Fourth report of the Wisconsin State Drainage Association. Containing the more important proceedings and extracts of some of the papers and discussions from January, 1918 to December, 1920. 1920

Wisconsin State Drainage Association
[Madison, Wisconsin]: The Association, 1920

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FOURTH REPORT

OF THE

Wisconsin State Drainage Association

Containing the

Proceedings

From

January, 1918, to December, 1920

Fourth Report

of the

Wisconsin State Drainage Association

Containing the more important proceedings and extracts of some of the papers and discussions from

January, 1918

to

December, 1920

Edited by the Secretary

and

O. R. Zeasman

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Upon request, copies of the Third and Fourth Reports will be sent to any person or firm interested in land drainage. Send us the names.

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NOTE THESE DATES!!

PROGRAM

SEVENTH ANNUAL CONVENTION
WISCONSIN STATE DRAINAGE ASSOCIATION

Room 106 Agricultural Engineering Building
Madison, Wisconsin

February 22, 23 and 24, 1921

Informal meeting at Capitol Hotel at 8:00 o'clock Monday evening, February 21.

TUESDAY, FEBRUARY 22

9:00—Back Water from Dams on the Wisconsin River, H. V. Tennant, Drainage Engineer, Portage, Wisconsin.

Should not Benefits be Determined by the Cost, Rather than the Cost by the Benefits? E. R. Jones, State Drainage Engineer, Madison, Wisconsin.

Reports of Committees.

2:00—Drain Tile—S. H. McCrory, Chief of Bureau of Drainage, U. S. Department of Agriculture, Washington, D. C.
Investigations with Cement Tile, G. R. B. Elliott, Drainage Specialist, College of Agriculture, St. Paul, Minnesota.
Reports of Committees.

6:30—Banquet at Capitol Cafe ($1.00 a plate).

WEDNESDAY, FEBRUARY 23

9:00—The State and the Home Seeker—B. G. Packer, Commission of Immigration, Madison, Wisconsin.

Experience with a Small Dredge—B. M. Apker, Drainage Commissioner, Chetek, Wisconsin.

Are Our Drainage Laws Perfect?—B. M. Vaughan, Drainage Attorney, Wisconsin Rapids, Wisconsin.

2:00—How Much Land in Our Drainage Districts is Now Cultivated?—O. R. Zeasman, College of Agriculture, Madison, Wisconsin.

Standard Forms Needed by County Drainage Board—Nye Jordan, Juneau County Farm Drainage Board, Mauston, Wis.

Extending Credit for Tile Drainage—James A. Reeves, Streator Drain Tile Co., Streator, Ill.

Election of Officers.

7:00—Theatre.

THURSDAY, FEBRUARY 24

9:00—Tiling Different Kinds of Soil—Carl Foll, Farmer, Deerfield, Wis.

Cost of Tiling—Orlando Holway, Drainage Engineer, Neillsville. Wisconsin.

Announcement of new committees.

11:30—Adjournment.

Give this program to the editor of your local paper and ask him to publish it and urge farmers interested in drainage to attend the convention. Everybody is invited to every session.

FOURTH ANNUAL CONVENTION

Madison, February 4, 5 and 6, 1918

The convention was held in conjunction with the annual Farmers' Course of the College. It was the chief attraction of the course for Monday afternoon, February 4. The program of the Soil Improvement Association was the center of interest on Tuesday afternoon. Agronomy and Animal Husbandry held the center of the stage for the remaining afternoons of the week but the Association continued its drainage program at forenoon meetings, and late afternoon meetings until Thursday, when the convention adjourned. Some of the members remained at the Farmers' Course until the end of the week.

The report of the secretary and treasurer as audited by the auditing committee showed a balance of $23.80 in the treasury.

Extracts and summaries of the addresses follow:

DRAINAGE AND NATIONAL DEFENSE

Professor J. A. Jeffrey, Duluth, Minn.
Agricultural Commissioner, D. S. S. & A. Ry.

We are living in days of pithful expressions. "Save the waste and win the war" is one of them. To me that means "Save your crops from drowning, and you'll save civilization from perishing." Save the crop on the wet spots in your wheat field and you'll put yourself and the world "Over the Top."

The average American farm is probably not more than 50 per cent efficient. Part of the loss is chargeable to mismanagement, and part of it to the soil and its condition, including poor

drainage. There is no better way of proving what we are losing by poor drainage than to give specific cases where men have gained by good drainage.

Some years ago a large area of clay lands in northern Indiana was said to have become practically worthless for agricultural purposes. A Scotchman, knowing the value of tile, purchased a tract of this land. He purchased a tile machine, made tiles from the clay, tiled the land and became rich from what the land produced. The soil had become difficult to manage, and unproductive because nature had provided no way for the quick removal of excess water, and because of improper tillage. The installation of a successful tile system removed the excess water rapidly and nature and good management did the rest.

Large areas of low land which may function well in normal seasons, producing large crops, may fail partly or wholly in abnormally wet seasons and sometimes when subjected to but a few weeks of excessive rainfall. On portions of the Saginaw Valley, in Michigan, in 1916, thousands of acres, set apart for sugar beets, remained unplanted because excessive rains made it an impossibility for horses to be driven over them during what should have been the planting season.

On portions of the same valley that year lands originally wetter, but provided with drainage systems yielded excellent sugar beets.

In 1897, in the Red River Valley, thousands of acres of wheat and other grains were destroyed during a period of excessively rainy weather, beginning the last week in June. Since then reasonable surface drainage has been developed and these lands have produced excellent yields of grains on years wetter than 1897 was.

On fields of fairly heavy soil a few low spots or an occasional low area will prevent the complete preparation of the field for the sowing of the crop. In some cases the farmer will delay the preparation of the higher ground until the lower areas are in condition to work. This delay in the early tillage of the upper areas results in excessive drying which in turn renders these upper areas impossible of proper preparation. In this case lack of drainage on the low spots must be charged with reduced yields and loss of labor on the entire field.

A single wet spot may occur in a field well up on the slope

or it may occur at the highest point in the field, which, in an unusually wet season may not become sufficiently dry to plant and is therefore, not only unproductive for the season but may have had a considerable amount of work previously bestowed upon it which is also lost.

Low spots and higher springy spots, both permanently wet, are also permanently non-productive and yet, around these, or over these, teams and machines must pass in the operations upon the rest of the field, with the resulting loss of time and of crop. These wet spots are not neutral. They are enemies.

Large, low areas, permanently wet, and small shallow ponds frequently exist which, if drained, would furnish at least good pasture, and thus release other lands for crops.

Mr. James N. McBride, Head of the Department of Markets of the Michigan Agricultural College, and himself a practical farmer says, "The effort to increase the food supply is nullified to probably 25 per cent by lack of adequate drainage. Unoccupied land involves no large, if any, outlay, while seed and labor are applied unprofitably on land subject to wet weather losses. As a rule, these wet areas are exceedingly fertile in plant food, and are so near the profit point that an occasional favorable season lures to their continued cultivation without drainage. An accounting of gains and losses would probably leave the balance on the side of actual losses."

Professor E. O. Fippin, in a recent article in the Country Gentleman, says, "Thousands of acres of beans in New York state, planted with seed that in some cases cost twelve to fifteen dollars a bushel, will be good only for green manure. Late planted corn is frosted. Could it have been planted early, on well drained, warm land, it might have reached maturity before the frost came. . . . . The public has thought only of the reclamation of the almost totally waste swamp lands and has overlooked the great need for drainage of land already in farms and under cultivation in a half profitable way."

In 1914, R. D. Marsden, of the office of Drainage Investigations, in an article, "The Economy of Farm Drainage," says, among other things, "In Iowa a field of 40 acres too wet for planting was tile drained at a cost of $24.00 per acre, after which it produced 60 bushels of corn per acre. Another field was drained at $23.00 per acre, thereby increasing the yield from 15

bushels to 40 bushels of corn per acre. Owners have found that tile drainage has reduced the cost of farm operations 20 to 50 per cent. So the increased production of land cultivated previous to drainage is clear profit."

Ten years ago the Secretary of Agriculture, in his annual report said, "It is estimated that there are one hundred fifty million acres of occupied land whose production would be increased 20 per cent without additional labor in management or cultivation, were it judiciously drained." This would mean, very roughly speaking, an increase of from six hundred million to one billion bushels of food stuffs annually, assuming that these lands would be used in the production of food.

We cannot drain all of this in one year, or two years. But we can yet increase the crop yields for 1918 by better drainage. That increase will help to win the war.

TILING MACHINES

A. W. Dibble, Madison, Wis.

Since I have had experience with but one make of tiling machine, I shall confine my remarks to its construction and operation rather than to a comparison of different makes of machines.

The tiling machine is mounted on a set of apron or caterpillar wheels which enable it to work on ground too soft for teams to travel. The power for propelling the machine and digging the ditch is furnished by a gas engine. The digging is done by buckets fitted to a wheel which revolves as the machine moves forward. The dirt is discharged on a conveyer which deposits it along one side of the ditch. The bottom of the ditch is left smooth by a shoe. The tile are laid with a hook just back of this shoe and inside of a shield, which prevents the sides from caving until the tile are laid.

The digging is done according to grades established by survey. The engineer figures the height to set the targets above hubs set every 100 feet above the line. These targets are set by an assistant while the operator is moving the machine back.

A machine operator should be something of a mechanic. He must also have a good eye, and the power to concentrate his mind on the work all the time. He must not be afraid of dirt, grease, wet feet or an occasional mud bath. Tiling marshes in

Wisconsin is not a lady's job. In addition to the operator, at least two helpers are needed with a machine. One lays the tile and the other is a general handy man.

Among the chief difficulties encountered in tiling machine operation are the following:

1. Very wet ground and spring holes. In springy marshes two hand tilers can with profit be kept on the job digging the lines where the machine would have difficulty when wet spots must be crossed. I have found it desirable to bridge ahead of the caterpillars with oak boards about 6 feet long or long willow brush. I have developed considerable respect for innocent looking old ditches and find that it pays to bridge them with poles.

In spite of ordinary precautions the machine will occasionally mire. I have found that a machine can pull itself out of most holes by means of two cables. One end of these is attached to the apron wheels and the other ends to a dead man buried ahead. On two occasions we were so badly mired that the apron wheels merely tilted upward as we pulled on the cables. We detached the digging wheel and attached the lifting cables to the dead man and pulled the machine out by the four cables.

2. Willows are frequently encountered, but up to a height of 10 feet, are not troublesome. The line of sight must be cleared of brush but the roots are no serious obstacle to the digging wheel.

3. Stony ground makes operation quite difficult, but not impossible. Stone of a diameter less than 10 inches will be brought up by the digging wheel without damage to the machine. Smaller stone give more trouble because they fall back into the digging wheel. The digging wheel cannot handle gravel. Of course when large rock are encountered the wheel has to be raised over them and the ditch completed at that place by hand. I have never broken anything more serious than a link in a chain.

4. Very sticky soil is hard to handle. Peat is the ideal soil to handle with a machine. Ordinary clay will handle very well but the work cannot be done so rapidly. I have been compelled to quit only one job because the clay was to sticky for the machine. In this instance the machine pulled so hard that the traction afforded by the slippery ground was not sufficient to move the machine forward. Running sand can be handled suc-

cessfully, but one must have extra help to place the tile quickly and hold them in place while weighing them down with black dirt.

From experience I would estimate cost of operation and upkeep on the following basis: 20 gallons gasoline per day; one-half gallon lubricating oil per day; 2 gallons black oil per day. It is well to use plenty of cheap black oil. If the chains and gears are kept thoroughly lubricated the life of the machine will be doubled or trebled. The only part that cannot be lubricated and is bound to wear are the sprockets that drive the digging wheel. These wheels work in mud and grit and a set of them will be worn out in digging about 15 miles of ditch.

The tiling machine has 4 digging speeds ranging from 3 to 10 feet per minute, and a road speed of 2 miles per hour. Under average conditions these machines can dig from 60 to 150 rods rods per day.

I have had considerable experience with many kinds of farm machinery including grain binders and tractors but I know of none which will perform the work for which it is designed more efficiently or economically than the tiling machine.

DRAINAGE DEVELOPMENTS IN WASHINGTON COUNTY AND VICINITY

C. F. Leins, West Bend, Wis.

In eastern Wisconsin tillable upland is worth from $125.00 to $200.00 per acre. The marshes consisting of clay, muck, and peat are usually very fertile when drained and properly managed. These marshes as a rule are parts of adjoining developed farms. The farmers of the locality are thrifty as a class, and try to make use of every foot of arable land. These conditions make a fruitful field for drainage. Many have attempted to drain by means of capstan plow ditches, but nearly all who have done this have been disappointed in not getting the thorough drainage they expected. Others have tiled their wet lands into natural outlets. Still others were not so fortunately situated, and were compelled to put in outlet ditches before they could tile.

