these examples are relatively straightforward, however, soil salinity and waterlogging problems are more typically caused by a combination of canal seepage and natural groundwater flow. It is recommended that good groundwater investigations always be carried out to ensure that seepage control systems will be effective.

For more information please contact Dr. Jim Hendry, Head/Groundwater Section, Drainage Branch, Agriculture Center, Lethbridge, Alberta, T1J 4C7. Phone (403) 381-5160. ■

SHEERNESS-DEADFISH WATER SUPPLY SCHEMES

Possible 18,000 More Acres Under Irrigation

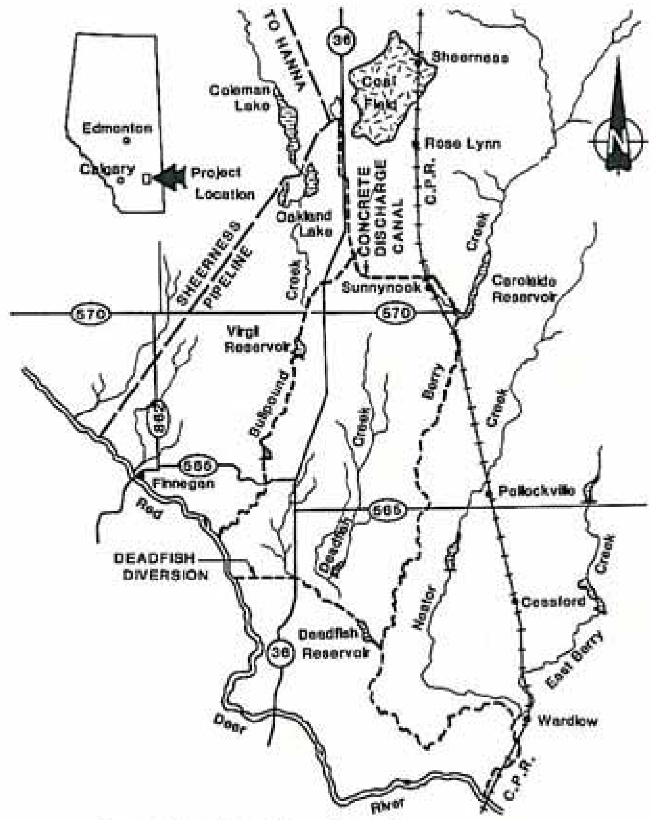
Overshadowed by the 380 megawatt, $630 million Sheerness Power Generating Station, is the feasibility of irrigating 11,000 acres (4,450 ha) of land with water from the plant's cooling system. Associated with the power station and its need for large amounts of cooling water, plans and developments were incorporated to increase the size of its water supply and discharge facilities. This enlargement has enabled irrigation and stockwatering deliveries to be made to the surrounding area, and for the municipal water supply to the Town of Hanna. Thus, 14,800 dam³ per year of water has been allocated for irrigation in addition to the water requirements of Alberta Power Limited.

Water diverted from the Red Deer River reaches the generating station's 1,300 acres (525 ha) cooling pond via a 40 km pressurized pipeline, jointly owned by Alberta Power Limited and Alberta Environment, which passes through large tracts of ranching country and irrigable land. Seven outlets have been installed along the pipeline for irrigation and stockwatering use.

Owing to periodically large amounts of sediment being carried by the Red Deer River during the season, pipeline pumping can be shut down for periods of two to three weeks. Consequently, buffer reservoirs are required in order to maintain a continuous water supply to each irrigation project along the pipeline and will, therefore, need to be constructed together with the installation of each project.

Water released from the cooling pond is conveyed via the discharge, or "Blowdown" canal to the Berry Creek, near Sunnynook, where the 18,500 dam³ Carolside Reservoir is situated. A turnout is provided at a point along the canal to supply water to the lower Bullpound Creek. Riparian water users on the Bullpound Creek and Berry Creek are fed by controlled deliveries from the canal turnout and through the Carolside dam respectively.

Concurrent with the development of the Sheerness Generation and Water Supply project has been the construction of the Deadfish Diversion project which was financed entirely by the Alberta Government and supplies water solely for agricultural purposes. This project comprises a pressurized pipeline to deliver water into the Janet, Woodrow and Deadfish (Forrester) Reservoirs for storage and subsequent use downstream on the Deadfish and lower Berry Creeks, which could facilitate the irrigation of up to 9,000 acres (3,640 ha).



