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Madison, Wisconsin: The Association, 1916

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PROCEEDINGS OF
SECOND ANNUAL CONVENTION
OF
The Wisconsin State Drainage
Association

GRAND RAPIDS, WISCONSIN
JANUARY 19-21, 1916

Drain Tile

Strong, hard-burned tile insure the permanent and perfect working of your drainage system. When you buy drain tile, be sure to get the best. Don't take chances by using inferior tile because they are cheaper. Our tile are more than worth the difference in price.

Haeger Tile

All Sizes—3" to 24" in Diameter

Our tile are well made, hard-burned, and are warranted to be durable. The name "HAEGER" is stamped on every tile and protects you against substitutes. Look for the name.

Write for valuable booklets on "Land Drainage" and also tell us what tile you need.

Haeger Brick & Tile Co.

No. 6 State Bank Bldg.

Dundee, Ill.

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no. 2

PROCEEDINGS

OF

SECOND ANNUAL CONVENTION

OF

The Wisconsin State Drainage
Association

GRAND RAPIDS, WISCONSIN
JANUARY 19-21, 1916

EDITED BY THE SECRETARY

SUMMER MEETING TO BE AT RACINE,
SEPTEMBER 4 AND 5, 1916

OFFICERS FOR 1916

PRESIDENT—W. B. Coddington, Plover
VICE PRESIDENT—B. M. Vaughan, Grand Rapids
TREASURER—A. C. Willard, Necedah
SECRETARY—E. R. Jones, Madison

WRITE TO OUR ADVERTISERS.

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Proper drainage increases crops on low and high land. Deepens fertility—prevents washing—lengthens the season from one to three weeks—promotes absorption of fertilizers.

As an example of increased crops, a lowland pasture after being tiled, produced 51¼ bushels of winter wheat per acre.

Write for the advice of our Service Bureau and learn without obligation how to secure the best results with

DENISON Double Process Tile

This tile is made of genuine blue shale clay, recognized as the best material. Denison tile is hard burned, making it impervious to water, frost or other exposure. Every piece is uniform in hardness. We allow for breakage in transit.

Learn about tile and drainage by sending for our free book. It is written by best authorities. All good dealers handle Denison tile. Write for prices and dealer's name.

Send the coupon for book.

Mail the Coupon

Mason City Brick & Tile Co.

Dept. 000, Mason City, Iowa

Largest Shippers of Tile in America

Mason City Brick & Tile Co.
Mason City, Iowa

Gentlemen:—Please send me
your free book on Land Drainage.

Name

Town

R. F. D.....State.....

THEY ARE READY TO HELP YOU.

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CONCRETE FOR PERMANENCE

Concrete for Drain Tile

Concrete drain tile is permanent, unaffected by alkaline soil, acids, and water. Low in cost, and easily made with collapsible steel forms.

Atlas Portland Cement is more used than any other make because it is uniform and reliable. For best drainage use Atlas.

Atlas Service

Our book on "Concrete Construction for the Home and Farm," gives important information on the building of drains and the making of reliable concrete drain tile.

It also describes in detail the construction of concrete sidewalks, fenceposts, floors, cisterns, watering troughs, silos,—numerous other structures that are best built in concrete.

This book and other information free on request. Use coupon.

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Members of the Portland Cement Association

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ATLAS CEMENT
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Name and address.....

Bristol Tile Works

Willett & Brown, Bristol, Wis.

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Write for Quotations

TILE YOUR FARM

With Everlasting Burned Clay

GUNTHER BROTHERS

Manufacturers of DRAIN TILE

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Ozaukee County C. & N. W.

DRAIN TILE--4 TO 30 IN.

Made from paving brick shale

Hard Burned

SPRINGFIELD DRAIN TILE CO.

Box 441, Springfield, Ill.

PULVERIZED LIME ROCK.

Write for prices direct to you, giving your receiving station. Our product has received the endorsement of county agricultural representatives throughout the U. S. Write for literature, sample, and free slips of litmus paper for testing the soil.

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AKING TILE

The man looking for a profitable vocation in which the field is unlimited and uncrowded will do well to look into the manufacture of cement drain tile.

We build equipment for the entire plant and furnish full instructions. Write for a copy of our free book "Money in Cement Tile"

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Wisconsin Drain Tile Co.

We take contracts for installing tile drainage systems.

Our work is directed by J. H. Harness, who has had 30 years of experience in Indiana.

James L. Stokes, Secretary
Elkhorn, Wis.

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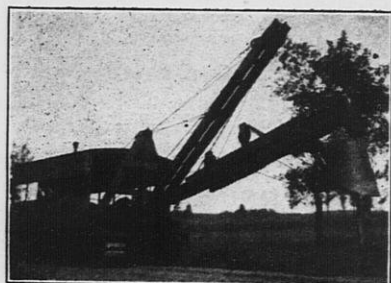
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We reach Northern Wisconsin
C. & N. W. Soo, C. M. & St. P.

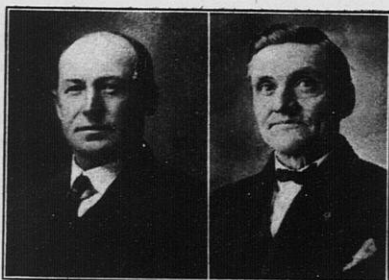
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OUR ADVERTISERS.

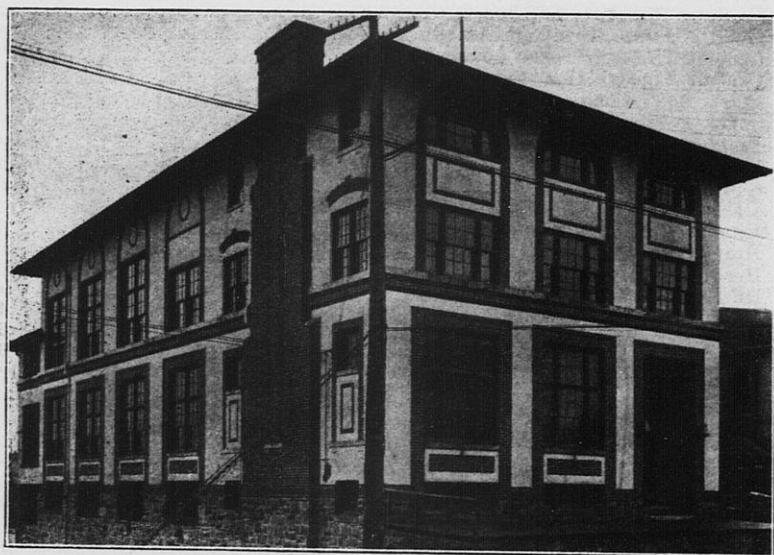
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THIS DREDGE
GAVE A
DEMONSTRATION



W. B. CODDINGTON H. H. SHERWOOD
Our New President Our First President



Elk's Hall, Grand Rapids
IT WAS HERE THAT WE MET



MANY WATCHED THE BUCKEYE MACHINE DIG A TRENCH IN
FROZEN GROUND

SECOND ANNUAL CONVENTION

Wisconsin State Drainage Association

GRAND RAPIDS, WISCONSIN, JANUARY 19, 20 and 21, 1916

MORNING SESSION, JANUARY 19

The meeting was called to order at 9:30 A. M. in the auditorium of Elk's Hall by President H. H. Sherwood, who summarized the progress of the year by a brief address.

PRESIDENT'S ADDRESS

H. H. SHERWOOD

Mauston, Wisconsin

At this time the Wisconsin Drainage Association completes the first year of its existence. During the past year we have witnessed a continued increase in its membership from 68, who signed the constitution to 194, our present membership. It is hoped we may double the membership at this meeting.

It is also gratifying to note the interest shown by the public in the workings of the association. Observing persons now realize more than ever before how fundamental is the practice of drainage to good soil management.

We were glad to have been able to place in your hand the past year the first volume of the Proceedings of the Association, together with those of similar associations in adjoining states on our exchange list. It is a pamphlet of which I think we may

WRITE TO OUR ADVERTISERS.



BUCKEYE TRACTION TILE DITCHERS

Will dig ditches better, faster and cheaper than hand labor. Actual experience proves they will do the work of 15 to 200 men, depending on the size. Built in a range of sizes for different trench dimensions. Complete units in themselves, furnishing their own power for digging and traveling.

Rugged construction, positive cleaning device, and apron wheels enable them to travel over and operate successfully in all soils. They make

A PERFECT TRENCH AT ONE CUT

leaving the ditch ready to receive the tile immediately. Encased digging equipment permits operating successfully in cavy soils.

The trench will be absolutely to grade with smooth, true, vertical sides and the finely pulverized, excavated dirt deposited to one side, convenient for back-filling. More than 1,200 Buckeyes are in actual successful operation today. You, too, can make big money easily with one of these machines.

Read What These Men Have Done and Earned

Brodhead, Wisconsin.

The machine I bought is a money maker. Will average from 125 to 200 rods per day, 3 to 4 ft. deep, in ordinary digging, for which I get 35 cents per rod. Cost of operating, two men besides myself, \$4.00. Gasoline, 12 gallons at 15 cents, \$1.80. Oil and grease per day, perhaps, \$.10. Repairs and depreciation, \$.40. Total daily operating cost \$10.00, making a net profit of around \$50.00 per day. The machine can be run 10 months out of the 12, and I can dig any place they can get the tile to me with horses or oxen.

L. I. Fairman.

Larsen, Wisconsin.

I purchased one of your No. 1 tile ditching machines in April, 1915, and my gross earnings from 84 days' operation were \$220.00. I paid out for help and supplies \$278.00 and my repair bills amounted to \$20,000. This left me \$1902.00 for my own work and investment in the machine. My crew consisted of one man besides myself, as the land owner furnished the man to lay the tile. I had never done contract tiling before getting your machine and my farm work also took up considerable time. I found no places on my jobs that were too soft for the machine to sustain itself and no soil so sticky that the machine would not properly clean.

Ed. Uvaas.

Write for Special FREE Book of Facts

It tells all about the Buckeye Traction Ditcher and contains letters from men who have made money with this machine. Describe your soil conditions and size ditches you wish to cut. We will gladly outline the machine and equipment best adapted and most profitable. Our Service Department will help you build up a steady paying, healthful contract tile drainage business. This advice and assistance free. Write us today.

THE BUCKEYE TRACTION DITCHER CO.

504 Main Street, Findlay, Ohio

THEY ARE READY TO HELP YOU.

be justly proud. Flattering compliments have come for it from outside of Wisconsin.

We had 2,000 copies printed, most of which have been distributed. The cost of the same was paid from money received from advertisers. The price of the publication to persons not members was 20c. We ask that we may have the full coöperation of all members and friends of the Association in the distribution of the yearly volumes, primarily because they will contain much information which will be of value to any person interested in farm drainage. The larger the distribution of our pamphlets the more will our movement receive attention and the practice of drainage thereby be promoted.

We feel that all of the agricultural organizations of the state should affiliate with this movement and we believe they will become associated with us when they become fully aware of the aim of our association and of the work which we are endeavoring to do in this state.

When we consider the interest in farm drainage practice, we see that substantial progress has been made in many lines and this gives us encouragement to continue our efforts coöperatively through this association. We believe that the best results can be obtained if the work of the association is properly distributed among several committees.

During the past year we have had the efficient assistance of committees on various phases of drainage law and assessments. Their report will show with what success they have met.

It might be advisable to have a regular program committee which shall prepare our next program in consultation with the executive committee. The association will fail of the highest realization of its opportunity if its work is confined to a few individuals. Let each member pledge to the officers of the association for the coming year his full coöperation for our common purpose.

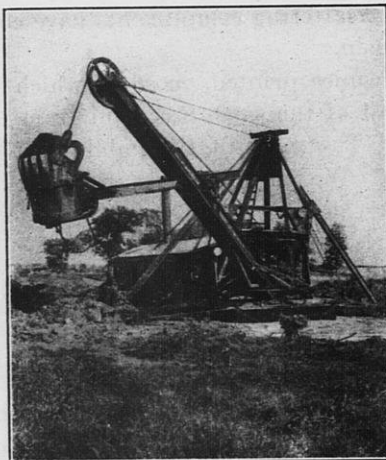
We will now listen to the report of the officers and committees.

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We contract
for the
construction
of open
ditches and
tile drains

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large and
none too
small.

**Drainage**

We sell the
best

**Hard
Burned
Shale
Drain
Tile**

Ask for
prices.

Estimates and suggestions cheerfully made upon request.

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CO.**

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WISCONSIN AND NORTHERN
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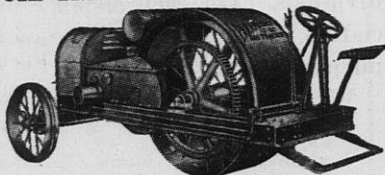
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for Digging. Economy in Operation.

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OIL TRACTORS**

Thoroughly tried out motor. Big
noiseless transmission. Positive
traction grip. Easy steering—auto-
matic when plowing. Floating draw-
bar. Highest ratio of power per
pound of tractor.

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REPORT OF TREASURER

December 9, 1914, to January 19, 1916.

Receipts.

| | |
|--|-----------------|
| To 194 membership fees..... | \$97 00 |
| To advertising in First Proceedings..... | 374 00 |
| To 21 Proceedings sold at 20c..... | 4 20 |
| Total receipts | \$475 20 |

Disbursements.

| | |
|---|-----------------|
| For engraving..... | \$11 61 |
| For incidentals | 1 66 |
| For postage | 65 10 |
| For printing | 255 15 |
| For stationery | 24 75 |
| For stenographic help..... | 59 43 |
| Total disbursements | \$417 70 |
| Balance in treasury January 19, 1916 | \$57 50 |

Respectfully submitted,

A. C. WILLARD,
Treasurer.

WRITE TO OUR ADVERTISERS.

Henry F. Schroeder

Drainage Engineer

Tomah, Wis.

Lock Box 222

H. H. TUBBS

Drainage Engineer

ELKHORN, WIS.

Prices Reasonable

LOOSELEAF BOOKS for Drainage Districts. Assists in forming Districts. Lessens litigation. Simple, Accurate, lasts 20 years.

NYE JORDAN

MAUSTON, WIS.

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Civil and Drainage Engineer

Engineer of drainage districts in Racine, Kenosha, Milwaukee, Waukesha and Jefferson Counties.

Small districts and town drains planned as carefully as large districts.

Offices in City Hall
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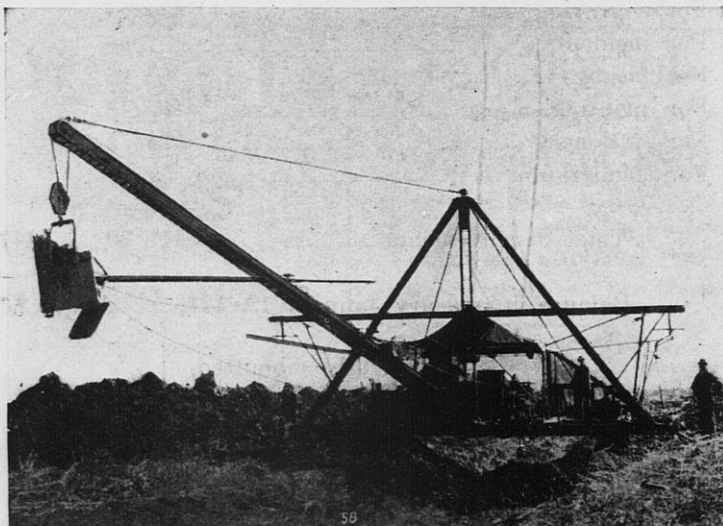
Warren Moore

Engineer for all District and Town Drains in Rusk County, Wis.

LADYSMITH, WISCONSIN

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Are used for all kinds of drainage and ditching.



The ideal machine for clean out work. Straddles the ditch, digs true to slope and depth and leaves clean, wide berm. Works up grade giving immediate drainage. Quickly assembled and easily moved from job to job. A large number of Bay City Dredges are successfully operating in Wisconsin, Minnesota and several other states on new and clean out work. Ask for particulars. Give us bottom width, depth and slope of your work.

BAY CITY DREDGE WORKS

Bay City, Michigan

THEY ARE READY TO HELP YOU.

REPORT OF SECRETARY

December 9, 1914, to January 19, 1916.

Membership.

| | |
|---|-------|
| Membership at close of session Dec. 11, 1914..... | 68 |
| Memberships added during the year..... | 126 |
| | <hr/> |
| Total membership | 194 |

Publication.

| | |
|---|-------|
| Proceedings published | 2,000 |
| Mailed | 770 |
| Sent to advertisers..... | 180 |
| Sent to New York and Iowa in exchange for their publications | 450 |
| | <hr/> |
| On hand | 600 |

There is due from advertisers \$41.00, but there is an outstanding indebtedness of \$126.57, due chiefly to the committee on legislation for their travelling expenses necessitated by their work at the last session of the legislature. We need \$28.07 to balance all accounts for the year.

Respectfully submitted,

E. R. JONES,
Secretary.

It was moved, seconded and carried that the reports of the treasurer and secretary be laid over until the accounts were audited. D. H. Pratt, A. W. Dibble and A. B. Larson were placed on the auditing committee.

The policy of the secretary in distributing freely copies of the Proceedings among non-members as well as members was unanimously approved.

WRITE TO OUR ADVERTISERS.

A. L. WEBSTER, Drainage Engineer

WHEATON, ILLINOIS

Consultation, Designs, Estimates, Surveys and Plans

Engineer for over 20 Drainage Projects in
Seven Counties in Northern Illinois, using
tile up to 60 inches in diameter.

Never use an OPEN DITCH where a PERMANENT TILE will do the
work.

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Drainage Engineer

Milwaukee County Surveyor

Member of Firm of
KAMSCHULTE & WEBSTER
Consulting Engineers,

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Milwaukee, Wis.

W. G. Kirchoffer

Sanitary and Hydraulic Engineer

Drainage and Water Supply a Specialty

Madison, Wisconsin
22 N. Carroll St.

R. S. Owen L. F. Pope

Madison, Wisconsin

Engineers for Drainage Districts

Broughton Cutler
Little Yellow
Rockland

Taylor Creek
Three Lakes Stokes
White River, Etc.

Philip H. Hintze

Civil and Drainage Engineer

Engineer for the following districts:

Nine Springs,
Starkweather,
Koshkonong-Mud Creek,
Lodi,
Springfield,
Middleton,
Springfield-Middleton
Town Drain
Smithback Town Drain,
Medina, No. 2,
Blooming Grove,
Door Creek,

and numerous other Township
Drains and tile projects.

Preparatory plans and estimates
made at reasonable figures. Local
and long distance 'phone No. 5071.

Madison, Wisconsin

THEY ARE READY TO HELP YOU.

Upon motion of Mr. Myers the membership fee was raised from fifty cents a year to one dollar a year.

Upon motion of Mr. Amidon provision was made for a list of "Special Contributors" to consist of those who felt inclined to contribute more than one dollar annually as a membership fee.

The report of the committee on legislation was announced by its chairman, B. M. Vaughan, but its presentation and discussion was postponed until the following day.

Mr. Myers announced that the special committee of the legislature with Senator Everett of Racine as chairman was at work on a drainage district law for the next legislature.

The secretary read the names of the other members of the special committee as follows: Senator J. H. Bennett, Viroqua; Senator F. H. Hanson, Mauston; Assemblyman William Nelson, Deerfield; Assemblyman Julius Hanson, Hilda, and William Arneman, Neenah. The secretary read a letter from Senator Everett expressing regrets that he was unable to be present at the convention.

The following resolution was passed unanimously and the secretary was instructed to communicate it to the special committee of the legislature:

RESOLVED, That each member of the Wisconsin State Drainage Association and particularly the Committee on Legislation be authorized and requested to aid in every way possible the esteemed committee of the legislature engaged in the important work of revising, simplifying and codifying the drainage district law of Wisconsin.

The president recited the manner in which ten attorneys got together in 1905 and authorized one of their number to draft the law of 1905 for introduction into the legislature. He was paid from a fund raised by the attorneys themselves with some help from the drainage districts whose organization was contemplated or begun.

Mr. Coddington, chairman of the committee on standardization of benefits, announced that a report of progress was all the committee was prepared to make.

The president then announced the opening of the program prepared for the morning.

WRITE TO OUR ADVERTISERS.

Chas. E. Buell 9 S. Pinckney St.
Frank W. Lucas Madison, Wis.

Buell & Lucas

Drainage Attorneys

Attorneys for the Koshkonong-Mud Creek, the Nine Springs, the Lodi and the Blooming Grove Drainage Districts.

By reason of our experience we are prepared to counsel with and advise other attorneys in all phases of drainage procedure and litigation.

Gerrit T. Thorne

Drainage Attorney

Office Phone 1555

Residence 1945

Oshkosh, Wisconsin

145 Main Street

LAND DRAINAGE

by J. L. Parsons

165 pages, 6x9, 36 figures, \$1.50
Valuable alike to drainage engineer, contractor, farmer and drainage official.

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"Every Technical Book in Print."

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will dig your drains true to grade and slope, and do it at less cost than is possible by other means. Will dig narrow ditches for large drain tile, as well as drains as wide as is practical to straddle.

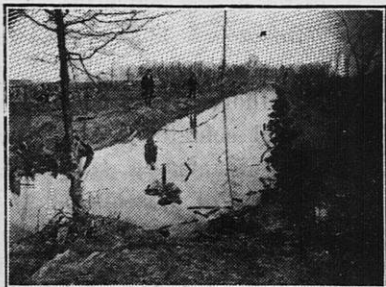
Tell us your requirements and let us advise you.

WICKES BROTHERS

SAGINAW, MICHIGAN



Making Holes for Blasting



The Ditch After Blast

Blast Your Drainage Ditches

THIS is the quick, cheap and practical ditching method approved by Government engineers, drainage experts and many prominent land owners in all sections.

DU PONT EXPLOSIVES are expressly made for ditch blasting. Try the powder plan for digging ditches,—thousands of pounds have been safely and sanely used for reclamation purposes.

ASK FOR HANDBOOK OF EXPLOSIVES—IT'S FREE

E. I. du Pont de Nemours & Co.
WILMINGTON, DELAWARE

THEY ARE READY TO HELP YOU.

ADDRESS

HON. E. P. ARPIN

*President of Wisconsin Advancement Association,
Grand Rapids, Wisconsin.*

Gentlemen of the Convention: It gives me pleasure to welcome you to Grand Rapids. We like to have conventions, particularly drainage conventions. Drainage has meant a great deal to Grand Rapids and vicinity.

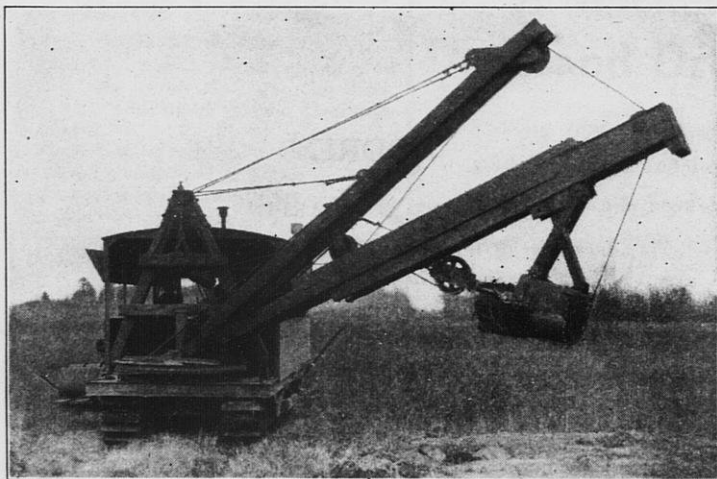
We used to have cranberries on all of our marshes. Then came the fire of 1896 and our cranberry area narrowed down to a single township—the town Cranmoor. The rest of our marshes had to be drained in order to make them produce any thing. Makeshift drains were put in at first. These we are replacing today with better drains.

I interested myself in two dredging companies, operating largely in northern Minnesota. I have here a map of a county in that region that has some commendable features. A single county there has 600 miles of dredged ditch, and better still, for 550 of those miles, roads have been made of the spoil banks of the ditches. I want to emphasize the building of roads with dredges. Both ditches and roads are built at the same time and the cost is reduced thereby.

But there is another feature of the Minnesota work that I like. That is the matter of financing the districts. The county is squarely back of the district bonds. This makes them classify as municipal bonds. They bear only 5 per cent interest, but they sell readily to conservative New Yorkers who will buy nothing but municipal bonds. Thus the county at no loss to itself is aiding the landowners in financing their drainage project.

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I think that some form of county guarantee would be a good thing for Wisconsin. I see my friend Judge Manning here. He advocates the financing of land clearing operations by the county. This will bring better machinery and more economical methods. I believe in this proposal. And if a county can afford to loan its credit to land clearing operations, it can do so for land draining operations. The county is not asked to give, or even to loan a dollar in either case. It merely loans its credit. The Wisconsin Advancement Association advocates this plan.

In conclusion I want to repeat that I am glad you are in our city. Not only our attorneys, our drainage commissioners, and our engineers, but our whole people are at your service. The city and all that is in it is yours.

The President: In behalf of the association I thank Mr. Arpin, and through him the people of Grand Rapids for their kind words of welcome. The local committee has spent its time and money freely in making preparations for this convention. We appreciate their well directed efforts in our behalf and mean to show the good people of Grand Rapids that we are as glad to be here as we hope they are to have us.

I think this is a proper time to discuss the question of bonds introduced by Mr. Arpin.

Mr. Myers: Up to five years ago our counties were back of our drainage bonds absolutely, i. e., the resources of the county were back of the drainage bonds. This made them virtually municipal bonds. About that time some member in the state senate introduced a bill which took away a good share of the backing of the county. The lands in the drainage district alone were back of the drainage bonds. Those of us who had to sell bonds as attorneys for drainage districts found it difficult. In the bill 1578 which was introduced at the last session of the legislature we got back the old law and if this bill is passed our drainage bonds will again be municipal bonds. This bill declares them to be municipal bonds. I think it is right that every county in the state should be back of the drainage bonds issued for the improvement of lands in that county. They can well afford it and save people in the drainage district this amount of money and the rate of interest which they have to pay when the country is not back of the bonds. I am satisfied that if this law goes into effect and

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the bill is passed by our legislature that there will be a great change brought about in the market value of our bonds. They will be municipal bonds absolutely once more. I think we have taken care of that feature very well in the proposed law.

Mr. McCaul: This would be very desirable, but there is going to be some opposition, and I doubt if in equity the county should be back of the bonds. These propositions are usually started by business men who hope to make some money out of it. Let them take the risk. I think it is going a little far to ask that the resources of the county be responsible for their adventure.

Mr. Coddington: But the county is benefited by the drainage. I have in mind a drainage district where drainage was started on 56,000 acres of land. The county received a tax of seventy-two cents per forty acres then. Since drainage the tax has crawled up until now it is \$12.50 a forty for regular tax not saying anything about drainage tax whatever. Did not the county profit by that increase in taxes? And did the county help? Whenever we make that land valuable are we not helping the balance of the county and township in the way of taxes? They are getting the difference between seventy-two cents and \$12.50 to help out the county without any trouble to guarantee it, but are not helping us in any way, shape or form. I think we should have one of two things. Either we should be exempt from increase in taxes from the date the drainage district is commenced until the last bond issued for construction is paid off, or we should have some backing from the county to whom we are paying the additional land tax. I believe it would be a great saving if the county would stand behind our bonds to that extent. They are reaping the benefits of our improvements."

Mr. Vaughan: The county had the benefit of the increased value of these lands on its tax roll, and the county assessment in each town has been increased from one to three or four times of what it was before. The county has had the benefit. We are not asking the county to donate one cent towards our bonds but we are asking the county to take these assessment certificates which are not bid in by private individuals and furnish us the money for them if we need it. They can get money for six per cent. These drainage certificates draw ten per cent. They are nothing out. They have the benefit of the increase in

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valuation on their tax roll and many other benefits and they should help us to that extent, especially when it will enable us to get money at a low rate of interest. The fact that the county was back of our bonds would enable us to sell our bonds anywhere at a rate of interest from one to one and a half per cent lower.

Mr. Sherwood: We should make a law to prevent the town assessor from assessing the property any higher in the drainage district than it was when you started to drain until after the drainage bonds are paid.

Mr. McCaul: We cannot get away from uniformity of taxation. It must be based on value.

Mr. F. J. Pratt: I know of land assessed at \$1.00 per acre before it was drained, and some kicked on that. Today it is assessed at \$70.00 and up, and the land is not worth it. We should not pay this high tax until the land is worth it, and need some legislation to protect us.

Mr. Jordan: The value of land is based on its productiveness and not on speculative value. The speculative value is absolutely untaxable and I do not think they can use this as a basis for taxation. Assessors at once raise the valuation of drained lands to ten times what it was before drained. If they would base the assessment on production, it would be all right.

Mr. Coddington: They should assess these lands at what they can produce or what they will produce at the time. The situation is this. As soon as a district is organized the assessor will begin to boost the taxes. From the time you go into the drainage district until you have it in good shape it will be from three to five years, and during that period of time the land has not brought in any more, only more money spent, and yet the taxes have been boosted up. As soon as the drainage bonds are issued the poor farmer has to dig down to pay these big taxes and he gets rather mad and begins to fight. It is not fair. This comes at a time when the farmer needs his money for drainage and this increase in tax makes it pretty hard for him. If the town is to be benefited by the improvements of this land they should show us a little mercy in not raising our tax until the drainage bonds are paid off. They should assess on the actual valuation or on what you reap.

WRITE TO OUR ADVERTISERS.

B. M. VAUGHAN

Attorney at Law

Revisor in fact of the Drainage District Law of Wisconsin in 1905. One of the revisors of the Town Drainage Law of Wisconsin in 1913. Chairman of the committee on legislation appointed by the Wisconsin State Drainage Association, December, 1914.

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Mr. Coffin: Would it be constitutional or advisable to exempt lands in drainage district from a tax for a period of time?

Mr. Vaughan: In 1905 the matter was considered very fully and Judges Parks and Gaynor and Mr. Goggins and myself took it up. We spent thirty-three days in Madison and came back with the idea that it was too dangerous a proposition to tackle at that time. If you want us to make an attempt and get such a proposition as this before the committee now, we will attempt it.

Mr. Myers: I think it would be constitutional to exempt a certain class of land from taxation for a certain number of years provided certain things were done. There is a similar law in the case of forestry. We are wandering into an indefinite field when we come to exempt drainage lands from taxation and I don't think we can get by with anything of that kind. It might prove a waste of time to attempt it. The matter might be carried to court for a jury trial. The question is up—what is the fair market value of that land and what will it bring? Land that has a bond issue outstanding is not any different than land of the individual owner where the owner has to put a mortgage on the land.

Land in Racine was selling at a speculative value of \$40.00 per acre. That same land is selling at from \$200.00 to \$300.00 per acre. The actual value is there; it is producing the goods. Some of the land last year produced 617 bushels of choice onions per acre that sold at seventy-five cents per bushel. This was a profitable drainage district. The assessed valuation today is \$150.00 per acre. We have no cause to complain in the southern part of the state. Our drained lands produce enough to enable us to pay taxes on them. We have roads enough there also.

Mr. Sherwood: But in Juneau county districts we have no roads. We need roads badly. Commissioners have constructed good roads out of the spoil banks of the ditches, and town boards have refused to accept them. How can you compel them to accept them?

Mr. Myers: It might be dangerous to insert a compulsory feature into our law.

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Mr. Vaughan: The proposed law makes a provision for coöperation between the town board and the drainage district in constructing roads. Where a good level road can be constructed out of a spoil bank for a cost of less than $\frac{1}{4}$ cent a cubic yard, it is folly not to coöperate.

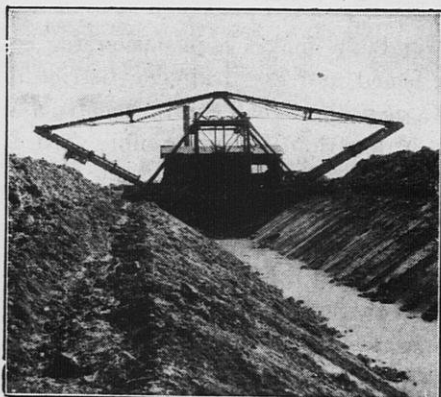
Mr. McCaul: It would be a good thing if we had a law which provided that wherever a highway had been opened by a private individual or the drainage district and this had been used by the public for three years it should thereafter become a public highway. I think this should be a general statute and not incorporated in the drainage law, however.

Mr. Jones: I believe that roads and drainage should go hand in hand, but it is a mistake to distort your drainage system for the sole purpose of getting the ditches where roads are desirable. Let us put our ditches where the topography says we must put them, and put our roads where they are needed. If the land is thoroughly drained, the construction of the road will be easy. A tile is often a better drain for a road than an open ditch.

Mr. Sherwood: I guess that is true. Some of us are apt to think that the only way to get a dry road is to build it up high above the water table. You can accomplish the same end by lowering the water below the surface of the ground. This is another reason why, instead of merely putting in the outlet drains, every drainage district should put in the lines of tile that are needed to complete the drainage. Where district bonds are sold, this makes it easier for the settler to get a start.

Upon motion, a recess was taken until 1:30 P. M.

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AFTERNOON SESSION.

JANUARY 19, 1916.

The meeting was called by the president, who announced that the assessment of benefits and allied subjects would be the subject for discussion for the afternoon.

QUESTIONS ON DAMAGES AND BENEFITS

B. M. VAUGHAN

Attorney at Law, Grand Rapids, Wisconsin.

Early in the history of each drainage district the commissioners are confronted with the problems of assessing benefits and awarding damages. These problems, both as applied to the lands in the district and to the towns, cities, villages, railroads and other districts that may be affected by the drainage, the commissioner must solve. Many difficult questions may arise in making these assessments and awards. In this paper, I propose to present some of these questions, that have been asked me, as attorney for drainage districts, in 14 years practice under the drainage laws of Wisconsin, and incidentally to present some illustrations and suggestions that may aid commissioners and supervisors in their work.

Understand me, I propose to *ask* the questions, not *necessarily* to answer them. That is for your committee on "Standardization of Benefits." To some of the question I may suggest answers. Others of them I merely launch at the committee, which of course you will expect to answer them quickly. Why shouldn't they? Haven't they had a whole year to prepare?

Let me say, before I go further, that, from the very nature of the problems involved, only approximate accuracy can be

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reached, or is required by the courts. Further, if your assessed benefits and damages throughout your district are proportional to the actual benefits and damages, and the assessed benefits are not higher than the actual benefits, no injustice will be done.

DAMAGES.

Awarding damages caused by drainage work, especially by open ditches, may usually present three questions, (1) What is the damage to the tract, arising from the occupation of the strip of undrained land by the ditch and its berms and spoil banks? (2) What, if any, decrease of value to a given tract will the ditch cause by cutting off access to other of the owner's lands, or to access to a highway? (3) What, if any, injury will be done to the owner's lands near the drain by excessive drainage?

The first two of these questions are not difficult to answer, with approximate correctness. The number of acres of land occupied by the ditch, its berms and spoil banks is easy to compute, and generally the value of that land, before drained, can be known with reasonable certainty. The number of acres occupied multiplied by their value per acre will give you in dollars and cents, this element of damage, as usually allowed. I think that this allowance is rather large, as part of this area is usually pastured by the land owner, and so is not a total loss to him.

The second element of damage, decrease in value by reason of cutting up the owner's farm, or of cutting his lands off from highway, is usually fairly compensated by building him a substantial farm bridge, and allowing him a just offset on benefits, to compensate for maintenance of this bridge. If the average annual maintenance cost of the bridge is \$6.00, allow him, as offset, such sum as \$6.00 is legal interest on.

The third element, that is damage to lands near a ditch by excessive drainage, is usually wholly imaginary or grossly speculative, and if considered at all should be considerate as a negative element in fixing benefits.

However, like all speculative elements in business and law suits, this is a dangerous element. To illustrate,—on a drainage trial that I took part in some years ago, the remonstrant's lands

could not have been sold for more than \$10.00 an acre, and were producing only $\frac{1}{2}$ to $\frac{3}{4}$ ton of wild hay an acre a year. No witness placed the value of this land above \$10.00 an acre. But witness after witness (the remonstrant's neighbors) went on the stand for the remonstrant and, against our objection, was allowed to testify that the damage to remonstrant's eighty acres of land near the ditch, due to the drainage, would be \$2500.00 to \$4500.00. The only possible element of damage to his land was the supposed excessive drainage, as the ditch did not touch his land, but was across the road from him. The jury found that the eighty acres of land would not be benefited, but would be damaged \$3,500.00 over four times its value. The court sanctioned a compromise of "no benefits and no damages." After the land was drained the owner boasted that this eighty was benefited more than a thousand dollars.

I have never heard a witness, who had farmed drained marsh lands along a ditch, place the damage by so called excessive drainage, anything more than nominal. Some witnesses with experience do not place the benefits to lands within a few rods of a deep ditch as high as they place the benefits to other lands further away but thoroughly within the influence of the ditch.

My opinion is that questions of damage submitted to a jury should contain questions *covering separately* such of these 3 elements as are involved, but I have never succeeded in convincing the court that I am correct in this.

Another small element of damage may be injected, where the land is cut into irregular pieces, so that it is difficult to work, but usually fixing the allowance for that is quite easy.

Damages to town, cities, villages and railroads involve the question of costs of building and maintaining extra bridges. These costs are comparatively easy to fix, if you have the data from which to figure.

DRAINAGE BENEFITS.

The term "benefits," as applied to land drainage is unfortunate, because in the average mind, it has no clearly defined meaning. One man regards as benefits only the improved crop yielding power of the drained piece of land. In the wheat

grower's mind drainage benefits are apt to be based wholly on the average increased wheat yield through a series of years. In the potato grower's mind benefits from drainage would probably be based on the average increase in the potato yield through a like series of years. To the stock grower's notion the benefits from drainage should be based on the greater number of pounds of meat that the drained land will produce after it is drained. But, the courts say (and they have the last say) that the special benefits to lands that the commissioners must assess as drainage benefits are the increase in the market values of those lands, especially due to drainage.

Are these measures of benefits the same? Sometimes they may be, but more often they are not. Sometimes following out these several suggestions, as to measure of benefits, lead to results widely different.

Let me illustrate:—In a city of ——— were thirty acres of undrained marsh land, which had been on the market for more than 10 years, at \$30.00 an acre, and so advertised for months. It finally sold for that price. High lands on three sides of this marsh tract were then held and selling for \$300 an acre and upwards. The value of this undrained 30 acres was practically determined by its productiveness as a wood-lot and pasture. Within a year after it was sold for \$30 an acre, a drainage district drained it sufficiently for building purposes, and the buyer soon sold it for \$10,000 or \$333.33 an acre. There had been no change of conditions except the change due to drainage and this increase of \$303.33 in value per acre might be said to have been all due to the drainage, i. e. to have been the actual rise in value of this land, caused by the drainage.

Should this thirty acre tract have been assessed a benefit of \$303.33 per acre? You say, yes, of course. But wait a minute. Within another 18 months after it sold for \$333.33 an acre part of this 30 acre piece sold in half acre, acre and two acre lots for \$800.00 an acre. This was a rise of \$770.00 an acre in less than 3 years, and practically the drainage created the only change in the physical condition of these lands. Its value now is about the same as surrounding higher lands.

Do you want to change your answer? Should the 6½ acres that sold for \$800.00 an acre have been assessed a benefit of

\$770.00 an acre? Probably this 30 acres of land will be worth \$1,000.00 an acre within 10 years after its drainage. Should it have been assessed benefits of \$970.00 an acre? I do not believe so. But what should the 30 acres have been assessed as special benefits by the commissioners of the drainage district?

The 30 acres were, in fact (the same as other lands of similar character in the same district three, four and five miles from the city) assessed a benefit of \$20.00 an acre. The other lands in the district that were assessed a \$20.00 benefit an acre were worth, before drainage \$10 to \$30 an acre and now are not worth more than \$50 to \$75 an acre, and probably will not, at the end of 10 years, be worth \$150.00 an acre. Yet under this assessment of benefits one acre that increases \$120.00 in value pays as much toward constructing the drainage as does another acre that increases in value \$770.00. Is that right? What part of this \$770.00 increase was due to drainage and what part to other causes?

I believe that, as agricultural lands, the products of the best part of this 30 acres tract would not, at present, pay 6% interest on more than \$150.00 an acre, while on about 12 acres of the 30 acres, rock is but 6 or 7 feet from the surface, and this 12 acres suffers so from drought that it now produces little if any increase of crop values over what it produced in its undrained condition.