I have had the fortune, or perhaps you would call it misfortune, to serve as a commissioner in the five districts organized in Washington and adjoining counties.

The first of these districts, Belgium-Holland No. 1, was completed three years ago. On this job we of course made some of the mistakes that inexperienced commissioners are heir to, but taken as a whole we have a pretty good ditch. The crops raised in this district as a result of drainage materially improved the sentiment for drainage in the locality.

The other four districts are completely organized. On two of them construction work is in progress now, in the third district, the Belgium-Holland No. 2, the dredge is on the job ready to begin work in the spring. In this district the ditch furnishes outlet for the sewage system of the village of Belgium, subject to the approval of the state sanitary engineer.

The maximum cost per acre for the main ditch in these districts is as follows:

Belgium-Holland No. 1	$36.00 per acre
Belgium-Holland No. 2	25.00 per acre
Jackson-Germantown	21.00 per acre
Hartford-Addison	20 00 per acre
Rockford-Polk (estimated)	25.00 per acre

The cost of tiling, clearing, etc , added to the cost of the outlet, frequently brings the total cost of reclaiming this land up to $75.00 per acre. Reclamation of our marshes even at this price is a good investment.

Most of this land will be cropped as soon as drainage makes it available, but only a few of our farmers know how to manage marsh land successfully. The drainage and development of marsh land could be greatly stimulated if a demonstration field were conducted under expert direction in each of our drainage districts. In this way farmers could observe what good drainage does, and note the kind of crops which are adapted to growing on drained marsh lands. They would be convinced that good drainage pays but that the money spent for makeshift ditches is usually thrown away.

BIG TILE IN PLACE OF OPEN DITCHES

A. K. Reindahl, Madison, Wis.

The Starkweather Drainage District contains approximately 3,000 acres of what formerly were marsh lands and is located immediately east and northeast of the city of Madison.

It consists of two distinct areas, each drained by a main ditch called the east branch and the west branch respectively. These two main ditches converge near the outlet forming one main ditch until it reaches Lake Monona. This main ditch, together with the west branch, form the eastern boundary line of the city of Madison.

Some of the lands in this drainage district lie within the city limits, but by far a larger part of it lies immediately northeast of the city.

This drainage district has 10 or 12 laterals varying from half a mile to two miles in length. Most of them empty directly into the main ditches. These laterals have a theoretical bottom width of three feet, a slope of one to one and an average depth of six feet.

Owing to the delay and inability of the drainage contractor to complete his work we induced the property owners affected by three of these laterals to substitute large tile in the place of these open ditches. They did very reluctantly. These tile drains have given almost perfect satisfaction. Most of the marsh land adjacent to and affected by them has been tiled by the farmers. It has been apparently an inducement to them to tile their land. Of course, these large tile drains are of no particular benefit unless the lands affected by them are tiled, but farmers should expect this.

The open lateral ditches, on the other hand, have not given satisfaction. They fill up with mud and sediment, grow full of weeds, are unsightly and besides waste considerable land, especially where we were not able to locate them on the boundary lines of the farms. Until we substitute large tile drains in the place of cleaning them out they will be a constant source of trouble and expense. The farmers now are all wishing we had put in large tile in the place of these open ditches.

If we had this work to do over again I am sure we would put in large tile instead of these open ditches in every instance except in the lower end of one of them where the water backs up from the lake into the ditch. Even now where we have tiled this land we have already abandoned two of these open ditches and in the place of cleaning them out we have put in large tile in their place, and it costs more to put in the tile now than it would have in the first place.

More land has been tiled and put under cultivation in this drainage district than in any other drainage district in Dane County. I may safely say that at least three-fourths of it has been tiled and a large part of it put under cultivation. About 1,000 A. has been tiled by two organized sub-districts.

The first one of these sub-districts is called the Orchard Farm Gardens. It consists of a tract of level land three-quarters of a mile in width and a mile and a half in length, containing 680 acres of land. It is located two miles from the city of Madison. It is all tiled and under cultivation. Immense crops of all kinds of garden truck and small grain are raised on it as well as various other crops.

From my experience as a drainage commissioner I would like to emphasize the following points:

Eliminate as many of the lateral ditches as possible and put in their place large tile drains. If surface runs are necessary for taking care of the flood waters they can be made better and more cheaply with a Martin grader or an ordinary road grader. They should be made wide and comparatively shallow with a sodded bottom.

BREAKAGE OF TILE IN SHIPMENT

James A. Reeves, Streator, Ill., with Streator Drain Tile Co.

Car shortage has increased the breakage of tile in shipment. Dilapidated stock cars and box cars unfit for general merchandise have been given us. Furthermore we have been forced to load heavily.

As a great many manufacturers make their prices f.o.b. factory it is easy to see how important the subject of breakage becomes to the consumer, and it is therefore only fair to supply figures showing about what the breakage in shipping amounts to.

All manufacturers should take precautions against unusual damage by properly crating and packing, and there have been certain definite regulations established by classification committees as to how this should be done. Special representatives call on manufacturers at frequent intervals suggesting how improvements in plans can be effected. The drawback is, that in their plans tile are tile, regardless of size and kind of material they are made from. What may insure better results with some

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ware may not with another, and in fact work a hardship on the shipper, causing enough extra unnecessary expense to actually bar him from certain markets.

I cannot speak for manufacturers generally as to methods of packing and crating, but I can show you by means of Blue Prints just how the concern I represent prepares cars for shipment. We have drawings showing manner of loading each size up to 30 inches in diameter and I will gladly allow you to examine these drawings carefully.

A great deal of lumber and straw is used to properly protect the tile. The cost of packing and crating has tripled within two years and is a considerable cost item which must be considered in making quotations. The farmer can usually salvage the material used in crating and it can be hauled out with the tile at no extra expense. In most cases it is worth much more than his loss through breakage.

From our records we find that in shipping 1,441 cars of tile during eleven months of 1917, our breakage amounted to $2.77 per car. The claims made by us and paid by the carriers amounted to $1.99 per car, leaving a net loss to us of 78c per car. It must be taken into consideration, however, that 75 per cent of our shipments were tile 12 to 30 inches in diameter. Breakage on small tile should amount to very little.

As our company has discontinued making allowance for breakage, claims would now be made by the consignee and the above figures could therefore be assumed to represent just what breakage in transit would mean to the purchaser.

Claims when filed should be accompanied by copy of the invoice, bill of lading and paid freight bill with railroad agent's notation verifying amount of breakage, or in the event of there being no agent an affidavit supporting claim, together with bill of lading and freight bill must be furnished.

It is not the long hauling which causes excessive breakage but the frequent switching of cars and rough handling due to unusual traffic conditions where trains are overloaded.

Considering the tremendous influence of drain tile on any community and increased crops and consequent increased industrial activity resulting therefrom, it is hardly conceivable that railroads would desire to put into effect restrictions that would interfere with the movement of drain tile into any locality needing drainage.

PAY YOUR DEBTS PROMPTLY

Percival Brooks Coffin
Room 311 New York Life Building, Chicago, Ill.

To get the best results from a dairy farm, you must keep your cows contented and happy; similarly, to get the best price for your drainage district bonds, you must keep your bond holders contented and happy.

When a drainage district issues bonds with which to borrow money for corporate purposes, these bonds are payable to bearer and bear coupons which are in fact notes that fall due once every six months, and represent the interest due.

These bonds are distributed by bond dealers who must satisfy the man with money to invest that he is purchasing a bond which will not alone keep his money safely, but will return him his interest promptly when due.

After these bonds have been sold, they pass by delivery and it is almost impossible to uncover the ownership of the bond. I mention this because at times drainage district commissioners want to know if we cannot tell the owners of the bonds why their interest has not been paid.

These bonds are often purchased by men who are living on their income and spend months away from home. They leave the coupons that fall due with a Bank, the Bank forwards them for collection and sometimes word is returned that taxes have not yet been fully paid in and they have no funds at that time, but hope to have within sixty or ninety days. The bank that collects them merely files this information, and when the owner returns he finds that he has not received the interest, and sometimes finds that he has drawn against these coupons for cash expenses, and there have been no funds in bank to pay his own checks. Naturally he is disgruntled and tells all his friends not to buy a drainage bond because you can't tell when you are going to get your interest, they are safe enough, but they are a nuisance.

Then again, a trust company buys these bonds to distribute amongst small trusts which they hold and when interest is not paid promptly, then a report must be made to the court and the company is censured for making such purchases. Here again,

if this thing happens once, a trust company declines to purchase drainage bonds again.

It is just as easy to send your money to the bank where the coupons are payable ten days before they are due, as it is ten days after, and drainage commissioners cannot be too careful to see that this is promptly done, and not let it be known when inquiry is made that the Commissioners have not held a meeting for three months, or are at that time scattered over three different states,

There are times when a district is short of money, but the taxes are in process of collection and a plain statement of facts made to the local bank will almost invariably induce them to advance the money to pay the coupons and to carry the same at their current interest rate until taxes are collected.

Please remember, that if you fail to pay interest on your bonds, either through carelessness or for any other reason, that thereby you limit the market for bonds and make other drainage districts pay high interest rates for the bonds they want to sell.

The bond dealer who is working for your interests in this matter, cannot help you unless you give him loyal support.

Therefore, I am today urging you, as commissioners, to take care in handling your financial affairs and to meet your obligations promptly.

SUB-DRAINAGE IN ROAD CONSTRUCTION

W. P. Graham, Rochelle, Ill.

Experience has taught us that, as a rule, the greatest destruction to our roads in this country occurs during the winter and spring months by the freezing and thawing because of the moisture in the ground at that time.

During the spring in very wet localities, high water level is a destructive element, causing the foundation to give way.

In contrast to this condition, we find that in most localities in July and August when the ground is usually very dry and the water level is low the destruction to our roads from any kind of traffic is not very great.

From these conditions we have a right to assume that there are fundamental principles in road building that must be recognized in all types of road construction.

This fundamental principle has been partly recognized by road builders, and the remedy, as they have seen it, was to grade a road, thereby providing surface drainage only at the side of the road, and then of late years, since oiling has come in vogue. the surface of the grade has been waterproofed by some kind of oil.

This, in my judgment, is beginning at the top and working down in road building, and in many instances it has proven so by the graded oil road giving away in the spring of the year because of too much water below, lying close to the surface, which affects the foundation and consequently the road.

This can all be avoided on any type of road, no matter how wet, by the use of tile 3½ to 4 feet in the ground to sub-drain the road-bed.

How to Drain

The proper way, then, to tile a road is to place a string of 5- or 6-inch tile 3½ to 4 feet deep parallel with the road nine feet from the center on both sides, taking these tile to nearest possible outlet, then grade the road, with 50 per cent less crown than you would if the road was not tiled, allow the grade then to settle for one year or more, keeping it dragged, then sweep it well and oil it and you have a 365-day road for all time with a small cost in maintenance, for the 18 feet between these tile will get drier and harder every year. In five years the moisture is practically eliminated from the 18 feet of ground and consequently during the winter months very little frost will enter this part of the road.

When you have produced such a condition, and it is absolutely possible to do this, you have the highest type of dirt road construction, and there is no road better to drive on than a good dirt road. And should one want to make a hard road of this you have the very best foundation and will need only half as much material to build the hard road, thereby eliminating a lot of expense, to say nothing about a good dirt road until such a time as the hard road is necessary.

The Cost

You doubtless will say that such a plan is all well and good, but it costs too much. Such is not the case, for I have sub-drained several miles, then with the grading and oiling, taking into account different prices of oil, have expended less than

$1,500 per mile. This is based on the present high cost of everything. Under ordinary conditions, when worked down to a system it can be done at much less. I am trying now to work out such a system, but of course have no control over the high cost of material and labor.

I feel confident that if this system had been used a few years previous to the present agitation for high-cost-per-mile road construction, it would have saved the taxpayers millions and millions of dollars, and we would have had good roads, too.

As an example, we had one mile of hard road in our township with a quicksand bottom, and for many months of the year this road was in a frightful condition because of the quicksand filling with water, consequently weakening the base and destroying the road. The taxpayers found it impossible to keep this road in repair. I tiled this road with two strings of tile 18 feet apart, scarified the surface, and added to the surface a small amount of stone, more to clean it than anything else, so I could use an asphalt dressing. Then I rolled it well and asphalted the top. It has been in use two summers and two winters, with very heavy traffic, and they have not made a mark in the road. The resurfacing cost only $1,800 per mile on an average haul of three miles. I could duplicate this job for $350 less per mile, as this was my first experience.