Sheerness-Deadfish Water Supply System

The capital cost of the total scheme, including construction of the Deadfish Diversion, enlargement of the Sheerness pipeline, construction of the Sheerness Blowdown canal and renovations to the associated dams, was about $15 million.

Day to day operation and overall management of the irrigation water supply scheme is the responsibility of the Operation and Maintenance Division of Alberta Environment. Direct technical assistance is provided for the producers, in their development and management of irrigation systems, by the staff of the Irrigation Branch of Alberta Agriculture.

A total of 5,700 acres (2,300 ha) of irrigation land were being served by the scheme during 1986 and this area is expected to increase to about 7,400 acres (3,000 ha) by 1987. The present installed pumping capacity at the Red Deer River can supply a total of about 10,000 acres (4,000 ha) of irrigation and the installation of all planned pumping capacity would enable a total irrigated area of about 20,000 acres (8,000 ha) to be attained.

Although a large amount of soils unsuited to irrigation occur within the scheme area, some 60% of the 91,000 acres (37,000 ha) of the land surveyed for the scheme was found to be irrigable. The nature of the soils and the topography of the irrigable land has deemed most of it (88%) as being suited for sprinkler irrigation rather than for flood irrigation; at the present time, the most common system being installed on the land is the centre-pivot sprinkler machine. Forty percent of the surveyed area, 36,000 acres (14,500 ha), was found to be non-irrigable although 50% of this area would technically be reclaimable through engineering and agronomic remedial measures. The cost of reclamation would likely render the exercise not feasible at this time.

For 1987, the farmers who have signed the water agreement will be paying an annual water rate of $10/acre to be applied against the pumping energy costs to Alberta Environment. Any escalation in the cost of energy to Alberta Environment will in future be passed on directly to the irrigation farmers as a proportion of the present $10/acre rate. No purchase cost is required for the water right, or agreement, which currently authorizes river flow diversion to a farm; however, should the project be abandoned, the agreement would lose effect and only the water licenses that existed prior to the project's implementation would then be valid.

Additional information on this scheme is available from Rodney H. Jones, Irrigation Specialist, Alberta Agriculture, Provincial Building (Box 1318), Brooks, Alberta, T0J 0J0. Phone (403) 362-5551. ■

DISTRICT ACCESS

On a recent monitoring trip in the Eastern Irrigation District, our staff came upon a unique sign posted at the approach to a recently rehabilitated canal bank. The message is clear and simple "Use At Own Risk Do Not Use When Wet," By Order of the E.I.D. Need any more be said.

MORE ON BACKFILLING FLEXIBLE PLASTIC PIPE

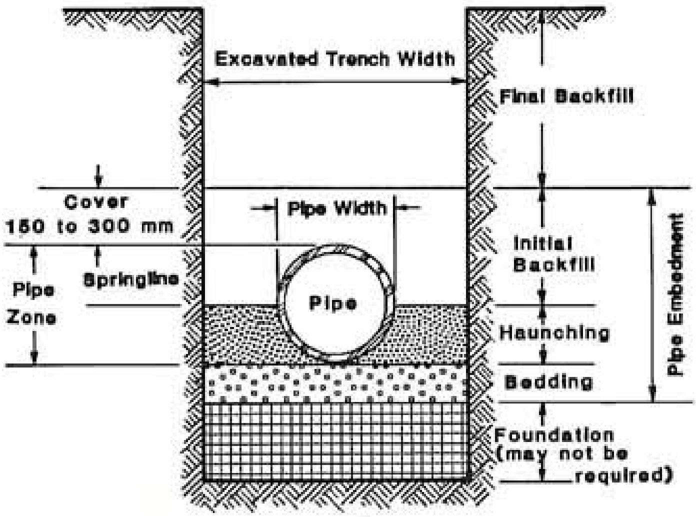
An Ounce of Prevention is Worth a Pound of Cure

More has been written about plastic pipe embedment backfill than all the other pipes put together. Nevertheless, since the introduction of polyethylene and poly vinyl chloride (PVC) pipe in the irrigation district rehabilitation and expansion program in the early seventies, some nagging questions still remain. This, however, is not surprising when one considers how flexible the pipe really is and yet not crushed by the earth load above it.

The "child prodigy" in the irrigation industry was relatively fast in proving itself. Today, there are few who do not recognize the plastic pipe for its many excellent qualities — non-corrosive, light weight, ease of installation, water tightness and a competitive cost. Therefore, it is not surprising that in many cases where in the rehabilitation of a small earth lateral, buried plastic pipelines are being used.