But strange as it may seem, that 12 acres is in fact the most valuable part of the tract, as it is on the highway, is accessible to a drain eight feet deep and is in demand. Undrained, it was worthless for residence purposes. Drained, it is very valuable residence property. Had the commissioners assessed benefits of \$770.00 against these lands would the court have set them aside as "speculative" or because part of these benefits were not caused by the drainage?

I probably should not have mentioned this tract, as it is an exceptional combination of conditions, but it is an actual case, and it so aptly illustrates several of the perplexing problems that often present themselves to commissioners in assessing benefits, that I plead that as my excuse.

I said perplexing questions that "present themselves to commissioners," but in fact the drainage commissioners tell me

that a probable large rise in value of this 30 acres, by reason of drainage fitting it for building purposes, never occurred to them when they were assessing benefits, and hence did not perplex them.

But to come back to the definition of "benefits" that we must use as our test. Benefits to lands, which should be assessed in drainage proceedings, are only the increase in market value of the lands especially due to drainage. How are those benefits to be fixed? You say that it looks easy. It looks like a simple problem in subtraction. Subtract the value of the land before it is drained, from the value of the land after it is drained.

In that answer you may be right or you may not, for in the value after drainage is often included an element of general increase in land values, which will be enjoyed by all of the lands in that neighborhood, drained and undrained alike. The remonstrants will claim that this general increase in values is not part of the special increase in values (special benefits) due to drainage. So say the courts of some other states, and I rather think our courts will follow them, unless we can show them good reasons to the contrary.

Can we show the courts that this general increase in land values would not have applied to the marshland if it had remained undrained? And if we can show that, will that showing eliminate this rise in general values from the problem?

If we have to concede that the general increase in land values will include undrained marsh, what allowance will we deduct from the drained land value by reason of this general rise in values? To make this deduction correct shall we figure this general increase as dollars per acre or shall we figure it as per cent of the value at the end of the term, or how shall we get it?

But even if you are right in the rule that you lay down for determining benefits, the hard parts of your problem are yet before you. Unfortunately the present value of anything is often not easy to determine. "Value" is quite usually little more than an estimate, as is shown by six honest, intelligent, competent witnesses on oath, at the same time, placing the value of a given piece of land, well known to them at \$5.00, \$10.00, \$12.50 and \$25.00 an acre. That was actually done, only a short time ago, on a drainage hearing, and each witness clearly stated

plausible reasons to sustain the value he testified to. Often drainage commissioners have very few, if any recent sales of land in their drainage district to aid them in fixing the value of the lands of the district before drainage.

So much for a difficulty that meets them at the first end of their problem. At the other end of that problem, that is fixing the value of the land after drainage, they are in a worse predicament. They would have to be veritable prophets to correctly predict the values of the different pieces of land in their district at any fixed date, after the lands have been drained.

Here we have another perplexing question. The drained lands will probably continue to rise in value for a hundred years or more. What is the period at the end of which the *rise in values especially due to dainage* will stop?

Mr. Gaulke may say 5 years, Mr. Jones may say 10 years, Mr. Coddington may say 15 years, Mr. Daniels may say 20 years, I may say 50 years. Which of us is right? Or is any one of us right?

Take a concrete example. Acre A is worth, before drainage, \$5.00. At the end of 5 years it will be worth \$30.00; at the end of 10 years, \$50.00; 15 years, \$75.00; 20 years, \$100.00; and 50 years, \$150.00.

Assuming that the value given at each period will be the true value of acre A, two perplexing questions, before suggested, are at once up to the commissioners, and they must answer correctly, at the peril of having their assessed benefits wrong, and of having the jury so find. These questions are, (1) What period shall they fix as the time when the increase of value specially due to drainage stops? (2) What part of the increased value, that the land then has, is due to drainage, and what part is due to the general rise in land values in that vicinity and what due to other causes?

We have *assumed* that these values are the correct values of Acre A, but it is up to the commissioners not to "assume" what will be its value, but to "reason out" what will be that value, and to be able to give convincing reason to the court and jury.

And now, Mr. Commissioner, and gentlemen of the Committee on Standarization of benefits, please also be ready to an-

swer the following questions: *Should topography be given any weight in assessing drainage benefits?* Mr. Jones says that topography should be given great weight in fixing benefits,—that low wet lands should be assessed more than high dry lands: (See page 66, 1915 Report.) You say, that that is right. But wait a minute. In the ——— drainage district is a high forty of land containing the only stone quarry in the district, within a radius of several miles. Before drainage was put in, this forty was practically inaccessible. There was no demand for the stone, no one wanted to build there, and for more than 10 years no one paid the taxes on the forty. Seven years after the drainage was completed that forty was sold for \$4,000.00. Probably no other forty in the district would have then sold for \$4,000.00. Drainage was responsible for a part at least of this rise in value, because it gave accessibility to the forty and gave a market for its building stone. What drainage benefits should have been assessed against it? Again a rich high clay island in the ——— drainage district was worth before drainage no more than the surrounding marsh. Although dry enough for cropping, it was inaccessible. After drainage, it is claimed by some good judges to be worth as much as, or more than, any of the surrounding drained marsh. What benefits should have been assessed against that clay island? These are exceptional cases, but they are actual cases, and I believe the commissioners should have taken notice of the necessary future rise in value of these lands due to drainage when they assessed the benefits upon these districts.

Should depth of muck or peat be given weight in fixing benefits and if so what weight? In some districts the commissioners have based their variations of assessed benefits, against lands, almost wholly on depth of muck or peat.

Should quality or origin of the surface muck or peat be given any weight in determining benefits, and if so what weight? The commissioners of one district assessed black-ash-swamp lands nearly twice what they assessed lands having a sphagnum moss peat surface of the same depth. Is that right? The commissioners insist that it is, and put up a pretty stiff argument to prove that it is right. But other districts have not made this distinction. (See Professor Whitson, p. 25, 1915 Report.)

Should the distance from drains be given any weight in assessing benefits to lands, and if so what weight? Two districts that I know, have made distance from a ditch practically the sole reason for variation of assessed benefits.

Should kind of sub-soil be given any weight in making assessments, and if so what sub-soils should be assessed the most, and how much, and why?

Should nearness to market or to shipping point be given any weight in assessing the benefits, and if so what weight? I have in mind one considerable drainage district in which the lands are of unusually uniform quality, and quite uniformly drained. They were assessed quite uniform benefits. One end of the district has three good shipping points within three miles, on two railroads. The other end of the district had no valuable market or shipping point within 11 miles by road. Now that they are drained, the lands in the end of the district next to the shipping point average more than twice the values of lands in the far end of the district. Before this district was drained, when the crops it grew were only swamp hay, not worth shipping, the lands in the two ends of the district were of about the same value. The only reason for this present difference in value that I can see is the greater ease of marketing the tame crops that drainage makes possible. Should the commissioners have taken this fact into account in assessing benefits? You say that it was the nearness to market and shipping points, not the drainage, which caused this difference in value after drained. Then why did not the lands of the district have a corresponding difference in value before they were drained? The market and the shipping points had been there several years before any drainage was put in, yet no one claimed that the undrained lands in the two ends of th district were much if any different in value.

Should particular adaptability of a soil, when drained, to some paying crop, for instance, celery, onions, or cabbages, be taken into account in assessing drainage benefits, and if so what weight should it be given?

Should adaptability to some other particular use, by reason of drainage (for example building), be given weight in assessing benefits? .It is evident that any or all of these questions may

and often do enter into the problem of determining what will be the rise in value of lands *after drainage*.

Other elements, more rarely tending to vary future values of drained lands have come to me and might be suggested here, and probably many others have not come to my attention. Proper answers to two or more of these questions usually are necessary, in fixing the future value of almost any tract of land in any district. And the most perplexing question of all that confronts the commissioner is, *What weight shall each of these elements involved be given in determining the future value of a particular tract of land?*

So far I have only considered the assessing of benefits against lands. Quite as difficult questions arise when commissioners assess benefits against corporations. Prof. Van Hagen's paper (p. 53, 1915 Report) deals with railroad benefits and, while I am not by any means sure that there are not other elements (not there suggested) to be considered, in assessing drainage benefits against railroads, I will not take your time to discuss them here.

ASSESSING CORPORATIONS.

With regard to benefits to towns, cities and villages I will mention a few of the questions that arise.

How much should they be assessed for benefits to highways already laid out and built? It is generally conceded that building and maintaining roads on drained soil is less expensive than building and maintaining them in undrained soil. You may have to ask several other questions to get at the facts necessary to answer the first one. Is the road in good safe condition before drainage? If so determine what is the difference between the cost of maintaining that road on the soil in its present condition, and on the soil after you drain it as you will drain it, and having found that difference determine what sum that difference is statutory interest on, and the sum that it is statutory interest on might be regarded to be a fair benefit to assess against the town, city or village for that road. (See paper of Hon. J. A. Gaynor, p. 50, 1915 Report.)

If on the other hand the road in question is not in good, safe condition, you should add to the benefits indicated above such

sum as will be the difference in cost of making the road good and safe in its present undrained condition and in the drained condition that will follow your work.

If the road is laid out but not built, what should you assess?

In that case, to the first element mentioned in the answer to the last question, should be added the full difference in first cost of building such road on drained and undrained land.

How much are the benefits to the public health? Drainage lessens malaria and other diseases prevalent on wet areas and eliminates mosquitoes. Anything referable to drainage, that makes the maintenance of desirable conditions in the town, city or village less expensive to that corporation, is a benefit, that I believe should be assessed as a special drainage benefit.

How much is each worth in cash to the town, city or village?

Should you not assess against towns, cities and villages, benefits that they will receive by reason of the greater ease in building and maintaining the roads that they must lay out and build in the near future, in the drainage areas? You are assessing lands in the district for future benefits.

An examination of several maps, of large areas of well settled flat lands, in the northern and central United States, satisfies me that the number of miles of highways average more than the number of miles of section line. I see no reason why the drained marsh lands in Wisconsin should ultimately have less miles of highway, to a given area, than flat lands in other states, and in other parts of Wisconsin. Most of the new highway will have to be built within 15 years after the completion of the drainage. It will cost the towns, cities and villages far less to construct and maintain these new highways on drained than on undrained soil. Why should not the towns, cities and villages be assessed benefits for this decreased cost of future highways?

What of the above suggested future benefits to lands and corporations are "speculative" and therefore not assessable and what part of them that are practically certain to occur, come from the drainage and are therefore assessable?

I have not touched upon assessment of other drainage districts. Such assessments are rather unusual at this time, although they will probably be more common as drainage goes on.

Now it is evident that no man can answer all of the above questions accurately, off hand. Probably no set of men that the court may appoint commissioners, or that you may appoint on any Committee on Standardization of Benefits, can correctly answer them, or give any rules for their answer. Certainly some of those questions may have to be answered differently for each different piece of land. But we should be accumulating data to aid in answering them. Some state board or boards should be set at work accumulating and saving those data. It seems to me that discussions and accumulated data may develop generalizations that will greatly aid commissioners in recognizing and giving to each of the elements, involved in any given problem, its proper weight. And when each element is given its proper weight in making assessments they will be equitable and just.

The same questions, or many of them, rise on assessing supplemental benefits, but in most instances, in making supplemental assessments, the questions are much easier to answer, by reason of the fact that much of the improvement to the land, etc., has been accomplished and is a measurable fact.

DISCUSSION.

Mr. Coddington: We divide land into three classes when we are giving it a value before drainage, namely wet land, medium land, and dry land. We place the present value of the wet and medium land at about 20 and 40 dollars an acre respectively. We aim to give every forty good drainage and make every forty worth, say 60 dollars an acre. That makes the benefit 40 and 20 dollars an acre respectively.

Mr. Sherwood: A method of estimating benefits that is fair in the northern part of the state may not be fair in the southern part of the state.

Mr. Jones: No method is fair in any part of the state unless it recognizes that the forty that is 80 rods or more away from the ditch will need more tile to complete its drainage than the forty next to the main outlet. The tax on the distant land must be enough lower to allow for that extra tiling. In Mr. Coddington's own district the drainage which he says is uniform is not uni-

form, and to that extent an injustice has been done to the distant forties. Another fault with his plan is that it is not enough to classify lands on the basis of their wetness. The cause of the wetness is also a factor. A seeped bench marsh adjacent to high land may be wetter than the level lowland near the creek, yet the bench marsh may be ten feet above the creek. You could tile the bench marsh without dredging the creek. The benefit that the dredging of the creek does to the higher marsh is less for the higher marsh than it is for the lower marsh. The engineer is the most necessary man on the job when it comes to assessing the benefits of a particular ditch.

Mr. Sherwood. In estimating benefits should productive, prospective, or market value be considered.

Mr. Thorne. Value is determined by what the general public thinks of the land.

Mr. Jones. The general public is apt to overlook the advantage of a fortunate topography. A portion of a marsh may have a good fall and still be very wet and non-productive. I would be willing to pay more for such a marsh because of its good fall. If the value after drainage of all the marsh is the same, the benefit to the sloping marsh is less because of its higher value before drainage.

Mr. Vaughan. The law recognizes only market value.

Mr. Sherwood. The difference between the producing value before drainage and the producing value after drainage should determine benefits.

Mr. Veeder. Mr. Vaughan is right from the legal stand-point. Mr. Sherwood and Mr. Jones are right from the practical. But I object to Mr. Vaughan's exclusion of speculative benefits. A wholesale house failing to deliver a shipment of goods, is held by law for the difference between the buying price of the goods and what the merchant could sell them for. If the law recognizes speculative profits or benefits in one case, it should in the other. I believe in estimating the benefits high, but after due comparison between the several parcels of land. In Wisconsin the cost of construction is limited by the estimate of benefits. In Illinois Mr. Raymond is not so limited.

Mr. Lucas. I believe with Mr. Thorne that the opinion of the general public is the best thing to tie to. It is making a moun-

tain out of a mole-hole to debate the justice of speculative values. The personal factor upsets most of the theories. One man might be successful raising onions, another might fail on the same land. The land is not responsible for the ignorance of the proprietor. The simplest way is to give every parcel of land a

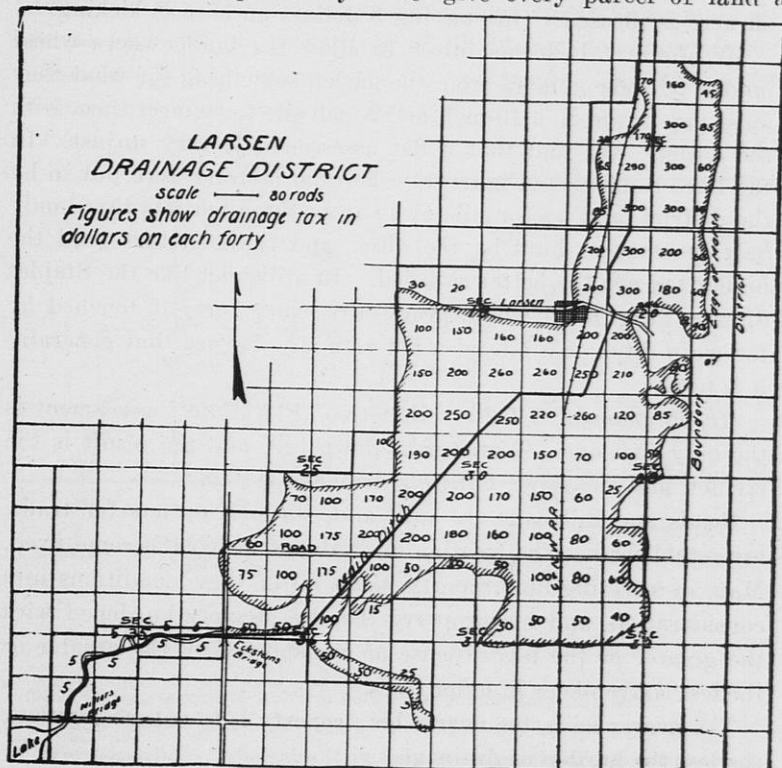


FIGURE 1.—A MAIN DITCH WITHOUT LATERALS.

Because the distant land owners had to install their own laterals they were taxed only about half as much for the main ditch as the land next to the ditch.—Courtesy Wisconsin Agricultural Experiment Station.

main drain or a lateral, tile or open ditch for an outlet, and then spread a flat assessment as is done with a sewer tax.

Mr. Raymond. Those are my sentiments. When dreams come true, you may tax the future. Until then, give every man an outlet, deep enough to drain all his land, and spread a flat assessment to cover the cost, regardless of distance from the outlet.

Mr. Coffin. But in Wisconsin we have to estimate benefits as well as the cost. We must do some guessing—guess as well as we can on the benefits. The law makes us dream.

Mr. Moore. If a man gets the benefit he is willing to pay the tax. In one of my districts a man who paid a tax of 28 dollars an acre is pleased. One paying 3 dollars an acre is kicking.

Mr. Jones: It seems fairer to allow the land owners whose land is 80 rods or more from the outlet, something for what they must pay to put in a 10-inch or 12-inch tile to connect them with the outlet. We find that a flat assessment is very unjust. In the Larsen district (Figure 1) where no laterals were put in by the district land half a mile away from the ditch was taxed only half as much as land by the ditch, and the men that paid the higher tax are the better satisfied. In a district like the Staples district (Figure 2) where practically every forty is touched by the main ditch or a lateral a flat rate may be just, but generally it is not.

Mr. Raymond: I believe that the "Flat Rate" assessment is the only just one. Water runs down hill, and the result is the rivulet, and the river, nature's drainage system.

Roads and railroads are built and, stations, outlets for trade, are established. The location of churches, schools, become fixed. Man, in selecting his property, takes all of these conditions into consideration, and his property thereby becomes burdened with the greater or the less expense of transportation, the greater or the less convenience in other lines.

The nearer he is, the nearer his property is to nature's outlets, the less the burden of drainage.

All of these conditions are a material element to be considered in the laying out and construction of drainage systems. The outlet of the drainage district should follow where nature intended it to be. It may consist of deepening nature's drains or straightening them. But, nevertheless, these natural conditions determine the line of drainage. The same conditions apply as to the location selected by the farmer, as to his particular piece of land, and the same burdens should follow.

If he borders the outlet, his expenses are less. If he is farther away, his burdens should be larger.

So that, applying this logic to your drainage plans, you can come to but one solution, that is the "Flat Rate". It is the only just one.

Mr. Angelo. There are two kinds of benefits, (1) general improvement in sanitation, convenience and appearance, and (2) special improvement, consisting of direct benefits for cropping purposes. With a sewer there are no general benefits. A lot is either benefited, or else it isn't.

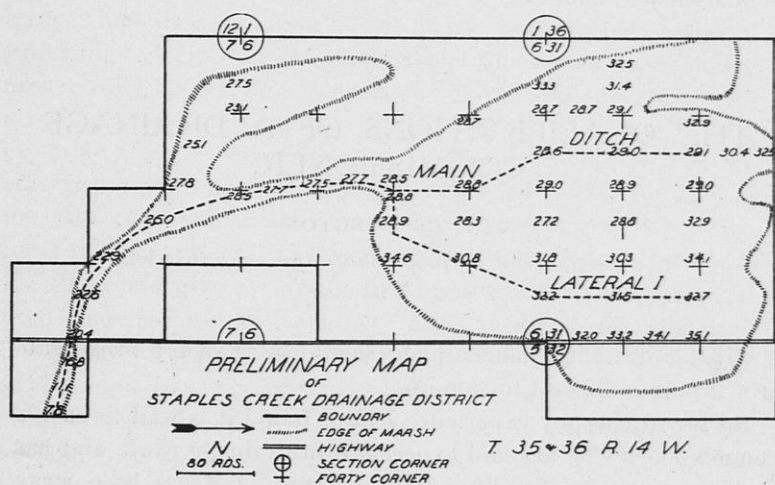


FIGURE 2.—A MAIN DITCH WITH A LATERAL.

Since most of the parcels of land are touched by the main or its lateral an assessment of uniform benefits is justified on that basis.

Mr. Vaughan. I believe it is fair to assess benefits on the basis of what they will probably be at the time of the maturity of the bonds. Mr. Raymond has given us an able talk but I disagree with him on the matter of dreaming with reference to benefits. We must do it. Under the supplemental benefit law we can correct an unjust assessment without waiting for the five-year provision. If a man is not getting the drainage he is paying for, give him another lateral.

Mr. Jones. But you must remember that if the outlet ditch is too shallow no number of laterals would give him first class drainage.

Mr. Sherwood: Be sure to assess your benefits low enough. You can raise the assessment later if it seems best, but you cannot lower it after the bonds are sold. We must protect the settler, who has to pay the tax. I believe in relying on your engineer but what are you going to do when you have a poor engineer? He can shift the blame upon the commissioners. It is upon their shoulders that the chickens light when they come home to roost. This is a good time to hear a talk on the kind of man a drainage commissioner should be.

THE QUALIFICATIONS OF A DRAINAGE COMMISSIONER.

W. B. CODDINGTON

*Commissioner of Portage County Drainage District,
Plover, Wisconsin.*

What a drainage commissioner should be is such a broad subject that it is difficult to sum up.

So far during my experience I have found it is well to have a commissioner who has had experience in drainage work, and has had experience in handling public monies, and has been away from home much. I think a man in order to handle that business in good shape should be fairly well educated; one who has mingled with the outside world; and one who is interested in drainage and the welfare and prosperity of his city, township, and county.

I think it is a help to a drainage commissioner to be a farmer. I do not believe that a banker or a lawyer would make a good drainage commissioner, generally, but at the same time we cannot get along without either one of them. A practical engineer makes a good commissioner. We must have the banker with us to sell our bonds and the lawyer to keep away mischief in our district, and above all things we must have the engineer. But we cannot have all on the same commission.

It has appealed to me for many years that we ought to have some head in the state in regard to drainage commissioners. I

always favored that there should be a State Drainage Commissioner who will be consulted in all drainage questions—a someone who has organized drainage districts before and knows the mistakes that might be made and the cost of such mistakes. I have thought and do think that such a man would be a big help and benefit to the drainage work in this state by working with our local commissioners.

I do not favor doing away with our local commissioners nor getting it down to one man handling the drainage district, but you all know there has been lots of money unnecessarily spent in organizing districts in the first step. There has been money thrown away by getting a poor start. We should educate our local commissioner and engineer, but it is always too late to lock the stable after the horse is stolen. After the money is gone we begin to dig down and ask such men as are here today for advice, men who have had experience and are trying to get the essence out of their experience. Some state authority would be of much aid. He could give examples of failures and keep the inexperienced commissioner and engineer from making such mistakes. The college of agriculture is helping us through Mr. Jones and Mr. Zeasman, but they have too many other duties to perform.

There is some sentiment for the election of commissioners by the land owners. I have never favored this. A man may be elected who is well liked but is against drainage. The man elected might be the owner of upland or highland and he therefore would not be interested in developing wet land that he thinks it worthless.

A commissioner should be a broad, level headed man and not afraid to spend money, and yet he must be able to hold on to money. He must be able to put up a nice smooth line of talk. He must be steadfast in his resolutions. I think I have opened up the subject so as to draw some ideas out of those present.

Mr. Vaughan: In Florida and one or two other states they have three commissioners appointed by the court to assess benefits, and when that is done they make their report and are discharged. Then three supervisors elected by the land owners carry out the plans. I do not believe in having two sets of officers, and do not believe in electing either by a popular vote. The two best

qualifications of a commissioner are, first good sense, and second, a willingness to learn.

Mr. Sherwood: I think it is proper and well to make a commissioner out of a heavy land owner in the district. It takes a man who is on the job, as there is much work to being a commissioner. His interests are there and he should make an excellent commissioner.

Mr. Myers: The new bill provides that all commissioners appointed shall reside within fifty miles of the drainage district and within the state of Wisconsin; that ownership of land shall not disqualify a person from acting as commissioner; that the commissioners shall hold their office for the term of five years and until their successors are appointed and qualified; that all appointments shall be made by the circuit judge, and that the commissioners appointed to fill vacancies shall serve for the residue of the unexpired term and until his successor is appointed and qualified; that the removal of a commissioner from the fifty mile limit or from the state of Wisconsin shall render his office vacant; and that the compensation of commissioners shall be \$5.00 per day and their actual reasonable expenses.

Mr. Thorn: I think one suggestion Mr. Coddington made was a very good one. A commissioner should not be afraid to spend money. More have made complete failures because they have not spent money enough than because they spent too much. Some have gone and put in outlet ditches and that is all they have done, and they have made mighty poor outlet ditches at that. The first thing to do is for the commissioner to get some idea about what he has got to do about spending money. If he is afraid to spend money he will never do anything and will continuously hamper his district. They cannot put anything in shape, and you will ultimately spend ten times as much. It takes three or four years after the main ditches are in before they get sense enough to know they need supplementary drains and the result is we have lost interest on the investment for three or four years.

Mr. Warren Moore: Commissioners and town boards are apt to think they know more than the engineer and do as they please. Then they blame the engineer for a poor job. I believe that it would be a good thing to have a state drainage engineer or commissioner to compel town boards and drainage commissioners to

follow the advice of their engineer so long as that advice is good. I believe that a supervising engineer and a local engineer would work in harmony in drainage work just as they do in railroad work.

Mr. Hurlgen: I believe it is better to have but one engineer and that preferably a local man with experience. Where two engineers are responsible, the local man may shift the responsibility on the other.

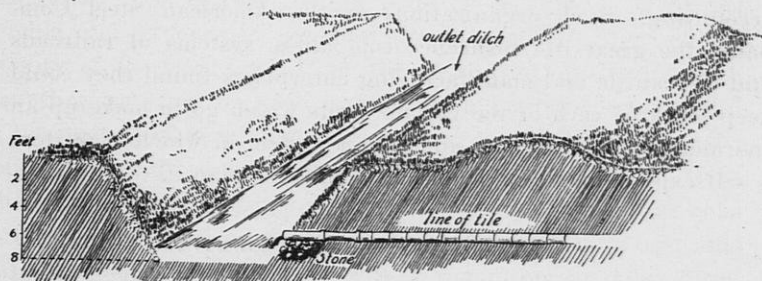


FIGURE 3.—THIS TILE HAS AN OUTLET.

The chief object of dredged ditches is to serve as an outlet for the tile that is to be put in later.—Courtesy Wisconsin Bankers' Association.

Mr. Moore: It does not work out that way between the chief engineer and the division engineer in a railroad system.

Mr. Myers: Who would pay this supervising engineer?

Mr. Coddington: With three million acres of land to be drained, the state could afford to pay him.

Mr. Myers: I do not think it would be wise at this time to try it. We can gain a great deal by having the same men for commissioners in several districts. Mr. English is a valuable man for that reason.

Meet with us in the field at Racine, September 4 and 5, 1916.

DRAINAGE RECORDS.

NYE JORDAN,

Commissioner of Cutler Drainage District, Mauston, Wis.

This is an age of progress. The tendency to consolidate business has brought with it a demand for systematic methods of accounting. Such organizations as the American Steel Company, the great life insurance companies, systems of railroads and mercantile and manufacturing enterprises found they could keep track of each of the various units which go to make up an enormous whole—only by adopting a system in which each item is self explanatory and a part of a uniform plan.

THE NEED OF A SYSTEM OF ACCOUNTING.

Bankers and railroads were first to put the idea into execution, and they found it efficient and accurate as well as economical.

The Wisconsin Tax Commission in its dealing with the various counties of the state found there were as many plans of accounting as there were counties. Checking the entries and balances with the state's books was next to impossible.

In consequence of this, the whole system was reorganized, and a uniform plan adopted. It centered in the state offices, but reached to each of the county offices also, and beyond that to each of the towns and school districts. The use of the form as prescribed, is now obligatory under the law.

This makes the books of each branch of the government within the state, a part of a great chain of accounts which reaches from the levy of tax to its final expenditure. The saving in clerical salaries is large and general efficiency is improved. The danger of error is reduced to a minimum, and if error does occur, it is readily traced.

In the levying of drainage assessments, the law exacts certain requirements, but makes no suggestions as to how the records shall be made up, either before or after the assessment is

levied. In the several drainage districts with which I am acquainted there are as many methods of accounting as there are districts. Some of these methods are efficient, but many are inefficient.

I consider this matter essential for at least four reasons. First, it affords to the land owner a means whereby he can ascertain the equity of his individual assessment. Second, it simplifies for the court and the district's attorney the matters of benefits and cost of construction, so often confused. Third, the trouble and expense in securing the favorable opinion of the legality of the bond issue from the bond attorneys is lessened. Fourth, it satisfies the bond broker and buyer who is interested in the method of keeping the accounts of the district issuing the bonds, especially as to the method of levying the tax from which the interest and principal are to come. This matter runs through a long period of years, and the purchaser of bonds wants to know that his money will be repaid on the dates specified. The better the system of the accounting, the better the impression made on the investor as to the safety of his security and the efficiency of the commission.

The average Commissioner is not an expert accountant, and the simpler the form in which he can arrange his accounts, the less liable he is to errors. All districts working under the same statute should adopt the same plan of accounting, as it will lend stability that does not come from the present diversity of methods.

I have worked out a plan, which our district has adopted, where I aimed to cover the requirements of the law, 1379—15, Chap. 434 and 541, also 1379—18—19—20—21—22, and place in clear and concise form, in figures, the acreage, value, benefit, and estimated cost of construction. I have submitted the plan to several commissioners with whom I am acquainted. Finding that it met with the most enthusiastic approval, I decided, when asked to discuss the matter of drainage records before this meeting, to present the plan here. My hope is to secure the recognition and adoption of this or some other uniform system of accounting by all districts in the state.

THE RATING OF BENEFITS.

The plan I will present to you is both legal and convenient. It gives at a glance the amount standing as a liability against any description of land in the district, the amount to be paid the present year, the amount of delinquency if any, together with interest, and is a record for any number of years.

The basis of computation is a topographic map of the district, giving the land in three classes. "High" lands are those with sufficient drainage. "Low" lands are those that are never submerged, but have the water table so near the surface as to impair the productivity of the soil. "Marsh" means land submerged during a part or all of the year. There are lines for sixteen forties or one section on a page, with a number of extra lines for subdivisions of forties. The descriptions are printed in the same rotation as is used by the United States Government land office, and are also numbered for convenience in following across the page.

The first three columns after the owner's name gives the number of acres as shown by the topographical survey to be in each class of land in the subdivision. The next three columns give the estimated value of each class of land before drainage. The seventh column under "Total Value Undrained" gives the total value of the description before drainage, or the amount arrived at by computing each class of land in the description at the estimated price, and adding the products together. This gives as nearly as possible the actual value of each description without drainage.

The next three columns gives the estimated value of each class of land when drained, and by computation as in the three previous columns, the total value for that description, after drainage, is arrived at.

The difference between the "Total Value Undrained" and "Total Value Drained," is the estimated amount of benefit of drainage to the description, and this amount is carried to the column under "Gross Benefit."

If a description lies immediately on a ditch, it receives quicker results from the ditch than when it lies 80 or 160 rods distant. Besides, the owner of the land more distant will be

to the expense of making an opening to the ditch. In consequence of this difference, we have assessed the land lying on the ditch at 100, land lying 80 rods from the ditch at 75 and land lying 160 rods from the ditch at 50. This plan we have used, but I do not consider the percentages applicable in all cases, as the porosity of the soil should be taken into consideration by the Commissioners in making this deduction.

The allowance on account of distance from the ditch, should be deducted from the "Gross Benefit," and the remainder carried into the column of "Net Benefit," which is the amount presented to the Court for confirmation.

The foregoing applies to all cases where the "Value After Drainage" is based on the value of the land with an outlet only carried to each subdivision, and is applicable to practically all districts in existence so far, in the State.

THE TILE QUESTION.

Since the question of having the tile necessary to drain the land, laid by the district is being agitated, I predict it will be the next feature of improvement to be adopted in a general way. The advantages of this will be many. In carrying on a large volume of business, the district can get better prices and freight rates on tile. The size of the undertaking will reduce the cost of excavating. When the tax becomes due the land will be ready for cultivation and will yield a steady income from which to meet the tax. The farmer, by borrowing as a part of the district, can secure his improvement on better terms than if he borrowed from his local banker, and in this way, the Commissioners would likely use better engineering talent than is usually employed on small jobs.

Since the matter of tile is at hand, and must be reckoned with I have added a column under "Tile Cost." Under this head is to be entered the estimated cost of tiling each description. Under this plan, the method of arriving at the "Net Benefit" is the same, except the "Value After Drainage" instead of being based on an outlet, is based on the land adequately tiled and ready for the plow. This will increase the amount of the "Net Benefit," and will do away with the feature of making a reduc-

tion on account of distance from the ditch, as all descriptions will have equal advantages as to outlet.

"Net Benefit" arrived at by either of the foregoing methods, is the amount certified by the Commissioners to the Court for confirmation, and when confirmed, is to be carried into the column "Confirmed Benefit." This amount, when confirmed, is permanent, and is the base for all future assessments and levies, and cannot be changed except at intervals of five years, and then only under order of the Court. This is known as a readjustment of benefit. A new sheet is to be made, with the changes as ordered.

THE COST OF CONSTRUCTION

The total of the items of "Net Benefit," when added together, is the amount of benefit allowed by the Court. From this the "Cost of Construction" is figured. It is a certain percent of the total benefit. The "Cost of Construction" is the amount the description must pay as its share of the whole.

In case tiling is planned by the district, and an owner wishes to do his own work, his "Cost of Construction" should be reduced by the amount of the "Tile Cost," as he pays that part of his assessment in tile and labor laying them, instead of money.

DAMAGES.

The question of damages may mean any or all of the following points: Bridges allowed for the crossing of the ditches when constructed, for land occupied by the ditch, or mutilation. A ditch running diagonally across a description is more of a detriment to the description than one along one of the boundaries. The diagonal ditch mutilates the land and leaves the description in two ill-shaped fields. The boundary ditch leaves the description practically intact except for the land the ditch actually occupies.

All awarded and confirmed damages must be paid in cash before the dredge enters on that description, and are not deducted from the cost of construction.

This completes the "Permanent Sheet."

PERMANENT RECORD SHEET (Jordan)

SECTION TOWN RANGE

| Description | Owner | Acres | | | Acre Value Undrained | | | Total value un-dr'in'd | Acre Value Drained | | | Total value drained | Gross benefit | Tile cost | Net benefit | Confirmed benefit | Cost construction | Damages | |
|-------------|---------|-------|-----|-------|----------------------|-----|-------|------------------------|--------------------|-----|-------|---------------------|---------------|-----------|-------------|-------------------|-------------------|----------------|--------|
| | | High | Low | Marsh | High | Low | Marsh | | High | Low | Marsh | | | | | | | Mutilation and | Bridge |
| | | | | | | | | | | | | | | | | | | | |
| 1 | N E N E | | | | | | | | | | | | | | | | | | |
| 2 | N W N E | | | | | | | | | | | | | | | | | | |
| 3 | S W N E | | | | | | | | | | | | | | | | | | |
| 4 | S E N E | | | | | | | | | | | | | | | | | | |
| 5 | N E N W | | | | | | | | | | | | | | | | | | |
| 6 | N W N W | | | | | | | | | | | | | | | | | | |
| 7 | S W N W | | | | | | | | | | | | | | | | | | |
| 8 | S E N W | | | | | | | | | | | | | | | | | | |
| 9 | N E S W | | | | | | | | | | | | | | | | | | |
| 10 | N W S W | | | | | | | | | | | | | | | | | | |
| 11 | S W S W | | | | | | | | | | | | | | | | | | |
| 12 | S E S W | | | | | | | | | | | | | | | | | | |
| 13 | N E S E | | | | | | | | | | | | | | | | | | |
| 14 | N W S E | | | | | | | | | | | | | | | | | | |
| 15 | S W S E | | | | | | | | | | | | | | | | | | |
| 16 | S E S E | | | | | | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | |
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| 22 | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | | | | | | | | | | | | | | | |
| 24 | | | | | | | | | | | | | | | | | | | |
| | Total | | | | | | | | | | | | | | | | | | |

Drainage Records—Jordan

ANNUAL SHEET (Jordan)

SECTION TOWN RANGE YEAR 19....

| | Balance unpaid | Maintenance assessment | Bond interest | Bond principal | Special assessment | Total for above year | Delinquent | | | Notations |
|---------|----------------|------------------------|---------------|----------------|--------------------|----------------------|------------|-----------|-----------|-----------|
| | | | | | | | Interest | Amt. paid | Date paid | |
| N E N E | 1 | | | | | | 1 | | | |
| N W N E | 2 | | | | | | 2 | | | |
| S W N E | 3 | | | | | | 3 | | | |
| S E N E | 4 | | | | | | 4 | | | |
| N E N W | 5 | | | | | | 5 | | | |
| N W N W | 6 | | | | | | 6 | | | |
| S W N W | 7 | | | | | | 7 | | | |
| S E N W | 8 | | | | | | 8 | | | |
| N E S W | 9 | | | | | | 9 | | | |
| N W S W | 10 | | | | | | 10 | | | |
| S W S W | 11 | | | | | | 11 | | | |
| S E S W | 12 | | | | | | 12 | | | |
| N E S E | 13 | | | | | | 13 | | | |
| N W S E | 14 | | | | | | 14 | | | |
| S W S E | 15 | | | | | | 15 | | | |
| S E S E | 16 | | | | | | 16 | | | |
| | 17 | | | | | | 17 | | | |
| | 18 | | | | | | 18 | | | |
| | 19 | | | | | | 19 | | | |
| | 20 | | | | | | 20 | | | |
| | 21 | | | | | | 21 | | | |
| | 22 | | | | | | 22 | | | |
| | 23 | | | | | | 23 | | | |
| | 24 | | | | | | 24 | | | |

THE FOLLOW-UP SHEETS.

In the following sheet, one of which is made for each year, the first column carries the amount standing unpaid against the description at the beginning of that year. It is the amount on which the bond interest is figured for that year, which appears in the column under "Bond Interest." The amount of bond principal is to be entered under the heading "Bond Principal." Maintenance tax, if any, or special tax if any, are each to be figured on a certain per cent of the "Confirmed Benefit" and entered under the appropriate headings. The total of these entries is the amount to be collected for that year. The columns following for "Delinquent" are self explanatory, and the remainder of the line gives space for notations.

These yearly sheets are made flat, and filed as made and dated, with the last one made, next to the permanent sheet. Those for previous years are kept in rotation back of this sheet. To refer to years past, it is simply necessary to turn back to the year wanted. The line numbers on this sheet correspond with the numbers on the permanent sheet. The descriptions are also on the second sheets for convenience.

ANNUAL REPORTS.

Under the law concerning the publishing of the annual statement, and the filing of vouchers with the clerk of the court, our attorneys advise us that the publishing of a lengthy statement is unnecessary, and we know it to be expensive. The vouchers should be made in duplicate, by carbon if possible, and are the detailed report as required by law.

As a means of keeping track of the cost of various branches of drainage matters and writing them up while they are still fresh in the minds of the commission, I have taken a trial balance book as being the cheapest and best, and changed the headings of the columns to suit the needs. As each page is filled, I carry the footings forward until the end of the year and copy them for the published report. Carrying the accounts in this manner allows a cross footing which is a sure check on the totals.

BOND ACCOUNTS.

In my bond book, as our bonds are payable in series, certain numbers falling due each year, I have taken a plain ruled journal, and headed the pages with the years over which the bond loan is payable and copied under each year the numbers of the bonds coming due that year, and the amount of each.

The interest account should always be kept separate from the contingent fund, and there should if possible be a balance kept in the interest fund. This balance to be regarded as a guarantee against default on interest, if through stress of bad years or other calamity the delinquent tax list should be large.

Disbursements from the interest fund should be for interest purposes only. The interest charges on a moderate balance carried in the interest fund will be more than offset by the increased value of the bonds of the district.

EXPLANATORY NOTES.

The time to enter an item is while all the details are fresh in the mind, and all entries should be so plain that a stranger can in ten years readily understand each item and what it stands for. Very often we find in good accountants' work, the plain entry of "John Jones to Loss and Gain," with no explanatory note. The entry meant something to the person making it, but in twelve months or a shorter time if a new man is placed in charge of the office, this is simply a transfer account, with no information conveyed whether or not it was a bad account, or was charged off for other reason. A judicious and liberal use of "foot notes" should accompany every entry that is not absolutely clear, and the transaction explained. It saves much trouble in solving puzzles, and makes an entry that might have a suspicious look, absolutely clear and comprehensive.

PRESERVATION OF RECORDS.

The matter of preservation of records should not be passed without comment. Drainage District Records are continuous for at least one bonding period, and the total amount of the transactions involves a large sum of money. The loss of these records

might mean serious complications in addition to the expense of getting up new ones. Under any and all conditions, each District should be provided with a fire proof safe or cabinet large enough to hold all its records. The expense is nominal in comparison to the amount expended for like purposes in mercantile lines. The Cutler Drainage District has a fire proof cabinet weighing about 600 pounds. It is 30 x 54 inches inside, and is fitted with filing cases to take care of all the records we will ever likely have. It cost about \$150.00 delivered.