The results obtained here can be obtained on any type of dirt road in any locality.

I believe the thinking people of today who are following this road question are almost satisfied that a brick construction on a much-traveled road is practically the only road that will hold up outside of dirt when a dirt road is dry. For this reason this road question, in my judgment, resolves itself to this, that if we will tile our roads and then grade them and allow them to settle two years and oil them we will have the best roads in the world until the time comes when we can afford the brick, and on much traveled roads the brick road will eventually be put in. Thus if the dirt road has been sub-drained previously the brick road when built will have the most satisfactory foundation possible.

We want to emphasize the necessity of the farmers keeping constantly in mind and to strongly insist when the subject of good roads is under consideration in their community, that the

all important item in good road construction—proper subdrainage, is adhered to.

Remember this, if you can keep 3½ to 4 feet depth of road dry 365 days during the year, that is all that is necessary to have a good road. The hard surface road will do away with the oil and especially if it is brick it will be dustless and almost everlasting, giving the horses a sure foothold and insuring easy traffic during all seasons of the year.

Surface drainage is all right so far as it goes, but does not prevent the water level from getting nearer than four feet from the traffic line. Subdrainage absolutely prevents this in time.

We must admit that moisture and frost are the two elements that destroy a road. By sub-drainage and waterproofing surface we eliminate both these factors. We must have sub-drainage to keep the bottom or foundation dry and an oil coating or a hard surface to keep the top dry.

One string of tile under the center of the road is not sufficient simply because it draws the water to the center. A string of tile on either side of the road-bed draws the water away from the road-bed.

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GRAND RAPIDS FIELD TRIP

July 25, 26 and 27, 1918

The first session was at the old City Hall in Grand Rapids (now Wisconsin Rapids) at 8 p. m. on July 25. According to a previous announcement, discussion centered around the proposed drainage legislation. These members of the special legislative committee were present:

Senator Isaac P. Witter, Grand Rapids,
Assemblyman S. R. Webster, Columbus,
Assemblyman Ed. Nordman, Polar,
Assemblyman W. R. Chipman, Morrisonville,
Assemblyman H. A. Stone, Oregon.

The other two members of the committee, Senators Everett and Huber, were not present. There were thirty-nine members of the association present. Senator Witter was made chairman of the informal meeting and Frank W. Lucas was made secretary. B. M. Vaughan, a member of the special committee appointed by Governor Philipp to redraft the drainage laws, was called to explain some of the important changes proposed.

PROGRESS IN DRAINAGE LEGISLATION

B. M. Vaughan, Attorney, Wisconsin Rapids, Wis.

One of the first jobs that the State Drainage Association tackled was a revision of the drainage district law pased in 1905. The law was always cumbersome and by 1915 it had been so amended and patched that some parts of it were conflicting.

In the Legislature of 1915 Senator Everett introduced a bill which condensed, clarified and broadened the existing law. The bill embodied the recommendations of the State Drainage Association, but the Legislature did not find time to act on it. It disposed of it by referring it to a special committee of the legislature, to report two years later. This committee reported favorably on two bills that were passed by the Legislature of 1917. One was the Drainage District Law and the other was a new Farm Drainage Law. Both of these bills were vetoed by the governor, who discovered several minor errors in both bills. The governor agreed, however, to include drainage legis-

lation in the call for a special session of the Legislature to be called in January, 1918. The governor did his duty, but the special sesion was so short that there was no time for a consideration of the drainage bills. The drainage bills were referred to another special committee, five of whose members are here tonight.

In the meantime, the governor had appointed the following committee to prepare a bill for the special session: Frank Hanson, Mauston; C. D. Rosa, Beloit; B. M. Vaughan and Theodore Brazeau, Grand Rapids; P. J. Myers, Racine; J. F. Mayer, Richfield; and F. W. Lucas, A. R. Whitson and E. R. Jones, Madison. This committee met first on Oct. 5, 1917, and organized by electing Brazeau chairman and Jones secretary. The work of drawing the bill fell largely upon a sub-committee consisting of the chairman, the secretary and Myers, Lucas and Vaughan. Judges Werner and O'Niell and Messrs. Nash, Thorn, Brown, Sanborn, Coddington, Pratt, Anderson and VanAlstine presented their views to the sub-committee, which worked about twenty days on the bill that was printed for the special session and is now being considered by the special committee. Copies of the bill have been supplied to all members here tonight.

The following comparison may be drawn between the present laws and the proposed bills:

The Drainage District Bill

PRESENT LAW	PROPOSED BILL
1. Not systematically arranged. Conflicting and ambiguous sections.	1. Ambiguous parts cleared up. Condensed and systematized.
2. Petitioners must make a preliminary survey and the map and detailed plans must be a part of the original petition. The difficulty with which the petitioners as individuals can get the survey made has caused delays and inefficiency. The hearing on the petition is also a hearing on the merits of the proposed work. This combined hearing promised to shorten the proceedings, but it is so difficult for the petitioners to get the proper evidence	2. The petition includes merely a general description of the drainage works desired. The hearing on the petition is confined to the sufficiency of the petition to give the court jurisdiction. With jurisdiction established the court appoints three commissioners to make a preliminary survey and plans. The commissioners have better facilities than land owners for making the survey, and the report on benefits. Upon hearing this report the court grants or-

before the court to determine the merits of the proposed work that delays have resulted, particularly where many small land owners are involved.

3. Petitioners must include in the petition an advisory report of the College of Agriculture on the quality of the soil and the feasibility of drainage. The report is not prima facia evidence and there is nothing to prevent the less feasible districts from proceeding in spite of the adverse report of the College. Neither is there a check on the final plans.

4. Surveying and engineering done by an engineer who is engaged by the commissioners but whose work is not checked.

5. Assessment of benefits made by commissioners, and reviewed by the court. Remonstrances tried by a jury.

6. No provision for purchasing dams. Most of these dams create water power more valuable than the land damaged. These should remain. But even where the water power is poor, and the backwater causes great damage to agricultural land, farmers are not permitted to purchase and remove such dams.

7. Remonstrances must be filed five days before the day of hearing.

8. Mortgagees not notified. The drainage tax becomes a prior lien without giving the mortgagee an opportunity to be heard.

ganization to the district or dismisses it, accordingly as it finds that the benefits will or will not exceed the costs.

3. Commissioners must include in their preliminary report a report from the State Engineer on the feasibility of drainage and the quality of the soils. The State Engineer shall call on the College of Agriculture for the report on the soil but he is left free to act more as a police officer than it is possible or prudent for the College of Agriculture to do alone. The report is also made prima facia evidence.

4. Surveying and engineering done by an engineer who is engaged by the commissioners but approved by the State Chief Engineer.

5. Same as now except that the report of the commissioners is reviewed by the chief engineer before it is given to the court.

6. Purchase of dams is referred to the Railroad Commission with power to determine whether or not any public rights will be materially injured by the removal of the dam. In case the Railroad Commission permits the purchase of a dam the owner shall be fully compensated for his property.

7. Remonstrances may be made on the day of the hearing, thus giving the remonstrants a better opportunity to present their objections.

8. Mortgagees whose mortgages containing their address are on record, to be notified either in person or by mail.

9. No provision for pumps.	9. Pumps provided for where necessary.
10. Contains 25,000 words.	10. Contains 18,000 words.

The Farm Drainage Bill

The Drainage District Bill does not conflict with or take the place of the proposed Farm Drainage Bill. The former is desired for the larger and more complicated projects and the latter for the smaller and simpler ones.

The proposed Farm Drainage Bill repeals the (1) Town Drain, (2) County Drain, (3) Mine Drain, and (4) Swamp Drain laws and consolidates the essential features of them all into one law. The County, Mine, and Swamp Drain laws have been used but little and the Farm Drainage Bill is drawn broad enough to provide for the organization of any small drainage project for which those laws were intended.

At present, most of the smaller drainage projects are organized under the Town Drainage Law, which has many weaknesses. The Farm Drainage Bill seeks to overcome these weaknesses as the following comparison may show:

Comparison of Present Town Drain Law With the Farm Drainage Bill

TOWN DRAIN LAW	PROPOSED FARM DRAINAGE BILL
1. Six freeholders in the town, only one of whom need own land affected by the proposed drain, are all that are required on the petition for the drain.	1 A majority of the land owners affected by the proposed drain or the owners of a majority of the acres, are required to sign the petition.
2. Petition addressed to Town Board consisting of the town chairman and the two supervisors elected usually for one year.	2. Petition addressed to county drainage board of three members appointed by the county judge for three years.
3. There is no supervision over the action of the town board. It is not required to engage a competent engineer, either for designing and laying out the drains or for inspecting the work of the contractor.	3. The county drainage board may act without supervision on areas of less than 200 acres. On the larger areas the engineer of the board must work under the direction of the state chief engineer who must report on the feasibility of the project.
4. No public hearing is required on the assessment of benefits or	4. Notice of assessments and awards is served upon all own-

award of damages before they are enforced. With but little experience and no supervision town boards have enforced many unjust assessments.	ers and mortgagees of land affected. The county judge shall order a revision of the assessments if he finds them to be unjust.
5. Town Treasurer handles the funds.	5. County Treasurer handles the funds.
6. Few definitions and no legal forms for notices or assessments. Aid of an attorney necessary.	6. Ample definitions and simple forms for the guidance of the county drainage board without attorney.
7. No provision for supplemental drains where certain parcels of land are not given an adequate outlet by the original drains.	7. Supplemental drains provided for with supplemental benefits so assessed that each parcel of land pays proportionately for the drainage it gets.
8. The town boards are changing elective bodies.	8. The county drainage board ls a permanent public corporation appointed in county court.
9. Drainages are not co-ordinated but are haphazard—put in without reference to each other.	9. Drainages are co-ordinated and systematized.

(Later: The two bills substantially as outlined here by Mr. Vaughan were passed by the Legislature in 1919 and were signed by the governor and became effective about August 1, 1919. The Farm Drainage Law is Chapter 446 and the Drainage District Law is Chapter 557, Laws of 1919. Senators Witter, Huber and Severson and Assemblymen Webster, Chipman, Ansorge and J. E. Johnson constituted the special committee that steered the bills through the legislature.—Editor's Note.)

Discussion

DR. H. H. SHERWOOD: What provision is contained in the proposed redraft for laying out highways through districts, and could not the provisions of the proposed redraft with respect thereto be enlarged?

MR. VAUGHAN: Section 1379—18a provides that the drainage district may level a spoil bank for a road, and after it has been used for two years as a highway, the town must assume responsibilityt for it.

C. P. MELTESON: What provision is provided in the

proposed redraft for securing a right of way through lands lying between a ditch and lands sought to be drained, and what provision is made for distributing the expense?

MR. VAUGHAN: Section 1379—31e provides that at any time an owner of land not touched by a drain, but assessed for benefits, may petition for a lateral to connect his with the district drain. The commissioners must hear the petition and lay out the lateral and levy an assessment for construction upon the land benefited—even though some of the land owners may be unwilling.

C. P. MELTESON: What right has a district to assess lands unless such lands are benefited?

MR. VAUGHAN: Unless lands are benefited the land owner should remonstrate in court against an assessment by the commissioners.

E. A. MORSE: What provision is contained in the law for assessing towns for future benefits and is it possible or advisable to assess towns for future benefits?

MR. VAUGHAN: The bill provides merely for assessing towns for benefiting highways already constructed. It would be right, although perhaps not constitutional, to assess for benefits to prospective highways.

C. F. LEINS: Is the matter of securing crossings of railroad rights of way fully provided for?

MR. VAUGHAN: Yes, and we have broadened the statute so as to include crossing under power lines.

G. T. THORNE: Under the proposed redraft of the drainage law may bonds be sold for less than par?

MR. VAUGHAN: Yes, if the highest bidder bids below par.

D. H. PRATT: Is the trial of remonstrances against assessments before a jury?

MR. LUCAS: The jury trial is retained for such remonstrances. (Mr. Lucas read the section referred to.)

At 9 A. M. on the following morning about sixty members started from Hotel Dixon in autos for a country trip. They returned to the city about 6 P. M., after a 75-mile trip through the Wood County, Kert Creek, Remington, Cranberry Creek and Little Yellow Drainage Districts.

The chief thing noted was that the better crops of rye, corn, timothy and alsike were near the deep open ditches. In the

Cranberry Creek and Little Yellow districts where new deep laterals have been constructed and all ditches deepened to about 10 feet crops were uniformly good.