The crux of the uncertainty rests with its flexibility and its ability/inability to support the earth load. The theory of soil-pipe interaction that allows the embedment soil (see diagram for terminology use) to essentially support the earth load is by stress transfer to the embedment soil. The vertical pipe deflection is necessary to allow the soil-pipe system to carry the earth load. However, unless the embedment soil, especially in the haunching area, is properly placed and compacted, deflection can be excessive. If deflection is too excessive, the pipe will continue to increase in deflection and essentially fail. Failure usually occurs by buckling or in a reduction of the pipe cross-sectional area.

Today, because of the research work done at Utah State University and elsewhere, the initial and final deflection can be predicted within reasonable limits. According to the pipe manufacturers and the latest ASTM Specifications, all soils except peat, muck, frozen soils and all organic soils are suitable for plastic pipe embedment. If the embedment soil is properly placed and compacted, especially in the haunching, long term deflection will be less than 7.5%, which is the acceptable long term maximum deflection.



Trench Showing Terminology Relationship

If all this is true, then why all the concern about too much pipe deflection? The problem occurs when wet conditions are encountered, the trench walls are unstable, the bedding is soft or there is running water and saturated soil. If these conditions are encountered and are not handled properly, then serious deflection or even failure will occur.

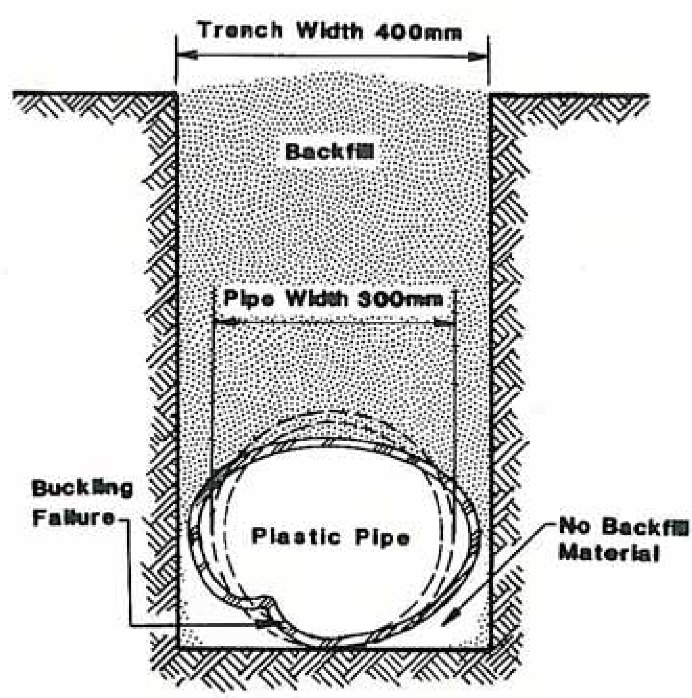
Soft native material may require over-excavating

and replacing the bedding material with crushed gravel and a geotextile. The geotextile will stop the migration of fines into the gravel and stabilize the bedding. Where water is seeping into the trench from a groundwater flow, it may be necessary to provide well points or underdrains. Class 1 material (crushed gravel or pea gravel) should replace unstable or soft bedding and wet unstable trench walls. However, one has to specify a well graded granular material that has enough filler in the gravel to restrict the fine material in the trench walls from migrating into the voids of the gravel. Again, in many of these cases, a geotextile membrane may be the least expensive alternative.

Pipe deflection is also the easiest physical change that can be measured. If the pipe is not installed properly then this should be manifested in the amount of deflection. By the use of a deflectometer, the pipe diametric deflection in the vertical, horizontal and the two intermediate directions can be measured. At present, there is only one such device in use in southern Alberta and it is owned by Project Planning Branch, Alberta Agriculture. One irrigation district has included the deflectometer check in their contracts, as a condition for accepting the work done.

The other concern we must not neglect while on the subject of deflection, relates to closed pressurized pipelines. Again, some people do not consider it a serious problem if the haunching and initial backfill are not properly placed and compacted. In a narrow trench, it is impossible to place and compact material under the haunching. No where in the literature or the ASTM Specifications does it say that a pipe can be properly installed into a narrow trench. Although we agree that irrigation district pipes are not buried deep, one must not forget they are empty for over half of the year. For this reason the pipe should not be installed in a "narrow" trench with inadequate placement and compaction of the haunching and initial backfill. In the worst case where there is no material or voids in the haunching, the pipe could fail by buckling when it is empty.