I have not taken your time with the idea of boosting my own inventions, but rather I have offered my plan with the idea of urging the adoption of some uniform method of accounting in Drainage Districts. Such plan should start with the survey and follow each step through the establishing of benefits, arriving at the cost of construction, the apportionment of damages, the levy of taxes, and payments of interest and bonds.

The move is only fair to the public, and will have a tendency to establish confidence in the drainage project. It will improve the standing of our securities in the financial world; it will avoid much expensive and unsatisfactory litigation; and last but not least, the Commissioners owe it to themselves, and those that come after them. All are under heavy bonds, and a clean, convenient record is the best guarantee against charges of ignorance and incompetency.

The President: It is time for our recess so we will have to dispense with a discussion of Mr. Jordan's valuable contribution.

Mr. Jones: I think there is one weakness in the scheme presented here, and that is in the method of allowing for tiling. Suppose that it costs 200 dollars or five dollars an acre to connect a distant forty with the ditch by means of a ten-inch tile. Mr. Jordan would deduct that 200 dollars from the gross benefit to arrive at the net benefit. That is, if the gross benefits are 1,200 dollars, the net benefits are 1,000 dollars after the cost of tiling is deducted. Suppose that the ratio of cost to benefits is one third. The tax without allowance for tiling would be 400 dollars, and 333 after allowance is made. In other words the owner is allowed only 67 dollars with which to put in 200 dollars worth of tile. The cost of the tiling should be deducted from the cost of construction, and not from the gross benefits.

Mr. Jordan: I believe you are right and I will consider making a small change in the form which I have prepared, to make the deduction in the proper place.

Upon motion the convention adjourned until 7:30 p. m.

EVENING SESSION.

JANUARY 19, 1916.

President Sherwood called to order at 7:30 and announced a business meeting.

Motion was made and carried that the president appoint a committee of three to represent the association before the Railroad commission in the matter of freight rates on dredging machinery and drain tile. A. E. Holcomb, E. P. Arpin and J. A. Reeves were appointed.

The president announced that the election of officers for the ensuing year was in order. A recess of ten minutes was taken to enable members to pay their fees and thus be entitled to vote. Upon re-convening C. A. Veeder, O. R. Zeasman and Nye Jordan were appointed tellers.

W. B. Coddington was nominated for president and H. H. Sherwood was renominated. The informal ballot gave Coddington 20, Sherwood 20 and Jordan 1.

In the following speech Dr. Sherwood withdrew in favor of Mr. Coddington:

Gentlemen: I thank you for your demonstration of your appreciation of my efforts to serve you as President of this Association, but I feel that the best interest of the association will be promoted by extending the honors to different members of the association.

I wish you to understand that I will labor for the association with a much enthusiasm out of the chair as in it. Therefore, with your permission I would move to suspend the rules and instruct the secretary to cast the vote of this convention for Mr. W. B. Coddington of Plover, Wisconsin for your next president.

The motion prevailed and Mr. Coddington was declared elected and escorted to the chair. He addressed the convention as follows:

Gentlemen: I thank you one and all for the honor you have conferred upon me by electing me to the presidency of The Wisconsin Drainage Association at our second annual meeting. I assure you I will do all in my power, with your co-operation, to further the success of our association in improving the drainage throughout the state. I want you all to feel that this is *our* association and for each member to feel free to suggest and recommend so as to make our association a thorough success. There are nearly two million acres of undeveloped marsh lands in the state and our association can be of great benefit to the development of the same in saving time and unnecessary expenses. I hope to meet you all as enthusiastic at our next meeting as you have been at this one.

B. M. Vaughan and J. H. English were nominated for vice-president. The informal ballot gave Vaughan 28, English 18, scattering 7. Upon motion of Mr. English, Mr. Vaughan was declared unanimously elected.

Upon motion of J. Q. Daniels, A. C. Willard and E. R. Jones were declared unanimously re-elected as treasurer and secretary respectively.

Upon motion of Mr. Myers, Madison was fixed as the permanent place for the winter meeting. but provision was made for a regular summer field meeting in drainage centers, the 1916 field meeting to be held near Racine at a time during August or September fixed by the executive committee.

The evening program then began.

Meet with us in the field in Racine County, September 4 and 5, 1916.

DRAINAGE SPECIFICATIONS.

FRANK W. LUCAS,

Attorney at Law, Madison, Wisconsin.

Several years back, I was called upon to prepare specifications for a district of considerable size, necessitating the crossing and recrossing of railway tracks; the removal, reconstruction and replacement of stone, wooden and steel bridges; the excavation of ledge rock, and involving other conditions not usually found in a single district. I sought to secure the benefit of the experience of other districts and wrote to a number of contractors and drainage commissioners in this and other states, requesting them to send me copies of specifications of various districts with which they had been or then were connected. As a result of such solicitation I received a number of copies of specifications of districts in this and other states. To my surprise these specifications were very incomplete and lacking in detail and I came to the conclusion that either they were not specifications of carefully planned districts, or that commissioners, engineers and attorneys, did not then appreciate the advantage of complete, detailed, uniform specifications.

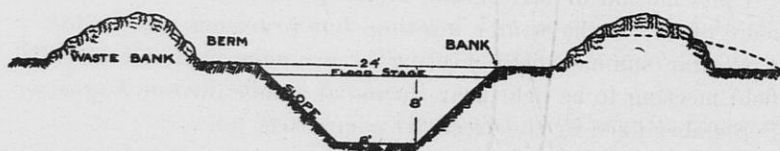


FIGURE 4.—CROSS SECTION OF AN OPEN DITCH.

For convenience and appearance the waste bank should be sloped as shown by the dotted line at the right. Grass seeded on the slopes of a ditch makes them permanent and saves the cost of cleaning out the ditch.—Courtesy Wisconsin Agricultural Experiment Station.

In considering the matter of specifications with contractors, I find that most contractors favor complete, accurate and detailed specifications for the reason that such specifications, as a rule, are indicative of careful, thoughtful consideration and determination of the method and plan of drainage by the commissioners and engineer. The more complete and detailed are the

specifications the fewer are the opportunities for delays, mistakes, misunderstandings, disputes, and litigation. These are matters which are carefully considered by intelligent contractors in making bids on the work. Contractors know that the more completely the work and conditions of doing the same are outlined to that degree will they be the more fully protected from unreasonable and unjust demands of commissioners and engineers, especially if they adhere strictly to the specifications; and in the same degree will disputes be eliminated and litigation minimized. The specifications are prior notice of what matters are subject to later determination and cause for possible dispute and friction. These matters enter into the amount of the bid of every intelligent contractor and the fewer are the matters left undetermined the more likely are the bids to be favorable to the district.

I have here a blank set of specifications, which I have used in a number of districts with success and which, if filled out and modified to meet the conditions found in the ordinary district, will, I believe, be found quite satisfactory.

(The specifications appear in italics. Mr. Lucas' comments on them appear in regular type.—Editor.)

STATE OF WISCONSIN—CIRCUIT COURT FOR
 *COUNTY.*

In the matter of the drainage district.

GENERAL SPECIFICATIONS.

I.

DEFINITIONS.

1. The term "Map" shall refer to the blue print of the drawing of said drainage district filed in the office of the Clerk of the filed in the offi of the Clerk of the Circuit Court for County by the Commissioners.
2. The term "Profile" shall refer to the blue print of the profile of the proposed ditches and drains within said district and which was filed in the office of the Clerk of the Circuit Court for County by the Commissioners.

3. The term "Contractor" shall refer to the person or persons or the corporation, or its proper representative, to whom shall be let the contract for constructing the work proposed in the report and in these specifications.

4. The term "Engineer" shall refer to such person as shall be employed by the commissioners to superintend under the direction of said commissioners the construction of said proposed work.

5. The term "Commissioner" or "Commissioners" shall refer to the person or persons and their successors in office, who shall be appointed by the Court under Chapter 419, Laws of 1905, and the laws amendatory thereof, and who are possessed of the powers and charged with the duties, provided in Chapter 419 and the laws amendatory thereof, in relation to the organization of and the prosecution and completion of the proposed work of the said Drainage District.

6. The term "Station" shall refer to a point dividing the ditch or lateral into sections of 100 feet each, and the stations shall be numbered consecutively from the outlet, which station is denominated zero, to the upper end of such ditch or lateral.

The work proposed to be executed under these specifications consists in the deepening and straightening of the Channel of the Creek in the Towns of
..... in County, State of Wisconsin, and in the construction of lateral drains in conjunction therewith, for the reclamation and drainage of adjacent lands to the end of improving the public health and welfare.

A general description of the ditches and laterals herein referred to is to be found in the map marked Exhibit "A" and the profiles marked Exhibit "B" filed in said court and in the detailed description.

If any terms or expressions are used in the specifications which are likely to be misunderstood or in relation to which there may be dispute, it is advisable to accurately define such terms and expressions in a preliminary paragraph of the specifications.

II.

DESCRIPTION OF STARTING POINTS, ROUTES AND TERMINI OF DRAINS.

That the starting points, routes and termini of the proposed ditches, drains and laterals and the location thereof, as nearly as the same may now be determined and which said Commissioners deem most proper and feasible for the accomplishment of the proposed work, are as follows: (Here insert accurate description of ditches naming or numbering them.)

It is advisable to insert in the specifications a description of the ditches, giving them a name or number for convenience of reference. The descriptions should be prepared with care and accuracy by the engineer, so that the contractor who contemplates bidding on the work may, in going over the district, readily determine the approximate location of the ditches.

III.

APPROXIMATE ESTIMATES.

| <i>Stations</i> | <i>Name of Ditch</i> | <i>Length in feet</i> | <i>Average depth</i> | <i>Bottom width</i> | <i>Total yardage</i> |
|-----------------|----------------------|-----------------------|----------------------|---------------------|----------------------|
| | | | | | |
| | | | | | |
| | | | | | |

It is also advisable for the engineer to prepare approximate estimates of the amount of excavation in each ditch, such estimates to include length of ditch by stations and in feet, depth and bottom width of ditch and total yardage. This will offer a ready means to the contractor, if he so desires, of verifying the whole or any portion of the engineer's estimates. These estimates, however, should be distinctly stated to be approximations only.

IV.

SLOPES.

All slopes in the ditches and laterals shall be one foot horizontal to one foot vertical.

The best constructed ditches should have a slope of at least one foot horizontal to one foot perpendicular. While it is almost impossible with any ordinary dredging machinery to secure an accurate slope, yet the contractors should be held strictly to the specifications in this regard. At least the practice of digging the ditch wider at the bottom with an almost vertical slope should be condemned for the reason that later the tops of the sides will begin to slough and slide in and when this occurs the material is likely to roll into the center of the ditch filling it up and interfering with the free flow of the water. While the contractor may slightly increase his bid because of this demand, yet the increased cost will be more than compensated by the saving to the district in subsequent cleaning out of the ditches. In fact in large districts where the contractor is required to keep the ditches in repair until final acceptance and such acceptance may not occur for a year or more, the contractor may realize that it is to his advantage to construct the ditches with proper slopes in the beginning, thereby removing the likelihood of any expense in cleaning out the ditches before final acceptance; and because of that fact, make no increase in the amount of his bid.

V.

BERMS.

All material removed from the excavation in the Main Ditch shall be removed to a distance of not less than feet from the top of the slope of the adjacent side of ditch, unless a smaller distance is ordered by the Commissioners, and in all other ditches and laterals, the material removed shall be removed to a distance of at least feet from the top of the adjacent side of ditch.

It is very important that material removed from the ditch should be deposited some distance from the sides of the ditch

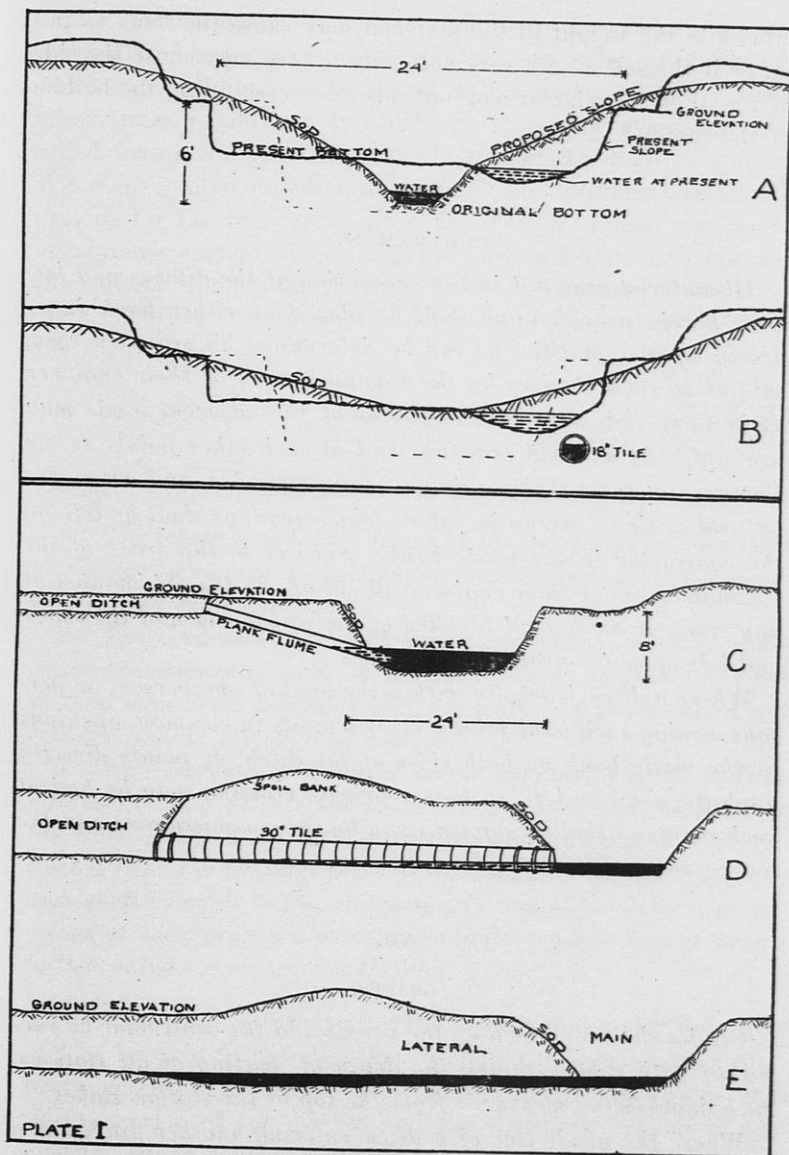


PLATE I.—DIAGRAMS OF DITCHES.

A and B show what could be done with the ditch shown in Figure 10. the original bottom was too wide. The 18" tile should have been put there in the first place, with the sodded surface run made by a road grader to remove the surface water.

C shows the method of letting water go from a shallow ditch into a deep outlet ditch.

D and E are designs for the outlets of deep laterals entering an outlet ditch without injury.

Diagrams like these help to clarify the specifications.

otherwise the weight of the material may cause the bank to fall in, or if the soil is of a very soft oozy nature may cause the side of the ditch to bulge or ooze out, in either case filling the bottom of the channel.

VI.

EMBANKMENT.

All material removed in the excavation of the ditches and laterals herein provided for shall be placed on either bank in as nearly equal quantities as can be determined by ordinary care, subject to such changes by the Commissioners or their engineer as in their judgment the conditions of the adjacent lands may warrant. At all road crossings and at such other points as the Commissioners or their engineers may determine, and where the natural drainage would be intercepted, openings shall be left by the contractor in the waste bank. Subject to the order of the Commissioners or their engineer all cut-offs in the old channel of any creek or ditch shall be filled at the upper end and the lower end left open for drainage.

Where a ditch is wholly within the land of one person, or persons owning such land jointly or as tenants in common, openings in the waste bank on both sides of the ditch, at points directly opposite, shall be left, so that a private crossing may be had at such points as shall be agreed upon by the commissioners and the owner or owners of the land.

VII.

GRADES.

Grades shall be shown on the profile and the contractor be furnished with a book giving the depth of cutting at all stations, such depth being measured from the top of the station stakes.

Where the grade line of a ditch entering another ditch has a greater elevation, the grades of the entering at its outlet shall have a slope not greater than one foot vertical to 50 feet horizontal for a sufficient distance to permit the entering ditch to have the same elevation as outlet ditch.

The contractor should be held strictly to the grades. This is especially of importance in the construction of lateral ditches in which capstan plows are used and unless vigilance is used, there is oft times a tendency to construct the ditch shallower than called for on the profile and the bottom of the ditch be uneven. Where one ditch enters into another, the specifications should provide for the connecting up of the ditches in such manner as to minimize erosion which tends not only to injure the bank and sides of the upper ditch but also to fill the bottom of the lower ditch. This is of even more importance in the case of tile laterals.

VIII.

CHANGES AND ALTERATIONS.

1. *The location and dimensions of the ditch and laterals shall be subject to change by and under the direction of the commissioners and their engineer.*

2. *The commissioners shall have the right to increase or decrease the amount of work on any part thereof, to such an extent as they may deem advisable and necessary but to an extent not exceeding 20 of the original contract.*

3. *Any increase or decrease in the amount of work shall be figured at the unit rate named in the proposal, and the value of the work included by such alterations shall be added to or deducted from the contract price as the case may be, and no allowance shall be made to the contractor, in case of an increase or decrease of such proposed work, for any damages or loss of profits to the contractor occasioned thereby.*

It oftentimes happens that after the work is well under way facts will be brought to the attention of the commissioners and engineers, making it advisable to change the location and sometimes the dimension of the ditches and the specifications should specifically grant to the commissioners the right to make such changes. A provision in the contract for such changes prevents disputes.

IX.

EXTRAS.

The amount of the bid for the construction of the proposed work shall include all work, material used, tools, machinery and all other matters necessary to complete the work according to the plans, profiles, and specifications, and shall cover all losses and damage to the contractor arising from any action of the elements, the nature of the soil or obstructions or difficulties which may be incurred in the prosecution of the work, and all losses and damages to the owners of lands resulting from any negligence to the contractor, in constructing said proposed work, and no charge for extra work shall be made unless it be ordered in writing by the commissioners or by the engineer with the approval of the commissioners and at a price therefor agreed upon previous to its commencement.

Comparatively few specifications are so complete that some extra work does not have to be specified before the completion of the job.

X.

MEASUREMENTS AND PAYMENTS.

1. *The profiles, maps and estimates herein referred to shall be considered as approximations only, and bidders for the proposed work must satisfy themselves by personal inspection as to the quantity and quality of the material to be removed and the difficulties to be encountered in the construction of said proposed work.*

2. *The material removed shall be measured by the cubic yard in the cut prism of the ditches and laterals, and the contractor shall furnish every facility for such measurements upon the commencement and after the completion of the work, and from such measurements will determine the amount of material removed.*

3. *Intermediate payments, based upon approximate estimates for work performed during the preceding month and made during the first week of each succeeding month during the progress of the work will be payable on or about the 15th day of such suc-*

ceeding month. Such payments shall be eighty per cent of the contract price for the work that shall be completed to the satisfaction of the commissioners or such other portion or percentage thereof as may be agreed upon between the parties hereto, and the remainder of the contract price shall be paid within ten days after the completion of the contract to the satisfaction of the commissioners. No charge or damage shall be made or claimed by the contractor for delay and hindrance resulting from any reasonable or unavoidable cause during the progress of any portion of the work, but it shall in the judgment of the commissioners be construed as entitling him to an extension of time allowed for the completion of the work.

4. If the contractor shall construct any ditch wider or deeper than called for in the specifications, or wider and deeper than is otherwise agreed upon by him with the commissioners, such fact will not entitle him to increased compensation by reason of such increased width or depth and shall not lessen the work elsewhere provided for in these specifications.

5. No ditch or lateral will be finally accepted until completed for its entire length and until such acceptance the contractor shall keep such ditch or lateral in good condition and repair at his own expense until it is finally accepted by the commissioners.

6. Before payments are made and before final acceptance and final payment for the whole of the proposed work the contractor shall be required, to the satisfaction of the commissioners, to protect the drainage district harmless against all liens for labor and material used in the construction of said proposed work and also against all claims for the use of patented articles, processes or appliances used in connection therewith, and against all claims or demands for personal injuries in whatsoever manner arising out of the construction of said proposed work.

It is well to keep back a percentage of the contract price, for occasionally the contractor is found to be negligent or incompetent, or even dishonest, and in such event the commissioners will then retain in their hands some means of satisfaction of any damage the district may incur by reason thereof. Some contractors are inclined to construct ditches wider and deeper than called for

in the specifications so as to be certain of complying with the specifications relating to the size and depth of the ditches, but the specifications should provide that such additional work should not entitle the contractor to increased compensation, unless otherwise agreed upon. Generally this extra width is a detriment because it is usually at the expense of vertical sides, and should be remedied by the contractor before the work is accepted.

XI.

PROSECUTION OF WORK.

The work provided for by the contract shall be begun at the time set forth in the contract or as otherwise determined by the commissioners and shall be diligently prosecuted in a workman-like manner until completion.

This prevents tedious delays which a loosely drawn contract is helpless to prevent.

XII.

SUPERVISION BY CONTRACTOR.

If the contractor shall not himself take immediate charge of the work in the field, he shall provide and designate to the commissioners and engineer a competent and experienced superintendent or foreman to take his place. In case the superintendent, foreman or other workman employed by the contractor shall neglect his or their duties or perform his or their work in an improper manner or shall persevere in misconduct after being warned by the engineer or commissioners, the contractor shall discharge such superintendent, foreman or workman.

This is a matter of considerable importance to the district. It is sometimes found that a contractor will have several jobs under prosecution and that he plans on looking after the work himself. As a consequence he may not always be careful to have a competent superintendent on the ground.

XIII.

GRUBBING.

All grubbing or clearing of stumps, trees or brush, and the removal of all loose stone necessary for the construction of said ditch, shall be done by the contractor and shall be removed outside the waste banks of the ditches.

This as well as other requirements should be known to the contractor before he submits his proposal. In this way he protects himself by including the cost of grubbing in the price.

XIV.

QUICK SAND.

If encountered in prism of the ditch, the commissioners shall be notified immediately and may order the grade of the ditch lowered and the slopes made less steep and continue at such increased depth and decreased slope until said sand disappears from the prism of the ditch, or until such increased depth is considered unnecessary by the commissioners, and the additional material removed shall be paid for at unit prices. Any filling of the ditch because of quick sand after its construction in accordance with the directions of the commissioners shall not be cause for refusal to accept the ditch when completed.

It is almost impossible to tell beforehand whether quick sand will be met with in the construction of the work, or when or at what point. The term "quick sand" is variously defined by engineers and contractors. My own judgment is that quick sand proper is a sand that by friction has had the sharpened edges of the sand worn off so that the sand particles are more spherical in form than ordinary sand and by reason of its rounded condition, as well as being filled with water, it has little resistance. Oft times when a ditch is being constructed, it is found that the soft muck or soil, lying just beneath the surface flows into the ditch and many speak of this soil as being quick sand. In fact this is not quick sand, and is found practically only in marshes that are very wet. The top soil as a rule is more firm and is bound to-

gether by the roots of the grass growing upon it. Just beneath this top soil will be found the slushy ooze of the marsh. When the soil is removed from the ditch to a point below the level of this ooze it flows out, by reason of the pressure of the water in the marsh back away from the ditch and will continue to flow until the water back in the marsh has made its escape. The treatment followed in one district in which I was connected that proved satisfactory, was to go down the ditch, which was a large one and tie up the dredge for the winter. In the spring, the contractor again came down the ditch cleaning it out and no bad results have been experienced since. If quick sand is encountered, the contractor should notify the commissioners at once and for his own protection should follow the directions of the commissioners with reference to dealing with the sand.

XV.

ROADS.

At the time of crossing any road or highway in the construction of any ditch, the contractor shall erect barricades in such road or highway on either side of ditch at a distance of at least 200 feet from the point of crossing, and at such points that teams and vehicles may be readily turned and in the night time shall keep lights burning sufficiently adequate to give notice to travelers along such road or highway and to protect such travelers from injury. The contractor shall remove all bridges, the removal of which shall be necessary in the construction of the proposed work doing no unnecessary damage to the same and such barricades and lights as herein provided for in the case of crossing of roads shall be maintained until such bridges are reconstructed. The contractor shall further take all and every precaution necessary to protect the public from damage or injury in the construction of any ditch.

The ditches of most drainage districts require the crossing of one or more highways thereby necessitating the removal of old bridges or the construction of new bridges. Contractors are sometimes careless about protecting the public against injury while crossing such highways and the specifications of every

drainage district should contain a paragraph making it incumbent upon the contractor to fully protect the public in such way as shall be satisfactory to the commissioners and further protect the district by making the contractor and his sureties liable for any failure to so protect the public.

XVI.

LEDGE ROCK.

In case ledge rock is encountered in the construction of said work, the same shall be removed upon the terms provided in the bid.

While many districts do not contain any ledge rock nevertheless a careful survey should be made to determine whether ledge rock is likely to be encountered in constructing the ditches. Although the survey may not show the presence of ledge rock, it is occasionally encountered and for that reason lower bids may be received, if the specifications ask for a separate figure for the removal of such rock rather than leave it as one of the undetermined hazards to be borne by the contractor if met with in constructing the ditches.

XVII.

FENCES.

The contractor shall remove all fences, the moving of which shall be necessary in the construction of said proposed work, and shall not cover up, destroy, or do unnecessary damage to same.

The contractor is on the ground with a force of men and he is the logical man to see that the fences are kept in repair.

XVIII.

SUPERINTENDING OF WORK.

1. *Directions shall be given in writing by the commissioners to the contractor, if present on the work, or to his superintendent or foreman in his absence, and such directions shall be received and obeyed the same as if given to the contractor.*

2. Any work condemned by the commissioners shall be remedied and in case the contractor shall refuse or neglect to remedy such defect as ordered, then the commissioners may cause such condemned portion to be remedied or repaired at the expense of said contractor.

There must be a responsible man on the job all the time with whom the commissioners can communicate.

XIX.

RAILROAD CROSSINGS.

The contractor will make all arrangements with the railway company as to the time and manner of crossing their right of way at bridge No. — where lateral No. — crosses said right of way. The contractor shall also make arrangements with the ——— railway company in case he shall seek to pass through or over the right of way of said company where the main ditch crosses said right of way.

The following provisions have been used where the commissioners arrange for the crossing.

1. The Contractor shall dig, excavate and construct the proposed work within the limits of the right of way of the Railway Company and the various points of crossing at his own expense, in conformity with the specifications herein contained, the Railway Company to open its tracks, remove bridges, piling and timbers and permit the passage of the contractor's dredge and dredge boat through the right of way and premises without expense to the contractor, under the direction and supervision of the engineer of the railway company.

2. The contractor shall, at least days in advance of the time when he shall enter upon the right of way of the company to begin the construction of the said proposed work, give a written notice to the company's Superintendent, Mr. ... of Wis., of his intention so to do.

3. The contractor shall, in digging, excavating and constructing said proposed work, within the limits of the right of way of the said company, deposit all dirt and material removed

therefrom inside said Company's premises, as directed by the Company's engineer.

4. The contractor shall obtain from the drainage engineer in charge of the proposed work, a certificate showing that the said proposed work across and within the limits of the right of way of the Company, at the various sites, is satisfactory to and has been accepted by the commissioners and shall deliver said certificate to the Company's engineer, Mr. of

5. The contractor shall complete the work of digging, excavating and constructing said proposed work across and within the limits of the Company's right of way at each of said crossings, within a period of not to exceed twenty-four hours, such time limit to begin as soon as the company shall open its tracks to permit the passage of the dredge and dredge boat, and to end so soon as said dredge and dredge boat have cleared the track on the opposite side sufficiently to permit the track being replaced for the passage of trains.

6. The contractor shall seek to co-operate with the company in designating the day and time for opening the Company's track to permit the passage of the dredge and dredge boat by the contractor, and in case the day mentioned in the foregoing paragraph "2" shall not fall on Sunday, the Company's superintendent shall have the right to postpone the opening of the track for the purpose aforesaid until the Sunday next succeeding the date so designated by the contractor.

7. The contractor shall co-operate with the company in preventing any unnecessary delay over the company's road, and shall, where conditions permit, dig, excavate and construct that portion of the said proposed work immediately under the bridge or embankment of the road bed, and upon the opposite side of said bridge or embankment for a sufficient distance to float the dredge and dredge boat from the bridge or embankment after passage through or beneath the same, before the opening of the Company's tracks for the passage of such dredge and dredge boat, and do said work with teams, scrapers or shovels and without the use of either dredge or dredge boat. The purpose of this provision is, that said contractor shall use his dredge or dredge boat to dig, excavate and construct said proposed work up to

the toe of the embankment of the bridge, as the case may be, and that the work of digging, excavating and constructing said proposed work immediately under such bridge or embankment and on the opposite side thereof shall be done by teams, scrapers or shovels without the use of dredge, so that when the track is open, the dredge or dredge boat may be passed through said track or embankment with the least possible delay.

8. *That the engineer of the drainage district shall be present at and during the time of the crossing of the company's right of way by the dredge at the various points of crossing and shall co-operate with the company and with the contractor in preventing unnecessary delay at the points of crossing the right of way of said company.*

In these districts where it is found necessary to cross the right-of-way of a railway company with ditches, two plans for securing a crossing are available—one is that the contractor shall make arrangements with the railway company, and the other that such arrangements shall be made by the commissioners. If the matter is left wholly to the contractor, the specifications need only provide that the contractor shall make all arrangements for crossing with the railway company. In my experience, I have followed both plans with success depending, of course, upon the conditions existing in the particular district. In one district, we had four crossings of a railway right-of-way and in that case the matter was taken up with the chief engineer of the railway company and a full and complete understanding was had with the railway company outlining in our agreement the exact conditions under which the crossings should be had. These conditions were made a part of the specifications and, without going into details, I have included in the blank specifications, attached hereto, a copy, of these conditions.

It will be further found that railway companies differ in the attitude that they assume towards drainage districts, but that most of the railway companies have been willing to co-operate with these improvements, believing that they will benefit the company in the future. I have secured the most satisfaction, however, by taking the matter up personally with the company

on behalf of the district and securing a complete understanding with it as to the exact times and methods of making the crossing.

XX.

BRIDGES.

1. *The Bridge near center of Section, Town of, is to be removed and replaced or a new bridge constructed over the main ditch at a point approximately rods north of the present location.*

2. *For the Culvert on the N. and S. quarter line of Section Town of, the Commissioners reserve the right to change the present location and in case of such change a new concrete culvert shall be constructed.*

In nearly every district it is found necessary to cross one or more highways thereby necessitating either the removal and replacement or the reconstruction of a bridge and in some cases the construction of a new bridge where none formerly existed.

The specifications should distinctly describe the bridge and location and should state whether the bridge is to be simply removed and replaced or reconstructed or a new bridge erected. In some cases the town authorities prefer a new and permanent bridge erected under the state highway law and for that reason it is advisable for the commissioners to confer with the town officers relative to this matter before advertising for bids.

In case a new and permanent bridge is to be constructed, it may also be advisable to arrive at an agreement with the town as to the character of such new bridge, what proportion to be paid by the district and by whom constructed. If such agreement be arrived at, it is well to state the provision in the specifications. Another reason for covering the matter of bridges fully in the specifications is that some contractors prefer to bid simply on the work of excavation and, if the specifications are prepared as herein suggested, bids may be received for the removal or reconstruction of the bridges independent of the excavation.

XXI.

DECISION OF COMMISSIONERS.

In the interpretation of these specifications and the contract and upon all questions concerning the execution of the work, the decision of the commissioners shall be final.

It is hardly to be expected that those preparing the specifications can foresee every possible matter of dispute that may arise in the construction of the work and for that reason it is advisable that some person or number of persons should be named in the specifications whose decision as to the interpretation of the specifications and the contract and all questions relating to the execution of the work shall be final. In my own experience I have found it very satisfactory to provide that the decision of the commissioners in these matters should control, but at the same time I have always insisted that the commissioners be fair and reasonable in their decisions.

XXII.

ABANDONMENT.

If the contractor shall, at any time before its completion, abandon the work he has contracted to perform, he and his bondsmen shall not be released from the provisions of part X-6 of these specifications; but he shall forfeit all moneys then due him for work performed and he and his bondsmen shall be liable to the district for all loss or damage occasioned by such abandonment and for any increased cost or expense to which the district may be put, in completing the work according to the contract.

Every set of specifications should be prepared in contemplation of the possible abandonment of the work by the contractor. Not only may the contractor become bankrupt, but death and other contingencies may result in the abandonment of the work. For these reasons, it is advisable that the specifications should

be explicit in this regard and in general the specifications should make the contractor's bondsmen liable for the completion of the work.

XXIII.

BONDS.

1. Upon being awarded the contract to perform the whole or any part of the work herein proposed the contractor shall give his bond conditioned for the full and faithful performance by him of such work under these specifications.

2. The amount of the bond shall be equal to one-half of the contract price and must be approved by the commissioners both as to amount, form and sufficiency of surety.

3. A copy of these specifications shall be attached to and made a part of the bond and no changes, alterations or modifications made in the plans or specifications, or in the contract entered into shall in any way release the contractor and his surety from the obligation of the bond; nor shall any acts of the commissioners or their engineer impair the obligation of the bond or be in any way a waiver of the rights of the district with respect to the protection of the bond; but the bond shall be understood to be given for a completed job, in accordance with these plans and specifications and any changes, alterations or modifications made therein of whatever nature or character.

No contract should be awarded except on the condition that the contractor give a bond in such amount as the commissioners or the court shall deem amply sufficient. The bond should be a complete protection to the district with reference to every contingency that may arise so far as such contingency can be foreseen. It should be approved by the commissioners or by the court as to the amount, form and sufficiency of surety and should in general cover any changes, alterations, and modifications made in the plans or specifications or in the contract, and should be understood to protect the district against actions for injury to person or property and, in fact, any contingency that may arise in the construction of the work.

XXIV.

BIDS.

1. No bids or proposals will be considered unless accompanied by a guaranty, executed in an amount equal to 3% of the amount of the bid, but in no case shall a guaranty of more than \$500 be required, and all guaranties shall be subject to the approval of the commissioners. The guaranty shall be considered as liquidated damages and be forfeited to the district in case the contractor shall refuse or fail to enter into a contract as provided in these specifications, after acceptance of his bid by the commissioners.

2. The bids and guaranties shall be enclosed in a sealed envelope and endorsed "Commissioners of Drainage District," "Bids for Construction" and delivered at the office of their attorneys, of Wisconsin.

3. Bids may be submitted as follows:

A. For the construction of the entire work included in the Specifications.

- (a) Amount per cubic yard for excavation of earth.
- (b) Amount per cubic yard for excavation of ledge rock.
- (c) Amount for removal and replacement of all the bridges and construction of all culverts specifically mentioned in and subject to the conditions of Section XX of the specifications.

B. For the construction of the Main Ditch.

- (a) Amount per cubic yard for excavation of earth.
- (b) Amount per cubic yard for excavation of ledge rock.

C. For the construction of all lateral ditches.

- (a) Amount per cubic yard for excavation of earth.
- (b) Amount per lineal rod of ditch constructed.

- D. For the construction of one or any number of ditches.*
- (a) Amount per cubic yard for excavation of earth.*
 - (b) Amount per lineal rod of ditch constructed.*
- E. For the replacement of all bridges and the construction of all culverts specifically mentioned in and subject to the conditions of Sec. XX of the Specifications.*
- F. For the replacement of one or any number of bridges and the construction of the culvert specifically mentioned in and subject to the conditions of Section XX of the Specifications.*

Bids submitted under subdivisions D and F shall in addition to stating the amount for which the bidder would construct the entire work include in his bid, state separately the amount for which such bidder would construct each separate ditch, or portion of the work included in such bid.

4. The commissioners will receive and consider all bids other than herein suggested, and any person may submit any number of bids covering any portion or portions of the work.

5. The commissioners reserve the right to reject any and all bids.

I have found it very satisfactory to allow great liberality in the making of bids; but this is a matter which must rest in the good judgment of the commissioners and the engineer and their attorney, and may vary greatly according to the size of the district. In a fair sized district, however, it may be advisable to request bids on portions of the work to suit the bidder. But in view of the fact that work may be added to or decreased under the specifications and that ledge rock may be encountered in the construction of the ditches, it may be well to require every bidder to state in his bid a price per cubic yard for excavation of earth and for excavation of ledge rock. The specifications may even provide that the commissioners will receive and consider any and all bids other than suggested therein and that any person may submit any number of bids covering any portion or portions of the work. The specifications under all conditions should recite

that the commissioners reserve the right to reject any and all bids.

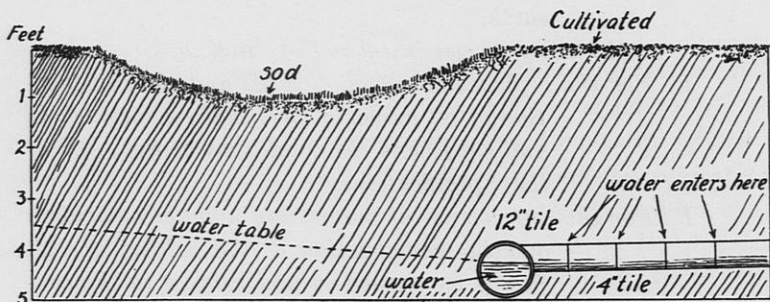


FIGURE 5.—A BIG TILE FOR DEPTH AND A SURFACE RUN FOR CAPACITY.

Where the marsh constitutes one-third or more of the catchment basin and the surrounding high land is not too steep, and enough small tile are put in to give thorough under drainage, a tile of reasonable size will do well without a surface run.—Courtesy Wisconsin Bankers Association.

Within the last few years, tile laterals are being specified more and more. It is usual to ask for bids for the entire construction of tile laterals and I have never learned of bids being asked for digging trenches and separate bids asked for furnishing, and laying the tile and filling the excavations. In requesting bids for such laterals, however, it might be advisable to require a unit price per rod to be stated so as to cover any changes in case the work is later increased or diminished. It may also be advisable to require in such bids a figure for the removal of ledge rock.

XXV.

CONTRACT.

1. A copy of the specifications will be attached to the contract and form a part of it.
2. Any changes or alterations made in the plans or specifications shall constitute and be a part of the contract, and the same shall be considered as contained within the contract, although the same shall be made after the execution of such contract.
3. A transfer of the contract or of any portion thereof, or of any interest therein or the subletting of any portion of the work

proposed to be done thereunder is prohibited without the written consent of the Commissioners.

4. Within ten days after the successful bidder shall have been notified of such fact by the commissioners, such successful bidder shall be prepared and ready and shall enter into a contract with the commissioners for the construction of said proposed work.

5. The contract shall provide for the commencement of the work under such contract within after date of the execution of the contract unless otherwise ordered by the commissioners.

6. The contract shall provide for the faithful and continuous prosecution of the work provided therein and for the completion of the same within the time to be determined therein by the commissioners upon consultation with the contractor.

The specifications should state explicitly that the specifications and any changes or alterations made therein should become a part of the contract. It also may be advisable to provide that no transfer of the contract nor the subletting of any portion of the work should be made without the written consent of the commissioners. It also may be advisable to state a time within which the successful bidder shall execute the contract and within which the work shall be commenced under the contract. While these are matters which in all probability would be considered by the contractor and the commissioners at the time of the execution of the contract, yet it is advisable that they be placed in the specifications so as to constitute notice to the contractor of just what will be expected of him before he files his bid.

XXVI.

EXPLANATIONS AND CORRECTIONS.

Any doubt as to the meaning of these specifications and any obscurity in the wording of them will be explained by the commissioners, who shall have the right to correct any error or omissions in them when such correction is necessary for the proper fulfillment of their intention.

As before stated herein, it is advisable to determine upon someone whose interpretation of the specifications is final, and with the commissioners logically rests that power. But as it is to the advantage of both district and contractor, that the work should proceed smoothly without interruptions or controversies or litigation, I must again impress upon commissioners and contractors the necessity of fair dealing. Commissioners should be fair in their interpretation of the specifications having due regard to the special conditions found in that particular district as well as to the uncertainties of the contracting business. The law does not presume that the commissioners or the contractors shall take any undue advantage of one another. Commissioners should remember that they are officers of the court and if matters cannot be determined amicably they should take such matters up informally with the court, for it will be found that judges are generally willing to assist in securing a friendly settlement of such differences. If, however, the matters are of such nature that the judge deems it inadvisable for him to act, it may be best for commissioners and contractor to refer the matter to outside parties.

DISCUSSION.