At noon a Red Cross lunch was served at the home of Anton Brost in the Cranberry Creek district. Mr Brost has made a fine 200-acre farm out of what was once a wild peat marsh with a few sandy islands. He has just completed a $6,000 house on his farm—paid for by crops raised on the drained marsh land. He has laid some tile to supplement the deep open ditches.

After the luncheon, and before the trip was resumed, the members of the legislature asked many questions of the farmers who were cultivating marsh lands. A resolution was adopted thanking the people of Grand Rapids and vicinity for their kindness. The following resolution was also adopted:

Whereas, the U. S. Fuel Administration has limited the coal used for the manufacture of drain tile to 75% of the amount formerly used, and

Whereas, this limitation has made drain tile scarce at a time when the nation needs them more than ever before to prevent losses of food crops in wet fields, and

Whereas, a shortage of coal encourages the burning of tile too soft to endure,

Be it resolved by the Wisconsin State Drainage Association in convention assembled,

That the U. S. Fuel Administration be urged to pursue a more liberal policy with coal for the manufacture of drain tile;

And be it further resolved that there should be a representative of the Clay Tile Industries on the War Industries Board of the Federal Government;

And be it further resolved that a copy of these resolutions be forwarded to the U. S. Fuel Administration and to such other organizations as the President of this Association may direct.

No formal evening meeting was held, but there were several round-table discussions. On the following morning about 25 members took a trip through the Portage County and Leola districts lying east and south of Grand Rapids.

PROGRAM FOR NEXT CONVENTION, PAGE 4

FIFTH ANNUAL CONVENTION

Madison, March 12 to 15, 1919

The first session was at the Capitol Hotel, Wednesday evening, March 12. The two drainage bills before the legislature then in session were the chief subjects of discussion. About 30 members were present. Again on Friday evening about 50 members met at a banquet table at the Capitol Hotel at which Frank W. Lucas was toastmaster. After the talks (and stories) Mr. E. W. Fisher presented a movie of operations on the Orchard Farm Gardens in the Starkweather Drainage District.

The Thursday and Friday sessions were in a large committee room in the North Wing of the Capitol. President C. F. Leins was in the chair. The average attendance was about 60. This included several members of the legislature. On Saturday morning the session was at the College of Agriculture.

Space does not permit the publication of all the excellent papers that were presented. Extracts of only a few of them are given here.

A QUICK WAY TO MAKE A SURFACE RUN

John H. Gault, Milwaukee

A surface run is a shallow ditch with a hard bottom and sloping sides. It carries water only during flood flow and the tile near it and deeper than it keep its bottom dry the rest of the time.

Our first flood ditch was made to remove excessive flood water from our tiled drained land near Vesper, and the other was a town drain to remove flood water from the flat land of a number of farms in the Town of Hanson, Wood county.

In this work we used a 10-20 Titan tractor and an 8-foot Russel road grader. The first round with the tractor threw out a slice of earth on either side, and on the next round the earth was shoved back from the ditch and leveled. This process was continued until the required depth and width were secured. The dirt was carried back and leveled thoroughly so that the field could be cropped right up to and even including the bottom of the ditch. I believe, however, that the bottom of the ditch should be kept in permanent hay grass sod.

This ditch when completed was approximately one rod wide and from 1½ to 2 ft. deep on the average but had a depth of from 2½ to 3 ft. at the high places. The average cost of the 260 rods of ditch was twenty-seven cents per rod.

Another surface run that we dug is known as the North Hanson Drainage Ditch. The chairman of this town board, who had a capstan plow ditch on his farm, favored that sort of drain and rather reluctantly consented to try the road grader on this job. He is now, however, fully convinced that the road grader is the proper tool to use for making a flood ditch, and is urging the farmers to avail themselves of this cheap and efficient manner of getting rid of surface water.

This 270 rods of ditch was dug at a cost of 40c. per rod. I believe that at least 5c. per rod of this cost was due to the wet spots in the line of the ditch. At the soft places we were compelled to unhitch the tractor, cross the soft spot, and then pull the grader through by means of a long chain. Some spots although not soft enough to make towing necessary, were wet enough to cause the tractor wheels to slip. In those places we made the load lighter by raking the earth from the grader blade with a manure hook.

From our experiences in digging flood ditches we have arrived at the following conclusions: (1) It is not necessary to plow the sod for the full width of the ditch. A sharp grader blade set at the proper angle cuts the sod quite readily and seems to require less power to remove the earth than when it is first messed up by plowing. One single plow furrow to mark the center line of the ditch is of advantage in making the ditch straight. (2) It is sometimes possible to cut more than one slice of earth from the ditch bottom before leveling, and then move back several slices of loose dirt from the ditch bank at one operation. (3) An ordinary tractor has a tendency to slip in the wet bottom of a newly cut ditch, and every effort should be made to improve traction. If available, the Caterpillar type is to be preferred for this kind of work, and in the round wheel type extension rims with spade lugs should be used. Horses could be used for power in place of tractors. (4) Surface runs can be constructed most cheaply during the dry season of the year and if they are to be dug on tiled land, lay the tile first and make the work of constructing ditches easier. (5) Surface

runs made in the way described above are inexpensive, do not cut up the land in an unsightly and inconvenient manner, and above all are efficient for the removal of flood water.

EXPERIENCE WITH BIG TILE

H. C. Webster, Drainage Engineer

490 Stratford Court, Milwaukee, Wis.

I will describe briefly my experience in constructing a drain in Milwaukee County known as the "Dietze-Kuphal Town Drain." It comprised about 300 acres of drainage area, about 130 acres of which was wet land, the area extending a distance of nearly one mile. At the lower end there was practically no wet land, the area sloping on either side to a natural surface channel which had a very good grade. At the upper end of the area the wet land was practically flat for a distance of about one-half mile. At one side of the area was a narrow area extending back about one mile, comprising about 100 acres of land which discharged water on the wet lands in question in varying quantities. This area the petitioners did not wish to include in their district.

I was anxious to have this drain constructed of tile because it was at the Town Hall and would be a good example for future districts, but there was a storm of protest from the land owners. We took bids in two ways, one for constructing an open ditch with a four-foot bottom, side slopes 1 to 1, and varying in depth from 6 to 7 feet, and another for a 12-inch tile with a depth of about 5 feet. The tile was found to be the cheaper method, and was ordered. Most of the land owners were skeptical at that time about its success.

There was a shallow ditch running through the area. This was used as a surface run.

At the point where this other area at the side discharged its water into our district I laid out a 12-inch branch to about the boundary of our district. No special inlet was constructed other than having the upper 100 feet covered with fine rock and gravel. At the outlet of our main tile a 10-foot piece of 12-inch corrugated iron pipe was laid, the open ditch below the outlet of the tile being deepened for a distance of about 1,000 feet which gave a free flow for the tile. The outlet of the tile

was brought to the open ditch from the side at a point where the bank was rather high and well sodded.

After the system was completed I happened to be at the outlet one day with a member of the Town Board who was surprised at the amount of water flowing in the open ditch, yet it all came from that 12-inch tile running only about half full. This outlet has caused no trouble at all and I believe will require very little attention in the future. There is but little water in the surface run even in the spring. The bed is now getting well sodded.

The size of tile laid on this drain was a size larger than I figured necessary, but I wanted to play safe as a matter of policy just then. We have a Town Board in that town now that preach tile wherever possible.

When the Mud Creek Drain was organized we succeeded in tiling only the upper one-half mile. This upper portion was owned by the County and they were very much in favor of tile on their land. This portion happened to be divided from the other by the C. M. & St. P. Ry., so the tile was laid to a point just across the railroad. The cost of constructing a tile drain across the railroad was very much cheaper than an open ditch. There was quite an area above the upper end of the tile which discharged a large amount of water at times. Nevertheless, no inlet was placed at the upper end of the tile. We simply back filled with as much gravel and loose material as could be obtained in the immediate vicinity. The tile has never failed to take the flow from the upper area within a distance of 100 feet from the end of the tile, except during the spring floods.

Within a short time after these two drains were completed, the clerk of the town interested his neighbors in a tile for a low wet area which ran through their lands and they laid nearly a mile of 12-inch outlet tile, giving them an outlet which would allow them to give complete drainage to their lands. This was done by mutual agreement without a regular organization.

In the Deer Trail District in Rusk County the drainage was accomplished throughout with tile outlets ranging from 8-inch to 18-inch, and where the sub-districts have been completed the marsh is now under cultivation.

What I believe is needed, though, in all large tile propositions is thorough continuous inspection during construction. An

engineer cannot give his whole time to the work in the field. Hence it is necessary for the district to provide an inspector to be under the direction of the engineer, the same as obtains in all municipal work.

Big tile for outlets are gaining in favor among land owners where they have a chance to see the real benefits derived, the saving in land, the elimination of troublesome ditches and crossings, etc. It is up-hill work to get the owners to see these extra benefits before the drain is constructed, but I have yet to see an owner that would want to change back to an open ditch after having the tile installed. They are all boosters afterwards.

After one open ditch was completed and after another drain was constructed with tile in the vicinity, one of the owners on the open ditch came to me and said: "Why didn't you force tile down our throats when we couldn't see your way?" That's not so easily done, but I think in most cases if that could be done the engineer would have more and better friends afterwards.

BARGAINING WITH RAILROADS FOR CROSSINGS

Jerry Donohue, Drainage Engineer, Sheboygan, Wis.

This paper is confined to our experiences in securing crossings over the C. & N. W., a steam railroad, and the Milwaukee Northern Railroad, an electric line in the Belgium-Holland District No. 2.

The district is about 5½ miles long, averages about ¾ mile wide, and comprises 3,090 acres. The railroads cross this district diagonally. The C. & N. W., because of its slight grades, and shortness of haul, handles the bulk of the freight that moves between the northern peninsula of Michigan and Chicago. As this heavy freight traffic had been built up with the development of the country, the railroad had been slowly reconstructed to accommodate the traffic. The floating roadbed of the early days was gradually filled with earth and ballast until the peat beneath the track was displaced and the ballast had settled down to the blue-clay subsoil, giving them a very good solid roadbed that could not be materially improved by drainage. The smaller bridges on the C. & N. W. were constructed of cast iron pipe with masonry end walls, while the larger bridges were wooden trestles resting on driven piles. The Milwaukee Northern Elec-

tric road was built only recently, and its roadbed across this marsh is floating. The fill and ballast was dumped on timber and brush corduroy placed at right angles to the right-of-way, and does not extend to the solid subsoil but floats on the wet peat. The bridges were temporary wooden culverts, built out of old ties and other cheap material.

From the description it is evident that the problems involved in securing and making crossings of these two roads were entirely different; one maintained a solid roadbed with permanent bridges, and carried a heavy freight and passenger traffic; the other immediately parallel maintained a floating roadbed with temporary bridges, hourly schedule for passenger traffic which is heaviest when the freight traffic is lightest.

If the original plans for using a walking dredge had been carried out the problem of crossing the railroads would have been simplified, but no satisfactory bids could be obtained except for floating dredge work.

Our commission availed itself of the provisions in Section 1379—29 of the old Drainage District law which prescribed the procedure under which the commissioners could deal with railroad companies. In all the dealings the railroad officials were very fair and showed a willingness to co-operate with the drainage commissioners. It was estimated that the bridges would cost $3,000.00 each. The commissioners, after considerable deliberation but without scientific methods of calculation, decided that the roads should bear one-half the cost of bridges, and since our assessment for construction was 30% of the benefits, the commissioners levied benefits of $5,000.00 against each road. Both railroad companies filed remonstrances.

In the interest of saving time we proceeded to stipulate, and both companies were willing to do this. Neither objected to paying one-half the cost of the bridges, but they did not want the assessment of $5,000.00 benefits to stand, because it might subject them to further costs in the future up to this limit. The stipulation with the C. & N. W. provided that for a consideration equivalent in dollars to one-half the cost of the work the railroad company would agree to open its track, remove all obstructions to the depth of twelve feet below the rail, width of twenty-two feet and a height of thirty-five feet, to permit the passage of dredging machinery through the right-of-way, the crossing to

be made on Sunday, and the railroad company to be given proper notice.

The electric road could not enter into an agreement because they had no funds from which to pay for their share of the required bridge. They were advised to make proper application for an increase in rates to cover the necessary costs, and as soon as their application was granted, they notified us that they were ready to draw up an agreement.