In conclusion, one cannot overemphasize the old English saying that an ounce of prevention, meaning good pipe installation practices, is worth a pound of cure. ■



Buckling Failure

UPDATE:

Fabriform Chutes Looking Good

Since its introduction in 1980 on the Imperial Spillway in the Eastern Irrigation District, the Fabriform chute has been used for rehabilitation of at least eight spillways in four irrigation districts. Fabriform chutes were first reported in the Water Hauler's Bulletin in the Summer 1981 (Volume 4) and again in the Winter 1984 (Volume 14) when an assessment of its durability was made.

As in the past articles we continue to be impressed with the effectiveness of the Fabriform chute in dissipating energy and handling winter flows and ice buildup. We reasoned it would last a very long time, but promised to update our readers from time to time.

On a recent inspection of all eight spillways, we found only two with minor problems.

One of these spillways — H-B Spillway in the Bow River Irrigation District has one transverse crack at the lower end. The crack appears to be due to the fact that the elevation of the Fabriform chute at the end is about 0.5 m higher than the invert of the Enchant Drain (the chute's outlet). This elevation difference has apparently caused the earth foundation below the concrete mat to slough. The resulting movement apparently caused the crack, but does not affect the structural integrity of the rest of the chute, or affect the performance of it. Should this lower portion of the Fabriform break off, the structure should perform just as well with no danger to the rest of the structure.

Lethbridge Airport Spillway

The Lethbridge Airport Spillway has some longitudinal cracks on its side slopes. These are on the central length of the chute and cracks have opened enough to tear the fabric. The width of the cracks are about 3 to 4 mm except one which is about 6 to 8 mm. These cracks are above the watermark and they do not appear to seriously affect the soundness of the chute. Now that they have developed and torn the nylon fabric, we wonder whether there will be more cracks appearing, and if the existing cracks will open more.

We are happy to report that, for the remaining six Fabriform spillways, there is no serious deterioriation since the 1984 inspection. The nylon fabric appears to be holding fast with very little evidence of degradation. If there are cracks in the unreinforced concrete, we cannot detect them because of the nylon fabric cover.

Common Brome grass growing in filter point of the Lethbridge Airport Spillway

In some of the filter points, weeds have established, but their roots are actually above the synthetic filters. They appear to survive on the small amount of soil settled in the filter depressions and nutrients from the water.

The Project Planning Branch will continue to monitor the Fabriform chutes and particularly the Lethbridge Airport Spillway. A record of the length and approximate width of the cracks will be kept and monitored periodically for change/no change.

As time continues to march on, we are becoming more confident that Fabriform chutes are a viable alternative, and require only a minimal amount of maintenance. ■

THE LAST OF THE MOHICANS ABOUT TO RETIRE

It's been a short 36 years with the Taber Irrigation District says Ken Anderson, the dean of irrigation district managers. Anderson, who will retire in June, started as assistant manager in June of 1951, under manager Ted Sundall.

Under Sundall, and the "pioneer board" as Anderson terms it, he states that "I gained an education no university could match. My education was at the feet of men who really knew how to serve, used their word as their bond, were far-seeing, and knew where they were going."

The past 18 years he has served the second generation board members. Board members who have been rehabilitating their forefather's original irrigation works built in the early 1900's. This board has taken the lead in important rehabilitation decisions and moved the District into the high tech era.

Anderson has served three generations of farmers and has seen the Taber Irrigation District grow from 21,500 (8700 ha) irrigable acres to the present 74,000 acres (29,960 ha). He has been a member of the Alberta Irrigation Projects Association (AIPA) for 36 years and was recently honored with a Water Wheel Award and a life membership in the association.

Photo: Taber Times

Anderson doesn't regret the dozens of long hard trips to Edmonton to champion the cause of irrigation when he sees the fruits of his labor today. There are no doubts left in his mind of the benefits of irrigation to our province and the rest of Canada. His love for irrigation and the T.I.D. are obvious, and it is with a note of sadness that he is retiring.

He feels it is time to retire because of ill health (failing eyesight). His one regret is that he will retire before reaching his goal of 40 year's service to his farmers. But he takes pride and great satisfaction in the state of the T.I.D. today.

Ken states "The best aspect has been working with men who were really dedicated to this area. It's been a privilege to serve irrigated agriculture and the fine people of Alberta."

The Taber Irrigation District Board will be honoring their retiring manager sometime in June. ■

CONGRATULATIONS ALLAN HERBIG

Congratulations to Mr. Allan Herbig, P. Eng. on your appointment to the position of Manager of the Taber Irrigation District.

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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