Mr. Holcombe. Mr. Lucas has given us some very good points, but I can not agree with him on all of them. Where commissioners reduce the yardage, they should increase the unit price. Some of the risk of maintaining the ditches in the face of floods that may occur during construction should be put on the commissioners. It is not fair to let the commissioners be the sole judges.

Mr. Sherwood. What price do you commonly pay for construction with those specifications?

Mr. Lucas. From 7 to 9 cents a cubic yard.

Mr. Sherwood. I am surprised that you can get the work done so cheaply with such rigid specifications.

Mr. Lucas. My commissioners are reasonable in settling with the contractor, but rigid specifications serve as the guide, and prevent uncertainties and quarrels.

Mr. Thorne. In the Center District the commissioners settled

with the contractor while the water was in the ditch. When the water went out, the slush staid in, and it has cost us more to clean out that slush than the additional unit price per yard would have amounted to if we had held the contractor under a tight contract. I believe in a tight contract, and in having the water out of the ditch before it is accepted. If the commissioners do not decrease the work more than 20% the unit price should remain the same. Usually contractors are willing to take increased yardage at considerable less than the contract price. They dug the bottom of our ditch 12 feet wide where it was specified 4 feet. The pressure of water below has made the bottom bulge upward.

Mr. Holcombe. Every good contractor likes tight specifications, but he must get good pay for good work. You should not have accepted the wide bottom and vertical sides. The narrow bottom would not have bulged. At any rate the contractor would not be responsible for the bulging if he made the bottom no wider than specified.

Mr. Hurtgen. Where our contractor makes us a bottom wider than that specified we make him slope the sides, by hand if necessary to whatever top width is necessary to obtain the slope. At railroad crossings we accept all we can of the ditch before the dredge crosses the track but we always take the benefit of a doubt. I believe in permitting a contractor to sub-let a job. After a contractor has lived up to specifications the engineer should help the contractor all he can.

For tile work it is best to have separate contracts for labor and material.

Mr. Coddington. If it freezes up when a contractor has only half a mile left on a ten-mile job, it is not fair to hold him up for all the damage that floods may do during the winter and spring. It may cost him \$5,000 to go back over the ditch to clean it out. If the fall is 4 feet to the mile and the ditch is 8 feet deep the ditch should be accepted and paid for in full down to within two miles of the dredge.

Mr. Moore. Mr. Lucas' specifications are not too tight. We do not know who will get our contract so we must prepare for the worst.

Mr. Vaughan. If the contractor digs 9 feet deep where the specified depth is only 8 feet, and makes the bottom no wider

than specified, yet before the work is accepted the bottom has bulged until it is only 6 feet deep, should the contractor be made to deepen the ditch at this own expense?

Mr. Myers. In a marsh where the slush closed in behind the dredge, we have made the contractor go over some of the work 5 times and still have held up 10% of his money. He has a motor boat now to agitate the slush, and the water is carrying it away. This is helping some, but I believe the commissioners should bear the cost of cleaning out from now on. The contractor has done his part and we must respect him for it.

Mr. Manning. Our ditch bottom bulged, but after the banks had settled, we blew the bulged bottom out with dynamite very successfully.

Mr. Vaughan. There are three conditions that cause the bottom to bulge; (1) the pressure of water from below, which may be remedied by digging holes to let the water rise without bulging the bottom; (2) the weight of the banks, which can not be remedied by digging such holes; and (3) the formation of gas in the decomposing peat. Where the bottom bulges due to either of these three causes, is the contractor at fault, if he has made the bottom no wider than specified?

Mr. Daniels. The best rule to follow is the golden rule. If the contractor has dug to proper grade and width once, he should have a reasonable compensation for going over the work a second time.

Upon motion the convention adjourned to 9:30 a. m. The demonstration of drainage machinery was announced for 8:30 a. m.

Meet with us in the field in Racine County, September 4 and 5, 1916.

MORNING SESSION.

JANUARY 20, 1916.

A Buckeye Traction Ditcher dug frozen ground on a vacant lot from 8:30 to 9:30. A Rood Traction Dredge also gave a demonstration.

The convention was called to order by President Coddington. He asked for the report of the Committee on Legislation.

REPORT OF COMMITTEE ON LEGISLATION

Gentlemen: Your committee on legislation, appointed at your first annual meeting respectfully reports:

That after notice given, your committee met at Madison, January 9-11, 1915, with Prof. E. R. Jones, Dr. H. H. Sherwood, Hon. Frank Lucas and such other interested persons as saw fit to confer with us, and decided that to patch up the Drainage District Law satisfactorily would be more difficult than to revise thoroughly and systematize the law by preparing a new bill covering all drainage district requirements so far as we knew or could anticipate them.

Pursuant to this decision we went over the law, corresponded with many parties about it, and on the 4th day of February, 1915 again met at Madison where we worked one and 1/2 days in the State Law Library on the proposed revised drainage bill. The new bill was completed early in February and we had it introduced into the legislature Feb. 17, 1915 by Hon. Chas. H. Everett of Racine, Senator from the Third Senatorial District. It was known as bill No. 157 S. and was a long bill. This committee here desires to acknowledge generally, the great help received by them from persons interested in drainage throughout the state, more especially by way of suggestions of new phases of drainage not directly covered or provided by the previous law,

and we especially desire to thank Hon. Frank Lucas, of Madison, and Hon. A. E. Matheson, of Janesville, for their generous, untiring and exceedingly valuable aid, both in the drawing of the new bill and in the hearings on that bill before the legislative committees.

The bill when introduced was referred to the senate committee on Judiciary.

On March 9th, the bill was on the committee calendar for hearing before the judiciary committee, and our Mr. Myers and Mr. Vaughan then appeared before that committee and they and others discussed the bill pro and con quite fully, calling to the attention of that committee all of the proposed changes in the prior existing drainage district law, and giving reasons for each change.

Members of the judiciary committee raised constitutional questions on the proposed method of trying issues of benefits and damages, and asked your committee to present a brief thereon.

This your committee did, going at length into the subject, and presenting a brief citing many cases which held that the proposed change in trial of benefits is constitutional.

On the 24th day of March, Messrs, Vaughan and Myers of your committee, upon notice, from the judiciary committee, of hearing on Bill 157S and other proposed drainage bills, again appeared before the Judiciary Committee and discussed the pending drainage bills, and on the day following appeared before the Assembly Committee on Public Welfare and discussed drainage bills which had been referred to that committee. Again, on April 1st, Messrs. Myers and Vaughan, of your committee appeared, this time before a joint meeting of the assembly and senate committees, having charge of proposed drainage legislation, and in behalf of this association discussed all of the proposed drainage legislation before those committees.

Sometime during the month of April, the committees of the legislature having drainage bills before them, decided that the many proposed bills were so lengthy and conflicting and proposed so many changes in the law, that, busy as the committees were during the session, they could not give the subject of drainage legislation the attention that it merited and it was decided that a joint committee of the Assembly and Senate be appointed to

consider all of the proposed changes in the drainage laws, and to report at the 1917 session of the legislature.

Some changes in the drainage law were so urgently needed that, after the joint committee was decided upon, the legislative committees asked us to prepare what I will here call an emergency bill, covering those urgently needed changes, which bill was prepared, was introduced as Senate Bill No. 637S and, with some changes, was enacted as Chapter 517 of the laws of 1915.

In the meetings of your committee, the preparing of the bills mentioned above, the appearances before the legislative committees and the preparing of the briefs mentioned,

Our Mr. Myers spent sixteen days,

Our Mr. Vaughan spent seventeen and one-half days,

Our Mr. Brown spent one day,

Our Mr. Wolf spent one day,

Our Mr. Kamper spent two days.

The secretary has an itemized statement of our necessary expenses actually expended by us in our works as members of the committee. They amount to \$120.57.

Respectfully submitted,

B. M. VAUGHAN, Chairman

PETER J. MYERS

G. E. BROWN

W. F. WOLFE

J. H. KAMPER

DISCUSSION.

Mr. Vaughan: A good drainage law should satisfy four requirements.

1. It should be so comprehensive that it clearly covers drainage requirements.

2. It should be so clear that it can be easily and certainly followed.

3. It should properly protect the property owner against imposition by the drainage authorities.

4. It should properly protect the man who furnishes the money to do the work, that is the bond-buyer.

No man drawing a new law, however thoroughly he thinks he

knows his subject, can know in detail all of the field that should be covered by that law. The result is that any comprehensive law must be a growth, not a creation, and drainage laws are no exception.

Early in the last century it was realized that, under the common law, little progress could be made in draining large wet areas.

Because of petty jealousies, adjoining land owners could not agree, either on location of drains, or on the damages to be allowed, or on the part of the cost of building and maintaining drains that each should pay.

The problems involved in drainage were akin to the problems of government, so a like way of working them out was hit upon;—that is to say, a public board, either then existing or to be elected or appointed, was given power to construct drains.

The first drainage laws were indefinite, vague and otherwise crude. Times without number the courts declared these early drainage laws unconstitutional, or decided that the public officers had not complied with their indefinite provisions, or had exceeded the powers granted by the law. These decisions often rendered the law completely or practically useless.

In the light of these decisions the drainage laws were amended and reamended or new ones were passed until finally a valid workable law was evolved.

Newer states borrowed the improved drainage laws from older states, adapting them to their requirements.

As the new conditions were discovered new provisions were added to the drainage laws, making them broader and more specific as to the rights of the public, of the property owner and of the bondbuyer, and more clearly defining the duties of the public officers having charge of the work, to the end that litigation might be lessened, mistakes avoided or corrected, and delays avoided.

The history of drainage laws in Wisconsin is not essentially different from their history elsewhere. The foundation of our present law was borrowed from Illinois.

In a new state like Wisconsin it was found that local money could not be obtained, with which to do the work. To borrow money from the money centers, the law under which the drainage

securities (bonds) were issued had to be passed upon by the attorneys of the men who were to loan the money. Those attorneys regarded the Wisconsin law as indefinite and uncertain and suggested amendments.

By 1905 these objections and amendments had accumulated until a complete revision of the law was thought desirable.

In the light of the various opinions of bonding attorneys, and of court decisions of this and other states, the bill that became Ch. 419 Laws of 1905 was drawn. That was, when it was passed, the most comprehensive and detailed drainage law in the United States, and it was hoped that little change in that law would be needed for many years. But drainage in Wisconsin developed rapidly, new drainage problems, not before thought of here, presented themselves. Many amendments to the 1905 law were passed by the legislature. Unfortunately these amendments were drawn to apply to some specific condition, or to satisfy some person's whim or fancied grievance, and the amendments conflicted with or were supposed to conflict with parts of the old law that they were not intended to affect. The result was that in 1914 a complete revision of the drainage district laws of the state was thought desirable.

Your committee on revision appointed at your last annual meeting attempted to draw a bill thoroughly revising the drainage district law of the state.

That bill was introduced into the Senate in 1915 and is known as Bill No. 157S.

In revising the law your committee sought to retain all desirable provisions of the present law, to eliminate all undesirable provisions, and to add all of the desirable new provisions to which their attention was called.

The following changes in the prior Wisconsin Drainage District Law are found in Bill No. 157S.

1. At line 2 page 2 in section 1379—10a the term "Drainage District Law" is defined. This is for brevity of reference, to avoid confusing this law with the other drainage laws of the state.

2. At line 5 page 3 is a section declaring drainage district proceedings to be equitable in their nature and under the equitable supervision and control of the court. This is, to a less extent, true under the present law, 1379—31m2 of the Statutes.

3. At line 10 in section 1379—10c is a general section providing how notice of entry of all orders must be given. This is added so that the practice will be uniform. It is substantially the same as provisions now scattered through various sections of the law.

4. At line 25 the same section provides a uniform method of serving all notices unless the bill provides specifically for a different service. This section provides an abundant and fair notice. It has been suggested that line 30 and 31 be amended to read "published in *each* county where *any part of said drainage district is situated* once each week for three successive weeks," the parts underscored being the new language suggested. The committee that drew the bill have no objection to the change other than the small additional expense.

5. At line 52 to 65 is a provision for waiver of notice, in case of failure to serve on any party, thereby avoiding the delay and cost of adjournments which are often costly to the district.

6. At line 72 is a provision defining what shall be sufficient notice, that is giving the substance of the notice. Buyers of drainage bonds who want to avoid their contract now have a trick of trying to do so by claiming that the notice is not sufficient to comply with the statute. This section seeks to remove any uncertainty on the contents of the notice.

7. At line 88 is a section authorizing the court to organize as one drainage district, lands that separately petition for the organization of two districts. This naturally cuts down costs and expenses in such cases.

8. At line 96 is the "University Section." The committee would be satisfied to let the University authorities (Prof. Jones and Prof. Whitson) word that as they desire, providing that the call upon the Department of Agriculture be left optional with the land owners.

9. After consultation it has been thought best to change lines 111 and 112 to read "A notice of *Lis Pendens* shall be filed after the filing of the petition for a drainage district." It adds some expense. Either the provision now in the bill or the one above will render the law certain.

10. At the end of line 145 of the bill should be added, "and if

it is desired to omit the preliminary report said prayer shall pray that said report be omitted.”

11. At line 254 is a provision that failure to serve notice of hearing on petitioners shall not render adjournment of hearing necessary. They are in court by virtue of the petition and usually represented by their attorney.

12. At line 290 is a section providing that before a petitioner withdraws from the petition he must file a bond to pay the costs in case withdrawals oust the court of jurisdiction. The court now holds such withdrawing petitioners liable for costs. Many withdrawing petitioners do not now, under the present law, realize that by withdrawal they become liable for costs. This calls their attention to that fact.

13. At line 392 the law is changed so that the commissioners may reside anywhere within 50 miles of the district providing they reside in the state. The present limit is 25 miles. It is claimed that by being given more latitude the court can get better commissioners.

14. At line 425 is a new sub-section providing that the district shall keep their *bond and interest fund separate from the general fund*. This is new and is added to prevent the mingling and use of funds, that should be used for paying bonds and interest, with the expense fund.

15. At line 436 is a provision that the compensation of the commissioners shall be five (5) dollars per day. The present compensation is three and one-half ($3\frac{1}{2}$) dollars per day. It is claimed that more latitude gives the court an opportunity to get better commissioners.

16. At line 579 and at line 2579 are provisions for submitting questions involving navigable waters to the Railway Commission. These are new and very much needed. A great many thousands of acres in Wisconsin are now rendered too wet for farming by dams, the use of which dams is nearly or quite worthless. The use of these lands for farming would often bring in many times the profit that the dams bring in.

17. At line 853 is a new section defining what may be assessed for as benefits against towns, cities and villages.

18. At line 872 is a provision authorizing the drainage district to build highways in certain cases. This is a very important and

necessary provision in view of the fact that in many towns it is impossible to get the town board to lay out highways in the drainage districts. This is new.

19. At line 884 is a provision for assessing state swamp lands in drainage districts the same as lands owned by individuals. This is new.

20. At line 898 is a like provision for assessing county lands. This also is new.

21. Section 1379—20 is changed in three respects. At line 933—95 it is so changed that the remonstrants must make their issues definite and specific so that the commissioners may know what they must meet.

22. At line 951 it is so changed as to require remonstrances to be filed and served 5 days before the return day. This enables the commissioners to prepare for trial without necessitating an adjournment and avoids delay and expense. Like provisions requiring filing remonstrances 5 days before the hearing will be found in all cases where remonstrances are provided for in this act.

23. At lines 957—967 is a provision that all issues except those of *damages* shall be tried by the court without a jury. By the existing law all issues except those of *benefits* and *damages* are triable by the court without a jury. This I regard as the most needed change in the drainage law and I take the liberty to append a short discussion of this change. (See Appendix p. 209.)

24. At line 986 is a subsection providing that, on the question of benefits and damages, evidence may be introduced enabling the comparing of the benefits and damages that will be caused to the lands in contest with the benefits and damages that will be caused to other lands in the district. This is a new section and is put in the bill because some of the circuit courts have refused to admit such evidence. This is in the "emergency bill" which became a law in 1915.

25. At line 1083—4 is added "or who have loaned money to the petitioners or commissioners for the purpose of carrying on the proceeding and work under this act." The provision is not in the present law in any form.

26. At line 1152 to 1156 is a new paragraph providing that if drainage bonds cannot be sold at par, they can, subject to the ap-

proval of the court, be sold at the best obtainable price. That is the practice now, but the commissioners' right to do so is some times questioned.

27. At 1300 is a new provision to the effect that when counties take drainage assessment deeds they must account to the drainage district for drainage certificates in the hands of the county.

28. At lines 1500 and 1505 the validation law is broadened to cover assessments for construction and additional assessments. Whether the present law covers them has been questioned. All assessments should be clearly within the scope of this provision (see Sec. 1379—28m Ch. 517, Laws of 1915, where this provision became a law).

29. At line 1576 is a slight verbal change asked by the University authorities rendering the meaning of the section clearer. This change shows on the corrected copy of the bill left with the chief clerk of the assembly.

30. At lines 1601 and 1611 fifteen days in each case is changed to seven days. The railroads have asked that this be changed back to 15 days, and after consultation the committee that drafted the bill have decided not to oppose this change back to 15 days.

31. At lines 1628 to 1646 is a provision requiring telegraph, telephone, etc. owners to raise their lines and cables and let dredges pass. This is new and is necessary, otherwise such company might hold up the work indefinitely.

32. Section 1379—30 at lines 1647 to 1670 is changed by cutting out the 25% limit contained now in the law and also cutting out the notice clause. Instead of the 25% limit clause benefiting the district, it, in its workings, has more often caused considerable unnecessary expense to the district.

The Supreme Court, in *Stone vs. Little Yellow Drainage District* 118 Wis.—, sustained such assessments without notice.

33. At line 1722 is a new section placing drainage district bonds on the same footing as municipal bonds. This is but just, as the drainage district is a public corporation, and this provision will aid in the sale of drainage bonds at par or above.

34. At lines 1751 to 1771 is a new provision authorizing emergency loans, and safe-guarding the same. Personally I believe that line 1767 after the word "force" to 1771 should be stricken

from this sub-section, as I believe those lines would authorize borrowing beyond the assessed benefits from which the loan must be paid.

35. At lines 1783 to 1799 is a provision requiring the district to keep a bond record. A few districts have no such record. The records of their bonds are found only in their minutes and one not familiar with those minutes cannot determine what bonds are outstanding against the district.

36. At line 2291 is a provision making assessments against municipalities come due in instalments the same as assessments against lands in the district. This enables the bonding of these assessments the same as assessments against lands.

37. At line 2324 is a new provision providing that drainage districts shall pay for the elongation of bridges where such elongation is made necessary by the widening of the drainage ditches.

38. At lines 2202 to 2205 is a provision declaring that damages to outside lands cannot be tried until they have occurred. That is believed to be the present law, and is held by most courts in such cases to be the present law. The fact, that one circuit court has held otherwise is pleaded as justification for embodying these lines in this bill.

39. At lines 2342 to 2353 is a new provision for agreement on assessments, when they have been inadvertently omitted by the commissioners.

40. At line 2428 is a provision for sub-districts. This is new. The provision is embodied in Ch. 517 Laws of 1915, the "Emergency Bill" and is now the law. (See Sec. 1379—31v, Statutes of 1915.)

41. At lines 2461 to 2478 is a new provision providing for consolidating two or more districts.

42. At lines 2514 to 2515 is a change from $\frac{1}{4}$ to $\frac{1}{10}$. It is believed that if the owners of $\frac{1}{10}$ of the lands in the district believe that the existing assessment is unjust there is reason for an investigation to determine the justness of the existing assessment and a re-assessment where it is unjust.

43. At lines 2802 to 2836 is a new section providing for leasing irrigation rights and safeguarding the surrounding lands. This section is of very great importance to those parts of the state where drained marsh is suitable to the growing of such high

priced crops as celery, tomatoes, cabbage, cauliflower, onions and perhaps several distinctly marsh land crops. (See Sec. 3932d, Ch. 517 Laws of 1915.)

44. At lines 2837 to 2885 is a new section requiring towns, etc., to leave sufficient water ways when they build bridges or culverts.

The provision is necessary in very many places in this state.

45. At lines 2886 to 2898 is a new section enabling the building of pumping stations, etc., in case the conditions justify the use of pumps in drainage.

Attention is also called to the fact that the following provisions of the statutes of 1913 will be repealed by and not re-enacted by Bill No. 157S if that bill becomes a law.

All of these omitted provisions have been carefully considered by the committee that drew that bill and that committee believes those provisions should be omitted.

First. Sub-section 4 of section 1379—25. This provision endangers the bond holders and renders the sale of bonds difficult.

Second. The last two and one half lines of Section 1379—31b are omitted as (1) unjust to the bond holder (2) rendering sale of bonds difficult.

It may be that slight changing of wording of the present statute to make its meaning more clear occurs in other parts of this bill. An effort has been made here to point out all material changes that this bill proposes to make in the present drainage district law, and it is believed your attention is herein called to all material changes.

The President: Mr. Vaughan has given us a very complete summary of the proposed amendments, but I believe our eminent drainage attorney, Peter J. Myers, of Racine, also on our committee on legislation, can shed some more light on some of the amendments.

Mr. Myers: It is the idea of the legislative committee that it is not wise to dispense with the preliminary report of the commissioners in the organization of larger drainage districts, although it might be expeditious to do so in the organization of districts containing less than two thousand acres of land to be reclaimed or benefited where the sentiment is very largely in favor of the organization of a drainage district. We believe that in the

larger work, and in work where there is considerable opposition to the proposed project, the preliminary report is a very essential step. We have therefore provided for no very material change in the requirements of the petition except that we leave it optional with the petitioners as to whether or not the petition shall be of sufficient detail as to description of the proposed starting point, routes and termini of the proposed drains, ditches and levees so as to warrant the omission of the preliminary report.

The bill requires that the commissioners shall keep an accurate record of all payments made by them and shall take vouchers for such payments and shall keep full, accurate and true minutes of their proceedings; that they shall keep a separate account of all moneys received for principal or interest on bonds and notes of the district. They are also authorized with the approval of the court to borrow money necessary to pay the expenses and do the work preliminary to the confirmation of the assessment of benefits provided for in the will. This means that the commissioners with the approval of the court, can go to a bank and borrow sufficient funds upon the notes of the drainage district after the confirmation of the preliminary report with which to pay for the necessary labor of making the surveys, leveling the assessment for benefits and cost of construction and legal work. Heretofore the matter of the preliminary work has been a burden upon the commissioners, engineer and attorneys and in most instances they have been obliged not only to wait for the compensation a year or more but have been obliged to advance money with which to pay the necessary expenses.

The provisions with reference to the requirements of the preliminary report remain unchanged except that under the bill proposed the commissioners are required to report as to whether or not in the doing of the work proposed it will be necessary to enter upon and do work in any navigable stream or other navigable waters of the state, the character thereof and whether the proposed work will in any wise permanently obstruct or interfere with the general navigability thereof.

We believe that under the Water Power Act giving the Railroad Commission jurisdiction of the navigable waters of the state this provision is absolutely necessary. It is the opinion of the writer that no drainage work can be done which will in any man-

ner change the character of any navigable water of the state without the permission of the Railroad Commission.

With reference to this feature the bill provides that if the court confirms the preliminary report and it shall appear that in doing the proposed work it shall not be necessary to enter upon any navigable waters and will not be necessary to remove any mill dam, upon the confirmation of the preliminary report the drainage district shall be fully organized. But if it shall appear from said report or upon the hearing of said report that it will be necessary to enter navigable waters of the state or remove any mill dam or obstruction from navigable streams, or clean out, widen, deepen or straighten any navigable streams, the drainage commissioners shall within thirty days from the date of the filing of the order confirming the preliminary report, file with the Railroad Commission of the State of Wisconsin, a certified copy of the petition and of all other papers and orders either made or filed with the Circuit Court in said proceeding, together with an application setting forth that the public health and the public welfare demand that certain mill dams or other obstructions shall be removed from a navigable stream, or that it is necessary to enter upon navigable stream or other navigable waters for the purpose of straightening, cleaning out, deepening and widening the same, and that the work proposed will improve the general navigability of said waters, which application shall be duly verified and shall be accompanied with detailed plans, profiles and specifications of the work proposed in such navigable waters. That upon receiving such application the Railroad Commission shall set a time and place for hearing upon the application and give notice by publication in one newspaper in each county in which any part of said drainage district is located. If the plans and specifications are approved the same shall be certified back to the court and thereupon the district shall be organized. If they are not approved the proceeding shall be dismissed.

The bill also provides for the removal of mill dams and other obstructions in navigable waters in drainage districts heretofore organized under similar proceedings, and for the reassessment of benefits where in the opinion of the commissioners greater benefits will be derived by certain land owners than those assessed prior

to the contemplation of the removal of the mill dams and obstructions in navigable waters.

The bill also provides for pumping plants, which is a new departure in drainage laws in this state. There are many instances where lands are so situated that levees can be built and the only water necessary to be pumped is the water which falls upon the lands. There are now no drainage districts in this state where pumps are used to provide an outlet. Such drainage projects have been very successful in other states and can be made just as successful in this state.

Section 1379—10b of the bill provides that all proceedings under the drainage district law are declared to be equitable in their nature, and at all times the district and its commissioners shall be under the equitable supervision and control of the court. Heretofore there has been some doubt as to whether or not the proceedings for the organization of a drainage district were legal or equitable. It is very essential that the proceeding should be in the nature of an action in equity, for the reason that there are many situations which arise in the organization, management and control of a drainage district which must necessarily appeal to the equity side of the court rather than to a strict legal construction of the statute.

The bill also provides that in the trial of contests on benefits and damages arising on any remonstrance under the drainage district law in addition to other competent evidence, evidence may be introduced showing what benefits are assessed against and what damages are awarded by the report to other lands in the district, and such benefits and damages may be compared to determine whether they are equitable and just. Evidence may be introduced on the condition of the various tracts of land in the district and of the cost of further drainage or under-drainage necessary to give any assessed tract the assessment or award which is being contested, a drainage equal to other tracts in said district, and any and all other evidence may be introduced which tends to establish what assessments and awards on lands under contest would be equitable and just as compared with other lands in the district.

(*Note by Editor:* The Supreme Court in the case of Ward vs. Babcock (see p. 205) has practically decided that comparison between several tracts of land in the district is permissible under the present law. In a letter of April 19, 1916, Mr. Myers says: "In that case also the court held in effect that after the time for appeal from the order confirming the preliminary report establishing the district and finding that the benefits will exceed the cost of construction has passed, the only matter remaining is the matter of the distribution of the cost of construction. This decision, I believe, it is the most important and helpful interpretation of the drainage law by our Supreme Court that has ever been rendered and will do much towards the reclamation of our vast area of marsh lands in this state.")

Chapter 419 of the Laws of 1905, which was a rather complete drainage statute, has been amended by the succeeding legislatures until the same has become more or less involved and at the present time we have a drainage statute which is very cumbersome and hard to follow, and it was the idea of the committee on drainage legislation to so arrange the law that the matter of giving notices of hearing would be uniform throughout the proceeding. In the bill prepared this has been provided for.

We have provided in the bill presented that in case the withdrawal of names from the petition shall reduce the number of signers of the petition below the requirements of the statute such withdrawing petitioner or petitioners shall either pay into court, or give an undertaking to pay the costs of the proceeding before they will be permitted to withdraw their names from the petition.

I believe that the commissioners should make a preliminary report to the court establishing the benefits. It is an important step and should be omitted only in rare cases.

The bill also makes additions to the requirements of the notice. It shall state that any remonstrance against the petition shall be filed with the clerk of the court and served upon the attorney for the petitioner at least five days before the day fixed for hearing upon the petition. The purpose of this provision is to give the land owners notice that if they desire to remonstrate they must do so promptly and not wait until the last moment—the purpose of this provision being to expedite the proceedings and

to eliminate the filing of remonstrances at the last moment and not give the petitioners an opportunity to be prepared to meet the remonstrances.

Section 1379-14 provides for the grounds of contest upon the petition, and among other grounds provides that objection may be made to the jurisdiction of the court, but requires the remonstrator to specify the grounds of his objection to the jurisdiction.

In the past in the organization of drainage districts it has sometimes happened that those opposed to the project, after the filing of the petition have induced a sufficient number of the signers to withdraw their names from the petition so as to leave the petition without the sufficient statutory number of signers so as to give the court jurisdiction of the proceeding. Our supreme court has heretofore held that the withdrawing petitioners must pay all of the costs of the proceeding up to that time. In some instances the withdrawing petitioners have not been of sufficient financial responsibility so that a judgment for the costs could be collected from them upon execution.

A very important change to which Mr. Vaughan has called attention is the elimination of a trial by jury from the assessment of benefits. After a very careful investigation of the authorities in other states your committee has reached the conclusion that the elimination of a jury trial upon the question of assessment of benefits is constitutional beyond all question, and in drafting the bill we have eliminated the trial by jury upon this issue. Attorneys and commissioners who have had to do with the organization of drainage districts in this state have had a very varied and unsuccessful experience at the hands of juries upon the question of benefits. Outside of my own experience, which in one case was very unsatisfactory, my attention has been called to a number of cases in which juries have seen fit to eliminate the assessment of benefits upon marsh lands adjacent to ditches of a drainage district and at the same time have awarded to the owners of such tracts very substantial damages because of the removal of the water from the land. In other words, it seems impossible to get to a jury in the way of proofs during the time consumed in the trial of an action of this kind sufficient information to give them an intelligent view upon the subject. If this bill becomes a law the only question which a jury may consider is the question of

damages. The award of damages is always a matter of more or less speculation, and it is an established principle of American jurisprudence that the party aggrieved has the legal right to have his damages assessed by a jury.

My experience with drainage districts in southern Wisconsin which have been carried through to completion and the land owner has done his part after being afforded an outlet is that it has resulted in great profit to the land owner and the community in general by reason of the increase in the fair market value of the lands in the district. I can point to many instances where the lands that were of but little value, not to exceed \$25 per acre when the proceedings were started, and these same lands are now selling on the market for upwards of one hundred and fifty dollars per acre, and where the expense including under-drainage has not exceeded \$50 per acre. This all adds to the material wealth of the community and of the state at large, relieves the burden of taxation to the public at large and results in a general good to all.

THE WISCONSIN LAW FROM THE ILLINOIS STANDPOINT.

JOHN M. RAYMOND,

Attorney at Law, Aurora, Illinois.

Gentlemen of the Convention:

I consider it a special honor and privilege to be invited by your Honorable Board to appear before this Convention for the purpose of discussing and criticising the new law that you propose to place upon your statute books.

I have had a large experience in the drainage line, both in the field and in the courts. As a boy away back in 1865, it was my privilege to see the first mole ditches built on the prairies of Illinois. This character of ditch is unknown to most of you. It was constructed with a machine by which a knob about six inches in diameter was pulled through the ground $2\frac{1}{2}$ or 3 feet in depth

over the level prairies, and, surprising as it may be, these ditches continued to flow a great many years and afforded reasonable surface drainage, but not sufficient for general agricultural purposes.

About this same time ditches were dug, and by the use of poles laid lengthwise in the bottom of the ditches, did fairly good drainage service, but were not of such a permanent nature as to be of much practical use.

In '71-2 and 3, I helped lay about eight miles of tile. This was the first drainage of this character that was constructed in Kendall County, Illinois, and while the first tile were not of sufficient size and were not put in at a proper depth, they afforded fairly good drainage, and by their development and the larger experience of men in these affairs, this system of drainage is the most practical and most generally used of any in existence, and the creator and developer have done as much as any other class of men in the increase and development of the production of the material crops of the world. Without this, the corn belt of Illinois would still be an unimportant, instead of the most important, territory of the State of Illinois.

I have organized a great many drainage districts and have litigated in the courts nearly every question that could possibly be raised under the laws of the State of Illinois.

In the contest with the Chicago, Burlington & Quincy Railway Company, I established a principle of law that has been of great value to the land owners of Illinois. The railroad had built a bridge over Rob Roy Creek about 12 feet in length. This bridge was built in 1858. In 1902 a drainage district was organized, the outlet of which was through this point. It had to be enlarged to permit the drainage so that there would be an expense in the building of a proper bridge of about fourteen thousand dollars. The railway claimed that this expense should be borne by the drainage district; that the bridge furnished by the railroad had been in place for more than forty years and had proved itself in every way sufficient to take care of the natural flow of the water, and that this was all that could be required. I claimed that the railroad company, being a public serving corporation, must not only take care of the natural flow of water,

but all further flowage that results from necessary farm drainage.

The question was a constitutional one and the railway plead the Constitution of Illinois and the Constitution of the United States. The Circuit Court of Kendall County, the Supreme Court of Illinois and the Supreme Court of the United States held with me on that proposition, and it is now the established law of the State of Illinois and is being observed by all railroads.

From what I observe in your State, a very large percentage of your drainage is not effective, has not been worth while, and has resulted in the expenditure of large sums of money without any adequate return. In other words, your drainage in this State is too largely surface drainage only, mainly on account of the fact that your ditches are not of sufficient depth.

The open drainage ditch, as a rule, is the outlet ditch. It must be constructed on such lines as will afford drainage to the smaller bodies of land adjacent and tributary to it, and this ditch therefore must be of sufficient depth so that in flood times there is ample and reasonable fall or outlets for the smaller drains tributary to this outlet. This may require longer ditches to get the fall, but unless you can have outlets so that the smaller or tile ditches can be placed at a depth of at least $4\frac{1}{2}$ feet, the drainage resulting therefrom will not be effective. If the flood waters remain on the cultivated land more than a few hours, the crop is destroyed and the year's work of the farmer is of no avail.

The first thing necessary in drainage is a law for the small drainage district. There are hundreds of these where there is one of the larger, and for that reason, an adequate law for this purpose is more important than one to meet the requirements of the drainage of your great swamps.

In Illinois we had four different kinds of drainage districts. A man owning a piece of land does not desire to have it drained; the man owning the next above desires and must have drainage. Under our law, the first land owner can be forced to permit the drainage of the other and to contribute his proper and reasonable part of the expense thereof. The land owner desiring drainage can go before a Justice of the Peace, file an affidavit and plat showing his plan of drainage, have a summons issued, and

the matter is brought into court. In five days the whole matter can be determined without even the necessity of a lawyer's fee.

This is the most necessary and essential law and it should be simple, so that the layman can understand it, and the procedure be conducted without material expense.

The next law that we have in the line of larger matters is what is called the Township drainage law. This law is simple, elementary and expedient, and it is necessary and essential, from a practical standpoint, that these matters be brought to a conclusion within a brief space of time. Otherwise it is possible for a fellow landowner, by his personal efforts, even though not on right lines, to use his influence to prevent the doing of a thing that is beneficial not only to him but to all interested.

Under this law, the three highway commissioners are ex-officio drainage commissioners of the Township, having full power and authority to do any and every act necessary for the construction of these ditches. It is necessary that a petition be filed with the Clerk of the Highway Commissioners, which shall contain a description of the land, the name of the owners, and shall be signed by one-third of the landowners owning a majority of the land or a majority of the landowners owning one-third of the land. The only condition necessary to set forth in the petition, after a proper description and the names of the owners, is that the petitioners desire a district organized for drainage and sanitary purposes.

It is necessary and essential that this conjunctive condition be in the law, for in the majority of cases you can only get a third of the land owners owning a majority of the land to execute the petition, and without this condition in the law, a large percentage of the drainage would never be had in the State of Illinois.

It is the duty of the Commissioners, within five days, to call a meeting of the land owners in not less than eight nor more than fifteen days to hear any objections and to determine for themselves whether or not there is necessity for the drainage and whether or not the benefits to be derived therefrom will exceed the expense. If they believe this to be true, then it is their duty to organize the drainage district, and the whole

matter can be consummated under this law and the contracts let within thirty days from the time of the filing of the original petition.

This feature of time is all-important, for it is true that when you want drainage, you want it at the present time,—this year not next. One year's crop frequently will pay the whole expense.

Another law we have is a law applicable where the drainage system is in two or more townships. This is the general law of the State of Illinois. The conditions in regard to the petition and the requirements of the petition are the same, the difference being that this petition must be filed with the Clerk of the County Court, and all matters applicable thereto are heard and determined in the County Court. The notice required, is a little longer and the time required for organization is longer, but as the matters at issue are larger and of more importance, this is a good feature of the law, as it gives the parties in control and the parties interested more time to determine what should be done.

We have another provision in our law that is most essential and that is this: when a petition is once filed, the signers to that petition cannot withdraw their names of their own volition. Unless this were the law, it is always possible for some cantankerous fellow to go about among the owners of the lands of the proposed district and, by his influence or subterfuge, get enough names withdrawn to deprive the court or other officials of their jurisdiction in the premises.

We have also what are known as special drainage districts, that can be formed under the laws of the State of Illinois. It is sometimes said that there are two parts of Illinois, Chicago and "Egypt." the southern part of Illinois is known sometimes as "Egypt." It was settled originally by men from Kentucky and Tennessee. They still believe that the old province or county division is the only division required for proper government. In these many counties they have no township organization, and it therefore was necessary that a law be formulated to meet these conditions. The practice or method of procedure in these special districts is similar to that of the other districts.

Under the general or county drainage law above specified,

dykes can be built, pumping stations established, and all those things done that are necessary and essential to create proper outlets for the larger drainage districts.

From what I have said, you will get a general idea of the drainage law of the State of Illinois. It is somewhat crude, is not perfect, and never will be, but, as nearly every feature of the law has been criticised and become fixed by the Supreme Court of the State, we now have a method of procedure for drainage purposes that is simple, well-established and effective for the purposes intended.

You know, it is true that the legislators of our different states furnish only the crude material for the law, and the Supreme Court finally makes the law. In other words, you never know what the law is until you have had the last guess of the Supreme Court on the proposition at issue.

The bill now pending before your State legislature and which you intend eventually to place upon your statute books, in my opinion, needs considerable reformation before it will be sufficient to meet the requirements for the purpose intended.

The drainage law of a State should be clear, concise and so formulated that the business men of the State who have charge of your drainage work can understand it and apply it. This bill as now presented is too redundant, it is confusing, and it would puzzle and perplex your best lawyers specially posted in drainage matters to determine what was intended by the law.

The first part of the law should cover the ground required for the elementary drainage work of your state, and this part of the law should be, in my opinion, on the lines of the Illinois law, as I have suggested, and should be so formulated that in these minor drainage matters, there should be quick and immediate relief, a procedure that could be carried out within a period of thirty or sixty days. This should be followed by a broader and more comprehensive law for your drainage and levee work, and this law should be in a more condensed, more clear and concise form than that set forth in this proposed legislation.

Another proposition that should be changed is this: The township or county, and not the drainage district, should build all highway bridges required in the construction of all drainage

systems. By the drainage of the lands, their valuation is increased, the taxable property of the township is increased, and all of this redounds to the benefit of the township. It relieves the district from an additional expense which might make drainage prohibitive, and the fact that the landowners are willing to furnish the fund necessary for the drainage of the lands should, in all cases, be encouraged by putting that part of the burden on the township or county which it should meet on account of the new and better conditions resulting to the township from such improvements.

Another similar proposition is that of the railroads. In my opinion, they should build all bridges and make all improvements that are required by the construction of drainage systems across their right of way. They are required to do this in Illinois, and there is merit and justice in such a law. By the drainage of the land, the production is increased, and by the increase in the production, there is more work to be done by the railroads. Had it not been for the fact that the railroads of Illinois have been held for their just proportion of the expense of such improvements, the greater part of Northern and Central Illinois would still be swamp and undeveloped land. An acre of swamp land brings the railroad nothing; an acre of drained swamp land gives the railroad 75 bushels of corn for transportation. Figures won't lie if you use them rightly, and any intelligent consideration given to this proposition will clearly demonstrate the fact that the railroads should bear this part of the country's development.

Another criticism of this proposed legislation is that it provides that the State University shall be an active element in the development and construction of all drainage matters. This is not only unnecessary but it is not in keeping with good business principles. It makes your University a sort of a court that shall sit in judgment on all drainage matters. It takes away from your commissioners and from the land owners the primal right vested in them by virtue of their ownership or of their office. It causes delay and makes procedure difficult.

(Mr. Raymond forgets that the report of the University is advisory only, and is submitted only for the consideration of the court and the land owners.—EDITOR.)

Again, as a general rule, your University men are academic, theoretical, book men, men without experience in the affairs of life. In this character of work, more than in any other, it is necessary that the man who finally determines what should be done, should be a man of affairs, a man who has done things, a man who has had a large experience and who by hard knocks has come to conclusions that are worth while. I say without fear of contradiction, that a large part of the results or findings of your University men on any subject are of but little value to the world at large until they shall have been first strained through the minds of practical men, men of the world, men who have done things.

Fortunately, the men you have now at your agricultural college who are taking a leading part in drainage work, are men who have been out in the field enough to know and appreciate the practical side of things. But they are exceptions to the rule. They will be supplanted in a little while by others of less experience, and then your drainage work will suffer.