Our big job is done. Carrying out the agreements will be easier than making them. The contractor must select the time for crossing and notify the district engineer, who in turn must notify the railroad companies to open their tracks. Both tracks must be opened at the same time because there is not sufficient room between them to store the dredge. The high tension line, and the trolly line of the electric road will have to be raised or removed. The signal line and Western Union Telegraph lines on the right-of-way will have to be cut. The bridges are to be built before the contractor is ready to cross. At the time set for crossing, the bridges will merely be opened and put back into place in a short time. The commissioners, on the other hand, are to direct the cutting of a chanel to cross the right-of-ways and a pit to store the dredging outfits, before the crossing is to be made in order to avoid unexpected delays that might be occasioned if the dredge is obliged to dig its own way through. If adequate preparations are made beforehand I feel confident that the problem of crossing railroads is not a serious one.

(Later: This plan was executed exactly as Engineer Donohue outlined it. Within 3 hours after the bridge was removed on the steam railroad, the house boats trailing the dredge had cleared both the steam railroad and the electric road.Temporary bridges were completed and traffic resumed on both railroads 5 hours after the first bridge was removed.—Editor's note.)

HOW THE STATE DRAINAGE ASSOCIATION CAN HELP

Carl Foll, Deerfield, Wis.

I believe some of you know me; I am a farmer. If a farmer makes a success, he has not the time to study the making of

speeches. He has got to study his farming and work. If you only study and do not work, you fail.

Now, Gentlemen, I believe the Wisconsin Drainage Association is one of the important associations that we have in the state. (Applause.)

We have thousands and thousands of acres of marsh land in this state, productive today, but that a short time ago did not earn anything. True it is that we have hundreds of farms that have more or less wet land, that produces very little or next to nothing. Some of such farms have timbered wet lands which produce building materials, fence posts and fire wood. But even they have some wet marsh land that produces hardly anything.

Now, my friends, here is one thing for us and for the professors from the University to do: Go to such farms and help the farmers tile or drain the wet marsh land. I do not mean to help with shovel and spade. We can help them in another way.

I know the larger number of these farmers that own such marsh land do not know today how to go at it to make the improvements so as to have good soil. What this Drainage Association should do is to go and find out where such farms lie and hold meetings—four or five miles apart if necessary. Hold a meeting, for instance, in the schoolhouse; notify every farmer and have our professors come and explain to the farmers how to go on this land and make the wet lands good soil.

Hold these meetings often, and if in a radius of every four or five miles you can get one man who will go to work and make the improvements on his marsh land, when the rest of the farmers see the result of his work, they will start immediately on this work themselves.

I can tell you my own experience. Twenty years ago I started to improve my own marsh land and the farmers within seven or eight miles, after seeing the results of the improvements I had made, immediately began to come to me and talk about drainage. One man had a wet pasture—so wet that his cattle got mired in it. He said: "After seeing the results of your work I am going to tile my pasture." He did this and had a very good result therefrom.

At another time, a friend of mine helped me thresh and saw the rye I raised in that poor marsh. He also saw the big crop

of hay growing there. In the fall he helped me fill silo and saw the enormous crop of corn I raised there. He went back and tiled his marsh and that man has good soil now; he has raised big crops of corn, hay, potatoes and sugar beets, and rutabagas by the wagon load. Of course, he was a good farmer; a lazy farmer could not have accomplished this.

Another man I remember had a forty-five acre marsh. He tiled it and put in a crop of potatoes and had good results. His brother also tiled his marsh and had good results.

A man eight miles away from me came to me one time in June, looked over my crops, and from then on came every month to watch the growing of the crops. He told me he had sixty-five acres that were hardly worth paying the taxes on. He said: "I am going to work and tile the sixty-five acres." I said to him: "My good friend, it will cost you a lot of money to tile sixty-five acres at one time." He told me he had had a contractor there that had made a plan for the tiling and the contractor had told him if he would do the hauling of the tile and cover the tile that he would tile his land for $26.00 an acre. This man said he had half of that money on hand and the other half he would borrow. He said: "I see your marsh here pays you more than seventy-five or eighty per cent. Why can't I pay five per cent to borrow the money?" He did so. He put the sixty-five acres in the easiest crop and had excellent results.

Other farmers in my locality laid single strings of tile in the low places of their marshes; other farmers made new ditches; and other farmers cleaned out their ditches. The result was that a good many acres of marsh land were improved in the northern part of the town of Deerfield and a good many hundred dollars have rolled into the farmers' pockets, all because old Carl Foll made a start.

The farmers who tiled their marshes have increased their herds by ten or fifteen head of cattle and more. They built additions to their barns; put up silos—some two; put up new corn cribs; built additions to their houses; and you can see what the result was.

I do not claim all this result came from the marshes, but if the farmers want to improve their marsh land and will work that marsh land together with their good land, the combination brings the result.

Now, gentlemen, I say again, if this Drainage Association would go out to these farmers that have wet land, and would get them together and hold meetings, explaining to them what they can do, you will see the result in the next fifteen or twenty years in this state. I believe honestly if I had not started twenty years ago to improve the marsh land in my locality, the northern part of the Town of Deerfield, that very little would be done today.

Gentlemen, so far as I know, we have in the state of Wisconsin a good many drainage districts; districts in which big ditches have been made and for which thousands and thousands of dollars have been spent by the farmers. Now, I would like to ask you: "Have the larger number of these farmers that spent their money in building these ditches, got good results? Has the average man got good results for the money he spent?"

(By a voice: NO!)

I must say that I know of two districts in which some of the farmers have got good results, but the larger number is not satisfied. Why are they not satisfied? I know in the better districts that every forty acres has an outlet, but the farmers do not know today that they must lay some tile in their marshes to keep the outlets busy. Without such tile the outlet is not much good.

Now I will say again: Here is work for our drainage association. Go to those districts where the farmers are not getting good results. Go there, give them a talk, hold meetings, try to organize a sub-district on from seventy-five to a hundred acres; tell these farmers to go and get a contractor and tile their land, and after they have tiled their land promise them another meeting. If the farmer wants to raise hay, tell him exactly what to do. Tell him what time he should plow his marsh, what time to put on the fertilizer and what kind of fertilizer to put on; what kind of seed to put in, and what time to seed it.

At such meetings we should have a farmer along who has actually tiled his farm. That farmer could talk to the other farmers and tell them what he has done with his own land and the results he has achieved. They might believe him when they wouldn't believe the professors.

I have never seen a failure of marsh land to produce a good crop of corn if you handle it right. I have had twenty years'

experience with it and have never had a failure with it except one year. That year the frost caught me awfully bad and that is the only failure I had.

Now, gentlemen, if the Drainage Association does its duty, each of us must become a missionary—a swamp angel. If we do this, we will help the farmers and we will help the whole community, as well.

SLOPES IN OPEN DITCHES

P. J. Hurtgen
Drainage Engineer, Kenosha, Wis.

The subject assigned to me is "Maintenance of Slopes in Ditches." I think that most of us will agree that if ditches could be constructed as most specifications provide that they shall be constructed, and if the cross-section of the ditches would remain unchanged after the work is completed, many of our troubles would be reduced to a minimum. This, however, is not the case. It is true, however, that the greater portion of our trouble is due to caving banks, and if this trouble could be overcome the cost of maintenance would be comparatively low.

As a rule the caving of banks is due to three causes:

Caves or breaks due to the inability of a layer of drift to hold the weight of the overhead bank. These breaks usually occur where a layer of sand or gravel or unstable clay lies some distance below the surface of the ground and as this layer crumbles a crack develops in the bank some distance from the edge of the ditch, and as the crack gradually widens the bank moves slowly into the channel. Where caves occur due to this cause, the only practical remedy is to flatten the slopes until sufficient weight has been removed to establish a state of equilibrium in the ditch banks. It is also necessary that the spoil bank be deposited far enough from the edge of the ditch to relieve the ditch banks from the excessive weight of the excavated material.

A second cause of caving banks is due to gravity slides, which result from the movement of the overhead bank upon a slippery layer of clay or other material due almost entirely to an excavated slope steeper than the angle of repose for the particular

soil excavated. This condition will be further aggravated if the spoil bank is deposited too near the edge of the ditch.

The third cause of caving banks is due to erosion, which is a gradual breaking down of the banks due to rain and wave action and the action of frost. The freezing and thawing of the bank especially contributes to the breaking down of the slopes. This condition can be remedied to a great extent by sowing grass seed on the slopes.

The necessity of sloping banks in ditch construction is almost self-evident. Solid rock is about the only material which will stand up permanently if excavated with vertical sides, all other materials will wash and slide until they come to a certain slope where they will remain stationary, this slope or angle of repose varies with different soils.

The selection of a proper slope for drainage ditches must be determined by soil conditions, such slope or ditch section as will not deteriorate or cave is the proper slope to adopt. The caving of ditches to some extent is inevitable, yet can be reduced considerably by the construction of wide and sloping banks. Where ditches are constructed with floating dredges the U-shaped ditch is invariably the result.

Dredge owners and operators will argue that the banks will break at the weak points and melt down to its line of repose and form a proper slope. This argument seems plausible, yet it is not true that the ditch will adjust itself to such a slope. It is true, however, that large sections of ditch will break down and form a slope that will remain intact for years.

As a rule the slope adjustment on a U-shaped ditch will be followed by a vertical crack from three to six feet from the bank line and extend down to the medium stage of water in the ditch or to a stratum of sand or gravel or other unstable soil. The base of this rectangular section slides and falls into the channel; if it does not immediately slide into the center of the channel, it will remain on the slope, and eventually slide down to a 1 : 1 or 1½ : 1 slope depending on the soil. In any event the section of broken bank eventually reaches the center of the channel with the result that the final ditch is a wide shallow one with a capacity of anywhere from 20 to 50 per cent less than was orig-

inally planned. I have seen the same results in ditches constructed with a 1 : 1 slope.

We know that the water level in the ditches varies from time to time, as does the water table in the ground. In dry periods there is considerable shrinkage of the soil above the water table and with the water table changing frequently there is certain to be a shifting of the soil due to shrinkage. It is therefore absolutely certain that this shifting for a distance of three to six feet from the ditch bank, will be in the direction of the ditch, which is the line of least resistance, the result is that the shifting soil usually lands in the ditch and very materially reduces its capacity.

The sloping bank will reduce the amount of caving to a minimum. Just what this slope should be depends on the nature of the soil. My experience has been that a peat soil will stand up well with a ¾ : 1 slope; clay 1 : 1; and loamy soils should be provided with not less than a 1½ : 1 slope or better still 2 : 1 slope.

A great deal of attention has been given to the design of open ditches, but comparatively little to their maintenance. In sections of the country where drainage has been only partially developed the general impression is that a ditch once constructed will require no maintenance, unfortunately this is not true, and open ditches like roads and bridges, will require more or less attention from time to time in order to keep them up to their highest state of efficiency. While the amount of repair work will vary with conditions, considerable can be eliminated by careful designing. The method of construction has a bearing on the maintenance, yet in spite of the most careful designing and construction all ditches will require more or less repair work from time to time. Economy requires that this work be done at regular intervals during the dry months of summer and fall and not be allowed to fill in gradually until they will no longer carry off the water, or until the outlets are no longer sufficient. As a result of such conditions there usually follows a general agitation and condemnation of all parties who had anything to do with the construction of the ditch, followed by perhaps several years of quarreling among otherwise friendly neighbors, until finally steps are taken to have the ditch cleaned

out or reconstructed. My experience has been that the reconstruction or clean out work generally costs as much as the original construction. Railway companies have bridge men and track men to patrol their right of way; road builders all over the country have had or are at the present time arranging for a patrol system to keep their railways or highways in a condition for traffic, realizing that maintenance work must be provided at regular intervals in order to protect their structures. How many drainage districts do we find that have followed this policy?

Such a system is surely needed and unless this is done at regular intervals it will be necessary to re-dredge the neglected ditches at great expense. At the summer meeting at Racine I mentioned this necessity for establishing a patrol system for open ditches and I believe such a system could be maintained at an annual expense to the district of approximately $10 to $15 per mile. We are spending approximately $30.00 per mile per annum for the maintenance of permanently improved concrete highways. Is it therefore unreasonable to spend less than one-half of this amount per mile for the maintenance of our ditches?

The time in which our ditches are subject to the greatest filling action is during the first year after construction when the waste banks, and slopes are in a loose unsettled condition, and easily affected by the action of frost and water. If during this period the patrol system was rigidly and effectively maintained the plan would result in a great saving to the district and less grief for the commissioners and others connected with the work. I have sometimes thought that our drainage laws should contain a provision making it necessary for the commissioners to file a written report to the court at least four times a year during the working season stating the condition of the drainage ditches. Each report would necessarily be based on a thorough inspection of the ditches. This plan if followed would make it possible for the commissioners to note all sections of the work which would require attention and the court would be provided with a record of the true condition of the drains within the district and having these records could demand that the commissioners give them proper attention. Some such an arrangement would also furnish a valid reason for frequent trips of inspection by

the commissioners, and thereby eliminate criticism from the landowners that the commissioners are incurring unnecessary expense to the district by making unnecessary trips of inspection. It is a common practice for engineers in designing drainage ditches in Wisconsin to specify a 1 : 1 slope regardless of soil conditions. I believe that a 1 : 1 slope should be the minimum regardless of soil conditions and a 2 : 1 the maximum.

In order to avoid excessive top widths with these flatter slopes the bottom may be kept comparatively narrow. This will aid in making the ditch more nearly self cleansing and would also reduce the cost of construction.

The comparison of yardage in a ditch with a ten-foot bottom and eight foot deep is as follows:

1½ : 1 slope 20 per cent greater than 1 : 1.
2 : 1 slope 20 per cent greater than 1½ : 1.

In a ditch with a twenty-foot bottom the comparison is as follows:

1½ : 1 slope 14 per cent greater than 1 : 1.
2 : 1 slope 14 per cent greater than 1½ : 1.

In railroad and highway construction the slopes in cuts are never less than 1 : 1 and 1½ : 1 is now more commonly specified. The slopes of railway and highway cuts are exposed to less erosive forces than the sides of open ditches.

However, in specifying such flat slopes for open ditches and adhering strictly to the specifications it would practically eliminate the construction of ditches with the floating dipper dredges for the reason that dipper dredges cannot cut a smooth or true side slope. Yet we cannot eliminate the dipper dredges for the reason that some of our marshes are so soft that no machine other than a floating dredge can be successfully operated. It has been my experience in drainage districts where floating dredges were used that the work was usually completed within the time limit specified in the contract. On the contrary the majority of the dry land machines while by a careful manipulation of the dipper they will cut almost any desired slope, yet they require more time to complete a job than does the larger floating dredges.

It is therefore necessary to provide specifications for practi-

cally all types of excavators as well as varying soil conditions and in order to maintain a proper slope on ditches constructed with a dipper dredge the specifications should provide for a deeper and wider ditch so that when the banks cave in and the sides erode the ditch will still have sufficient depth after the sides will have broken down to their proper slope. On ditches constructed with a dry land machine the specifications should provide that the slopes vary from 1 : 1 to 2 : 1 depending on soil conditions as it is far more economical to excavate the side slopes to the necessary inclination in the first instance than to later reconstruct the entire ditch. If this is done and a systematic patrol system adopted until such time as the ditch slopes have become firm, less trouble and expense would be experienced in maintaining the side slopes and as stated before after the sides of the ditches have become smooth they should be sown with grass seed which will protect them from erosion. Let me say in closing that the best way to eliminate the maintenance of slopes in open ditches is to eliminate, wherever possible, the open ditches and use tile.

Note: On both the Racine and Watertown field trips examples were seen where spoil banks of dredge ditches were levelled and the slopes of the ditch seeded for less than 50 cents a rod.—Editor.

A SANE PLAN FOR MARSH DEVELOPMENT

E. R. Jones

College of Agriculture, Madison, Wisconsin

Well drained and well managed marsh lands are among the most profitable in Wisconsin. Poorly drained and poorly managed, they are about the most unprofitable. What our marsh lands need is safe and sane development. In Wisconsin we have examples of success and examples of failure.

A typical successful project may be cited in southeastern Wisconsin. The main ditch and large tile laterals were installed by the district about 1910. No one man owned more than 80 acres of marsh land. Some of this was peat to a depth of six feet, but all of it was a part of the farms on the surrounding upland, which was thickly settled, highly developed and selling for about $200 an acre. In its natural condition the wet land

furnished poor pasture or poor hay. A part of it had a growth of willow brush but none of it was heavily timbered. Today corn is being raised on every acre of this wet land. The spoil banks of the main ditch have been leveled and the slopes have been seeded. Lines of tile from four to eight rods apart have been put in by the farmers themselves to complete the drainage begun by the outlet drains. This land is worth just as much as the surrounding upland. These farmers can raise better corn on their drained lowland than they can on their highland, just as they can raise better alfalfa on their highland than they can on the lowland. The drainage of the lowlands has produced well balanced farms. The only regret that some of these farmers have is that a large tile and surface run was not put in originally in place of about two miles of the upper end of the main ditch.

Another project in southeastern Wisconsin has not been so successful but is typical of some drainage districts. The soil and the condition of the surrounding upland farms are similar to those of the successful district just noted. It was probably the engineer and the commissioners who made the first mistake. They dredged the outlet ditch to a depth of only six feet. It should have been eight feet. Instead of putting in large tile for laterals they put in capstan ditches about three feet deep. Nevertheless, the main ditch is deep enough that it can serve as a satisfactory outlet for tile on probably two-thirds of the wet land in the district. The farmers have not taken advantage of this outlet. To date, only three farmers in this district have land tile. They are meeting with good results and more tile will be laid there in the next few years. We have succeeded in getting a good tiler from northern Illinois to take up his residence in this district to stimulate the tile industry and incidentally to make good wages. The farmers have been disappointed because they expected too much of the outlet ditch, but that does not excuse them from laying tile now that they see that tile are necessary and profitable. The unfortunate feature is the loss that has been sustained by the delay in starting to tile.

In Juneau, Portage, Wood and Jackson counties, as well as counties in the northern part of the state, there are large areas of marsh land surrounded by upland that has not been developed

into farm land. These projects are less attractive because of this isolation. Strangely enough, more than half of the 800,000 acres in drainage districts in Wisconsin are of this type of marsh land. It is little wonder that three-fourths of the land in these districts is not being cultivated today. It is gratifying to note, however, that men with plenty of grit and some capital have built up farms in such drainage districts. In Wood county there is a man who settled on 160 acres of marsh land back in the nineties when the marshes were dry, and some people thought they were always going to remain dry. But when the wet years came it was evident that these marshes needed drainage. Our swamp angel stuck to his farm, organized a drainage district and put in outlet ditches. This improved his drainage so that he could make a living. The sub-soil was of sand and less tile were necessary than if the sub-soil were clay. Nevertheless, he laid a carload of tile occasionally. By 1915 he had over 200 acres of land drained and under the plow, with buildings on his farm worth more than $10,000. He used barnyard manure and commercial fertilizer on his land. His land is just as productive as lands that are selling for more than $200 an acre, but he does not want to sell. It is his home. Three-fourths of the land in this whole district, however, is still undeveloped. Pointing to the success of our swamp angel as an example a few real estate sharks are trying to get $50 an acre and more for the wild land. These men would require the prospective settler to pay down perhaps his last dollar on the land. They would leave him no money with which to lay tile and to break the sod or clear the brush. They are tying their settler hand and foot. There is little wonder that many settlers have to move away and leave the land to be sold to other unfortunate home seekers within a year.

There is another district in central Wisconsin that has a fall of about thirty feet to the mile. The wet land is wooded and is what may be called rolling swamp. Ditches are being dredged in the narrow swales and a large real estate company is planning on selling these rolling wet lands on the strength of the benefit that will be done by the outlet ditches. As a matter of fact the outlet ditches will not affect more than ten per cent of the land. It would have been a better investment to have laid out a system of section line roads on this area with a ditch four

feet deep at the side of each road discharging into the ravines and water courses. The underlying rock is so near the surface that tile must be laid there in order to effect drainage. These ditches would give each settler an outlet into which he could tile the first ten acres and thereby get a start. As it is, settlers are being asked to come to a country where there are no roads, no schools, no churches, and where they must make a considerable investment in tile drains and land clearing before they can raise any crops at all. With no money left, failure and discouragement is inevitable.

The outstanding fact in the drainage movement in Wisconsin is that such a large percentage of the lands in drainage districts has not been cultivated since the outlet drains were installed. This is due chiefly to the following reasons:

1. Sparse settlement from the surrounding uplands.
2. Promoters have been penny-wise and pound-foolish. They ask too much for their land and require initial payments that the settler cannot afford to make. They have also represented the drainage to be better than it is.
3. Outlet ditches have been made too shallow.
4. Too much has been expected of the outlet drains.
5. Many drained marshes have been poorly cultivated and managed.
6. Mineral fertilizers have not been used as much as needed.

But it is of the possibilities of Wisconsin's wet acres if properly managed that I would speak. If I were living on a farm that contained marsh land, I would drain that marsh as soon as possible. If the marsh were timbered with good timber there would be less need for haste than if the marsh were merely brushy or cleared.

The settler buying 80 acres of land in a drainage district should see to it first that the outlet ditch is deep enough to tile every foot of the land with tile four feet deep and falling at least 1. in 100 feet to the top of the water in the outlet ditch. Here also cleared marsh land is preferable to timbered or brushy marsh. It should be on a road. It is desirable to have an island of hard land near the road for a building site but that is not necessary if drainage is deep. For such an eighty he should not pay over from $30 to $50 an acre, depending upon the locality, and if he had but $2000 he should not pay over $200

down, keeping the other $1800 to tile his first ten acres intensively for cultivated crops. Then tile 20 acres slightly for timothy and alsike, and then put up some temporary buildings. These thirty acres would make him a living and increase his credit so that he could tile and develop the other fifty acres and gradually improve his stock and buildings. In addition to the purchase price there would be the drainage tax which he would pay in installments.

The man buying 640 acres of marsh land in a drainage district should get it for less per acre than the 80-acre man, because it is to be assumed that he has plenty of capital or else he would not tackle so large a tract. He does not ask for credit from the seller and hence does not need to pay for that service. Nevertheless, if the outlet ditch has been constructed, he should ascertain carefully the amount of the drainage taxes against the land and the sufficiency of the depth of the outlet ditches. He should also measure his finances in advance. Many a man has had to drop a half-finished project because he lacked funds. He should plan on financing the development for ten years, because the chances are that he will have to hold it that long. With proper management there will be an income during these ten years. I believe firmly that a developer of marsh lands should carry the development to a stage where the land is self-supporting before he asks anybody to buy those lands of him. The same applies to the promoter who buys 10,000 acres of marsh land and organize a district and then tries to unload it upon someone else or sell it to unsuspecting settlers before the outlet ditches exist anywhere except on paper. We do not want that kind of a promoter.

There is a place for a promoter who buys up 10,000 acres of marsh land at about $15.00 an acre, even in an undesirable locality, and then after organizing a district and assuring the construction of the outlet drains, sells it at about $20.00 to a development company with sufficient capital. In that case the promoter has assumed some risk and has rendered some service which entitles him to $5.00 an acre. The development company then should lay tile and make the land produce valuable crops—part of it tiled intensely for corn and potatoes where temperature permits, and part of it more sparsely tiled for timothy and alsike. This converts the marsh into income property. Big

companies are making large profits each year farming large areas of drained marsh on a big scale. Some day these companies may desire to sell their holdings to home seekers, and when that time comes, the settlers will get what they pay for. They will build happy homes and live contented lives. Only in this way should large areas of marsh land be developed in Wisconsin.

There is some land adjacent to deep (7 feet or more) outlet ditches in all drainage districts where the drainage is such that timothy and alsike can be raised without any tile at all. The width of this strip varies with the nature of the sub-soil and the depth of the ditch. But however wide or narrow this strip is, it should be seeded as soon as possible so that there will be tame hay for revenue. As soon as a few deep lines of tile are put in at the edges of the marsh to cut off seepage, the timothy and alsike area may be enlarged. A few more deep lines in well selected places within the area make it all available for timothy and alsike. One crop of tame hay should be actually harvested with profit on at least half of an 80, by the big development company, before the land is sold to a settler for a home, and the company should stand ready to loan the setttler at a reasonable rate of interest and on liberal terms such money as he needs to complete the development of the farm. Unless the company can do that, it had better stay out of the game.

It takes two years to get land well seeded to timothy and alsike. Break the land the first year, disk it well and seed it to buckwheat or flax. Put in the seed deep and roll with a heavy roller. Frost may take the crop, but the chances are fifty-fifty that there will be thirty bushels of buckwheat to the acre. In any case the land will be in fine shape to seed to grass on the following spring, when heavy disking will prepare a good seed bed without plowing. Then seed about one and one-half bushels of oats to the acre for a nurse crop with plenty of grass seed. About July 1, mow the oats for hay and the grass will get a good start for a second crop of hay that year. If the oats are allowed to ripen they may lodge and smother the grass.