The purpose of this law should be to eliminate every element not strictly applicable to drainage work, in order to simplify conditions. In that time I would suggest that the proposition relative to the building and establishing of roads should be left out of this bill, as you undoubtedly now have a road law sufficient for all such purposes.

Another proposition that should be clearly set forth in your law is the question of benefits and damages. From what I have listened to at this meeting, an attempt is being made to standardize benefits, and you do not seem to be getting anywhere with the proposition. In fact, it reminds me of an argument of an Irish lawyer in our city, before a jury. He stated in his opening, referring to the matters at issue, "This is a very intricate proposition, it is much mixed up and confusing. Even His Honor on the bench, the more he considers it the more stupid he becomes."

There is no such thing as a standardization of benefits and damages, for the reason that you cannot speculate in regard to these matters. You are forced to take things as they are and not as they may be, and the courts of all states have held that

speculative benefits and speculative damages cannot be considered in any matter. So that you are limited, in determining benefits, to the one thing, and that is this—What is the land worth now, and what would it be worth if the drainage were now completed? What the land might be worth one year from now or ten years from now, or any time after the improvement has been made is not a factor.

In the application of benefits you can only charge against each tract of land its proportionate cost of the construction of the drainage system, and that proportion of the expense that can be legitimately charged against each plot of land is the measure, and the only measure, of the benefits that you can charge against land, or any portion thereof.

Again, the purpose of a drainage district should not be to furnish to each parcel of land complete drainage. It should be only for the establishment of main outlets, and the subdrainage or minor drainage should be left to the landowners themselves. Each can take care of his own, or a number may get together and form a Sub-Drainage District within a District for the purpose of their minor or local drainage.

Again, distance from the main channel should be considered. The main channels should be put along lines wherein nature intended they should be placed, and the fact that one man's land is farther from the main channel than another's should not be taken into consideration in the charges against the land. The fact that one man's land is nearer town than another's is a circumstance of choice or of fortune, and he should not, and cannot legally be charged therewith.

There is much more that might be said in criticising this proposed legislation but they are largely matters of detail. I have attempted to cover the main proposition from my viewpoint, and I trust and hope that some things that I have said may be of value to you in the final formulating of your drainage law.

Nothing man-made is perfect, but if we do the best we can in the beginning, time and experience will do the trimming, and in the end you will have a drainage law in keeping with the requirements and one that may be adopted and applied in other states.

Upon motion the convention adjourned to 1:30 p. m.

AFTERNOON SESSION

JANUARY 20, 1916.

Called to order by President Coddington, who announced the appointment of a Committee on Resolutions. The program followed.

DREDGING FROM THE CONTRACTOR'S
POINT OF VIEW.

A. J. BRACKEN,

With R. H. and G. A. McWilliams, Drainage Contractor, McCormick Bldg. Chicago, Ill.

The subject assigned to me is—"Dredging from the Contractor's Standpoint." I don't know just what your secretary had in mind, or rather wished me to discuss when he assigned this subject to me. I was on your program a year ago to discuss this same subject, but I was called south and missed the convention and Mr. Jones said he was quite sorry for he had hoped I could be present to explain why it is that a floating dredge cannot dig a ditch with a better slope. He stated further that the lack of greater slope on ditches cut by floating dredges had been responsible for half the clean-out work necessary in Wisconsin. In view of this statment, it is quite clear and in fact ample notice that he expects me to devote part of my discussion to the defence of the work of the floating dredge.

I accept this task with no hesitancy, but let me say before I start in that the drainage firm with which I am associated, operate nearly all of the different types of ditching machines, not only floaters, but the different kinds of dry land machines such as the dragline mounted on trucks, on caterpillars, the walker and the straddle ditch type, so there is no selfish or business rea-

son which would prompt me to try to say more in behalf of the floating dredge than it justly deserves. The floating dredge has long been styled—and I think very appropriately—“The mother of swamp land reclamation,” for it has unquestionably played the part of the pioneer in every country, and I dare say has dug more miles of drainage ditches and excavated more yards of material, many times over, than all the other types or



FIGURE 6.—A DITCH WITH A FAIR SLOPE.

Hand work and grass seed as a finishing touch make these perfect at about 1 to 1 (one foot horizontal to one foot vertical.) The dredge is of the drag-line type and is moved on rollers. It can not be used for the wetter marshes.—Courtesy Wisconsin Agricultural Experiment Station.

kinds of ditching machinery put together. It has played the part of the pioneer in nearly all large drainage projects, where no other type of plant could get at all and performed its work under most unfavorable circumstances. Its economy in operation, its ability to handle such a wide variety of work and keep continually pushing ahead day and night, in all kinds of weather, has put it in a class by itself.

We must concede that all the different types have their strong points and their weak ones and I am willing to admit that when it comes to digging a complete, uniform slope on the sides of the ditch, or producing work of beauty for immediate inspection, the floater is handicapped. But we must bear in mind that much of the work performed by the floating dredge, such as Mr. Jones says was done here in Wisconsin and now needs cleaning out, was performed under conditions where no other type of ditcher would work at all. Much of it was done in your wet marshes where the material was so soft and light, and where the surface was so covered with water that no given slope would stand, even if it had been so dug, especially after the water had been let off and the surface began to settle. In many of your marshes here in Wisconsin either a sand subsoil or poor outlet, has been chiefly responsible for the congestion that has followed.

Now, then, to get at an understanding of the possibilities and limitations of the dredge, let us analyze its construction and operation and see whether better results can be reasonably expected and, if not, let us carefully consider how serious this objectionable feature really is. It is difficult to explain the workings of any kind of machinery in an address of this kind and I will not devote much time in that direction, but you are all sufficiently familiar with the workings of a dredge to know that the dipper works back and forth immediately below the boom or crane and is fastened to the end of a long arm which is hinged midway between the base and point of the boom, this dipper arm being permitted to slide back and forth at the hinge or shipper shaft. In digging, the dipper is dropped into the ditch, the arm is released, and the dipper goes to its greatest depth below this hinge or shaft. It is drawn forward and upward by a direct pull of the cable working over a sheave at the point of the boom. The dipper is thus loaded by a sort of circular sweep at the bottom and lifted out in such a manner as to make the digging slant or bottom of the ditch rounded. The edges of the ditch can be slanted more if conditions will permit loading the dipper when the boom is swung well to the side, but the width of the ditch or soft conditions usually prevent such a working position of the boom. In soft material such as you have in

many of the marshes in this state no side support can be depended upon through the use of the side arms or spuds, and, consequently, the stability of the boat, left to buoyancy alone, will not permit any attempt to dig with the boom swung far out of line from the sides of the boat.

The length of boom, width of ditch, stage of water, soil and spudding conditions all have a bearing on the sloping possibilities. Proper allowance for the passing of the boat is a very important factor and is almost entirely accountable for the short slope in narrow ditches where the lower corners could easily be left in if they did not interfere with moving the dredge forward.

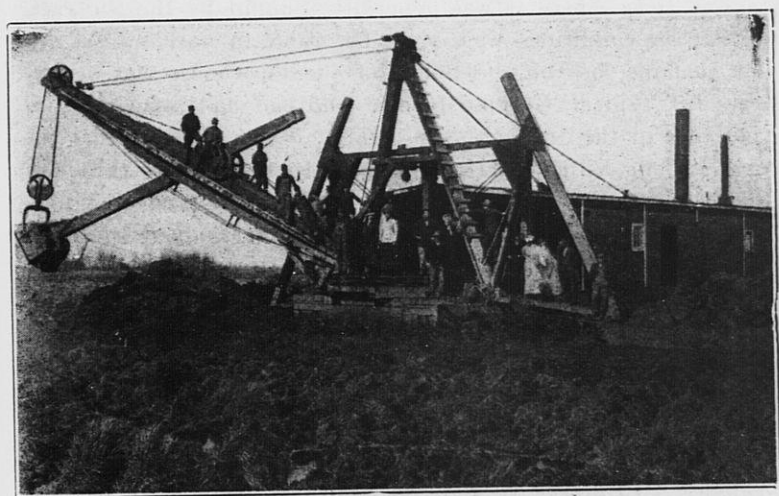


FIGURE 7.—A FLOATING DREDGE.

To obtain water enough to float itself a floating dredge must begin at the head of the ditch and work downstream. Careful operators can cut fair slopes even with a floating dredge. On many marshes the floating dredge is the only kind that can be operated.—Courtesy Wisconsin Agricultural Experiment Station.

On this subject of slope, I am referring to the complete gradual slope from the bottom edge of the ditch to the surface of the ground on either side in the proportion of 1 ft. horizontal to 1 ft. vertical, which is the usual specification. What I wish to make clear is that the very construction and operation of a floating dredge makes this exact slope not only difficult but practically impossible to get. There is a slope to all dredge

work, characteristic in itself, resembling quite closely the letter "U", and when anything different is expected disappointment is quite likely to follow. There is a serious question in my mind whether this is, in the long run, a practical defect, for in any constructed ditch which carries any considerable amount of water nature will sooner or later regulate the slope to conform with soil conditions, no matter how it is excavated in the beginning, and I think I can safely say that the channels of our natural rivers, creeks and other streams conform more closely to the typical dredge slope of the "U" type than they do to the more popular theoretical type with a slope of 1-to-1.

I was once looking over some proposed drainage work in the State of Iowa where it was generally thought by the contractors that the conditions were more favorable to work with a dry land machine, but on the Board of Commissioners was a very successful, typical, German farmer who had had some years of experience in the drainage game and who was insisting that the work be done with a floating dredge. In response to the question as to why he had taken such a decided stand he said—"Well I tell you, I don't pretend to know much about engineering with the running of levels by instruments and the calculations made with reference to yardage and slope, but I do know that if a floating dredge is put in at the upper end of our district and goes through to the outlet she has got to stay with the level of the water. She cannot very well slight the high places and get through herself and so, in the trail left by this dredge, there is bound to be a pretty good place for the water to flow through." Professor Leonard S. Smith of your State University once said to me that good, common, horse sense was a very necessary requisite in an engineer, and the more I go from place to place and observe the result of drainage systems the more I am convinced that this farmer had enough of Prof. Smith's fundamental requirements to have made a good practical engineer. He at least had the reputation in his locality of a man who made but few mistakes and usually got good results.

Now, it is far from my purpose to find fault or criticise engineers or drainage engineering as a general proposition for it is due to their skill and able direction that millions upon millions of acres of submerged, worthless land have been successfully re-

claimed, and we could not get along without them, but the real benefit that results from meetings of this kind is to familiarize ourselves with the part the other fellow plays, his possibilities and limitations. We must be frank, speak our minds plainly and let our complaints and problems be known. We are then very likely to be beneficial one way or another.

Now I think I voice the sentiment of practically every drainage contractor, when I say that we are continually confronted and annoyed by specifications in ditch work which call for something that is practically impossible of construction so far as doing it with machinery is concerned, and the estimated cost is generally based upon machine work and will usually permit the installing of but one machine. Here in Wisconsin where your surface conditions are so irregular, perhaps part of the work is in soft marshes suitable only for a floating dredge, while part of it is through higher ground where the same machine works with difficulty and where a dry land machine would do much better work. Contractors are always anxious for work, so on the day of the letting it is announced that strict adherence to the specifications will not be required, and with this encouragement, every type of ditcher in the whole category goes into the contest for the work and the specifications are about as far from the possibilities of one machine as they are from another. At any rate, some one gets the work. A contract is drawn which, under the law, must conform with the specifications as approved by the court, and so the contractor agrees and binds himself to do the work in a manner he knows he cannot, and it is not intended by anybody that he shall. The bars are, therefore, let down so far in the way of modifying the specifications in this manner that they really become of little value as a guide in determining just what kind of a ditch was finally agreed upon, when it comes to the final day of settlement.

The result is, of course, that the ditch which the district gets is just that which the possibilities of the type of plant installed will permit and nothing more. If the commissioners and engineer are a fair lot of men and the contractor does the best he can under all conditions he gets his money without much trouble, but if the district runs short of money, as they usually do, and if for any reason the drainage does not come up to the

expectations of every one concerned and perfect from the very start, the contractor stands in a very inviting position to be made the goat. Some say that the ditch is as good or better than the one planned, others that it is not, and there are always those who are continually looking for something to base an objection on, especially the fellow in the district who is really getting the most benefit but has been bitterly opposing the improve-

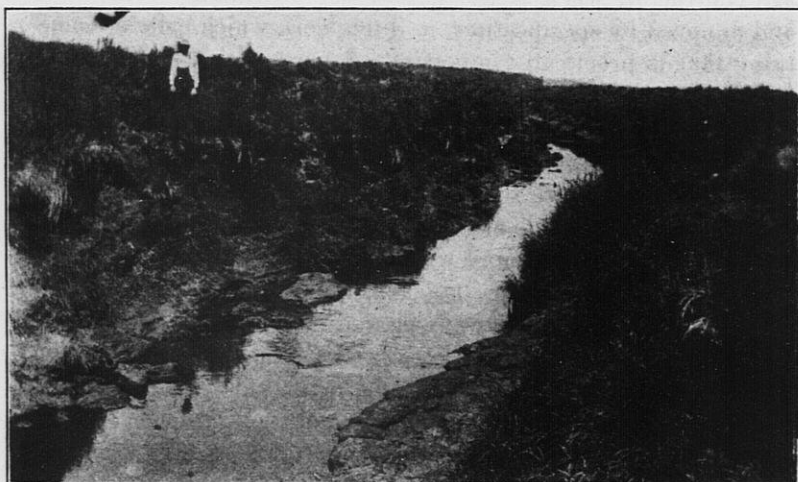


FIGURE 8.—SLOPES THAT DO NOT STAND.

No attention was paid to these slopes and big chunks are falling in from the sides.

ment from the start, or the fellow who doesn't pretend to know anything about drainage, but argues that the success of the project is impossible. These fellows point out the variations in the ditch pictured by the specifications and the one excavated, and explain it by calling the contractor a cheat, the engineer a fraud and the commissioners a bunch of crooks.

I well remember when a drainage district was organized about 20 years ago near my home in Illinois, for the purpose of draining what was then known as the "Green River Swamp", located in Bureau and Whiteside counties. It was a typical peat or muck formation from one to 20 feet deep, underlaid with a sub-soil of sand and clay, principally the former, and so wet that it produced only the poorest kind of marsh hay. It was the

hunter's and trapper's paradise. I shall never forget a few of the strenuous opposers of that drainage movement, and how they hung on to the very end with their pessimistic theories. First they said it couldn't be drained, when they saw it had been they declared it would all burn up, and when disappointed in this they swore it wouldn't produce crops anyway. It is needless to say that their mumblings finally faded away for that whole district has been in a high state of cultivation for many years, the land now being worth from \$200 to \$300 per acre.

This is the story of countless drainage districts and strange as it may seem, nearly every drainage district still has a number of these fellows to contend with, advocating the same old theories and encouraging trouble wherever they can. But I am drifting from my subject.

There are, and have been for many years, several large manufacturers who make a specialty of ditching machinery of one type or another. Competition has been keen and ingenious and skilled machinists have done their best to bring about all improvements possible, giving due consideration and study to the experience and suggestions of contractors. I think we can safely say that the progress in ditching machinery has kept well abreast of the times. There is still room for improvement, to be sure, but be that as it may, the contractor cannot go beyond the possibilities of modern machinery and certainly no specifications should so require.

The thing which I would emphasize before you today is for more practical specifications. Is there any good reason why the engineer, after he has made a map of the district, taken the levels and determined the probable size of the channels necessary to carry off the water, should not know the type of machine that is best suited to do the work? Perhaps the conditions will warrant the installation of more than one machine, differing either in type or size. At any rate, should not the engineer be familiar with the practical possibilities of ditching machinery so as to know when laying out his work the most likely type and size of plant that will be required, and then make his specifications within the reasonable working possibilities of such plant? It is a very common thing to find specifications calling for a system of ditches where the bottom width varies from 2 ft. in some of

the laterals to 20 ft. at the lower end of the main ditch, and the funds available and the general conditions make it a one machine job. Such specifications are not confined to Wisconsin but prevail everywhere. Now don't understand me to say that it is a common practice for engineers to pay no attention to the operating features of ditching machinery, for this is not the case. Few are, however, as thoroughly posted along this line as they should be, and engineers are very naturally inclined to lean toward the plan that will look the best on paper. I do not care how much scientific ability an engineer may have, he is not fully capable, in my judgment, of preparing specifications and directing drainage work unless he keeps thoroughly in touch with the different types of ditching machinery, their respective excavating possibilities and limitations. If he does this more practical specifications will follow, less misunderstandings and trouble will arise, the ditching contractor's business will become less risky and he can thereby do his work cheaper, resulting in general good to all concerned.

Perhaps it becomes within the scope of my subject to mention and emphasize some of the things which appear to me to be important factors in any drainage system. Of course, we all realize that the first requisite is to get a good outlet and then locate the ditches as close to the natural course of the water as possible. This provided, get your ditches plenty large enough and deep enough. Few are ever too large or too deep, but in countless places they have been made too small or shallow, and it is a common thing for districts to make this mistake. Large ditches are made much cheaper, comparatively speaking, than small ones. This is for various reasons. In the first place, the ordinary organization expense, engineer's and attorney's fees, and commissioner's compensation, are the same, and when it comes to actual construction of the ditch large machines handle material much cheaper per yard than small ones.

Bear in mind that the contractor never figures by the yard, although he expresses his charge in that way. He figures the cost of doing the work and then divides such cost by the number of yards he is to be paid for. In other words, if the engineer specifies a 2 ft. bottom ditch, totaling 20,000 yards, and the contractor finds that it will be necessary to dig the ditch much

wider in order to get his dredge through, and thereby remove 30,000 yards, he simply makes his price 12c on the 20,000 yards when he would just as willingly make it 8c per yard if he were to have credit for the full 30,000 yards. A dredge or any drainage plant once installed can dig a ditch its ordinary capacity just about as cheaply as to skimp through and it is a waste of opportunity for the district not to avail itself of this fact and get its ditches plenty large enough in the start. Their extra carrying capacity and advantages in maintenance make them well worth while.

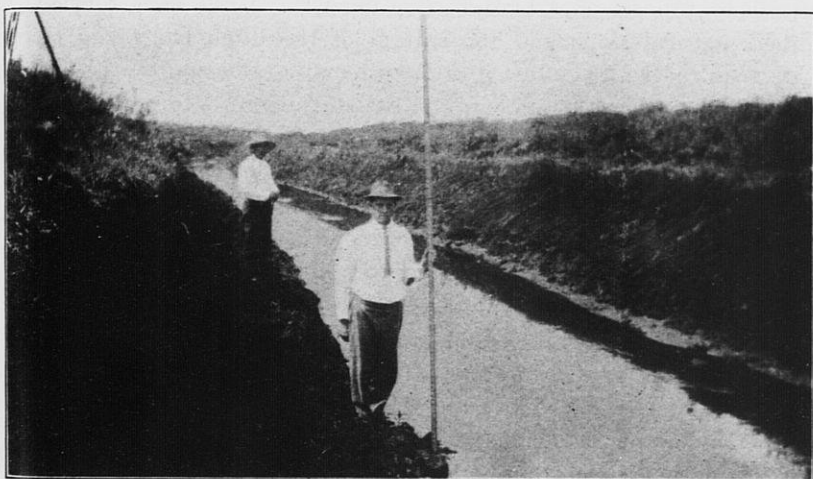


FIGURE 9.—SLOPES THAT DO STAND.

It cost 90 cents a rod to patch the slopes shown in Figure 8 until they looked like this.

By getting well down with your ditches you not only provide better tile outlets and lower water table over the whole district, but by tearing up the subsoil you open up countless little water veins that become running springs, so to speak, and it is difficult to estimate how far reaching the benefits realized from this source are. Keep always in mind the fact that the bottom is the real beneficial and business portion of the ditch. Another thing to bear in mind is, that in draining land you are dealing with nature and necessarily it takes time to accomplish your purpose. You have performed an operation, so to speak.

New adjustments must be made and the wound must have time to heal. Some material is bound to cave in off the bank until the surrounding surface has completely settled. It may take 2 or 3 years, during which time some attention should be given to prevent congestion and allow the current to have full sway in keeping the bottom of the ditch clean. Various means of assistance are used, such as the pulling of a drag of some kind through the center of the ditch occasionally. A motor boat is generally very effective if used at the right time. Some use hand shovels, but it is a simple problem if it is only given proper attention and looked after until the banks have formed their natural slope and the bottom of the ditch has taken on its required width. Just a little systematic attention to a newly cut ditch will work wonders and the cost amounts to practically nothing.

Just one other suggestion along the line of ditch maintenance. If your ditch is filling up be sure to locate where the real point of trouble is. The cause is generally at some other place than that where the trouble appears. Watch for the shallow places where the current is rapid and the ditch is perfectly clean. Deepen these places if possible and if the benefits are not immediately noticeable at the points of trouble perhaps they will be after the next rain. The point that I wish to make clear is, that a perfect system of drainage ditches takes time to perfect and if a drainage district thoroughly understands this in the beginning and makes its plans accordingly it will get the best results at the least cost and usually in the shortest time.

You understand that my subject has to do with dredging and so the comments or suggestions which I have made are intended to apply especially to the initial drainage work where the dredge is usually employed, embracing the main outlet and lateral ditches required in the reclamation of raw marshes and large tracts of land which have had but little, if any prior drainage. Small surface ditching, clean-out work and ditching where conditions will permit the use of the large type of dry land machine involves a different field and presents an entirely different proposition from that which I have attempted to cover in this discussion.

There is no state in the Union that has so much good land near the threshold of reclamation as has Wisconsin today. The cream of your higher lands and cultivated fields has been washed into your low lands and marshes and your farmers have but partially awakened to the possibilities that lie before them. And here as a closing thought let me urge this Association to see to it that correct information is given to the farmer or those who will undertake the tilling of this land immediately after it is

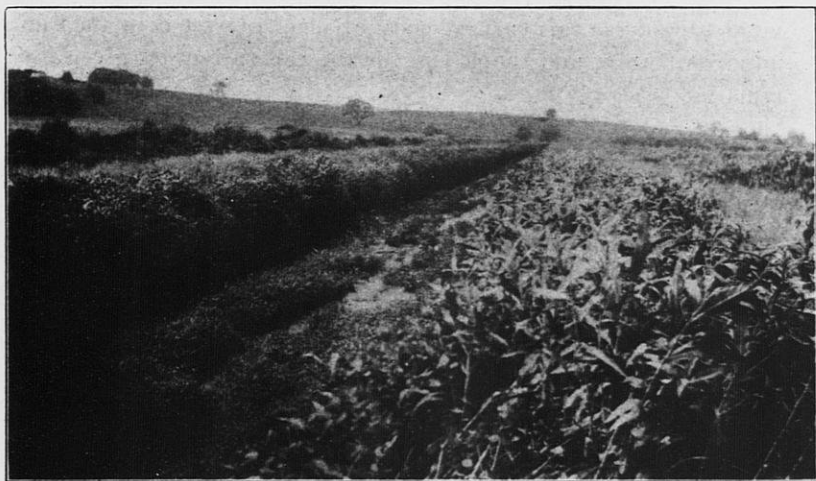


FIGURE 10.—THIS BOTTOM WAS TOO WIDE.

A ditch with vertical sides and a wide bottom with but little water in it is sure to fill up like this in two or three years. The contractor should have cut better slopes, but after the damage is done a remedy similar to that shown on Plate I (page 69) must be used.

drained—such information as they will digest, for this is most important. It is needed not only to enlighten the skeptic who thinks that the land is of no value, but likewise needed to warn the optimist who sees only the roses and none of the thorns.

Now, gentlemen, I feel that I have consumed all the time I should take, but before closing I want to say to you, not only for myself personally, not only for the firm of R. H. & G. A. McWilliams of Chicago, whom I represent, but in this I think I express the sentiment of all the drainage contractors in the country when I say I take off my hat to the State of Wisconsin in recognition of the splendid and complete organization of

drainage interests which you have perfected here in this state. I think I can safely say that your State has taken the lead in this respect. The contractor's chief purpose may be to dig your ditches, but nevertheless he is vitally interested in the real success that ultimately follows, and such an organization as you have here represented is bound to be of vast assistance toward transforming the waste marsh lands of your state into producing fields.

I wish, in closing, to acknowledge the compliment of being invited to address this earnest body of men interested in such an important work, and thank you for the close attention given my remarks.

DISCUSSION.

Mr. Jones. What method have you found best for cleaning dredge ditches?

Mr. Bracken. A motor boat to agitate the soupy mixture works well. It is generally best to wait five years and then go through with a dredge once more.

Mr. Sherwood. Does marl stand up well?

Mr. Bracken. Very well, indeed.

Mr. Hurtgen. If commissioners keep bars from forming in the ditches, they will clean and deepen themselves.

Mr. Coddington. They clean best where their bottoms are narrow.

Mr. Sherwood. It is better still to use big tile except where a big steady stream is to be carried. Drag line dredges do better work than floating dredges but there are many places where they can not work.

President Coddington. Mr. Bracken has let us into many of the secrets of the dredging game and we appreciate the message he has given us but we must pass to the next subject.

HOW COMPLETE DRAINAGE AND THE USE OF LARGE TILE WILL REDUCE FLOODS.

ARTHUR L. WEBSTER.

Drainage Engineer, Wheaton, Illinois.

By complete drainage, I mean not only the installation of sufficient tile to keep surface water from the low lands, but also the extension of laterals into the higher lands. Investigations show that very little land exists which would not be benefited by tiling. All tile must of course be installed deep enough to give vegetation an opportunity to extend its roots down where drought will not affect it or you can not say you have complete drainage. A great many people do not distinguish between ditching or tiling land, and actually draining it. It is only recently that people have recognized the fact that the complete drainage of a territory would permit of the substitution of large tile for a large percentage of open ditches.

The drained area becomes a vast reservoir and its capacity to absorb, I can best demonstrate by an example.

Government investigations show that ordinary land will absorb from 25 per cent to 40 per cent of its volume in water. Using the lower percentage, four feet of well drained land would absorb one foot of water. The maximum rainfall for this locality would be about four inches in 24 hours. Only twice in twenty years in Du Page County, Illinois, has it exceeded this. Now if in a water shed of four thousand acres, one thousand acres are low or flat land, we will have a storage capacity capable of storing a one foot depth over the one thousand acres. Assuming that the land is drained four feet deep and there were no run-off or evaporation, this thousand acre tract would store a maximum rainfall of four inches. Even though the other three thousand acres had no capacity for absorption. In fact no more than sixty to seventy per cent of the water falling on the three thousand acres would reach the low land, as the higher lands, unless unusually steep, would absorb a large portion of the water falling upon them. But during the twenty-four

hours in which the four inch rainfall is taking place, your drainage, properly planned, is rapidly removing surplus water and your vast sponge of drained land is feeding gradually to the various laterals, the water it has stored. Now if your drainage had only been one or two feet deep, it is apparent that your ditches or tile would have to remove a greater amount of water in twenty-four hours in order to prevent overflow than if it were

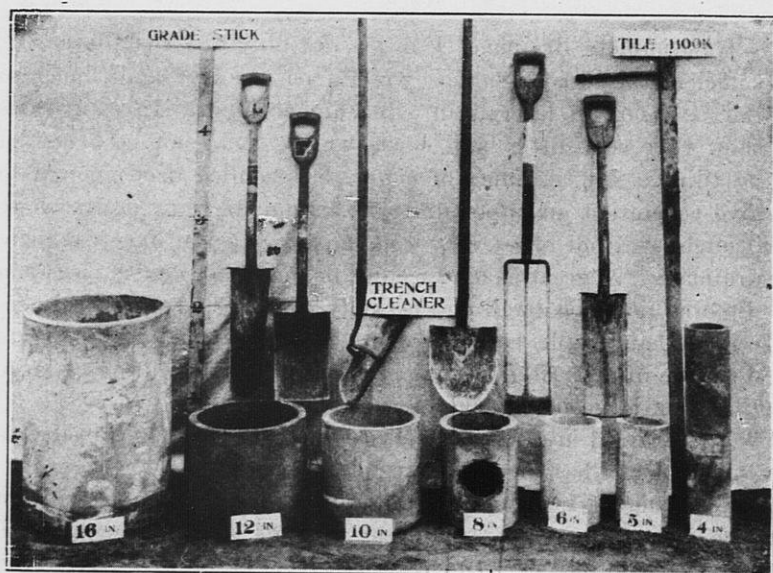


FIGURE 11.—BIG TILE ARE TAKING THE PLACE OF OPEN DITCHES.

By carrying water from the soil 24 hours a day they make the soil dry enough that it can absorb a great deal and sometimes all of the surface water.—Courtesy Wisconsin Agricultural Experiment Station.

three or four feet deep. It is also apparent that floods must be greater where land is continually wet and there is no storage capacity.

There is a warning I would like to introduce at this time and it comes from a knowledge gained by experience. We should not expect the main drains of a drainage system to handle the waters of a watershed without the aid of the necessary branches or laterals, any more than we would expect the trunk of a tree to bear the fruit that we would expect from a complete tree.

Often it is expedient in saving time to include in our first contract only the trunk lines of our system, but the landowners should be made to understand that efficient drainage is only secured by a complete system of under drains, without which floods may occur. Frequently the existence of a gravel strata will permit the omitting of small laterals, but careful and complete borings should be made to prove its extent and continuity.

Eventually tile ditches, being permanent and economical, will prevail in the upper sources of all our water courses, as a tile laid to the same depth as an open ditch will maintain a lower water level than would the open ditch. The tile always being free from obstruction and maintaining an even grade and depth, would furnish a greater storage capacity than the ditch and thus would never have to carry as much water at flood times as would the ditch.

The more progressive farmers of our country are now tiling their high lands and find it a paying proposition, but incidentally they are lowering the water level in these soils and increasing their capacity to absorb heavy rainfalls.

TABLE I.—COST OF LABOR (Reeves)

| Depth or Cut | Size of Tile or Diameter | | | | | | | | | | | |
|-----------------|--------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | 8 in. | 10 in. | 12 in. | 14 in. | 15 in. | 16 in. | 18 in. | 20 in. | 22 in. | 24 in. | 27 in. | 30 in. |
| 1 foot..... | .013 | .014 | .015 | .018 | .02 | .025 | .027 | .03 | .033 | .037 | .04 | .06 |
| 1 foot..... | .013 | .014 | .015 | .018 | .02 | .025 | .027 | .03 | .033 | .037 | .04 | .06 |
| 3 feet..... | .089 | .042 | .045 | .054 | .074 | .06 | .081 | .09 | .099 | .11 | .12 | .18 |
| 3½ " | .046 | .041 | .053 | .063 | .07 | .083 | .05 | .105 | .12 | .128 | .14 | .21 |
| 4 " | .052 | .014 | .06 | .072 | .08 | .068 | .108 | .12 | .132 | .146 | .16 | .24 |
| 4½ " | .059 | .061 | .068 | .082 | .09 | .113 | .122 | .135 | .15 | .164 | .18 | .27 |
| 5 " | .035 | .067 | .075 | .09 | .10 | .125 | .135 | .15 | .165 | .182 | .20 | .30 |
| 5½ " | .072 | .074 | .083 | .099 | .11 | .138 | .148 | .165 | .182 | .20 | .22 | .33 |
| 6 " | .078 | .081 | .09 | .108 | .12 | .15 | .162 | .18 | .198 | .222 | .24 | .36 |

The figures in the table show the price in cents per lineal foot of digging the trench, laying the tile, and back-filling for the several sizes and depths indicated.

In estimating cost of work deeper than six feet and not exceeding ten feet, first figure out cost of such deep work as if six feet. Ascertain average depth in excess of six feet. Double the rate given in table for one foot depth and multiply by the average excess depth over six feet and add to the table rate for six feet. In case of fractions use next higher basis shown in table. To estimate cost of work deeper than ten feet proceed as if for ten foot work and add for average excess depth over ten feet, three times the rate per foot for one foot as shown in this table.

This plan is intended to be used where good work is anticipated. If difficult work is expected as for instance, "hard pan" or water bearing sand or gravel, use this basis and add such percentage as your judgment will suggest as proper.

In freezing weather the tile drained land also has an advantage, first because ice does not interfere with its flow and second because the better drained soils do not freeze so deep and begin thawing earlier. This allows the lower water to be removed before surface water is free. It diminishes a spring flood by distributing it over a longer period, and incidentally benefiting lands below the drained area.

In spite of this fact, I have often found considerable opposition to a drainage project among land owners whose property was situated at or near the terminus of the proposed ditch or tile, on the theory that the tiling or ditching would turn all the flood waters down upon their lands, drowning them out at times of high water. In fact one meeting called for the purpose of organizing a drainage district was monopolized by land owners who would not be convinced that the drainage of 8,000 acres of swamp land above them would not also be a protection to their lands. This fear of increased floods is often used as a means of extending ditches or drains farther than was originally intended.

I know that all engineers who have had an opportunity to observe drained areas and the lands immediately below them, will agree that drainage benefits not only the drained area but also the lands below it.

TABLE II.—COST OF TILE (Reeves)

| Size | Weight per foot | Price per 1000 feet | Size | Weight per foot | Price per 1000 feet | Size | Weight per foot | Price per 1000 feet |
|--------|-----------------|---------------------|---------|-----------------|---------------------|---------|-----------------|---------------------|
| 8 inch | 18 lbs. | \$62.50 | 15 inch | 50 lbs. | \$225.00 | 22 inch | 100 lbs. | \$475.00 |
| 10 " | 25 | 82.50 | 16 " | 53 | 240.00 | 24 " | 112 | 525.00 |
| 12 " | 33 | 110.00 | 18 " | 70 | 300.00 | 27 " | 170 | 850.00 |
| 14 " | 43 | 185.00 | 20 " | 83 | 400.00 | 30 " | 240 | 1,100.00 |

These figures show the prices of hard burned shale tile including freight charges to Madison, Wisconsin. For points with higher freight rates than Madison the prices will be from 5 to 10 cents higher.

A splendid explanation of this was brought out in the cross examination of a witness in a claim for damages by an owner at the outlet of a 20 foot ditch. The attorney asked the witness if there would be any more water run through the new ditches

in the course of the year than if no ditches were dug. He answered—“No.” He was then asked if the installation of all tile and ditches would not cause more flow during dry weather. The answer was—“Yes.” “Then does it not follow that there must be less water flow in wet weather?” The answer to this was—“I suppose that’s right.” Needless to say, no damage was allowed.

Others will doubtless discuss needed legislation, but I would like to suggest that we are badly in need of laws which will exercise more control over drainage districts. First to insure that they are adequate, practical and economical, and second that the future has not been lost sight of so that some day they will fit into a complete and efficient system.

TABLE III.—CAPACITY OF TILE (Webster)

| Size | Area in sq. ft. | Acres Drained | | | | Tile and labor per rod |
|------|-----------------------|--------------------------|----------|----------|----------|------------------------------------|
| | | Fall per 100 ft. Station | | | | |
| | | 0.08 ft. | 0.10 ft. | 0.15 ft. | 0.20 ft. | |
| 4" | .0873 | 16 | 18 | 23 | 26 | \$0.75 |
| 5" | .1364 | 29 | 32 | 40 | 46 | 1.10 |
| 6" | .1963 | 46 | 51 | 62 | 72 | 1.40 |
| 7" | .2673 | 67 | 75 | 92 | 106 | 1.65 |
| 8" | .3481 | 94 | 105 | 129 | 148 | 2.00 |
| 10" | .5454 | 163 | 182 | 223 | 258 | 2.50 |
| 12" | .7854 | 258 | 288 | 353 | 408 | 3.50 |
| 14" | 1.069 | 378 | 423 | 518 | 598 | 5.00 |
| 15" | 1.227 | 450 | 503 | 616 | 712 | 5.50 |
| 16" | 1.396 | 529 | 591 | 724 | 836 | 6.25 |
| 18" | 1.767 | 693 | 710 | 971 | 1,122 | 8.00 |
| 20" | 2.182 | 923 | 1,032 | 1,264 | 1,460 | 10.00 |
| 22" | 2.632 | 1,177 | 1,300 | 1,560 | 1,832 | 12.00 |
| 24" | 3.142 | 1,457 | 1,629 | 1,995 | 2,304 | 14.00 |
| 27" | 3.977 | 1,844 | 2,061 | 2,528 | 2,947 | 18.00 |
| 30" | 4.909 | 2,545 | 2,845 | 3,485 | 4,024 | 23.25 |

These figures show the area from which one-eighth inch of water will be carried in 24 hours. Every drainage area is a problem within itself. The requirement depends on the shape of the area and the steepness of the surrounding slopes. These figures are a valuable guide under average conditions.

The cost of tile and labor per rod is on the basis of a depth of 3 feet for 4" tile; 4 feet for 5" to 8" inclusive; and 5 feet for 10" and the larger sizes. Freight is included for 100 miles and allowance is made for hauling the tile two miles by team. Computations by Zeasman.

A great deal of wealth and energy is being used to construct immense levees and walls of concrete and stone as a means of flood prevention, but I am inclined to believe that if part of this

energy and wealth were diverted to better drainage in the tributaries of the Mississippi River, floods would be greatly reduced and incidentally the productiveness of this great valley increased. We must look to such organizations as the Wisconsin State Drainage Association to work hand in hand with engineering societies, commercial associations, universities and the like to see that in the near future this vast water shed shall have at its service more drains to make reservoirs of the soils at the heads of the valleys, as well as the levees and channels to provide for handling the floods of the Mississippi itself.

DISCUSSION.

Mr. Wakeman. Have you ever seen tile settle in peat?

Mr. Webster. I have seen the peat above the tile settle six inches, but I have never seen the peat below the tile settle any.

Mr. Zeasman. About what is the ratio of area of marsh land to that of the high lands in the drainage basins you are draining with big tile.

Mr. Webster. About $1/3$ marsh and $2/3$ high land, generally. Every drainage area is a problem in itself and the rapidity of the run-off is determined by many features, such as the shape of the area to be drained, whether long and narrow or short and fan-shaped, the character of the soil, the steepness of the slopes, etc. One of these projects was inspected by your Mr. Jones on a recent trip to Du Page County, Illinois. This particular drain has a 22 inch outlet and serves about 1,500 acres with a grade of two feet per 1,000 feet for the outlet portion. This area was formerly poorly drained by an open ditch which was closed, and near the outlet the tile ran through a ten foot stone arch culvert which could now be replaced by a small pipe culvert to carry surface water during a spring thaw as otherwise the old channel is always dry.

Mr. Leins. What does 22 inch tile cost per rod?

Mr. Webster. About \$12 a rod for tile, labor and reasonable hauling, when laid 6 feet deep. They are as good as an open ditch 8 feet deep, 8 feet wide at the bottom and 24 feet wide at the top. At 15 cents a cubic yard the ditch would cost \$12 a rod. It would occupy a strip of land 4 rods wide. This would

add about \$4 a rod to the cost of the open ditch, saying nothing of the inconvenience of the ditch and the cost of maintenance.

Mr. Leins. Do vertical drains remove surface water?

Mr. Webster. Yes if you have an open dry layer of soil below the tight top layer. Otherwise the vertical hole may give you an artesian well.



FIGURE 12.—LAYING TILE BY HAND.

On stony or soft areas the work must still be done by hand.—Courtesy Wisconsin Agricultural Experiment Station.

Mr. Zeasman. Vertical drains remove surface water by keeping the soil dry enough to absorb the surface water when it does come.

Mr. Sebenor: As I am a ditcher and have had no experience in speaking in public, I am obliged to put it on paper. My theory of draining is somewhat different than the people here today have mentioned. My way is first to get a drainage engineer and a good farmer who understands the country well go over the neighborhood and find the dividing ridges and have the engineer take notice of the slopes and the amount of acreage between the dividing ridges and marshes to be drained. If the en-

gineer does not know the exact amount of rainfall which falls in that part of the country, according to the weather bureau, he should write to the agricultural college where they could give him all the information about how much water has fallen in that section of the country. Then have the engineer run a line of levels to the supposed outlet and see how much fall there is. The fall affects the size of the ditch which should be dug. A large fall in the ditch requires a smaller ditch than a small fall.

Have the engineer estimate what the cost will be to drain it and drain it properly, and my theory is that if it cannot be drained properly, not to drain it at all. I prefer an open ditch on these marsh lands over a tile, for the simple reason that the first thing is to get rid of the surface water and not to take it off from the lowest places only. Head off the water before it gets on marsh lands. In my estimation this is more important but, it is overlooked by much drainage done in Wisconsin today.

Now the demand so often made for a ditch with a one to one slope is far from being right in my opinion. My idea of an open ditch is about ten feet on top to every foot in depth, and it should come together to a point in the center instead of being four to eight feet wide at the bottom. For instance, the ditch which is four feet deep should be forty feet wide in the top.