To sum up: Timothy and alsike are good crops for marsh soils because (1) they do not require such thorough drainage

as cultivated crops; (2) they resist frost; (3) they require comparatively little labor per acre; and (4) they are a profitable crop for the first five years while the excessive acids are being drained out of the soil, and while the operator may lack the time or capital necessary to put in enough tile to complete the drainage sufficient for the more intensive crops.

PROGRAM FOR NEXT CONVENTION, PAGE 4

WATERTOWN FIELD TRIP

"The field meeting of the Wisconsin State Drainage Association will be at Watertown Tuesday, September 9, 1919. Arnold Kraft, City Engineer of Watertown, will pilot the visitors over a 20-mile route in the forenoon, and another similar trip in the afternoon. Assemble at the Commercial Hotel at 9 A. M. and again at 2 P. M. There will be a talk fest during the lunch hour at the Commercial Hotel. People of Watertown and vicinity have placed their autos at our service and can take care of all who come.

"Several tile drainage systems will be inspected, including the Marlow-Lewis Town Drain—a tile outlet 3½ miles long. Our path will be cut occasionally by a capstan ditch and we'll look at that too.

"Come and decide for yourself whether you want a capstan ditch or a tile on your farm. Plan on taking in the State Fair at Milwaukee for the rest of the week.

"Wednesday, September 10, will be 'Drainage Day' at the State Fair. Commissioner Norgord has given us a room on the third floor of the Grand Stand for a meeting at 1 P. M. Wednesday. Short talks will be made chiefly by men exhibiting machinery and equipment for draining and cultivating marsh lands.

"This call is issued by the Wisconsin State Drainage Association to its members and all others interested in studying land drainage in the field. Everybody is welcome.

Respectfully,

J. Q. DANIELS, Pres."

This call brought together about 60 men who rode about 75 miles observing tile drainage systems and capstan ditches. The feeling prevailed that if the same amount of money had been spent for drain tile as had been spent for capstan ditches it would have been a much better investment.

One tiling machine was observed at work. It was laying tile only about 3 feet deep in a peat soil. This is too shallow.

It was gratifying to talk with the farmers along the Marlow-Lewis Town Drain. Originally some of them wanted a capstan ditch in place of the big tile, but now everybody is glad that the advocates of tile won out.

The Waukesha County Farm Drainage Board, the first board to be appointed under the new Farm Drainage law, was in attendance.

At the luncheon State Chief Engineer John G. D. Mack announced that he had added a new division to his department, the Drainage Division, and that E. R. Jones had been appointed State Drainage Engineer.

The following resolution was adopted:

Whereas, death has removed from us Mr. Augustus Cincinnatus Willard of Necedah, for years a commissioner of the Little Yellow Drainage District and a charter member and the treasurer of the Wisconsin State Drainage Association since its organization, and

Whereas, in their social and public relations with Mr. Willard, the members of this Association have always found him to be kindly, courteous, generous, honest and ever willing to sacrifice and labor for the public good;

Be it resolved, that the Wisconsin State Drainage Association hereby expresses its appreciation of the sterling qualities and public service of Mr. Willard and its sense of loss by reason of his death.

Be it further resolved, that a copy of this resolution be extended upon the records of this Association and that a copy be forwarded to the Necedah Republican for publication.

PROGRAM

SIXTH ANNUAL CONVENTION

WISCONSIN STATE DRAINAGE ASSOCIATION

February 19 and 20, 1920

Room 306 Soils Bldg.
College of Agriculture

Thursday, February 19, 10 A. M.

A Necessary Additional Drainage Law.
B. M. VAUGHN.

How the Manual Could be Improved.
F. W. LUCAS—JERRY DONOHUE.

2:00 P. M.

Report of Committee on Contracts and Specifications.
O. R. ZEASMAN—Discussion led by F. W. Lucas.

Experiences in Making Railroad Crossings.
JERRY DONOHUE.

Report on National Drainage Congress.
J. G. D. MACK, State Chief Engineer.

7:30 P. M.

Drainage in Louisiana (Illustrated by Lantern Slides).
J. A. FOX, Director of the National Drainage Congress.

Flood Protection in the Fabius River District, Missouri.
R. O. JEHU.

Friday, February 20, 9:00 A. M.

Effects of Back Water from Dams.
H. V. TENNANT.

Advantages of Consolidating Districts.
PERCIVAL BROOKS COFFIN.

Flood Control on the Lower Mississippi (Moving Picture).
J. A. FOX.

Friday afternoon and Saturday our members were invited to attend the sessions of the Wisconsin Engineering Society, including the banquet Friday evening. The meetings of this society were held in the auditorium of the Engineering Building.

The headquarters of our convention were at the Capitol Hotel.

The usual number of members and friends of drainage heard the foregoing program. President J. Q. Daniels was in the chair. In the absence of the secretary, O. R. Zeasman acted as secretary, and the result was one of the best conventions ever held by the association. Space does not permit the publication of the addresses. Mr. Tennant's paper was of particular interest. He was asked to continue his discussion at the convention in 1921.

SUMMER OF 1920

The executive committee decided to have no field trip. The annual convention of the American Peat Society at Madison, Sept. 2, 3 and 4, took the place of the annual field trip. All of our members were invited to that convention.

COMMITTEES

These committees, with but little change in the personnel, have served for the past three years.

Legislation—Peter J. Myers, Chairman, Racine; Frank W. Lucas, Madison; B. M. Vaughan, Grand Rapids; Percival Brooks Coffin, 39 S. La Salle St., Chicago, Ill.; G. E. Brown. Madison.

Standards—B. M. Vaughan, Chairman, Grand Rapids; J. Q. Daniels, Babcock; James L. English, Waterford; O. R. Zeasman, Madison; A. E. Matheson, Janesville.

Methods and Results—O. R. Zeasman, Chairman, Green Lake; P. J. Hurtgen, Burlington; Anton Brost, Babcock; A. P. Nelson, 1712 9th St., Racine; W. B. Coddington, Plover; A. .W Dibble, Madison; W. J. Hansche, Racine; C. H. Pratt, Plainfield; P. C. Frederickson, Necedah; Carl Foll, Deerfield.

Clean-out Machinery—C. F. Leins, Chairman, Madison; John Swenehart, Bayfield; E. I. Philleo, Grand Rapids; R. F. Roberts, Randolph; E. R. Jones.

Auditing—Nye Jordan, Chairman, Mauston; H. C. Webster, Milwaukee; A. W. Dibble, Madison.

Financial Statement Since December, 1914

Receipts

Account	Before Jan. 1, 1920	Since Jan. 1, 1920	Total
Membership Fees	$ 720.00	$190.00	$ 910.00
Contributors	20.00	11.00	31.00
Proceedings	4.90		4.90
Advertisers	1437.00		1437.00
Total	$2181.90	$201.00	$2382.90

Expenditures

Account	Before Jan. 1, 1920	Since Jan. 1, 1920	Total
Printing and Stationery	$1299.20	$ 28.35	$1327.55
Stenographer	292.16	9.00	301.16
Postage	277.29	9.40	286.69
Travel (Raymond, Webster, Vaughan and Graham)	101.95		101.95
Incidentals	44.46	3.00	47.46
Engraving	35.44		35.44
National Drainage Congress Contribution		203.00	203.00
Total	$2050.50	$252.75	$2303.25

Balance on Hand December 1, 1920—$79.65.

Audited and found correct:
Nye Jordan,
H. C. Webster,
A. W. Dibble.

PROGRAM FOR NEXT CONVENTION, PAGE 4

LIST OF MEMBERS WISCONSIN STATE DRAINAGE ASSOCIATION

The number in parenthesis indicates the years of membership. Members marked (6) have been members since the organization in December, 1914.

Acheson, Bob, Evansville (1)
Albrecht, Fred, Ohio, Ill. (6)
Aldrich, H. N., Three Lakes (1)
Allen, C. L., Eau Claire (2)
American Concrete Pipe Asso., 538 S. Clark St., Chicago, Ill. (2)
Ames, F. M., Brooklyn (6)
Anderson, N. A., Morrisonville (1)
Andrew, J. M., Marinette (2)
Angelo, W. B. Stevens Point (1)
Arends, A. H., Cleveland (2)
Arpin, E. P., Wisconsin Rapids (6)
Arpin, E. P. Jr., Wisconsin Rp'ds (1)
Atwell, V. P., Stevens Point (1)
Auby, J. H., Madison (1)

Baird, I. L., Lake Beulah (1)
Baker, R. V., Racine (1)
Baldwin, Boyd M., Brooklyn (1)
Bangs, J. W., Dalton (2)
Bazeau, O. W., Lena (1)
Beaumont, Geo., Kansasville (2)
Bell, Frank, Madison (1)
Bender, Chas., Wisconsin Rapids (1)
Bestman, Wm., Randolph (1)
Bieck, W. H., So. Milwaukee (1)
Biglow, O. H., Palmyra (1)
Binder, Chas., Camp Douglas (1)
Binnie, John, Poynette (1)
Bishop, C., Omro (1)
Bodenheimer, M., Green Bay (6)
Boeckh, Julius, Lansing, Iowa (1)
Borner, H. J., River Falls (1)
Boston, H. D., Stevens Point (1)
Bovee, A., Ladysmith (1)
Bowden, W. H., Babcock (6)
J. J. Bowman, Lodi (1)
Boye, A. J., Plainfield (2)
Braddock, W. S., Mather (1)
Brann, Geo. W., Rt. 2 Peru, Ill. (2)
Brehm, John, Waukesha (1)
Brost, Anton, Babcock (6)
Brown, G. E., Madison (5)
Brown, J. W., Peru, Ill. (1)
Bruins, H. A., Brandon (1)
Brusewitz, A. G., Appleton (1)
Buboly, Fred, Rt. 2 Reedsville (1)
Buckeye Traction Ditcher Co., Findlay, Ohio. (1)
Butterfield, Geo., Baraboo (3)
Carlson, Ed., Blair (4)
Carswell, N. L., Lone Rock (1)
Chaatz, Chas. B., Kansasville (1)
Chandos, B. G., Wisconsin Rp'ds (1)
Channing, Adam, Whitewater (6)
Chapman, Wm., 827 Mineral St., Milwaukee (1)
Charlesworth, F. M., Kaukauna (1)
Chase, John B., Oconto (6)
Choak, Chas., Kansasville (6)
Clark, D. D., 1703 College Ave., Racine (1)
Clark, J. J., Rt. 1 Berlin (4)
Clark, W. W., Wisconsin Rapids (2)
Class, L. B., Cambria (1)
Clousing, Louis, Thiensville (4)
Coddington, W. B., Plover (4)
Coffin, P. B., 323 Groveland Ave., Chicago, Ill. (6)
Comstock, J. T., 1101 Mitchell St., Milwaukee (1)
Comstock, H. G., 1125 Mitchell St., Milwaukee (5)
Constance, F. R., Waupaca (1)
Corbett, John, Elkhart Lake (1)
Corning, C. E., Portage (4)
Cox, L. M., Martinsburg, Ia. (1)
Cragoe, T. J., Oakfield (4)
Creydt, A. W., Watertown (1)
Cronk, Phillip, Brodhead (1)
Cuff, R. L., Bloomington, Ill.
Cull, A. J., Hartland (2)

Daelke, Otto, Seymour (1)
Dahlen, Andrew, Madison (1)
Dale, D. P., Storm Lake, Ia. (1)
Dalton, Frank, E. Poynette (2)
Daniels, J. Q., Babcock (6)
Daniels, Dr. J. S., Omro (2)
Darling, H. W., 712 N. Y. Life Bldg., Chicago, Ill. (2)
Davis, F. M., Rapattee, Ill (3)
Day, James B., Hartford (1)
Day, Jerod, W., Ashland (1)
Day, Seth, Rock Island, Ill. (1)
Dean, Seth, Glenwood, Ia (5)
De Lap, F. J., Shennington (2)
Delbridge, J. H., Oconto Falls (1)
Delta Land Co., Trempeleau (1)
Dettinger, Stanley, Hixton (1)

Dibble, A. W., Madison (4)
Dietz, Geo., Greenville (1)
Differding, Wm., Black Creek (1)
Dodge, Mc. L., Madison (2)
Donohue, Jerry, Sheboygan (4)
Drill, A. E., 304 Vine St., Woodstock, Ill. (6)
Duff, P. J., Trempeleau (1)
Dunegan, J. W., Stevens Point (1)
Durbin, H. A., Waukegan, Ill. (6)
Durbin, W. O., Backus, Minn. (1)