This ditch will sod over and act as a ravine, which requires no looking after when it is done, over which a mowing machine can be run to cut the grass off and the cattle can be pastured without damage to the ditch, for you can say all you want to the farmer cannot keep the cattle out of the ditch. That has been my experience. If these ditches are run at the proper place I don't see any use of any tile in that place unless there is a spring or a sink hole. Now I don't intend to condemn tile. A tile is the best thing there is in certain locations. That in my experience is on side hills where the water comes out of the hills, on flat land where it has a clay subsoil, and in sink holes anywhere on the farm.

Mr. Webster said things which I cannot quite swallow. As I am a little hard of hearing I didn't understand quite all he said, but I understand that he said the water that filled a bridge eight

feet by three feet or four, soaked into the land and ran in a 22 inch tile. Now any water which will crowd through a bridge certainly couldn't run into a tile of that size. A party in Fond du Lac county had his farm tiled about eight years ago, by a machine and I am quite sure that the work was done right. I have proof that the tile were laid true, and it was a total failure and the owner told me that the expense was \$5,000. There was a stream running across his land something like this man described, and he laid a 24 in. tile and side tiles. I cannot say how far. When I came to ditch it, it was so soft that there wasn't a sign of a cow ever going across it and it was pastured.

Mr. Jones: Mr. Sebenor is talking about a 24 inch tile that didn't work. Mr. Webster told us of a 22 inch tile that did work. Instead of condemning the 24 inch tile, why not try to find out what was wrong with it? Perhaps it was a very simple trouble.

Upon motion the convention adjourned to 7:30 P. M.

At 6 P. M. the citizens of Grand Rapids tendered the guests a banquet in the parlors in the Congregational church. More than one hundred were in attendance.

EVENING SESSION.

JANUARY 20, 1916.

Called to order by the president.

Before giving his prepared address Mr. White announced the general plan of the tractor demonstration at Madison in August or September.

Moved and carried that the summer meeting at Racine be held the first two days of the week of the tractor demonstration so that members might attend both with the single trip.

ADAPTABILITY OF THE TRACTOR FOR LAND RECLAMATION WORK.

F. M. WHITE.

Chairman of Department of Agricultural Engineering, College of Agriculture.

President of American Society of Agricultural Engineers, Madison, Wis.

In considering the farm tractor for reclamation work we ought to know the uses to which a tractor may be put in reclaiming marsh land. These uses are:

1. Pulling a ditching machine.
2. Pulling small willows, old logs, and stumps and removing from the field.
3. Pulling a grub breaker and ordinary plow.
4. Pulling a heavy roller to settle peaty soils.
5. Pulling heavy dises to pulverize the ground after breaking.
6. Pumping water during flood water periods.
7. For hauling tile.

The three million acres of marsh land in Wisconsin are one twelfth its total land area. The reclaiming of this land will

add materially to the value of our agriculture. This low land from the drainage standpoint is similar in many respects to the Kankakee marshes and to the great flat area of central Illinois. These areas are among the most valuable farming land in this country. I can remember the big floating dredges which opened up a water way through Illinois, making available thousands of acres of the most fertile land in the world. Miles and miles of ditches from 30 to 50 feet wide had to be dug through this county before one could be reasonably sure that a summer rain would not wash out an entire crop. Now the land on either side of these ditches is as valuable as land two or three miles from them. Two hundred and fifty dollars is a good price for land but in Illinois what might have been marsh land is now selling for this price.

Here in Wisconsin much of the land is very fertile, it is close to good markets and there is no reason why its value will not be increased many times when the land is thoroughly drained.

Reclaiming land in this day of machinery is easy compared with that of 10 years ago. The gas engine is a source of power which can be applied to all kinds of work and it seems to be especially adapted as an aid in land reclamation. The farm tractor is the most recent development of a mechanical power suitable for farm work and it ought under the conditions first mentioned, be a very practical method of decreasing the cost of reclaiming land.

Removing the water is only the first consideration in preparing a marsh soil for cultivated crops. Many tracts of low land present difficult problems even after the water table is lowered two and a half to three feet. Muck and peat soils are very apt to be springy even if there is no danger of miring down. Wet clay soils are soft and afford very insecure footing for horses. When the surface is dry it is difficult even for a man to walk over it on account of the springy nature of the surface. When dry a peaty soil might be compared with a straw pile. Most of us have had experience tramping around on straw. It's hard work. A horse walking on marsh of this character causes the soil to tremble so that it can be felt two rods away. Working a horse under such a condition is almost cruelty to animals. Some have tried to attach marsh shoes to the horse, which does,

perhaps, give him a few more square inches of bearing surface. Even with this additional foot area the horse is at a decided disadvantage. It is true the horse may become partially accustomed to using marsh shoes and when there is danger of miring he will not become excited and struggle to free himself. However, it is dangerous at best to attempt to accustom a horse to work where there is danger of miring down. The struggle and strain that a horse is likely to make may result in his serious injury. Most anyone would welcome a mechanical power that will save horses from this danger.

Tile ditching is the feasible method of removing the underground water. The disinclination of good labor to ditch on marsh lands or in fact to do ditching of any kind, makes it necessary to adapt mechanical power in ditching. A tractor is specially adapted to furnishing the power for pulling most any type of ditching machine. The horse ditching machines require from six to eight horses. A tractor will furnish this amount of power easily. It can be kept going throughout the working day. It will require less man power to operate the entire outfit and it ought to go on the soil where horses would be impractical.

A tractor can travel on land when it is impossible to get on it with horses and at times even with men. A tractor weighs all the way from 3,000 to 30,000 lbs; the average weight of a draft horse is about 1600 lbs.; and the average weight of a man is 180 lbs. A 60 H. P. tractor weighing 24,000 lbs. and equipped with what is known as a Caterpillar or flat wheel 6'-4" long and 24" wide, has a pressure of about 5 to 6.4 lbs. to the square inch. The same machine equipped with a 30-inch track would have a pressure of 4.4 pounds per square inch. A wheel machine of about the same horse power with a 69" wheel has a pressure of about seven lbs. A Caterpillar machine weighing 6,000 lbs. has 1,152 sq. in. of traction surface. This weight machine has a pressure on the ground of 4.3 lb. to the sq. in. The same machine can be equipped with a special track which reduces the pressure to about 2½ lbs. The horse has a pressure of about 10 to 12 lbs. and a man has a pressure of about six pounds. The wheel tractor of about 25 B. H. P., weighing about 7500 lbs. and having a weight of 5600 lbs. on

the rear wheels, has a pressure of about 4.8 lbs. per square inch. This figure is based on a 56 inch wheel having a 20" face and equipped with an 8" extension rim. Without this extension the pressure is 6.4 lbs. The actual pressure of these machines is less than that exerted by the horse. The pressure as given is not the governing factor in keeping a machine on top of the ground. When the machine is pulling a heavy load the pressure exerted is materially increased. The proper lug equipment has much to do with the "toe hold" which the tractor has on the soil.

The question of the tractor being able to travel on soft ground is not necessarily the deciding factor in the use of a mechanical power. The decision should be based upon what can actually be accomplished. Pulling small willows and clearing up marsh land is a considerable part of the work in preparing marsh soil for cultivation. The root system of this type of soil is very shallow and therefore little trouble need be experienced in pulling the small trees and shrubs found on many marsh soils. The tractor affords a power which is steady and on which severe strain will not have serious effect. The strain of steady long pulls on horses is serious.

A good many tracts of land are of tamarack marshes and on them we find many old logs buried in the mud, and many stumps which are easily pulled. Removing these is just the job for a tractor.

The use of a tractor as a power for plowing is almost ideal. A grub plow is designed especially for plowing in tough land full of roots and covered with small shrubs. The plow is 30" wide but set to turn a furrow slice of 24" leaving the rest of the share to cut under the previous furrow and cut off any remaining roots. A heavy grub breaker, depending on the size of the tractor, is sufficiently strong to cut off small willows $\frac{1}{2}$ " to $\frac{3}{4}$ " in diameter and turn them under. A tractor will handle one, two or three of these 24" grub breakers depending on the size of tractor, and turn the soil over in better shape than can be done with horses. It will be practically impossible to get enough horses together to do the same amount of work. Deep tilling disc plows may be used to advantage in some peaty soils. They require lots of power and in places where the condition of

the ground is suitable very satisfactorily mixes the top peat with the caly subsoil. Tractor plowing in marsh land has one advantage over many of our upland soils, there are no stones and no hills.

After turning the soil, a good practice would be to roll the ground by attaching to the tractor a heavy concrete roller. This settles the soil rapidly and is a decided advantage in further pulverization and preparation of the soil for the seed bed.

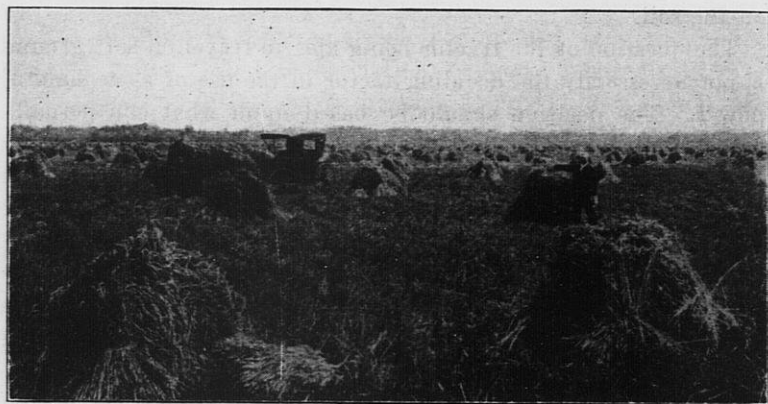


FIGURE 13.—A GOOD FIELD FOR A TRACTOR.

Broad areas of drained marsh land can be plowed and cultivated more cheaply with a tractor than with horses.—Courtesy Wisconsin Agricultural Experiment Station.

A good roller can be a home made affair built of concrete. Concrete will stand the wear and can be made any desired weight and is very cheap. After the rolling comes the pulverization of the ground by means of heavy disc harrows especially designed for tractor work. The discs are about one-third heavier than ordinary horse disc harrows. They are built tandem and can be weighted as desired for work to be done. These engine discs may be set to run straight when it makes a good sub-surface packer. A disc should not only cut the ground up thoroughly but should pulverize any willows which had been turned under by the grub breaker. Under a heavy load it will require about a 20 H. P. tractor. These machines are built in 8' and 10' widths.

In most of our Wisconsin Drainage Districts it is necessary to provide some means of rapidly removing the water during flood periods. As the tractor will not be in use performing other operations mentioned throughout the year, it can be kept busy by attaching it to the pump which will be necessary to take care of the water during heavy rains. This is a cheap source of power and will eliminate the expense of an extra engine for pumping water.

Hauling several thousand tile along the line where they are to be placed is a good job for a tractor. It will go over the soft ground wherever the wagon will go. A tractor will pull several wagons and keep loaders and distributors busy where hands are short. On large reclamation projects the tractor ought to be a very busy machine.

After considering the various jobs to which a tractor is adaptable in Wisconsin marsh work, before selecting the machine, there are some points which ought to be considered very carefully if success is to be secured with the tractor. We have two general types of tractors, the round wheel and the flat tread. In the flat tread type there is less pressure, for the same horse power, on the soil than in the round wheel type. The adaptability of a particular type of tractor for Wisconsin marsh land depends considerably on the grouter equipment.

ENGINES.

Any engine ought to be reduced to its greatest simplicity because the average operator is not an experienced engine man.

There are three general types of engines used in tractors: (1) the heavy duty, slow speed type and (2) the high speed, present day 4 cylinder automobile type and (3) combination of the two general types. The first class are one, two or four cylinder motors. The designers of the one and two cylinder machines claim simplicity for their machines on account of the fewer parts, more easily understood by the inexperienced and just one-fourth or one-half as likely to give trouble as the four cylinder machine. In the second class the claim is made that it is easier and cheaper to build multiple cylinders of small light parts than heavy parts of the slow speed motors; also that cooling is easier to accomplish which is difficult in any tractor

type of motor. There is being brought out a motor having the characteristics of the two main types of engines. It seems to be the general opinion of the conservative designers of this latter class that a combination of the high speed and low speed engines solves the problem of a tractor motor. I have seen high speed ordinary automobile engines in use on tractors that did not give 100 hours of satisfactory service. Mr. Eason speaking about tractors, at the meeting of the American Society of Agricultural Engineers, said that any engine for a tractor ought to give about 5,000 hours service before any of the principal parts need replacement and at least twice that service before the replacement of parts would make the cost of repairs prohibitive.

Low cost of maintenance is a point of great consideration in selecting a tractor. This will be reduced by purchasing one where repairs can be quickly obtained. A few hours delay during a rainy season may cost the operator hundreds of dollars.

Once equipped to run a farm with a tractor, one wants to be absolutely sure that the tractor can be kept going and be just as reliable as a horse.

COST.

Cost of operating a tractor is governed largely by design, total weight and quantity produced. Low first cost can only be obtained from a concern manufacturing a large number of tractors yearly. The tractor firm which has a production that is constantly on the increase ought to put on the market a machine which should give its owner the greatest value for the money invested.

The weight of a tractor enters greatly into the cost of operation. Fuel economy will be materially cut down with the tractor's weight. In cutting down weight better materials will be used. It is also true that the lighter weight machines have their gears better protected from grit which causes so many parts of a tractor to wear out rapidly. The final success of the machine depends upon the operator. Men with "machinery sense" will always get better results than the indifferent know nothing operator.

DISCUSSION.

Mr. Dibble. Tractors mean much to marsh land. I plowed land too wet to get on with horses. With a long chain to chain out when you get into a soft place, you can go almost anywhere with a caterpillar tractor. I pulled willows with mine also, but it made such large stump holes that I began to plow the willows under without pulling them.

Mr. Myers. Horses will go in soft places if they are trained. They must walk steady and hold their fetlocks at a certain angle.

Mr. Jones. We had better drain our marshes thoroughly before we attempt to cultivate them with either horses or tractor.

Mr. Coddington. But even on a dry marsh a light tractor is better than a heavy one—12 to 14 H. P. pulling three plows is load enough. It is better to go fast with a moderate load than to go slow with a larger load.

Mr. Bracken. The big problem has been to break the marshes after tiling. The tractor has solved this. It has been as great a benefactor as the tile.

Mr. Thorne. I lost \$400 breaking 65 acres in 65 days with a heavy caterpillar tractor. I covered willows 10 feet high, but later they were in the way. I believe in a light round wheel tractor. The breakage on the others is heavy.

Mr. Pratt. I have three heavy caterpillar tractors that I will sell for one-third what they cost me.

Mr. White. Each of the 25 companies making tractors are now making them as light as possible. One 28 H. P. tractor weighs only two tons.

Mr. Galligher. I have a 3,400 pound tractor. I broke 100 acres in six weeks and seeded it without ever putting a horse on the land.

Mr. Wakeman. I have found breaking wet marshes very expensive with a tractor. Furthermore it is hard to get the manufacturers to stand back of even their guaranteed machines.

Mr. Amidon. A great deal depends on the skill and intelligence of the man operating the tractor. Some men can not run a wheelbarrow, much less a tractor.

The President. We will now call on Mr. Ullsperger to tell us of the value of marsh land after it is drained and plowed.

THE FERTILITY OF MARSH SOILS.

H. W. ULLSPERGER,

Soils Department, College of Agriculture, Sturgeon Bay, Wisconsin.

Marsh soils, from the fertility standpoint, may be divided into three classes: peat, muck and marsh border soils. By peat we mean a soil that is high in organic matter, usually 70 to 90%, but sometimes as low as 50%. The organic matter may be fairly well decomposed or it may be fibrous or brown in color. Muck soils are those having from 15 to 50% of organic matter; it is usually quite well decomposed and does not show vegetable tissue. The term "marsh border soils" is used to apply to those soils where the change from marsh to upland occurs. The organic matter varies from 5 to 15% and consists of black humus which is shallow in depth and underlaid by sand or clay according to the character of the surrounding upland.

Each of these classes of soils have marked characteristics in regard to weight and fertility. Peat soils are light and as a rule have a smaller total amount of plant food than the other classes. They are high in nitrogen and low in phosphorus and potash, which in general is true of the other two classes of marsh soils, with the exception that the nitrogen content decreases with the organic matter, making marsh border soils lower in nitrogen.

ACIDITY OF MARSH SOILS.

The general impression prevails that marsh soils are very acid. This, of course, is true of undrained marshes where the organic acids formed have no chance to leach away or are not neutralized by a limestone wash from the upland. However, it is also true that these marsh lands become less acid when drained and placed under cultivation, so much so, that in several cases studied recently only a trace of acidity could be found in soils that were very acid several years ago.

LIMING MARSH SOILS.

Lime is usually added to a soil to furnish a suitable medium for the development of those bacteria which live with legumes and add nitrogen to the soil. Marsh soils are high in nitrogen, and it is usually supposed that they do not need lime even though they are acid, because legume crops do not have to be grown to furnish nitrogen. Experiments in this state with air slaked lime have shown that it is beneficial on acid marshes in increasing crop yields. Peat marshes contain a large amount of nitrogen, but this nitrogen is not available to plants. It must be made available, principally through bacterial action. The proper decay of humus or organic matter, and proper nitrification i. e. making nitrogen available, are largely dependent on the presence of lime; and if lime is not added there will be an insufficient supply of available nitrogen for plant growth. Lime will, to a limited extent, liberate plant food, but its principal use is to furnish a suitable medium for those bacteria which make plant food available.

The amount of lime to apply will depend on the kind of marsh soil and the amount of acidity present. Raw peat lands which have just been drained and are quite acid will need relatively large applications of lime to neutralize the acidity present and assist in hastening the decay of organic matter. Four or five tons per acre are usually advisable on these soils. Muck soils or marsh border soils do not as a rule need as large an application of lime as they are not so acid. One to two tons per acre is usually sufficient for these classes. Marsh soils in southern or eastern Wisconsin where there is a limestone wash from the uplands do not in general need an application of lime. Before applying lime to your soils it is always advisable to make an acidity test to determine the degree of acidity. These tests are made free for any resident of the State by the Soils Department, College of Agriculture, Madison, Wis.

In the experiments carried on throughout the state two forms of lime have given good results: air slaked lime and wood ashes. Ashes contain potash also which is beneficial. Other forms of lime can be used but they do not appear to be as beneficial or as efficient in quickly neutralizing the acidity and hastening decay of organic matter.

MANURE ON MARSH SOILS.

On marsh soils where there is a deficiency of only one or two elements and a comparatively large amount of nitrogen it does not seem wise to add manure which in itself contains a large amount of nitrogen. Marsh soils in central and northern Wisconsin in general need phosphorus and potash. The amount of phosphorus and potash in 10 tons of barnyard manure can be purchased in the form of rock phosphate and ashes for \$5.00 while the manure is worth \$15.00 to upland soil. The ashes also contain lime which is not found in manure. The commercial phosphorus ashes or potash should be purchased to supply this deficiency and the manure applied to upland soils where the organic matter and nitrogen are needed. However, there is one exception to this rule. On raw peat lands where horse manure has been applied the crop yield are usually larger than when the same amount of phosphorus and potash are applied in the form of commercial fertilizers. This increase in yield is partly due to the amount as well as availability of plant food added but is largely due to the addition of those bacteria which cause the decomposition of organic matter. Manure not only adds these bacteria in large numbers but also furnishes readily available plant food for them to live on and develop until such time when they can gain a foothold and do their work in the soil. It is advisable therefore to apply horse manure to marsh soils, but the application should be light and be put on with the idea of inoculating as much soil as possible. Three to four tons of manure per acre will be sufficient for this purpose. Loam soils rich in limestone where bacteria are present in large quantities may, possibly, also be used to inoculate newly drained, raw, peat lands with the necessary bacteria. Experiments along this line are being carried on at the present time and further data will be available soon. As stated previously, lime should be applied to furnish a suitable medium for those bacteria to develop.

POTASSIUM ON MARSH SOILS.

The analyses of marsh soils made up to the present time indicate that the potassium content varies from 200 to 1,820 pounds per acre for peat soils and from 4,200 to 8,300 for marsh soils

having more earthy matter. Upland clay soils contain from 16,600 to 50,000 pounds of potash per acre eight inches. These figures show that nearly all marsh soils comparatively speaking are low in potash, and need it to grow good crops. Field experiments throughout the state have also indicated very clearly that potash in some form is necessary to grow the best crops on these soils.

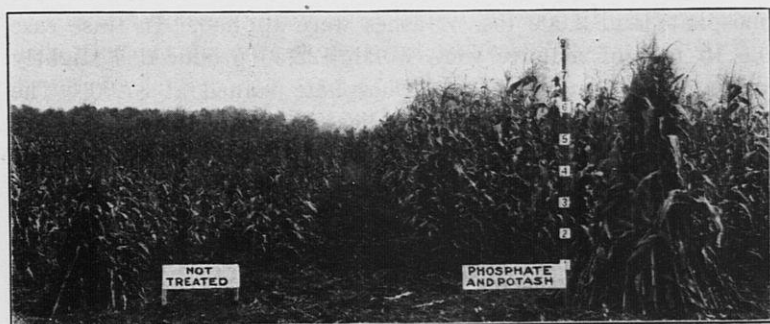


FIGURE 14.—THIS SOUTHERN WISCONSIN MARSH RESPONDED TO PHOSPHATE AND POTASH TREATMENT.

This soil is not acid, yet it requires both phosphate and potash fertilizers. No treatment produced 2 tons, and a mixture of acid phosphate and muriate of potash produced 14.5 tons of green corn per acre.—Courtesy Wisconsin Agricultural Experiment Station.

PHOSPHORUS ON MARSH SOILS.

Chemical analyses have shown that the phosphorus content of marsh soils is variable to a large degree. In some cases it does not exceed 200 pounds per acre eight inches, while in others it may be as high as 1,000 pounds or more per acre. This variability indicates the need of a chemical analysis before applying phosphorus to marsh soils in any large quantities. There is also a wide variation in the availability of phosphorus in different soils in the state. As a general rule acid soils are low in available phosphorus. Recent experiments have shown that most of the marsh soils in Wisconsin are benefited by an application of phosphorus.

Three forms of phosphorus are available, they are, acid phosphate, bone meal and rock phosphate. The last two are more available and give quicker results. However, rock phosphate is

cheaper and if applied properly will give better results for the money expended than the other two forms.

RESULTS SECURED WITH FERTILIZERS ON MARSH SOILS.

In Marinette county on peat underlaid by sand the yield of potatoes was 77 bushels per acre on the field not treated, 218 bushels where manure was applied, 168 bushels where 3,000 lbs. of ashes were applied and 196 bushels where 300 lbs. of acid phosphate and 2,000 lbs. of ashes were applied. In these cases the 15 tons of manure were worth \$22.50 produced a slightly larger yield than ashes and phosphate valued at \$7.00. The yield in all cases due to the application of fertilizers is very large, thus showing that fertilizers are necessary for these soils.

At Babcock, Wis., the following results were secured in 1915 on potatoes:

| | |
|--|-------------|
| Check Plot | 110 bushels |
| Phosphorous (400 lbs. bone meal) | 128 " |
| Potash (200 lbs. of Muriate of Potash) | 128 " |
| Potash and Phosphorous | 160 " |

At Bancroft the following results were secured with potatoes in 1915:

| | |
|------------------------------------|------------|
| No fertilizer | 43 bushels |
| Acid Phos. (300 lbs.) | 59 " |
| Potash (150 lbs. of Muriate) | 91 " |
| Potash and Phosphorous | 110 " |

At Palmyra in 1911, an application of 15 tons of manure produced 10.5 tons of silage, while 500 lbs. of muriate of potash produced 13.5 tons per acre. The value of the manure was \$22.50 while the potash cost \$9.00 per acre. This data again shows that commercial fertilizers will supply these deficiencies as well as manure. This work at Palmyra was carried on under the direction of W. W. Weir of the Soils Department.

On marsh in Waukesha county an application of 150 lbs. of muriate of potash produced 15 tons of silage per acre while the field receiving no treatment only three tons per acre were harvested.

In central Wisconsin a 19 acre field of potatoes which was killed by frost on August 27th, 1915, yielded better than 150

bushels per acre where 300 pounds of acid phosphate and 150 pounds of muriate of potash was applied. A neighbor who did not believe in fertilizers did not secure a crop sufficiently large to pay for seed and labor.

Numerous other illustrations could be given where commercial fertilizers have benefited marsh soils, but these illustrations selected from different locations in the state show that marshes in all sections are benefited by proper treatment.

The fact that fertilizers must be purchased and used on marsh soils need not discourage the prospective buyer or the man who wishes to develop this type of soil, providing he can purchase the land at a reasonable price. He must bear in mind though that he has special problems to meet before he can secure his harvest. The money that must be expended for drainage and fertilizers is comparable to money spent on other types of soils for land clearing operations. Marsh soils, when properly drained, cultivated and fertilized will produce good crops. However, there is a period of development of from one to three years depending on the soil management, which must be gone through before the best crops can be secured.

CROPS ON MARSH SOILS.

Marsh soils which are newly drained and are peaty should be planted to such crops as buckwheat and flax, because:—1st, they have a short growing season and can be planted late in spring or early summer thus giving ditches or tile an opportunity to do their work thoroughly before the crop is planted; 2nd, these plants will grow on soils high in nitrogen without as much danger from lodging as grain crops; 3rd, their feeding roots are shallow, thus permitting them to grow on soils where the water table may be high during the first season; 4th, if planted thickly, they form a dense shade which prevents the growth of weeds and marsh grasses. It is generally supposed that a cultivated crop like potatoes or corn will grow well during the first year on newly drained marshes, however, experience has shown that this opinion is erroneous. The stand as well as growth of these crops is usually very uneven and the irregularities of the land and coarseness of the peat make cultivation almost impossible so that grasses and weeds grow in

abundance. During the second year if the land is well drained it can be planted to corn and potatoes. An application of fertilizers as previously indicated should be made after the field is plowed. Fall plowing is preferable to spring plowing. After the plowing the field should be disced thoroughly and deeply to place it in good physical condition. Compacting is also essential to prevent the surface from drying out. On soils where drainage is not very good the second crop should be timothy and alsike clover and used for pasture and hay. Fertilizer should also be applied for this crop. Among other crops that can be grown successfully are potatoes, corn for silage, onions, soybeans, alfalfa, cabbage, beets, and other truck crops.

SYSTEMS OF FARMING.

Two systems of farming may be followed on marsh soils. They are dairy or truck farming. Grain farming will not prove profitable due to the lack of phosphorus and potash and excess of nitrogen which causes lodging and improper filling of the head. Blight and rust are quite bad and lower the yields of grains on these soils. The practice of fattening cattle in the summer and selling in the fall gives some profit, but it will later give way to dairy farming, and the quicker this transition occurs the more profitable farming will be. It is gratifying to note that on marsh lands in central Wisconsin, farmers are building many silos showing that they are planning on winter feeding of stock. With dairy farming such cash crops as onions, potatoes and soybeans could be grown.

Truck farming can be followed in those localities which are near to market. Cabbage, beets, celery, etc., are being grown quite extensively in southern and eastern Wisconsin.

There undoubtedly have been many crop failures on marsh soils as well as many successful crops. The man who purchases land of this kind must bear in mind that additional money besides the purchase price is needed to develop his property. On most peat lands the purchaser must have from ten to twenty dollars additional per acre to pay for the usual every-day expenses, cost of drainage, fertilizers, etc., that is, enough to take care of him until his farm is in condition to produce good crops. There are in sections of Wisconsin at the present time, quite a number

of farmers, who, through lack of sufficient capital, are discouraged and are condemning marsh soils because they do not have the means to do those things which are essential to success on this type of soil. A large percentage of these people may have been deceived as to the quality of the soil, or were possibly under the impression that the land which they were purchasing was similar to other land which they knew but which was under a high state of cultivation, while the new land must first be developed. I believe it the duty of every one who wishes to aid in the development of marsh soils to state the facts as they are, that is, if a certain field needs special treatment, emphasize that fact, and do not let a man struggle along when, as the old saying goes, "a dollar expended in time will save nine." With proper coöperation among all people interested in the development of marsh soils, there is no doubt in my mind that with better drainage, proper cultivation and fertilization most of the marsh soils can be made as productive as any soil in the state.

DISCUSSION.

Mr. Wakeman. What can you afford to pay for wood ashes to fertilize marsh land?

Mr. Ullsperger. Five dollars a ton for unleached ashes. Leached ashes are almost worthless.

Mr. Dibble. When do you seed flax?

Mr. Ullsperger. About the middle of June at the rate of half a bushel to the acre.

Mr. Myers. I think that manure sweetens the soil and helps it more than commercial fertilizer. Horse manure is both cheaper and better than commercial fertilizer.

Mr. Ullsperger. If you have upland that needs your manure, the commercial potash is cheaper for your marsh.

Mr. Bracken. Is it not true that tile takes the place of fertilizer?

Mr. Ullsperger. Yes, by introducing air and decomposing the peat so as to make its ingredients available. It can not liberate potash, however, when there is so little in the peat. You can not get blood out of a turnip. Both tile and fertilizer are needed.

Mr. Thorne. Does not tiling make the roots go deeper so that the plant can get potash from the sub-soil?

Mr. Ullsperger. Bacteria and the weathering agents work very slowly in the sub-soil, so very little of the potash in the sub-soil is made available by drainage.

Mr. Myers. Burning makes a marsh soil better.

Mr. Ullsperger. It makes the potash more available, but it drives off the nitrogen. It is all right to burn on the surface, but I do not believe in burning any of the peat.

Upon motion the convention adjourned to 9:30 A. M.

The Wisconsin State Drainage Association holds its summer meeting in the field in Racine County September 4 and 5, 1916. Arrangements are being made by the people of Racine to visit several drainage districts by automobile. From there we go to Madison to see tractors and excavating machinery demonstrate on marsh lands. About September 1, each member will be notified of the exact hour and place of the Racine meeting.

The next annual meeting will be held at Madison in January or February, 1917, while the legislature is in session. A program will be sent to all members and to all others who apply.

MORNING SESSION.

JANUARY 21, 1916.

The members manifested great interest in the exhibition of drain tile. Several firms had sent samples of their tile. Of special interest was the tile that Mr. Adam Channing brought from Whitewater. It was made by hand in 1859 and had been working for 55 years when it was dug up.

The convention was called to order by the president, who announced the following committees for the ensuing year:

Committee on Legislation: Chairman, B. M. Vaughan, Grand Rapids; P. J. Myers, Racine; J. L. English, Waterford; F. W. Lucas, Madison; G. T. Thorne, Oshkosh.

Committee on Standardization of Benefits: Chairman, H. H. Sherwood, Mauston; A. R. Whitson, Madison, A. E. Matheson, Janesville; T. H. Hanna, Stevens Point; R. S. Owen, Madison.

Committee on Railroad Rates: A. E. Holcombe and E. P. Arpin, Grand Rapids; and J. A. Reeves, Chicago.

Auditing Committee: Nye Jordan, Mauston; H. C. Webster, Milwaukee, and C. F. Leins, West Bend.

The first paper of the morning followed.

METHOD AND MACHINERY FOR INSTALLING DRAIN TILE.

J. H. HARNESS

With Wisconsin Drain Tile Co., Elkhorn, Wisconsin.

The outlet is the most important part of the tile drain. There should be a drop from the lateral into the open ditch or large tile into which the lateral empties. Without such a drop, the outlet will be submerged at the time when it is needed most. A submerged outlet causes sediment to settle in the tile. This is particularly true where the outlet is an open ditch which itself is filling up.

SOME TILE ARE LAID TOO DEEP.

A free outlet is more valuable than a particular depth. Some engineers with limited experience advise a particular depth regardless of whether or not the outlet will be submerged in obtaining that depth.

The majority of soils are benefited very little by lateral drains laid deeper than three feet. I have made a very thorough study of subsoils throughout Indiana and find the conditions in Wisconsin to be very similar as to subsoils.

My experience has taught me that in ninety per cent of the cases where I find a subsoil very close and hard the water makes its way on top of this strata of close or hard subsoil until it drops to the tile and is carried away. Therefore it is not only an extra expense to lay tile at an unnecessary depth but also a detriment.

I also find that the majority of deeply laid tile are more apt to be improperly laid as the work is much more difficult to perform properly. The majority of contractors take this extra depth too cheaply—a natural cause for poor work. I find that most engineers advise an expense that is unnecessary and detrimental.

However, the laying of a tile too shallow or too near the surface is a much worse mistake. When dealing with peat or similar soft soils we find that the soil settles and leaves the tile too near the surface to obtain the best crop results.

In determining the proper distance between laterals an engineer is needed who has had practical or field experience. There is a great difference in soil conditions. For this reason I find it impossible to give any fixed rule. I find some soils will drain much better with lateral tile laid one hundred feet apart than others when laid fifty or sixty feet apart.

Some soils require wide cracks left at the joints to let the water enter the tile freely. Others require tight joints. These differences often occur within short distances of each other, perhaps within the same line of tile. I have examined drains many times where the water would lie on top of the land long enough to damage the crop, and found the tile to be on a true grade and apparently in good shape except for the fact that the

tile were fitted too closely together for that particular kind of soil.

There should be a line of tile at the foot of every hill to cut off the seepage. This line is usually the most important line in the system. With such an intercepting drain you can afford to have your laterals farther apart, if that is necessary in order to keep down the expense.

As to main or outlet tile, I would advise them laid at a sufficient depth to allow the laterals to empty into the main as near the top as possible, taking care not to go to an unnecessary depth. This insures a more lasting drain for a number of reasons. The deeper the drain the less need there will be for repairs.

I have laid a great many main tile drains that could have been installed for a great deal less money and have been much more valuable if they had been planned by an engineer who had practical experience. With unnecessary depth you are apt to encounter soft beds or pockets of sand underlaid by some very hard substance making it difficult to maintain the tile on a true grade. A number of times I have taken up and repaired drains of this character.

Where the drain is laid deep and on solid bottom, the majority of workmen fail to make the bottom concave so as to fit the tile. Tile lying on a flat bottom have the weight concentrated upon one place and they break under the unnecessary weight where the tile are laid too deep.

Furthermore deep trenches invariably cave and here is where the inexperienced engineer is apt to fall down. He goes ahead and makes an estimate which he thinks is sufficient to perform the work, seldom getting it high enough to attract a competent contractor. When the work is under construction along comes the caving proposition or soft sand. The next step for the contractor is to do poor work or lose money or both. Such work and its results gives rise to the saying among farmers that the tile drain is a failure.

It is necessary in all cases where the adjacent land is much elevated, causing the water to flow quickly to the drain to construct an open or storm ditch over or near the main tile. There should be catch basins or inlets with perforated coverings placed

at intervals along the drain. I find this to be one of the most important parts of the drain. When the ground is frozen or heavy rains come, the water passes through the inlets with a pressure and almost invariably washes out any obstruction that may be lodged in the drain.

On the long narrow marshes with long sloping ridges of hard land on either side, the engineer without practical experience

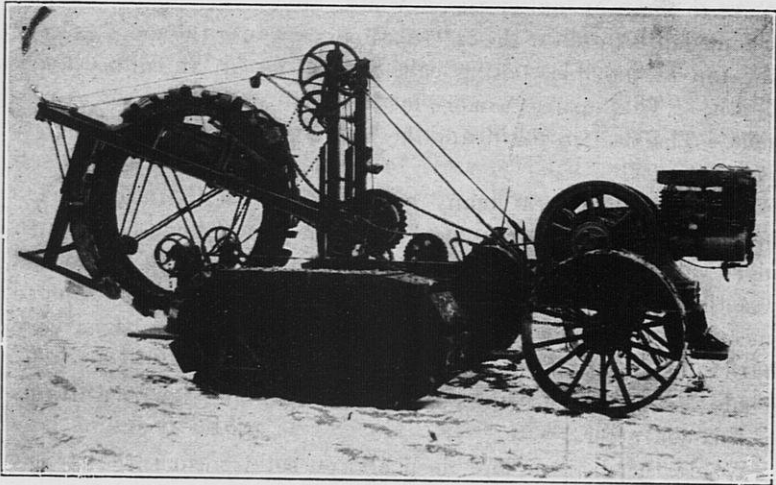


FIGURE 15.—A TILING MACHINE.

Two men operating this machine under good conditions can lay as many tile in a day as a crew of eight good men working by hand.—Courtesy Wisconsin Agricultural Experiment Station.

is very apt to make a mistake as to the size of the tile required. He takes into consideration only the marsh, and omits the flow from the high land. The resulting drain may have only about one-half the capacity it should have.

LABOR AND MACHINERY.

Machinery for installing tile drain is one of the greatest problems with which we have to contend. Machinery has been invented to do almost any kind of work and do it perfectly, but the tiling machine is a problem that is not yet entirely solved. To be sure, there are a few machines that do good work under favorable conditions, but it is a very difficult proposition. A

tiling machine must meet with such a variety of conditions that it has to be several machines combined in one. The most difficult thing is to make a machine that will be a paying investment for laying large tile mains.

We all know there are a number of tiling machines on the market but the contractors who are running these machines must leave out at least 20% of the land that is most in need of tiling and look for land firm enough for his machine. I find a great many marshes throughout this state, that are entirely too soft for any machine that is now built. This is why contractors are not interested in this class of work. They say "Do this work by hand." But I have had experience in that too, and am convinced that as a business it does not pay.

The greatest difficulty under present conditions in Wisconsin attends the installation of the main tile. It is necessary in a great many places first to cut an open ditch so as to carry away the water and allow the land to settle and harden in order to operate a tiling machine. I know of no cheaper method of cutting this ditch than with a large ditching plow and capstans. After tiling, this ditch may be retained to carry storm water.

I have operated a tiling machine that will follow these open ditches and cut them to a sufficient depth for tile. This makes the work of first and second cutting much easier than to try to do it all at once by any kind of machinery put on the soft marsh.

It also eliminates the caving proposition. I saw a machine that cost two thousand dollars trying to lay a main tile four and one-half feet deep through the soft marsh. This machine was making a total failure of the work and was not making operating expenses.

I have operated tiling machines on almost all kinds of soil and find that the only machine that really pays is the web or caterpillar traction type. But even with this the contractor must sort out the jobs to suit his machine.

I have operated a tow-line machine over open drains which had been dug long enough to allow the banks to settle and the sod to form, making an excavation from two to four feet deep in the bottom of this open drain. This makes the laying of the tile fairly profitable, where if I had tried to excavate a trench to the same depth over this land before the open ditch had

drawn the surface-water out of the soil, I would have made a failure with the same type of machine.

In conclusion I will say that this open ditch work must and will be accomplished before much outlet tile is laid. There has been very little tile laid in this state compared with the amount in Indiana and I see a great future for the business here.

The President. The next subject is closely related to this, so we will listen to Mr. Jones and then throw it open for discussion.

WHY TILE SOMETIMES FAIL

E. R. JONES

Soils Department, College of Agriculture, Madison, Wisconsin.

An Englishman landing at New York City met three men while he was walking on the pier. Two of these were negroes. The Englishman immediately wrote to his people at home that two-thirds of the population of America were negroes. His conclusions are just as warranted as the conclusion that half of the tile drainage systems are a failure because one out of two that some man may have examined was not wholly successful. It is unfair to jump at conclusions without an examination of the premises.

Two kinds of men are apt to draw these conclusions—first, the man who has had an opportunity to see only one or two tile drainage systems; and second, the man who has seen a great many tile drainage systems but who has wanted to see only those that were apparent failures. In fairness to good tile drainage, we must teach the first man the error of his ways and spike the guns of the second. It is hard to teach a man who is prejudiced.

COST AND BENEFITS.

Wrong ideas prevail as to the cost of tile. A 4" tile laid 3 feet deep in a soil where the digging is reasonably easy costs 75c a rod for tile and labor; a 8" tile laid 4 feet deep costs about \$2.00 a rod for tile and labor. If the laterals are 4 rods apart,

40 rods are required to the acre, and the cost of the laterals is \$30.00 an acre. An 8" tile with a fall of 1/10 of a foot in a hundred will usually serve as an outlet for the entire under-drainage from forty acres. The cost of the outlet distributed over the entire area may amount to \$3.00 or \$4.00 an acre. This added to the cost of the laterals makes the cost of tiling, under ordinary conditions, in clay soils less than \$35.00 an acre of actual cash outlay. To this may have to be added the inconvenience of boarding the tilers, hauling the tile and filling the trenches, but this estimate is sufficiently high to cover a portion of these inconveniences. Furthermore, many areas require lines only every 8 rods. In deep peat, the digging is easy and 5" tile can be laid 4½ feet deep at a cost very little more than that of 4" tile 3 feet deep in a clay soil. The deep lines may be 8 rods apart, thus cutting the cost of tiling practically in half. On many areas, still less than this is required for satisfactory drainage. On a half township of land in Outagamie county and another one in Walworth county where practically all of the wet swales had been tiled, it was found after a careful field study that the amount of tile required averaged only about 8 rods to the acre. This is significant, because a large part of Wisconsin consists of rolling upland with such wet swales as were formerly found on the two areas studied.

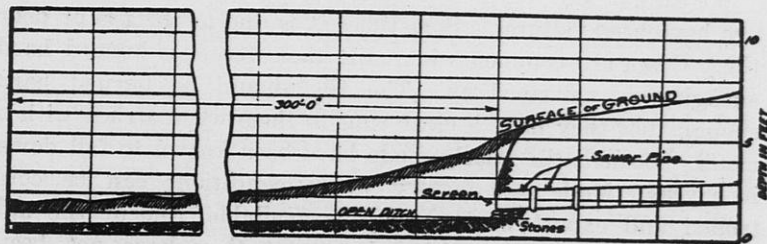


FIGURE 16.—A MAKESHIFT OUTLET FOR TILE.

An open ditch should extend back from a shallow creek until it is deep enough to afford an outlet for tile as is shown in Figure 18.—Courtesy Wisconsin Agricultural Experiment Association.

Time does not permit, and necessity does not require that we go into detail at this time citing the benefits of drainage. Cases of such benefits may be seen on every hand. Mr. Webster has told us how tile reduce surface water. Ask M. J. Veal, Stoughton, Wisconsin, about the 80 bushels of seed corn that he raised

per acre on peat land thoroughly drained and fertilized. Ask Gilbert Richmond, of Lodi, how he made a cornfield out of a 30 acre lake-bed where he had lost every crop he had planted before his tile drainage system was installed. Both of these men will tell you that the first crop paid for the entire drainage system. L. M. Thiers, Kenosha, Wisconsin, has drained with tile a number of such potholes as are shown in the photograph. There is not a man in Fond du Lac county more pleased than C. W. Keyes with the results of the tile which he laid in 1915. William Kamman, near Manitowoc, says that a few lines of tile draining wet swales on his 120 acre farm, and costing less than \$500.00, increased the selling value of his farm more than \$2,000.00.

But someone may say that the same results might have been accomplished with open ditches. George Carpenter, of Baraboo, has had an opportunity to see the drainage which his neighbors have received from capstan ditches, and compare them with the benefits which he has received from tile. In a recent letter to me he said that he would not take the capstan ditches as a gift provided tile were available.

SOME EXAMPLES OF FAILURES.

We cannot, and will not, deny that some systems of tile drainage have been failures. Sometimes it is due to the use of poor tile. Cases are common where tile that were not burned hard enough have not stood up. The tile should be burned hard enough that they have a clear ring to them when struck with a metal. Cement tile poorly made have been known to fall down in a year. Made at a factory where conditions can be controlled and expert workmanship is available, cement tile appear to be satisfactory, although as yet they have not been tested so long a time as the clay tile.

Cracked tile are sometimes laid. As an experiment, ten years ago, on the red clay at Superior, I laid a tile that was split on one side from end to end. I put the crack on the side where the weight of the earth would prevent it from spreading. Three years afterwards, I dug this tile up and found that while it was still in place it had cracked on the other side also and was in two pieces. I think that the spreading of the former crack

due to freezing, cracked the other side. It convinced me that it is unsafe to lay a cracked tile under any conditions. Where a piece is broken out of a tile, it appears to be safe to lay it with the defect on the upper side so that it can be thoroughly patched with pieces of tile.

The tile drainage system on the peat at Mather, Wisconsin, has been held up as an example of a failure. The history of this is interesting. About 6 acres in a depression was tiled

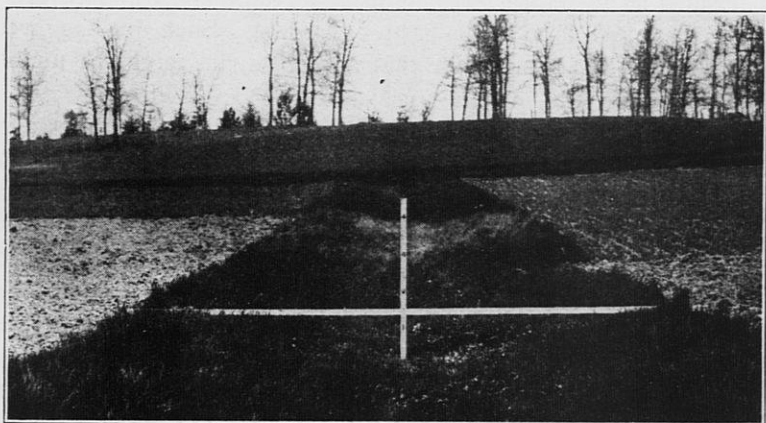


FIGURE 17.—A SURFACE RUN.

This surface-run has a tile about two feet beneath it to keep its bottom dry. It carries flood water about 10 days in the year and raises grass the rest of the time.—Courtesy Wisconsin Agricultural Experiment Station.

with lines 4 rods apart. The tile kept the soil dry enough for crops but the flood water from more than a section of land flowed through this pocket and remained there to a depth of 2 feet after a flood. It took the tile three days to remove this water and the crop was ruined. On the second year, a shallow ditch was dug around the tiled area with a dike on the side toward the drained field. This caught the flood water before it entered the field, and carried it to an outlet, and the area did not suffer from excessive flood water as long as this ditch and dike was in operation. To be sure, the College of Agriculture discontinued its work on this station, but it was because of lack of funds necessary to keep this station in operation. Local workmen whom we hired tried to charge us two prices for their

work. However, today the drainage system is not in bad shape. When Mr. Zeasman examined it a year ago, he found that some sand had got into the tile due to an opening which somebody had made to permit the direct entrance of surface water.

H. J. Grell, Johnson Creek, has a tiled area which is still suffering from flood water at intervals. He could remedy this by constructing a surface run with a road grader for the relief of the tile. This he has neglected to do. Another remedy would be to induce his neighbors to thoroughly underdrain all of the marsh land in the basin above him. Such drainage would so reduce the flood water that a surface run might be unnecessary.

At Sparta, on the farm of Horace Howell, a few years ago, I examined a system of tile drainage that had been laid too shallow. The lines were laid less than 2 feet deep in a muck soil, and in three years' time had heaved until the plow reached the tile. Here, also, the outlet, a 6" tile, had become almost filled with sand. This was due to the fact that no effort had been made to pack muck around the tile in the trench before it was filled with sand.

On the farm of Chris. Weller, near Coddington, we found a tiler wasting all of his fall in the first 300 or 400 feet, and then laying the tile at a depth of less than 2 feet from there to the head of the lines. This gave a limited fall to the upper ends of the lines. The shallow depth in this case is a mistake, not because of danger of heaving, but because the tile are too shallow to be efficient. To be sure, it is difficult to lay tile in sand below the water table, but you should either wait for a dry season or else use curbing to keep the soil from running while you are laying the tile. Tile laid in sand on the top of the water table during a wet season is too shallow to be of value.

On the University farm we have spots where the lines of tile are a rod apart. The area is at the foot of a hill, and in the subsoil there is a layer of sand containing water under pressure. There are hundreds of little springs on this area which the tile have not dried up yet. By having an upright tile to connect the water bearing sand with the tile from below, we hope to dry all of the springs. It is going to be expensive to drain this area with tile, but if we put in open ditches enough to drain it, a rod

apart as the tile are, there would not be land enough left between the ditches to cultivate at all. Dr. Updike, at Lake Mills, has an area of peat land underlaid with gravel and lying about 3 feet lower than a lake a quarter of a mile away. This causes excessive seepage and there are places on this area where the lines of tile will have to be very close together in order to cut off all the seepage.

Some lines of tile laid in the tight Colby clay have been called failures. I have measured the water running from these

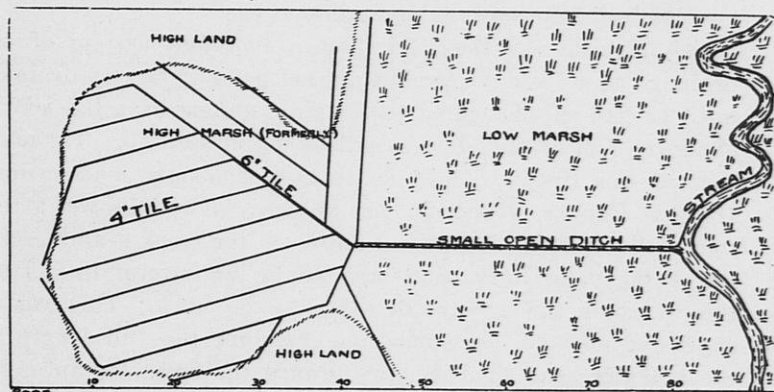


FIGURE 18.—TILE THE HIGHER MARSH FIRST.

Note the lines at the edge of the marsh to cut off seepage. When the creek is dredged the makeshift outlet may be replaced by tile. In the meantime this open ditch is paying for itself. Many small open ditches do not pay for themselves.—Courtesy Wisconsin Agricultural Experiment Station.

tile during a wet season and found that it amounted to 1-14 of an inch in 24 hours from the area drained. In clay soils generally $\frac{1}{4}$ of an inch is removed by under-drains in 24 hours. This convinces me that if tile are needed 4 rods apart on ordinary clays, they will have to be a rod apart on the areas of tight Colby clay in the north central part of Wisconsin. The expense is prohibitive except in small areas where intensive cultivation is to be practiced. Here we have advised thorough surface drainage by means of well planned dead furrows. It is probable that the deep rooting that will result from a deepened drainage will tend to make drainage easier and may make drains 4 rods apart sufficient on this soil, and it is reasonable to believe that tile will be profitable on vast areas of this soil.

On the blue clay subsoils of southern Wisconsin, tile 4 rods apart are doing satisfactory work generally. The same is true on the red clay of the Fox River Valley and the Superior area.

On a farm near Sheboygan, I think it belonged to William Kolb, I found a 2" tile 300 feet long that had silted full. A 3" tile laid at the same time about ten years later was in good condition. I think that the small diameter of the 2" tile was the factor that made it fill up so quickly. To be on the safe side, we are advising no tile any smaller than 4" in diameter now, and 5" will soon be the smallest used.

Nels Holman, at Deerfield, laid a thorough system of tile drainage on a 30-acre area, but did not get satisfactory drainage until he had supplemented the original system by a line of tile along the foot of the adjacent hill to cut off seepage. The omission of this line is a mistake that is commonly made. John Hatz, at Bangor, Wisconsin, has an area where it is wet at the foot of the hill but dry as you approach the creek near the center of the valley. He contemplated laying several lines from this wet strip through the dry land to the creek. This was an expensive mistake. A single line running the full length of the wet strip and then bending toward the creek for an outlet would dry this strip more cheaply and better than several lines running the other way.

On the University farm, we made a mistake in not giving a line of tile at the foot of a hill enough slope. It had only $\frac{5}{8}$ of an inch in a hundred feet. It aided some in cutting off seepage but with a gradient so limited the water ran so slowly in the tile that it was not efficient in cutting off seepage.

A great many have made the mistake of having too many outlets. It is better to have four or five lines of 4" tile discharge into a 6" or 8" tile which has but a single outlet into a ditch than to let each of the small lines of tile have an independent outlet. The single large outlet will be sufficient, and will carry water enough during the winter that it will not freeze. Any one of the small outlets will give more trouble than the large one.

On one area in Clark county where it was claimed that the soil was too tight to yield to tile drainage, I found that an obstructed outlet was the real trouble. As soon as we had cleaned

out the outlet and allowed the water to escape, the line worked satisfactorily. The outlet was obstructed so that it backed water into the tile to the head of the last lateral.

Some outlets discharging into a running stream may be permanently submerged and still be satisfactory. On J. Bowman's farm near Lodi, however, such a submerged outlet proved to be a failure. The main tile discharged into a shallow creek. It was laid in a trench 2 feet deep in which the water stood to a depth of one foot, or one foot below the surface. The tile were 10" in diameter. They worked for a time satisfactorily, but they did not dry the land enough to make it firm and cattle

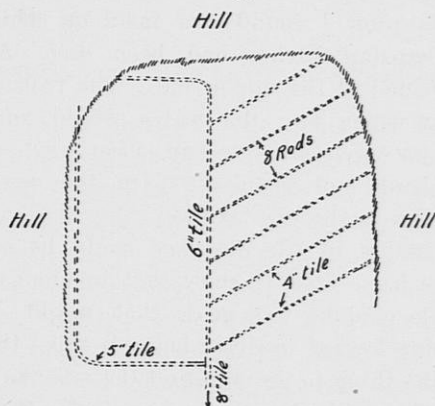


FIGURE 19.—CUTTING OFF THE SEEPAGE.

The money expended in the single line of tile to cut off the seepage is more judiciously expended than that in the several lines of tile on the other side of the main.—Courtesy Wisconsin Bankers Association.

stepped through the soft soil to the tile thus getting them out of place. In two years the 10" tile were dug up for about 500 feet and the open ditch has since carried the water from the rest of the tile drainage system satisfactorily. This is one of the few cases where an open ditch is preferable to a large tile for an outlet. However, as soon as the creek is dredged, it will be possible to lay a 10" tile in the place of the open ditch which can then be filled up to make cultivation convenient.

Except for the expense, there is no objection to making the tile outlet too large. Many mistakes have been made in the other direction. The main should be large enough that there is

still some empty space in the top of the tile. Where one main is found to be too small, the remedy is to put in another one near it to help it. The second line of tile, however, should be at least a rod away from the first one. It is a mistake to put two lines of tile in the same trench. The water has a tendency to run from one line to the other thus causing eddies which agitate the soil and cause large cavities to wash out near the tile.

Perhaps the most common mistake made in tiling is that of laying tile by guess. With a carpenter's level a man can tell whether he has a hard job or an easy job, and if the fall is limited he should get a competent surveyor to lay out the drainage system. Near Waupun, I found one farm on which several hundred rods of capstan ditches had been dug. All of the ditches were connected at the upper end. The reason was that they did not know which way the water would run so they wanted to give it an opportunity to run either way. Such haphazard methods should not be tolerated in the case of open ditches, and still less in the case of tile.

Many other mistakes in tile drainage could be named, but enough cases have been sited to show that in almost every instance some simple mistake was made that might have been avoided. The point I want to drive home is this—that when a mistake is made the thing to do is to find the mistake and remedy it, and not condemn tile drainage generally for the failure of one feature of one system. The majority of our farmers are analyzing mistakes that have been made and are profiting by them. For every one system of tile drainage that is a failure, there are ten that are grand successes.

WOULD DITCHES BE ANY BETTER?

One advantage of an open ditch is that it will stand abuse and still render some service, while tile are either a success or a flat failure. The farmers commonly over-estimate the services of an open ditch. About half of the capstan ditches that were dug in Wisconsin held water within a foot of the top of the ground last June. The unthinking are apt to think that a ditch standing full of water is rendering more service than the main which is empty to a depth of 3 feet. They forget that it is the amount of water that a ditch will carry, or has carried,

and not the amount of water that it is holding that determines the efficiency of the ditch.

Open ditches are sometimes called more efficient on tight soils. Where surface drainage alone is sought, they will carry the water faster than tile; but where underdrainage is sought an open ditch 3 feet deep does not act any more quickly than a 4" tile laid 3 feet deep with a good outlet. A drop of water finding its way through the soil to either has the same path to travel. Since surface drainage is all that the open ditches in these soils accomplish, is it not better to use well planned dead furrows and a surface run rather than to have the land cut up by an uncrossable ditch?

TILE AS EFFECTING DRAINAGE DISTRICTS.

In the southeastern part of Wisconsin, Mr. Peter Hurtgen, the efficient drainage engineer of Burlington, Wisconsin, is designing large tile where, in the less developed portions of the state, they use open ditches. The use of large tile for laterals is on the increase.

In practically every drainage district in the state, there is an urgent need for supplementary drains to complete the drainage for which an outlet is afforded by the outlet drains of the district. An outlet drain without any laterals discharging into it is like a train of cars without any passengers. In order to realize the maximum benefits from the outlet drains, we must put in smaller drains to carry the water to these outlets. In these supplementary drainage systems, tile play a leading role.

In conclusion, I want to say that if you are going to lay tile, lay them right and give them a square deal. Unless you are going to do that, keep your money in your pocket until such time as you are ready to do it right.

DISCUSSION.

Mr. Moore. Do tiling machines do the work cheaper than hand laborers?

Mr. Harness. No, but they get more work done.

Mr. Amidon. Furthermore, jobs that could be done only at a loss by hand are done with profit by a machine in the hands of a good operator.

Mr. Uvaas. I am a beginner, but I cleared \$1,800 over and above expenses with my tiling machine. I have work enough promised me now to keep me busy all of next season. With a machine you can get work done quickly. Some areas are too wet for a machine.

Mr. Harness. On wet marshes a capstan ditch should be pulled a year or two before the main tile is laid.

Mr. Jones. That means adding \$1.50 per rod to the cost of the tile. You can buy 12 inch tile and lay it 4 feet deep for \$3.50 a rod if you do not have to haul the tile more than 3 miles. It costs about the same to lay tile by machine as it does by hand. If a farmer begins to look for his tiler the winter before he needs him, he can get his work done by hand, if he can not get a machine. I believe in using tiling machines, and know that excellent machines are on the market, but I believe that every machine should have with it a small crew of hand tilers to dig the trenches in the soft places. Good tilers make from \$3 to \$5 a day and they are needed to work where the machines can not go.

Mr. Harness. The capstan ditch may remain for a surface run after the tile are laid.

Mr. Jones. For fifty cents a rod you can make a surface run with a team and at the same time fill the trench over the tile. You are still throwing away a dollar a rod for the luxury of a capstan ditch.

Some of the ditching companies are making better capstan ditches than used to be made, but even the best of them are only a makeshift until big tile or a small dredge ditch 6 feet deep or more is installed. Many capstan ditches are paying for themselves, but my contention is that the same money spent judiciously for tile would pay better. If you want merely to let off the surface water so that the land will be firm enough to support a tiling machine, hire a trench dug two feet deep for fifty cents a rod. Properly laid out, it will firm the land more in a week than many of your capstan ditches do in a year.

The President. We had better end this discussion before it gets too hot. Furthermore, many of us must leave the city on trains soon after noon. We will listen to the report of the committee on resolutions.

RESOLUTIONS.

RESOLVED by the Wisconsin State Drainage Association in convention assembled at the city of Grand Rapids, January 19, 20 and 21, 1916, as follows:

That the Wisconsin State Drainage Association keenly feels the loss to the drainage interests of Judge J. A. Gaynor, who was called by death during the past year.

That we thank all who have taken part in the program and discussions which contributed largely to the success of the convention.

That we extend to the city of Grand Rapids our appreciation of the courtesies they have extended to us at this convention, and that we wish to assure them that we appreciate the hospitality and good-will that has been shown to us, and the excellent banquet provided with the co-operation of the ladies of the city.

That we are especially thankful to Mr. C. W. Roed, Mr. B. M. Vaughan, Mr. E. P. Arpin and the Commercial Club and the Elks Club of the city of Grand Rapids for the diligent effort put forth by them in providing entertainment.

Finally, we renew the pledge to work together that our Wisconsin lands in need of drainage may be made more productive, thereby enriching the private owners, and at the same time promoting the public welfare.

GERRIT T. THORNE,
JAS. H. ENGLISH,
O. R. ZEASMAN,
Committee on Resolutions.

The resolutions were adopted unanimously.

Upon motion the convention adjourned, subject to the call of the president.

Members who remained in the city for the afternoon were shown through the large paper mills by a committee of citizens.

APPENDIX

LIST OF MEMBERS, 1916.

- American Concrete Pipe Assoc.
538 S. Clark St., Chicago.
- Ames, F. M., Brooklyn.
- Amidon, W. S., 36 36th St., Milwaukee.
- Anderson, N. A., Morrisonville.
- Andrew, J. M., Marinette.
- Angelo, W. B., Stevens Point.
- Arpin, E. P., Grand Rapids.
- Arpin, E. P. Jr., Grand Rapids.
- Baird, I. L., Lake Beulah.
- Beaumont, Geo., Kansasville.
- Biglow, O. H., Palmyra.
- Bishop, C., Omro.
- Bodenheimer, M., Green Bay.
- Borner, Henry J., River Falls.
- Bowden, W. H., Babcock.
- Braddock, W. S., Mather.
- Brost, Anton, Babcock.
- Brown G. E., Madison.
- Butterfield, Geo. W., Baraboo.
- Channing, Adam, Whitewater
- Chapman, Wm.,
827 Mineral St., Milwaukee.
- Chase, John B., Oconto.
- Choak, Chas., Kansasville.
- Charlesworth, Frank M., Kaukauna.
- Clark, D. D.,
1703 College Ave., Racine.
- Clark, W. W., Grand Rapids.
- Clark, J. J., Berlin.
- Coddington, W. B., Plover.
- Coffin, P. B.,
323 Groveland Ave., Chicago.
- Comstock, J. T.,
1101 Mitchell St., Milwaukee.
- Comstock, H. G.,
1125 Mitchell St., Milwaukee.
- Connell, S. A.,
301 Germania Bldg., Milwaukee
- Corbett, John, Babcock.
- Creydt, A. W., Watertown.
- Cuff, R. L., Barron.
- Daniels, J. Q., Babcock.
- Daniels, Dr. J. S., Omro.
- Darling, H. W.,
712 N. Y. Life Bldg., Chicago.
- Dean, Seth, Glenwood, Iowa.
- DeDap, F. J., Shennington.
- Dibble, A. W., Madison.
- Differding, Wm., Black Creek.
- Drill, A. E., Hebron, Ill.
- Duff, P. J., Trempealeau.
- Dunegan, J. W., Stevens Point.
- Haeger, E. H., Dundee, Ill.
- Elwood, Frank,
8012 Exchange Ave., Chicago.
- English, J. L., Waterford.
- Feeley, J. F., Eagle Grove, Ia.
- Fisher, C. E., Sprague.
- Forster, Carl A.,
813 Majestic Bldg., Milwaukee.
- Foster, W. A., Elkhorn.
- Frazer, J. H., Rose Lawn.
- Frederickson, P. C., Necedah.
- Gallagher, D. J., Babcock.
- Gaulke, Wm., Grand Rapids.
- Gault, J. H., Milwaukee.
- Gerner, Walter, Fredonia.
- Giddings, C. C., Racine.
- Glass, W. T., River Falls.
- Goodwillie, A. L.,
112 W. Adams St., Chicago.
- Green, E. H., Benson, Minnesota.
- Haeger, E. H., Elgin, Ill.
- Hall, W. B., Oconto.
- Harness, J. H., Waterloo.
- Harrison, A. P., Reedsburg.
- Harsell, John N., Milwaukee.
- Hay, W. J., Oshkosh.
- Heath, E. S.,
Republican House, Milwaukee.

Herrick, H. E., Nekoosa.
 Hintze, P. H., Madison.
 Hirsch, Aug. C., Hales Corners.
 Holcomb, A. E., Grand Rapids.
 Holland, J. L., Cutler.
 Holway, O. G., Merrilan.
 Horn, Henry, Omro.
 Hulbert, J. M., Richardson.
 Hurtgen, P. J., Burlington.

Jawart, J. Will, Manawa.
 Jenks, Frank, Brodhead.
 Jones, E. R., Madison.
 Jones, H. M., Auburndale.
 Jordan, Nye, Mauston.
 Juergens, Carl H., Milwaukee.
 12th and Vliet St.

Kamper, J. H., Franksville.
 Kiekhieffer, Henry, Thiensville.
 Killen, W. H., Minneapolis, Minn.
 1st Nat'l Bank Bldg.
 Kirchoffer, W. G., Madison.
 Knoller, G. G., Dancy.
 Koelsch, Andrew, Hales Corners.
 Kriebel, E. S., Pistville.
 Kuechenmeister, G. A., West Bend.
 Kuney, Clark G., Three Lakes.
 Kurchel, Albert, Clintonville.

Larsen, A. B., Tomah.
 Leins, C. F., West Bend.
 Lerch, E. D., Morrisonville.
 Lindas, M., Deerfield.
 Lockman, Frank, Columbia.
 Lucas, Frank, Madison.
 Luedke, August, Abrams.

Madsen, Andrew, Oregon.
 Manning, W. S., Ladysmith.
 Mathes, Lloyd, Grand Rapids.
 Matheson, A. E., Janesville.
 Mayer, J. F., Richfield.
 McCaul, W. R., Tomah.
 McDowell, Geo. F., Sprague.
 McFetridge, W. L., Oshkosh.
 McGill & Williams, Ladysmith.
 McKay, N. B., Fall River.
 Meltesen, Chris, Shennington.
 Meyer, H. J., Fort Atkinson.
 Meyer, Frank J., Milwaukee.
 Millerd, A. W., New London.
 Mills, G. W., Chicago.
 1100 Great Northern Bldg.
 Moore, Warren, Ladysmith.
 Morgan, F. W., Chicago.
 1312 1st Nat'l Bank Bldg.
 Morse, Dr. E. A., Appleton.

Mortensen, Chris, Camp Douglas.
 Moyle, O. R., Walworth.
 Murgetroid, R., Vesper.
 Myers, P. J., Racine.
 Neitzel, C. J., Watertown.
 Nelson, A. P., Union Grove.
 Nelson, George R., Aurora, Ill.
 Netland, Elmer, Eagle Grove, Iowa.
 Nickell, O. C., Waukesha.
 Norris, W. G., La Moille, Ill.
 Norsby, Ole., Miner.
 Novotny, Emil, Kewaunee.
 O'Connor, E., Hancock.
 O'Connor, J., Grand Rapids.
 O'Dea, Mike, Reedsville.
 Olson, Nels, Tomah.
 Olson, O. C., Larsen.
 Opitz, Will, Elkhorn.
 Orr, Fred, Blair.
 Owen, R. S., Madison.

Pfeiffer, Henry, Union Grove.
 Parrette, R. L., Three Lakes.
 Peddie, A. F., Cedar Rapids, Iowa.
 Philleo, E. L., Grand Rapids.
 Pomeroy, H. S., Edgerton.
 Pope, L. F.,
 College of Engineering, Madison.
 Post, L. D., Waupaca.
 Potter, Guy, Grand Rapids.
 Pratt, C. H., Plainfield.
 Pratt, D. H., Plainfield.
 Pratt, F. J., Plainfield.
 Prout, George L., Vesper.

Rademaker, John, Middleton.
 Raymond, W. B., Grand Rapids.
 Reeder, Charles W., Milwaukee.
 Suite 1126-32 Wells Bldg.
 Reeves, J. A.,
 305 S. La Salle St., Chicago.
 Rietbrock, A. C.,
 700 Cedar St., Milwaukee.
 Ristau, E. A., Osseo.
 Roberts, R. F., Randolph.
 Rocque, Alfred, Lena.
 Romberg, Wm., Allenville.
 Rood, Chas. W., Grand Rapids.

Salter, Henry, Plainfield.
 Savage, Fay, Soldiers Grove.
 Scanlon, D. J., Oregon.
 Schilling, E. C., Abbotsford.
 Schroeder, H. F., Tomah.
 Sherman, J. J., Appleton.
 Sherwood, E. J., Mauston.
 Sherwood, H. H., Mauston.
 Siebenaur, Otto, Rosendale.
 Smith, W. J., Plainfield.

Spreiter, Walter, Onalaska.
 Stokes, Jas. L., Elkhorn.
 Stewart, C. B., Madison.
 Sutherland, G. A.,
 Sweet, H. L., Fond du Lac.
 Swerig, O. P., Stoughton.

Techtman, Chas., Kewaskus.
 Temple, Willard, Mauston.
 Tennant, H. V., Madison.
 Thorne, G. T., Oshkosh.
 Trowbridge, L. A.,
 N. Y. Life Bldg., Chicago.
 Tubbs, H. H., Elkhorn.

Ullsperger, H. W., Sturgeon Bay.
 Uvaas, Ed., Larsen.

Vaughan, B. M., Grand Rapids.
 Vaughan, Dayle W., Whitewater.
 Veeder, C. A., Mauston.
 Volk, W. E., Oconto Falls.

Waite, J. H., Waukesha.
 Walker, Alfred, Hancock.
 Wakeman, C. A., Oshkosh.
 Warren, George E.,
 208 S. La Salle St., Chicago.
 Warriner, C., New Lisbon.
 Webb, W. H., Superior.
 Webster, A. L., Wheaton, Ill.
 Webster, H. C., Milwaukee.
 Webster, L. B., Elkhorn.
 Werner, Ed., Appleton.
 Whitson, A. R., Madison.
 Willard, A. C., Necedah.
 Williams, Rowland, Beaver Dam.
 Wolf, W. F., Appleton.
 Woods, W. S.,
 Batavia Bank Bldg., La Crosse.
 Wortham, E. L.,
 1128 Otis Bldg., Chicago.
 Zeasman, O. R., Madison.
 Zimmerman, Carl, Thiensville.

CONTRIBUTING MEMBERS.

Blackmer & Post Pipe Co., St. Louis, Mo.
 Clancy & Loverud, Stoughton.
 Dayton-Dick Co., Quincy, Ill.
 Keuffel & Esser Co., 516 So. Dearborn, Chicago.
 Mariner & Hoskins, 2009 Harris Thust Bldg., Chicago.
 Plymouth Clay Products Co., Fort Dodge, Iowa.
 Rudolph, Alfred C., Suite 1126-32 Wells Bldg., Milwaukee.
 Thompson, Myers & Kearney, Racine, Wis.
 Sprague & Jenks, Brodhead, Wis.
 Western Wheeled Scraper Co., Aurora, Ill.
 Whitehead & Matheson, Janesville, Wis.

TILING CONTRACTORS.

Channing, Adam, Whitewater.
 Drill, A. E., Hebron, Ill.
 Feeley, J. F., Eagle Grove, Ia.
 Harrison, A. P., Reedsburg.
 Hirsch, Aug., Hales Corners.
 Kelly, J. W., Brodhead.
 Lockman, Frank, Columbia.
 McKay, N. B., Fall River.
 National Drain Tile Company, 305 S. La Salle St., Chicago.
 Netland, Elmer, Eagle Grove, Ia.
 Orr, Fred, Blair.
 Perry, W. S., Waterloo, Wis.
 Schultz & Bieck, South Milwaukee.
 Uvaas, Ed., Larson.
 Wisconsin Drain Tile Company, Elkhorn,

IN MEMORIAM.

The cause of land drainage lost one of its best supporters when Judge John Alexander Gaynor of Grand Rapids died on May 12, 1915. Death was due to anaemia. During the last weeks of his failing health he lived with the family of his brother, James Gaynor, in the town of Cranmoor.

On April 29, 1916, James Gaynor, also, was called by death.

This removes from activity two men whose life work has been the development of Wisconsin marsh lands for cranberry and agricultural purposes. The two brothers were born in Ireland and came to America with their parents when small boys. Upon reaching Wisconsin the family engaged in farming. As the boys grew up James became interested in machinery and John in books. Each followed his own inclinations.

JAMES GAYNOR.

James Gaynor worked as a machinist and farm hand and travelled extensively as a young man through the south and west. He finally settled in Minnesota, but later came back to Wood County, Wisconsin, where he spent the last forty years of his life. He designed many ingenious devices for working land, digging ditches and sorting cranberries. He was too considerate of his neighbors to profit financially by any of these inventions. The Gaynor cranberry grader is used for grading cranberries in all parts of the world. It was in describing his cranberry grader that he said in his characteristic way: "It doesn't take a very big cranberry to be twice as big as another cranberry." He was a keen student of men and in judging them he applied his cranberry test.

On page 178 he describes his last contribution in the machine line. The article is written by the editor from notes made during a conversation with Mr. Gaynor at the close of the Grand Rapids convention in January.


JOHN A. GAYNOR.

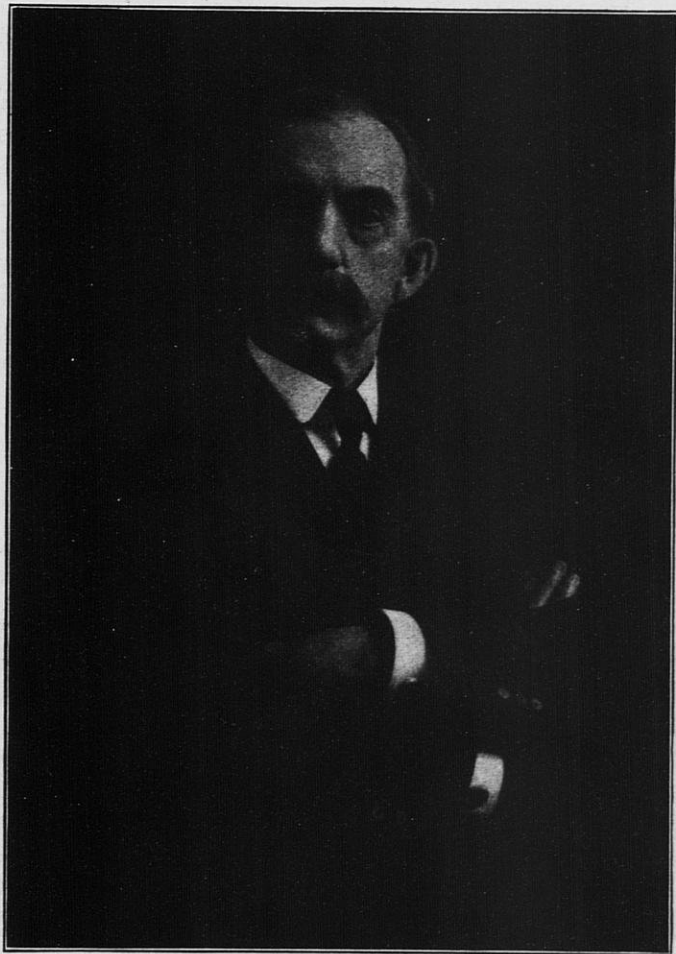
John Gaynor spent his early manhood teaching district school in winter and working on a farm in summer. He finally entered the University of Wisconsin and graduated in 1871. He received his master's degree in 1874 and began the practice of law. He was district attorney of Wood County from 1876 to 1882. Repeatedly he was city attorney for Grand Rapids, member of the school board and county board. In 1893 he was elected to the Assembly and he was County Judge from 1897 to 1901.

In 1905 he was a central figure in revising the drainage district law. It was he who with Hon. B. M. Vaughan was selected by a committee of ten attorneys to make the final draft of the bill.

His eminent fairness in dealing with legal matters is exemplified by the article on page 179, which is an excerpt from an address delivered in 1906 at the Farmers' Course at the College of Agriculture.

Judge Gaynor was a great student of drainage. He studied not only the legal side of it, but the engineering and agricultural sides as well. He was also a power in the cranberry industry.





JUDGE JOHN ALEXANDER GAYNOR.

Courtesy Wisconsin Cranberry Growers Association.

PLOW ATTACHMENT FOR MARSHES.

JAMES GAYNOR.*

I wish to present to the Wisconsin State Drainage Association a simple device for turning over grassy marsh land with a plow so that the grass will be well covered. Too often grass projects out between the furrow slices after they are turned. Such grass keeps on growing and it is hard to kill it by subsequent cultivation. If it is well covered, the wild marsh grass is easily killed.

We usually like to have the turned furrows lap one on the other so that the harrow can get a better hold of them. Even with a jointer you can not cover all the grass in this way on a tough sod. The furrow must be turned over flat and each must butt up close to the other. The flat surface is harder to cultivate effectively, but the grass is effectively covered.

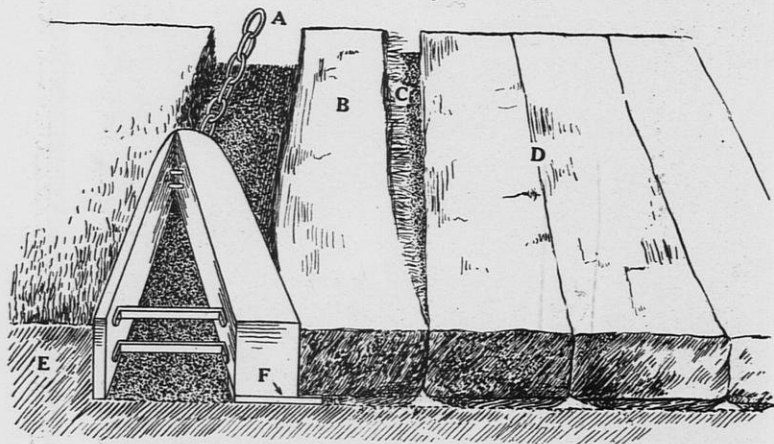


FIGURE 21.—COVERING ALL THE GRASS.

By sliding the furrow the grass is tucked beneath it. This attachment is pulled behind the plow by the chain, or it may be bolted to the landside of the plow.

I believe in plowing marsh lands deep—10 inches or more. This gets the grass down where it is out of the way and leaves a mellow layer on top.

The attachment to the plow is shown diagrammatically in the cut. F is an 8"x10" with an iron shoe projecting to tuck un-

* See page 175.

der the grass on that side of the furrow as the device is dragged in the furrow behind the plow, to which the chain A is attached. The device is wide enough to slide the furrow slice over about 4 inches. This tucks the grass under the other side of it and pushes it firmly against the last furrow slice. It leaves the furrow about 4 inches wider than the next furrow slice to leave room for that to be pushed up against the last one.

B is the furrow before it has been pushed over. C shows the projecting grass. At D none of the grass is visible. It is not even between the furrow slices. It is well tucked in beneath them.

This device is not patented. It is yours to make use of. If any member of this association finds it as successful as I have, I shall be very glad.

THE COMMON LAW OF DRAINAGE.

JUDGE JOHN ALEXANDER GAYNOR*.

“The common law had grown up and become fixed and settled long before there was any legislation affecting it. It is the outgrowth of the customs of the times. The underlying principle of common law is, or should be, very similar to that underlying the Bill of Rights in our Federal Constitution—namely, that equal privileges should be granted to all and special privileges to none. This principle has perhaps been carried too far, since the common law gives the landowner almost exclusive right and sovereignty over his own land, to the disadvantage of his neighbor.

A good way to get at what the common law in regard to drainage is, is to put one's self alternately in the places of the parties concerned. It is easy to see that a neighbor, or corporation, has no right to obstruct a natural waterway to the detriment of the landowner above. It is also very easy to see that if the landowner collects superfluous water in tile drains, or otherwise, and discharges it at a place on his neighbor's land, the neighbor can recover damages unless it empties into a waterway or stream.

* See page 176.

For the purpose of drainage under the Common Law, as already stated, it is necessary that the landowner should conduct the surface water to a stream on his own lands; so it becomes important to know what constitutes a stream. Decisions on this point are by no means uniform, and the best rule I can give you now is that if the eye of the casual observer is able to see a channel through which water frequently flows during the year in its ordinary course of drainage, it is a stream within the meaning of the law, and he has a right to turn water into it and the lower owner has no right to put a dam across it that would cause the water to back up onto the lands of the adjoining owner. It is not necessary that the channel be continuous, but the casual observer must be able to glance over the ground and see that there is a water course down the slope, in order to give him the right to treat it as a stream and turn water into it."

EXTENSION WORK IN DRAINAGE OF THE COLLEGE OF AGRICULTURE.

DEMONSTRATIONS IN FARM DRAINAGE.

Where an individual has a drainage problem that is of interest to no one but himself the department gives him general advice by correspondence, but advises him to secure the services of a practicing drainage engineer for detailed plans. Where the individual agrees to interest ten or more land-owners in his drainage problem, the department makes demonstrations in the field as far as its time permits. The demonstration consists of laying out one farm drainage system in the community, holding a meeting at a school house for a general discussion of land drainage, and making general examinations of several farms in the community having marsh land. Communities applying for such service will be handled as far as possible in the order of their application, and the college makes no charge, except for traveling expenses. {

AID TO DRAINAGE ORGANIZATIONS.

Many groups of land owners whose lands are kept wet by a shallow sluggish stream, know that the creek should be dredged or that a big tile should be put in, but do not know how to proceed. When they apply to the college for help they are asked to send in a sketch showing the forties and sections traversed by the creek and the wet land. This enables the college authorities to make specific recommendations to the land owners as to the features they should have their engineer investigate in his preliminary survey. After the preliminary survey is made the college is glad to aid the engineer in making his preliminary plans.