Edwards, B. F., Wales (1)
Edwards, E. W., Cambria (1)
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Elwood, Fran, 8012 Exchange Ave., Chicago, Ill (1)
English, J. L., Waterford (3)

Fairman, L. I., Brodhead (1)
Falk, W. E., Oconto Falls (1)
Fechter, John, Belgium (1)
Fedderson, P., Davenport, Ia. (2)
Feeley, J. F., Eagle Grove, Ia. (1)
Filitz, N. J., Cedarburg (1)
*Finucane, F. J., Antigo (2)
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Flohr, Frank, Watertown (6)
Forster, C. A., 613 Majestic Bldg., Milwaukee (2)
Foster, W. A., Elkhorn (1)
Frazer, J. W., Rt. 2 Pulaski (1)
Frederickson, P. C., 826 E. Cook St., Portage (6)
Froehlich, W. H., Jackson (5)

Gaines, W. L., 5700 Drexel Ave., Chicago, Ill. (1)
Gallagher, D. J., Babcock (2)
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Gault, J. H., 657 Cass St., Milwaukee (4)
*Gaynor, J. A., Wisconsin Rapids (1)
Gerber, W. D., 913 Chamber of Commerce Bldg., Chicago, Ill. (1)
Gerner, Walter, Fredonia (1)
Giddings, C. C., Racine (2)
Gilbert, A. E., Rio (1)
Glass, W. F., River Falls (1)
Goldsworthy, C. R., Vesper (6)
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Green, Howard T., Genesee (1)

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Hahn, F. J., Tomah (4)
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Hall, W. B., Oconto (2)
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Hanson, Robert L., New Lisbon (1)
Harloff, Paul F., Madison (1)
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Harness, J. H., Oakfield (3)
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Haseleu, Chas. F., Reeseville (1)
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Hurtgen, P. J., Burlington (5)
Hyne, Edward, Evansville (1)

Icke, John F., Madison (1)
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Jacobson, James, Waterford (1)
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Jenks, Frank, Madison (2)

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Johnson, Easton, Whitewater (2)
Johnson, H. B., Whitewater (1)
Johnson, J. G., Blair (1)
Johnson, M. J., 1102 Sherman Ave., Madison (1)
Jones, D. W., Wales (6)
Jones, E. R., Madison (6)
Jones, H. M., 1822 Chadbourne Ave., Madison (6)
Jordan, Nye, Mauston (6)
Judd, Geo., Footville (6)
Juergens, Carl H., Milwaukee (1)
Jung Bros., Randolph (2)

Kamper, J. H., Franksville (3)
Kamschulte & Webster, Milw'kee (1)
Kastenson, H. E., Franksville (6)
Kelly, J. W., Brodhead (1)
Kieher, Louis G., Thiensville (2)
Kiekhiefer, Henry, Thiensville (5)
Killam, K., Milton (1)
*Killen, W. H., Minneapolis, Minn. (3)
Kirchoffer, W. G., Madison (2)
Klefstad, Iver, Prairie Farm (1)
Klein, H. F., Deerfield (2)
Klipper, Edward, Menominee Falls (1)
Klitzman, Carl, Marshall (1)
Knoke, E. A., Shiocton (1)
Knoke, Hugo, Readfield (1)
Knoller, G. G., Dancy (2)
Koelsch, Andrew, Hales Corners (4)
Kolb, J. A., Berlin (2)
Kolb, W. F., Berlin (3)
Kraft, Arnold, Watertown (3)
Krause, J. L., Reeseville (4)
Kressin, Wm., Cedarburg (1)
Kriebel, E. S., Pittsville (1)
Kuechenmeister, G. A., West Bend (4)
Kuney, Clark G., Three Lakes (4)
Kurchel, Albert, Clintonville (1)

Lackman, Frank, Columbia (6)
Lambrecht, Gus, Lena (1)
Lange, Ben, Denmark (1)
Larsen, A. B., Tomah (6)
La Fay, William, Stoughton (1)
Lee, F. J., Randolph (1)
Lein, Lars Sr., Edgerton (1)
Leins, C. F., West Bend (6)
Lemonweir Drainage District. Tomah (1)
Lerch, E. D., Morrissonville (2)
Lewis, H. W., Racine (6)
Libberton, J. H., Chicago, Ill. (6)
Lindas, M., Deerfield (6)
Link, Wm., Reedsville (1)
Litch, Geo. H., Oregon (2)
Livingston, E. C., Randolph (1)
Lucas, Frank W., Madison (3)
Luedke, August, Lena (2)

Maas, Chas., Marshfield (1)
Mack, M., Shiocton (3)
Madden, T. H., Pulaski (1)
Madsen, Andrew, Oregon (6)
Mahnke, Otto, Rt. 3 Reedsville (2)
Manning, W. S., Ladysmith (1)
Marsden, L. W., Edgerton (1)
Marshall, Geo. W., Fond du Lac (1)
Mathes, Floyd, Wisconsin Rapids (1)
Matheson, A. E., Janesville (6)
Mayberry, A. W., Cumberland (1)
Mayer, J. F., Richfield (4)
McCaul, W. R., Tomah (1)
McComb, J. A., Milton (1)
McDowell, Geo. F., Sprague (4)
McFetridge, W. L., Oshkosh (1)
McGill & Williams, Ladysmith (1)
McKay, Geo., Doylestown (1)
McKay, N. B., Fall River (1)
Meltesen, Chris., Shennington (6)
Meyer, Dan, Box 588 Minneapolis, Minn. (2)
Meyer, F. J., Milwaukee (1)
Meyer, M. J., Fort Atkinson (1)
Michels, Math., Peebles (2)
Miller, A. H., Waupun (4)
Miller, F. J., Kaukauna (1)
Millerd, A. W., New London (6)
Mills, G. W., 801 Bedford Bldg., Chicago, Ill. (2)
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Moore, Warren, Ladysmith (3)
Morgan, F. W., 1312 First National Bank Bldg., Chicago, Ill. (6)
Morgan, H. S., Whitewater (1)
Morgan, John, Appleton (2)
Morgan, W. D., Ladysmith (1)
Morse, E. A. Dr., Appleton (4)
Mortenson, Chris., Camp Douglas (3)
Moyle, O. R., Walworth (1)
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Myers, P. J., Racine (6)

Neitzel, C. J., Watertown (2)
Nelson, A. P., 1712 9th St., Racine (6)
Nelson, Geo. R., Aurora (1)
Netland, Elmer, Eagle Grove (2)
Nichols, E. G., Elkhart Lake (2)
Nichols, W. N., Elkhorn (1)
Nickell, O. C., Waukesha (2)
Niles, A. P., Necedah (1)

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Norris, W. C., La Moille, Ill. (2)
Norsby, Ole, Miner (2)
Novotny, Emil, Kewaunee (1)

O'Connor, E., Hancock (1)
O'Connor J., Wisconsin Rapids (1)
O'Connor, M., Hancock (1)
O'Dea, Mike, Reedsville (3)
Olsen, Nels E., Tomah (6)
Olson, O. C., Larsen (3)
Opitz, Will, Elkhorn (2)
Orr, Fred, Blair (2)
Orr, Henry, Eagle Grove, Iowa (1)
Owen, R. S., Madison (6)

Palmer, C. B., Milton (1)
Parrette, R. L., Three Lakes (1)
Parskow, Theo. J., Madison (1)
Pautsch, L. C., Juneau (1)
Peddie, A. F., Cedar Rapids, Ia. (6)
Perkins, Edmund L., Engineering Co., 1210-56 First National Bank Bldg., Chicago, Ill. (1)
Pettegrew, Frank, Fox Lake (1)
Petty, W. H., Brillion (1)
Pfeiffer, Henry, Union Grove (2)
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*Phillips, J. A., Neillsville (1)
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Pierce, Edwin, Merrillan (2)
Pomeroy, H. S., Edgertotn (2)
Pope, L. F., Three Lakes (2)
Post, L. D., Weyauwega (5)
Potter, Guy, Wisconsin Rapids (1)
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Powell, Gerard, & Co., 39 La Salle St., Chicago, Ill. (1)
Pratt, C. H., Plainfield (3)
Pratt, D. H., Plainfield (3)
Pratt, F. J., Plainfield (1)
Prout, G. L., Vesper (2)

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Ramsey, U. S., Bay City, Mich. (1)
Raymond, W. B., Wisconsin Rapids (1)
Reeder, Chas. W., 927-46 Wells Bldg., Milwaukee (5)
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Reichenbach, Ed., Jefferson (1)
Reif, Henry, Berlin (1)
Reindahl, A. K., Madison (2)
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Reynolds, F. T., Oconto Falls (1)
Rice, Ernest, Ogdensburg (1)
Richards, L. A., Payne Investment Co., Omaha, Neb. (1)
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Rietbrock, A. C., Milwaukee (2)
Ristau, E. A., Osseo (1)
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Rood, Chas. W., Wisconsin Rapids (2)
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Rush, A. H., Reedsville (3)

Salsich, H. E., Hartland (6)
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Sanborn, Q. W., Pardeeville (2)
Savage, Fay, Soldiers Grove (1)
Sawle, Wm., Arena (2)
Scanlon, D. J., Oregon (2)
Schaefer, Geo. J., Sherwood (2)
Schafer, Richard, Fremont (1)
Schernecker, F. G., Sun Prairie (1)
Schilling, E. C., Abbotsford (6)
Schindler, L. M., Appleton (1)
Schroeder, H. T., Tomah (4)
Schroeder, J. F., Davenport, Ia. (1)
Schultz, A. W R, Clarion Iowa (1)
Sherman J J., Appleton (3)
Shepard, L. G., Waterloo (1)
Sherwood, A. P., Bayfield (1)
Sherwood, E. J., Mauston (1)
Sherwood, H. H., Elkhart Lake (6)
Siebenour, Otto, Rosendale (1)
Skeen, W. J., Antioch (1)
Smith, Chas. A., Antioch, Ill. (1)
Smith, Chas. A., Brodhead (1)
Smith, D. L., Markesan (6)
Smith, John, Chehanse, Ill. (1)
Smith, J. M., Shell Lake (6)
Smith, K. S., Fond du Lac (1)
Smith, W. J., Plainfield (2)
Somers, J. T., Chetek (1)
Spreiter, Walter, Onalaska (4)
Standemayer, E. R., Portage (1)
Stangel, O. A., Virginia, Minn. (1)
Steinberg, A. C., Farrington, Ill. (1)
Steinhagen, G., Milwaukee (6)
Stelter, Geo., Fairwater (1)
Stewart, C. B., Madison (6)
Stokes, Jas. I., Elkhorn (2)
Stone, J. A., Reedsburg (4)
Storms, W. W., Racine (1)
Strang, C. J., Grantsburg (1)
Strecker, R. A., Elkhart Lake (1)
Sutherland. G. A., Stevens Point (1)
Sweet, H. L., Fond du Lac (1)
Swerig, O. P., Stoughton (6)

Techtman, Chas., Kewaskum (3)
Techtman, Edwin C., Kewaskum (1)
Teeple, G. E., Whitewater (1)

* Deceased.

Teigen, Nels, Rt. 2, Edgerton (6)
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Tennant, H. V., Portage (5)
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Thalacher, Albert, Packwaukee (1)
Thiede, Aug. F., Two Rivers (1)
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Tietgen, W. H., Milwaukee, Station D, Rt. 3 (1)
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Tucker, L. W., Kilbourn (1)
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Twedt, John H., Wyocena (4)

Ullsperger, H. W., Sturgeon Bay (4)
Uvaas, Ed, Larsen (1)

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Vaughan, D. W., Whitewater (1)
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Veeder, C. A., Friendship (1)
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Wagers, Ralph E., Wisconsin Rapids (1)
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Wakeman, C. A., Oshkosh (2)
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Wallace, R. Y., Fox Lake (2)
Wallace, W. C., Oakdale (1)
Waller, Geo., Burlington (1)
Wallis, W. R., Marks, Miss (1)
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Warren, Geo. E., 208 La Salle St., Chicago, Ill. (5)
Warriner, C., New Lisbon (1)
Wait, Frank, Clintonville (1)
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Webb, W. H., Superior (1)
Webster, A. L., Wheaton, Ill. (1)
Webster, H. C., 490 Morse Ave., Milwaukee (6)
Webster, L. B., Elkhorn (1)
Weidman, Geo., Green Lake (4)
Wenninger, Bruno, Hartford (1)
Werner, Ed., Appleton (1)
Wesselink, G. W., Hingham (1)
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Williams, Rowland, Beaver Dam (1)
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