If the organization is to be a drainage district the college is compelled to write a report on the soil and the proposed drainage. It is best for the land owners to have the preliminary survey made first. This simplifies the work of the college to the extent of requiring only one examination of the preliminary topographic sketch and a soil survey by a member of the State Soil Survey or one of the regular staff of the department of Soils. The field man is prepared to run a limited amount of levels to supplement the preliminary survey of the local engineer. When a field examination has to be made delays sometimes occur before a man is available to send into the field. It is best for land owners to apply for the soil report two or three months in advance of the time they actually need it. Apply to Professor A. R. Whitson, Madison, Wis. The law provides no fund for this work and land owners are asked to make a deposit of money sufficient to pay actual traveling expenses, the unexpended portion to be refunded to them.

In cases where there is a need of coöperation between several proposed adjacent drainage districts, and there does not seem to be any central organization to bring them together, the college acts in that capacity. For instance, in Outagamie county there are three proposed drainage districts, but neither can have a good outlet until the Embarrass River is straightened. Mr. Zeasman of the department of Soils made a preliminary survey of the course of the Embarrass River and a soil survey is to be made of the entire area, upon the initiative of the college. When

the preliminary plans and soil report is ready a general meeting of all interested land owners will be held for an open discussion of the whole matter. The land owners have coöperated in furnishing Mr. Zeasman with living and working necessities while he was engaged in the work. This included a crew of axe-men to cut brush so that levels could be run. Mr. A. W. Millerd, drainage engineer, New London, Wis., kindly coöperated to the extent of furnishing the data which he had collected on the area in connection with other matters. It appears that this timely preliminary work by the college will aid in getting a wise drainage movement started in this county.

On several occasions Mr. Jones has acted as arbitrator between drainage districts, between town boards, and between commissioners and land owners in the assessment of benefits. While town drains do not require a report from the college the department of soils is glad to suggest plans and in some cases takes the initiative in getting town ditch proceedings started. The college aims to make all of its work educational in character.

SUMMARY OF WISCONSIN DRAINAGE LAWS.

There are many areas in Wisconsin for which an outlet can be secured only by digging a big ditch or laying a big tile through the lands of several land owners. "How can I make the man below me do his share of the ditching," is a vital question. There is a town drain law and a drainage district law prescribing methods by which a drain can be forced, if necessary, through the land of an unwilling land owner. Both laws provide that the land benefited shall be taxed a special drainage tax to pay for the improvement.

While the law does not place a limit on the size of the area that may be handled under the town drain law, it is usually only the smaller areas—500 acres or less that are operated under it. The larger areas usually organize under the drainage district law.

TOWN DRAIN LAW.

The steps may be summarized as follows:

1. One or more land owners cause a preliminary survey to be made. A sketch similar to Figure 2 is made. It shows the fall and the approximate location of the ditch or big tile.*

2. The sketch is attached to a petition, preferably drawn by an attorney. The form is substantially as follows:

*To the Honorable Supervisors of the Town of -----
County of -----, State of Wisconsin:*

Your undersigned petitioners, more than six in number, all land owners in your town and at least one of whom owns lands affected by the proposed drain, respectfully ask you to lay out and construct, as provided in Chapter 579, Laws of 1913, and acts amendatory thereof, a town drain hereinafter described. We respectfully represent:

I.

That the proposed work is necessary and will be beneficial to the public health and welfare, because there is along the proposed town drain a large amount of wet and marshy land affording breeding places for mosquitoes, causing an infection, damps, and fogs, and having but little value for agricultural purposes.

II.

That Exhibit — is a map of the proposed town drain.

III.

That said map shows approximately the location of the proposed drains, subject to minor changes that may be shown advisable by the final survey.

IV.

That Exhibit — shows the fall along the course of the proposed drains in all of the places where the amount of fall appears to be a critical factor.

* See page 47.

V.

That the name of the proposed town drain is the-----

VI.

That the following are the names and addresses of the land owners concerned, as we verily believe:

VII.

That ----- caused the preliminary survey to be made upon which the plans have been based and

VIII.

That the cost of said survey was ----- paid to -----

IX.

Finally we ask your honorable body to lay out and construct with due diligence and speed the town drain hereinbefore described, subject to the minor changes that the final survey made by your engineer may prove to be advisable. In testimony of our desires we hereunto affix our signatures.

3. The petition must be signed by six or more land owners in the town. One or more of the signers must own land affected by the drain. If the proposed drain lies in more than one town a petition must be signed by six land owners in each of the towns affected.

4. The town board fixes a day for a hearing and all land owners affected are notified.

5. The town board views the land and hears complaints. They

decide whether or not the proposed drain should be constructed. If they decide adversely, three commissioners appointed by the county judge may compel them to lay out the drain.

6. The town board engages an engineer to make the final location and design for the drain.

7. They award such damages as they think the proposed drain will do.

8. They let the contract for construction.

9. They add the cost of the survey, of administration, of damages and of construction, and make a reasonable addition for unlooked for expenses, and thus find the total cost.

10. They spread the cost as a tax on the land benefited, on the basis of the benefits. It is customary before the tax is finally ordered, to have a day of public review to adjust the tax of land owners who claim that their taxes are too high, or their damages not high enough.

11. Upon the request of the land owners the town board may borrow money for ten years to pay for the drainage, but all who so desire may pay their taxes at once.

12. The town board and their engineer supervise the construction. They condemn a crossing over a railroad or highway right-of-way where necessary.

13. They refund to the parties who paid for the preliminary survey, the cost of that survey.

14. The town treasurer collects the tax against each parcel of land or uses the proceeds of the town notes to pay for the drainage. He collects interest on the unpaid taxes for the ten years during which the drainage taxes are being paid.

15. The town treasurer keeps to the credit of the drainage the unexpended portion of the money raised. It can be used upon order of the town board to keep the drains in repair.

THE DRAINAGE DISTRICT LAW.

The more important steps are outlined as follows:

1. One or more interested land owners cause to be made a preliminary survey of the area similar to that shown in Figure 2.*

2. The land owners apply to the college of agriculture for an advisory report on the soil and proposed drainage of the area. The college requires a deposit of money from the applicants to

* See page 47.

cover the cost of actual traveling expenses incurred by a field examination.

3. This report is made a part of a petition, preferably drawn by an attorney, but substantially as follow:

To the Circuit Court of ----- County, Wisconsin:

Your undersigned petitioners, constituting a majority of the land owners affected by this petition and representing more than one-third of the area hereinafter described, aggregating ----- acres, desire to have organized under the provisions of Chapter 419, Laws of 1905 and acts amendatory thereto, a drainage district lying in ----- Wisconsin. We, therefore, respectfully represent:

I.

That the proposed work is necessary and will be beneficial to the public health and welfare, because there is in the proposed drainage district a large amount of wet and marshy land affording breeding places for mosquitoes, causing an infection, damps and fogs, and having but little value for agricultural purposes.

II.

That Exhibit — is a map of the proposed drainage district and shows the proposed boundaries of the same.

III.

That said map shows approximately the location of the proposed drains, subject to changes that may be shown advisable by the final survey.

IV.

That Exhibit — shows the fall along the course of the proposed drains in all of the places where the amount of fall appears to be a critical factor.

V.

*That the name of the proposed district is the -----
----- Drainage District.*

VI.

That the following are the names and addresses of the land owners concerned as we verily believe:

VII.

That ----- caused the preliminary survey to be made upon which the plans have been based.

VIII.

That the cost of said survey was-----

IX.

That Exhibit — is a report of the College of Agriculture on the advisability of the proposed drainage system.

X.

That -----, ----- and -----, or some other suitable persons be appointed as commissioners for the execution of the proposed work.

XI.

That inasmuch as your petitioners approve the plans shown in the accompanying map and profile, and inasmuch as we believe that the cost of the proposed work will not exceed----- while the benefit of the same will exceed the cost by a considerable margin, we respectfully ask that the commissioners appointed be instructed to proceed directly with the final plans and assessments of benefits.

4. The petition is signed by a majority of the land owners or the owners of half of the land and is handed to the circuit judge.

5. All land owners are notified of the date of hearing the petition.

6. At the hearing testimony is taken relative to the merits of the proposed work.

7. If the court is convinced that the benefits exceed the cost he grants the district organization and appoints three commissioners, usually three men nominated by the petitioners.

8. The district becomes a corporation with corporate powers.

9. The commissioner may borrow money to refund to the petitioners what they paid for the preliminary survey and other obligations incurred during the early stages of the organization. If the district fails of organization the original promoters are not refunded what they have expended.

10. The commissioners engage an engineer to make the final survey and design.

11. They assess damages and benefits and compute the cost of construction and make their report to the court.

12. Land owners are notified of the date of hearing the report by the court, and if they desire to contest the assessment of benefits they file their remonstrance. The justice of the assessment is tried by a jury.

13. The court confirms the report of the commissioners with such modifications as seem necessary in the face of the testimony or the findings of the jury.

14. The commissioners advertise for bids and let the contract.

15. The commissioners sell bonds where the land owners desire time for the payment of the drainage tax. The land owners pay interest on the unpaid portion of the tax. The time for principal payments is fixed by the court, but the first must be made within five years and the last in not more than twenty years after date of the order.

16. The commissioners and their engineer superintend the construction and accept or reject the work of the contractor.

17. The commissioners remain officers of the court after the completion of construction, but only to carry out the wishes of the land owners and to meet once a year and report to the court the condition of the drains, and the expenditures for the year.

The commissioners get \$3.50 per day for the time actually given to service. They may or may not be land owners in the district, but must live within twenty-five miles of the district.

18. Upon the request of one-tenth of the land owners desiring additional drains the commissioners must at any time report to the court on the advisability of the proposed additional drains, and if they are ordered by the court, the commissioners levy a supplemental assessment to pay for these drains.

19. Five years from the date of the original assessment the commissioners must correct any errors in the original assessment, upon the request of one-fourth of the land owners.

20. The commissioners must annex to the district any lands benefited by the drains, but not originally included in the district.

21. They must keep an accurate account of the finances of the district until the bonds are paid.

22. A majority of any group of land owners within a district may petition for a sub-district. In that case the commissioners put in the lines of smaller tile needed to complete the drainage and pay for them by selling bonds against the lands specially benefited.

WISCONSIN DRAINAGE DISTRICTS AND COMMISSIONERS ON MAY 1, 1916

The commissioner named first in each case is secretary. Districts marked * have important work in process of organization or construction.

ALBION—Dane County; marsh area, 1,300 acres; cost \$14,000; D. P. Devine—H. S. Pomeroy, Edgerton; Wm. Le Fay, Stoughton.

AVON—Rock County; 3,200 acres; \$18,360; C. H. Stordack, Durand; Ill.; Leroy Stokes, Beloit, R. F. D. 25.

BADFISH—Dane County; 1,000 acres; \$11,000; Andrew Madsen—Clarence Hanan—Sheldon Tusler, Oregon.

*BASS CREEK—Rock County; 3,300 acres; \$31,000; S. J. Strang—Michael Mulcahy, Footville; Ole P. Gaarder, Orfordville.

- ✓ BEAVER—Jackson and Juneau Counties; 34,000 acres; \$160,000; W. S. Braddock—George Marvin—F. J. Hoffman, Mather.
- *BELGIUM AND HOLLAND—Ozaukee and Sheboygan Counties; 650 acres; \$9,750; C. F. Leins, West Bend; L. G. Kiecker, Thiensville.
- BLAEN•Y CAE—Dodge, Columbia and Green Lake Counties; 2,000 acres; \$14,000; Ezra J. Hughes—F. J. Lee—Al. Bradley, Randolph.
- *BROUGHTON—Green County; 1,000 acres; \$15,000; J. P. Smiley, Orfordville; E. A. Ross—W. H. Fleek, Brodhead.
- CENTER—Outagamie County; 2,500 acres; \$18,000; Frank Kohl—Andrew Gehring, Appleton, R. 3; T. H. Ryan, Appleton.
- CENTER—Rock County; 3,000 acres; \$20,000; R. E. Horne—Warren Andrew—Eli Crall, Evansville.
- CENTER No. 2—Outagamie County; 500 acres; \$4,500; Wm. Differding—Wm. Temm—Louis Hahn, Appleton.
- *CLARK COUNTY—Clark County; 30,000 acres; ditches primarily for drainage of highways; \$75,000; James A. Phillips—C. S. Stockwell, Neillsville; A. D. Merrill, Merrillan.
- ✓ *CRANBERRY CREEK—Juneau and Wood Counties; 19,175 acres; \$59,000 completed; \$76,000 more contemplated; Anton Brost—W. H. Bowden, Babcock; Ole Norsby, Miner.
- ✓ *CUTLER—Juneau County; 21,000 acres; \$104,500; 50 miles of ditch; Nye Jordan—Willard Temple, Mauston; F. J. De Lap, Cutler.
- DANCY—Marathon, Wood and Portage Counties; 33,000 acres; \$288,000 completed; Geo. Knoller, Dancy; H. M. Jones, Auburndale; T. H. Hanna, Stevens Point.
- DANDY CREEK—Jackson and Monroe Counties; 35,000 acres; \$120,000; C. P. Meltesen, Shennington; A. B. Larsen, Nels E. Olson, Tomah.
- DECATUR—Green County; 1,900 acres; \$13,000; A. P. Pierce—Edward McNair—James Oliver, Brodhead.
- DEER CREEK—Outagamie County; 3,200 acres; 18,000; J. J. Sherman—Wm. Peters—Wm. Conlon, Appleton.
- DOOR CREEK—Dane County; 3,000 acres; final plans not made; G. E. Brown, Madison; J. C. Olson—John Galvin, Cottage Grove.

- *FREEDOM—Outagamie County; 3,400 acres; final plans not made; Thos. Flannagan, Appleton; John J. McDaniels, Kaukauna, R. 12; Joseph Jaeger, Kaukauna, R. 11.
- GERMANTOWN—JACKSON—Washington County; 2,000 acres; \$14,000; C. L. Leins, West Bend; W. H. Froehlich, Jackson; John Mayer, Richfield.
- HOOSIER CREEK—Racine and Kenosha Counties; 8,000 acres; \$45,000; James L. English, Waterford; Chas. Choak, Kansasville; Wm. E. Tucker, Union Grove.
- *JUNEAU COUNTY—Juneau County; 14,440 acres; \$36,000; Lester Dunn; Mauston; Frank Bullis, New Lisbon.
- KERT CREEK—Wood County; 10,000 acres; \$116,500; Anton Brost—W. H. Bowden—D. P. Gallagher, Babcock.
- KOSHKONONG AND MUD CREEK—Dane County; 5,000 acres; \$37,000; G. E. Brown, Madison; Nels Holman, Deerfield; Julius Cooper, Lake Mills.
- LARSEN—Winnebago County; 2,700 acres; \$14,000; Fred Brooks—Thomas Grundy, Oshkosh; Major Ashby, Winneconne.
- LEMONWEIR—Monroe County; 12,000 acres; \$25,000; W. G. Wallace, Oakdale; Chris. Wagonsen, Camp Douglas; H. J. Vinz, Tomah.
- LEOLA—Adams and Waushara Counties; 15,000 acres; \$121,000 C. H. Pratt—Wm. Smith—Alfred Walker, Plainfield.
- LESSOR—Shawano County; 1,800 acres; \$15,000; J. W. Frazer, Rose Lawn.
- LIBERTY—Outagamie County; 5,000 acres; 20 miles of ditch; \$——; Giles H. Putnam—Joseph Reed—L. Van Strattan, New London.
- *LITTLE YELLOW—Juneau County; 55,000 acres; \$300,000 completed; \$120,000 in progress; 120 miles of ditch; Geo. A. McDowell, Sprague; A. C. Willard—P. C. Frederickson, Necedah.
- MARINETTE No. 1—Marinette County; 3,600 acres; \$18,000; W. C. Campbell—J. M. Andrew—Ralph Skidmore, Marinette.
- MEDINA—Dane County; 1,000 acres; \$10,700; J. H. Auby, Madison; W. H. Tasker, Marshall; A. C. Lindas, Deerfield.

- MILLERD—Waupaca County; 900 acres; \$9,000; Louis Klem—John Mullarky—E. H. Tesch, Welcome, R. F. D., No. 40.
- *MOUNT PLEASANT AND SOMERS—Racine and Kenosha Counties; 4,500 acres; \$15,000 completed; \$18,500 more contemplated; A. J. Piper—De Grove Bull—Henry W. Lewis, Racine.
- NINE SPRINGS—Dane County; 1,400 acres; \$13,500; G. E. Brown—G. E. Bryant, Madison; Sheldon Tussler, Oregon.
- *NORWAY AND DOVER—Racine County; 17,000 acres; \$80,000; Completed; \$50,000 contemplated; John F. Moyle, Union Grove; J. H. Kamper, Franksville; A. R. Hulbert, Burlington, R. 22.
- *OCONTO NO. 1—Oconto County; 1,500 acres; \$15,000; Alfred Rocque, Lena; G. R. Hall—T. F. Reynolds, Oconto.
- ✓ ORANGE—Juneau County; 8,500 acres; \$25,500; Chas. Warner—Chris. Mortensen, Camp Douglas; Robert Hanson, New Lisbon.
- PORTAGE COUNTY—Portage County; 56,000 acres; \$265,000 completed; D. H. Pratt, Plainfield; W. B. Coddington, Plover; Wm. Gaulke, Grand Rapids.
- RATTLESNAKE—Dane County; 2,525 acres; \$18,900; John Auby, Madison; M. Lindas, Deerfield; H. G. Clark, Cottage Grove.
- RATTLESNAKE ADDITION, No. 1—Dane County; 1,500 acres; \$17,000; same commissioners as Rattlesnake district.
- REMINGTON—Jackson and Wood Counties; 42,000 acres, \$121,000; Anton Brost—W. H. Bolen—J. Q. Daniels, Babcock.
- *RICHARESON—Polk County; 600 acres; \$7,500; J. M. Hulbert—J. P. Marx, Richardson; Geo. F. Clark., Dresser Jr.
- ROCKLAND—Manitowoc County; 2,000 acres; \$15,000; W. C. Maertz—M. H. O'Dea, Reedville.
- *ROOT RIVER—Racine and Kenosha Counties; 14,000 acres; \$70,000; final plans not made; Henry Pfeiffer, Union Grove; Geo. Beaumont, Kansasville; James L. English, Waterford.
- RUTLAND—Dane County; 3,000 acres; \$3,000; G. E. Brown, Madison; D. P. Devine, Edgerton.
- SHEPARD—Dane County; 4,000 acres \$27,700; W. H. Tasker—Frank Lazars, Marshall; F. G. Scherneck, Sun Prairie.

- STARKWEATHER—Dane County; 3,000 acres; \$30,500; G. E. Brown—Geo. C. Riley—A. K. Reindahl, Madison.
- STOKES—Green County; 1,500 acres; \$8,000; Ed Ross—Lee Bright, Brodhead; Ole P. Gaarder, Orfordville.
- THREE LAKES—Oneida County; 4,000 acres; \$30,000; C. G. Kuney—H. N. Aldrich—Ray Parette, Three Lakes.
- TREMPEALEAU—Thempealeau County; 6,500 acres; \$75,000; Wm. Merwin, Trempealeau; Henry Roettiger, Fountain City; Ben Davis, Galesville.
- *TROY—Walworth County; 4,000 acres; \$40,000; C. H. Nott—Geo. B. Cain, Elkhorn; Walter E. Babcock, Honey Creek.
- TURTLE CREEK—Walworth County; 3,300 acres; \$47,000; H. D. Barnes;—Charles Dunlap, Elkhorn; John Meadows, Lyons.
- UNION—Rock County; 1,175 acres; \$9,550; F. M. Ames—Walter Crocker—Gilbert Amidon, Brooklyn.
- *WILLOW VALLEY—Waupaca County; 1,680 acres; \$5,360; O. R. Schwantes—Albert Kuschel—Geo. W. Schlimke, Clintonville, R. 2.
- *WOOD COUNTY—Wood County; 5,000 acres; \$35,000; B. G. Chandos—Chas. Bender, Grand Rapids—H. H. Helke, Nekoosa.
- YORKVILLE AND RAYMOND—Racine County; 4,250 acres; \$49,000 completed; \$5,000 contemplated; A. A. Fritchen—Hans Kastensen, Franksville; A. P. Nelson, Union Grove.

These are the fifty-seven drainage districts in Wisconsin of which records are available. They embrace about 520,000 acres and represent an expenditure of nearly \$3,200,000.

Twenty-six districts with a total expenditure of \$1,165,000 average in classified expenditures as follows:

| | |
|----------------------|-------------|
| Construction ----- | 86 per cent |
| Engineering ----- | 4 per cent |
| Administration ----- | 10 per cent |

The other thirty-one districts have not reported their classified expenditures.

There are about 40 districts representing about 50,000 acres and expenditures of about \$500,000 for which petitions have been

prepared but where the organization is pending, according to records of the college of agriculture.

Six new districts have perfected their organization since our last report: LESSOR, CLARK COUNTY, GERMANTOWN-JACKSON, OCONTO No. 1, RICHARDSON and RUTLAND. The AVON and LIBERTY districts are old districts, but they failed to report in time to be recorded in the last publication. The LIMA district listed in the last report has been disorganized because many of the landowners withdrew their names from the petition.

No record is available of the area that has been improved under the town ditch law. It is probably between 100,000 and 200,000 acres.

EXAMPLES OF BENEFITS

LITTLE YELLOW—Mr. E. A. Witte averaged 600 bushels of onions per acre on 21 acres of peat land with a sandy subsoil. This was a larger acreage but a smaller crop per acre than he had raised for the three years previous. He applied 600 pounds per acre of a commercial fertilizer containing 2 per cent nitrogen, 8 per cent phosphoric acid and 10 per cent potash. It cost about \$7.50 per acre for fertilizer. Mr. Witte's son has grown onions in the famous South Bend onion country in Indiana, and feels that Juneau County is second to none.

The ditches in this district have been deepened recently and the sandy subsoil renders tile drainage unnecessary in many places. Mr. Witte writes, May 9, 1916: "We have 45 acres of oats and 18 acres of barley all up in fine shape in the drained marsh. We begin planting corn today. Farmers outside of the drainage district have not been able to sow their small grain yet."

Commissioners of several drainage districts have written as follows:

BADFISH. Thirteen carloads of tile have been laid. Good corn on tiled ground. Last year frost killed the corn.

CENTER No. 2. One carload of tile laid. Land that was worthless is now worth \$50 an acre without tile.

CUTLER. No crops matured in 1915 due to frost. Nels Olson bought 120 acres of August Lambrecht for \$20 an acre and Olson

is to pay the drainage tax. This transfer is between two local owners and the community generally feels that Olson got a bargain. Before the ditches were dredged this land was considered worth about \$3 an acre and that for speculative purposes only. Frank De Lap offered his farm, high land, low land and buildings, three years ago for \$10 an acre. Today he holds it at \$40 an acre. Some lands have been sold for \$50 an acre.



FIGURE 22.—ONIONS IN A JUNEAU COUNTY DRAINAGE DISTRICT.

Drained marsh soils raise good onions. If you want to know how to grow onions on drained muck, write to E. A. Witte, Sprague, Wis.

LEOLA. When the district was organized W. B. Angelo and C. H. Pratt bought several thousand acres at from \$3 to \$5 an acre. A few farms with open ditch drainage ready to break have been sold for \$40 an acre, but \$25 is the average price.

NORWAY AND DOVER. About 100 carloads of tile have been laid. About 5,000 acres have been plowed and raised corn that could not have been plowed without the drainage. The land is worth 150 dollars an acre, and sells for that to local people.

PORTAGE COUNTY. About 16,000 acres that were formerly marsh have been plowed and cropped. The sandy subsoil affords some underdrainage into the outlet ditches, but not enough. About 10 carloads of tile have been laid, and more is being laid.

Land that formerly raised one ton of wild hay per acre now raises two to three tons per acre of tame hay; 250 bushels of potatoes; and 75 bushels of oats per acre.

Assessed valuation before drainage was \$1.50 per acre. Now it is \$19 per acre.

Sale values were from \$1.50 to \$5 an acre before drainage. Now they are from \$18 to \$35 an acre.

ROCKLAND. No benefits yet, but they expect great benefits as soon as lines of small tile have been laid. First carload of tile is being laid now.

LEMONWEIR—In 1915 Chas. Rabe harvested 25 bushels of good wheat per acre from 4 acres of marsh land. He has also filled at 12 foot by 27 foot silo with corn from 3 acres of land.

W. G. Wallace tiled 10 acres of marsh two years ago into one of the outlet ditches of the drainage district. In spite of the outlet ditches the land had remained too wet for anything but poor pasture. The first crop after tiling was corn and 3 acres filled a silo 14 feet by 31 feet. The next year it produced 25 bushels of rye per acre and after the rye was harvested the timothy and clover grew until two good loads per acre of hay were cut in the early fall.

Mr. Guthrie has filled a 15 foot by 25 foot silo with the corn on $3\frac{1}{2}$ acres of drained marsh land that grew only wild hay before drainage. He has planted corn there for four years now and has obtained a good crop every year.

PROFITS ON MARSH LAND.

G. A. SUTHERLAND
Stevens Point, Wisconsin.

As far back as I can remember my father owned 80 acres of marsh land about six miles from the farm on which we lived. The description of the eighty was the S. E. $\frac{1}{4}$ S. E. $\frac{1}{4}$ Section 10 and the N. W. $\frac{1}{4}$ N. E. $\frac{1}{4}$ Section 15, Town 23, Range 8 East. The soil is muck from 6 inches to 3 feet deep, lying on sand. It was too wet to mow with oxen, so for years we cut the marsh grass with a scythe and raked it by hand. We stacked the hay on the ground but had to use stumps and logs to get our stack bottoms two feet from the ground. In winter we hauled the hay away.

In 1906 this eighty was included in the Portage County Drainage District. By August 1909 the big ditch was dug and the land was very dry. A fire had been run over it and had burned six

inches deep in places, leaving it very rough. I lacked confidence in the marsh, but my brother persuaded me to buy it jointly with him for 10 dollars an acre.

We broke the forty next to the ditch that fall. I hired a man with four good horses and a disc, and he disced it till it was as fine as a garden soil. We seeded 10 acres of rye that fall and the next spring put in 10 acres of wheat and 20 acres of oats. We did all our seeding in March, but had a foot of snow after that. The oats, rye and wheat went 90, 35 and 30 bushels to the acre, respectively. It was the best grain I ever harvested.

We cleared and broke the second forty from 5 to 10 acres at a time. Some of it was easy clearing but some of it was hard. I paid some cash and gave the first crop to men I hired to clear and break the land. This forty was farther from the ditch and the drainage was not very good, so I seeded it with timothy and alsike as fast as I could. However, I am going to break up 20 acres of this timothy sod next spring and put in oats. I have not put any fertilizer on this land and the open ditch gives me all the drainage I have. I wish the drainage was a little better.

I have had to hire every bit of work done on this farm, as my present business, that of restaurant keeper in the city of Stevens Point, would indicate I have had to handle it at long range. I lived 10 miles away from my land, but I knew what was going on there just the same.

I kept an itemized statement of every cent that I paid out or received from the day I began to break it. A summary of expenditures and receipts from September 1, 1909 to May 20, 1912 is as follows:

Expenditures.

| | | |
|------------------------------------|----|-------------------|
| Lodging, board and groceries | \$ | 78 79 |
| Machinery | | 84 00 |
| Men and teams for farm work | | 622 48 |
| Buildings | | 181 64 |
| Clearing and breaking | | 187 75 |
| Seed | | 119 44 |
| Taxes and Insurance | | 138 03 |
| Incidentals | | 47 75 |
| Twine and sacks | | 63 10 |
| Total expenditures | | \$1,523 18 |

Receipts.

| | |
|--|------------|
| Refund from Town of Plover | \$ 40 00 |
| Grain | 1,592 04 |
| Equipment sold | 31 85 |
| Straw | 220 00 |
| Hay | 80 00 |
| | <hr/> |
| Total receipts | \$1,963 89 |
| Excess of Receipts over Expenditures | \$ 440 71 |

These figures include all items connected with my crops for the years 1910 and 1911. The net profit of \$440.71 is what I had left after clearing and breaking the 80 acres and building a granary and a small shanty. I also had my machinery on hand.

Since 1912 my chief crop has been timothy and alsike, because that crop requires less attention. In the same careful way I have kept a record of all my receipts and expenditures and the following is the net profit for each year to date: 1912, \$360.78; 1913, \$373.74; 1914, \$330.00; and 1915, \$322.00.

It is needless to say that I feel my experiment with drained marsh land has been a success.

THE TOWN DITCH LAW

S. A. CONNELL

Attorney at Law, 301 Germania Building, Milwaukee, Wisconsin.

I have been requested to say something regarding the law governing the laying and construction of Town Ditches.

From my experience I am much pleased to observe that people are becoming so thoroughly acquainted with the value of drainage that the great majority of drainage projects are carried through successfully with very little friction by mutual consent and the courts are seldom resorted to. Within the past year I have assisted the Board of the Town of Granville, in this County, to carry out a drainage project involving assessments aggregating about \$20,000.00. The project provoked the usual discussion, often heated, and some "kicking" regarding dam-

ages and benefits, but the Board, with the assistance of Professor Jones and Mr. Webster, the engineer, soon convinced those interested that they intended to be fair, that they had worked out a system to guide them in making the assessments that would be applied to all, and there would be no discrimination. The result was that no legal obstacles were interposed and the assessments have all been paid, excepting one, and in that case it is only the question as to who should pay it. Every one interested now seems not only satisfied but pleased, although some of the assessments were very heavy. Joseph Siegert, owning 80 acres of land, only a part of which was benefited, paid an assessment of \$1,410.90. If you want to organize a drainage "booster club" don't fail to make him a charter member.

My experience in ditching matters has been so pleasant that I sometimes unconsciously feel that laws are not needed; that all the people need is education in drainage matters and they will do the rest. However, we must have laws. In every community you will find the fellow who refuses to be educated, who will not cooperate with his neighbors and stands in the way of progress and reform. Preparedness to compel generally makes it unnecessary to do so.

That branch of the law, known as common law, as distinguished from statutory law, provides no means for constructing ditches and defraying the expense by taxation. The law on that subject is wholly statutory. Courts must construe the statutes strictly and have no power to supply any substantial provision that is lacking but essential to complete the chain of procedure. Equitable principles and rules cannot be invoked. It is never a question of what is just and equitable, it is always a question of what the statute means when strictly construed and whether or not there is a statute covering the question under consideration. Statutes loosely drawn, or inadequate to meet the desired end, are always a fruitful source of litigation. Drainage is such an important matter that it should not be discouraged by fear of litigation or by want of ample legal means of execution.

The method of instituting the proceeding as the law now stands is quite simple and satisfactory. But I do not consider the recent amendment dispensing with the necessity of an estimate of the cost of construction and of the benefits to be derived an

improvement, especially when applied to larger projects. As the law stands now, the Town Board, at the first meeting, is called upon to decide upon the advisability of laying out and constructing the ditch without having before it any careful estimate of the cost or of the benefit to be derived. Either the College of Agriculture should furnish this information, or the Town Board, with the aid of the engineer, should be required to make its investigation before the first meeting so as to be able to pass intelligently upon the question of whether the ditch should be laid or not, as the cost and the benefits are really the deciding factors on that question.

The law governing the method of assessing benefits and collecting assessments, is loose, and loose practise has grown up under it. It provides that the benefits shall be assessed and be a lien against the lands benefited. Under this provision it is not always easy to decide just what land is benefited. It is not uncommon to find that in describing the land benefited it is the practise to say, for instance, "Five acres in the N. E. $\frac{1}{4}$ of the N. W. $\frac{1}{4}$ of Section 8." That is no description at all, and would not support the tax deed. If a part only of an entire tract owned by one person, described according to government subdivision or by metes and bounds is benefited, in my judgment, the whole should be assessed by its proper description as the land to be benefited. Upon inquiry made of Mr. Vaughn, I was informed that some of the courts of this state have placed that construction on the law as it now exists. Nevertheless, it will do no harm to make the law more definite and certain. It at least would have the effect of making the practise under it more definite and certain.

The present statutes do not require notice of the assessment to be given. I think this is a mistake and some day may give rise to litigation. The Board should sit as a board of review as in other matters of taxation, and notice should be given to those to be assessed of the time when and place where they will sit. The law should also be made plainer as to whether or not the assessments can be collected out of the personal property belonging to the owner of the land assessed. Our Supreme Court has held as to general taxes levied against real estate, that they may be collected out of personal property owned by the person

against whom the tax is levied. The court arrived at this conclusion after construing several statutes together. Many of these statutory provisions do not exist in the drainage law and I doubt whether the court would construe the law as it now stands as giving the right to collect the drainage assessments out of personal property. If this right were given it would expedite the matter of the collection of assessments very much.

Another very important matter is that of the number of assessments that can be made. At the present time the Town Board is limited to one assessment to cover the original cost and subsequent assessment for repairs. If the original cost exceeds the original assessment it is doubtful whether another assessment can be made. The law should be amended so as to give that right. The power of the Town Board should not be limited so strictly. This is especially true because, as we have seen, the Town Board has no authority excepting such as may be given to it by statute.

The question that has given me the most concern is that of the nature of a Town Ditch Project. Our Supreme Court has decided that the Town Board are only administrative officers when acting in laying out and constructing a town ditch, that they cannot bind the Town in any way. The Town is no party to the procedure whatever. The duties and powers of the Town Board are defined and limited and they cannot be compelled to exceed the powers given them. Suppose, for instance, a contractor having a contract for the construction of a ditch meets with some condition unforeseen, or suppose some misunderstanding arises, by which the contractor suffers loss for which he believes himself entitled to compensation, against whom can he proceed? Not against the Town, not against the Town Board, and not against the owners of the benefited lands. He may proceed against the Town Board to compel them as administrative officers to do what they are authorized by statute to do, but he could not proceed against them to compel them to exercise a power that is not specifically conferred upon them by statute. We have a situation where there is neither an individual or a corporation against whom one interested in a ditch project may proceed to redress a wrong or enforce a right. This creates a situation that is too loose and ethereal to be businesslike. It has occurred to me that it would be wise to require the district to be drained, even under

the Town law, to be formed into a corporation with such corporate powers as might be necessary to carry out the object of its existence. The town officers could still remain the administrative officers and all responsibility could be charged back where it belongs on the persons or lands benefited. In that way we would have something tangible. It has also occurred to me in looking at it from a still broader view, and I think the matter should receive serious consideration, that it would be advisable that all drainage matters, Town, County and Drainage District, should be placed under one jurisdiction and be governed by the same provisions. This jurisdiction could be conferred upon the County Court, which is always in session, and is near to the people, or it could be conferred upon certain of the County officers designated as a drainage commissioner, or upon an independent body of experts elected or chosen as a drainage commission.

I have given in a more or less rambling way some of my impressions in regard to the Town Ditch law. If I have made any suggestion that will contribute to the betterment of the Town Ditch laws, or to the encouragement of drainage projects, I feel that my time has been well spent.

Mr. Vaughan: I have been accorded the privilege of examining the foregoing article of Hon. S. A. Connell on the "Town Drainage Law" and with most of it I heartily agree. The law is general in its provisions. The trouble with attempting to make it specific, that is attempting to cover *in detail* all possible questions that may arise, is (1) that such a law would be so long that it would scare the average board of supervisors out of acting under it at all for they would decide against the drainage rather than run the risk of making mistakes in carrying the proceeding through; and (2) if one were to attempt to enumerate in detail the specific powers of the board of supervisors he would be apt to omit some essential power in his enumeration and thus be in trouble under the legal maxim, *expressio unius exclusio alterius est*, which may be roughly translated as, the specific mention of one thing or power excludes all others not mentioned.

Most of Mr. Connell's objections to the present town drainage law are well taken. Some of them are inherent in the situation. He says, "It is not always easy to decide just what lands are benefited."

Now benefits are questions of fact, and in deciding them the supervisor should determine what lands will be increased in value by the drainage and the amount of that increase. If the law said that only the lands touched by the ditch should be assessed that would be unjust, as in fact a tract not touched by the ditch may be more benefited than a tract through which the ditch runs.

I doubt the advisability of making the drainage tax collectible out of personal property and I also doubt the possibility of getting such a provision through the legislature. In order to get the drainage district law through the legislature in 1905 (see par. 2 of Sec. 1379-24 Statutes of 1915) it was necessary to provide that personal property be not subject to seizure for the drainage tax.

It is said that, if the original cost exceeds the original assessment it is doubtful whether another assessment can be made. Section 1363 provides that the supervisors shall assess such benefits against the benefited lands as in their opinion such lands will receive from such constructed ditch - - - whether the land is touched by the ditch or not. Then it provides for an assessment of the cost of construction (less what the town pays for road benefits) in proportion to the benefits assessed. To illustrate let me take the first three lines from the schedule of an actual assessment made by supervisors.

| Name of Owner | Description | Benefits | Assessed |
|----------------|--------------|-----------------|-------------------|
| | | <i>assessed</i> | <i>for Const.</i> |
| William Winter | NE NW Sec. 3 | \$ 450.00 | \$ 72.00 |
| William Winter | NW NW Sec. 3 | \$1000.00 | \$160.00 |
| John Monski | SE NE Sec. 3 | \$ 234.00 | \$ 37.44 |

Now if the "original cost" referred to by Mr. Connell exceeds the *benefits assessed*, certainly the supervisors are powerless to assess more. But if the "original cost" *exceeds the first assessment for construction* but falls below the *benefits assessed* the supervisors should have the right to assess enough more (not altogether exceeding the assessed benefits) to complete the work. The original draft of the bill that became our present town drainage law contained at the end of section 1363 the following, "If the first assessment for construction is not sufficient to complete

the work the supervisors may make other assessments sufficient to complete that work, but not exceeding in all the benefits assessed." That and two or three other provisions were "lost in the shuffle" between the time that the original bill was dictated to the stenographer and its passage by the legislature.

It is said that "it would be advisable that all drainage matters, Town, County and Drainage District, should be placed under one jurisdiction and be governed by the same provisions, and that they should all be under the jurisdiction of the County Court."

This I believe to be undesirable for several reasons:—

1. Drainage Districts are often partly in several counties.
2. I am sorry to say County Courts are often of small caliber and controlled to a considerable extent by local politics, that is they have their "political friends."
3. A law well adapted to handling small drainage propositions cheaply and quickly would be wholly inadequate in the case of large drainage projects.

These matter have been threshed out heretofore in this and other states. I have had occasion to examine the most of the drainage statutes in the United States, and I do not know of any state having extensive marshes and also small marsh areas that has not separate laws under which to handle their drainage.

I do not believe that town supervisors are an ideal body to handle even small drainage propositions.

I would like to see some more permanent body. I suggested to one of the committees of the legislature in 1915 that they put town drainage into the lands of the County Highway Commissioner and two other commissioners, one of whom should be a man experienced in drainage, both to be appointed by the circuit court, they to constitute a permanent drainage commission to be paid by the county. I still think that some such commission would be much preferable to town supervisors. Supervisors are only too often influenced by local politics, sometimes complete tools of local cliques.

I hope to see the Town Drainage Law improved in several respects at the next session of our legislature.

DECISION BY SUPREME COURT.

CASE OF WARD VS. BABCOCK.

The Troy Drainage District through its attorneys, A. E. Matheson of Janesville, and P. J. Myers of Racine, appealed to the supreme court from decisions of the circuit judge on several points. The following is the ruling of the supreme court on the points in controversy:

“The respondent contends that this appeal cannot be taken until after approval and confirmation of the modified report. The statute is somewhat obscure but the more accurate interpretation appears to be that approval and confirmation of the modified report do not precede an appeal to the supreme court by that such approval and confirmation will follow the modification of the report by the commissioners unless within thirty days an appeal be taken to the supreme court and in that case there shall be no approval or confirmation until after the appeal is disposed of. This seems the more reasonable interpretation because no good purpose could be subserved by requiring the report, before it is finally decided on appeal, to be rewritten and then compel the losing party to obtain an order of confirmation of said report so rewritten before the appeal to the supreme court from the final command to modify the same given by the circuit court in the special proceeding consisting of the trial of the remonstrances. This construction is confirmed by Sec. 1379—20m specifying when the confirmation should be made by the circuit court and enumerating certain past things, among them a remonstrance heard and determined and no appeal taken therefrom. This appeal taken after the trial last mentioned and the entry of the final order on such trial and before the commissioners rewrote their report to conform to the modification there ordered and before said rewritten report was approved or confirmed must be held to have been taken in time.

“The appellants complain of a mistrial of the issues framed pursuant to sec. 1379—20 and point out as the result of the alleged mistrial that the assessment district contains 4040.82 acres, the number of parcels of land assessed for benefits is 176 of which

the respondent Ward owned 8. The total estimated cost of construction is 61,476.99 dollars the total benefits assessed to the several parcels of land constituting the drainage district are 142,802.36 dollars. The benefits assessed to the 8 tracts of Mr. Ward by the commissioners was 7,438.76 dollars. The cost of construction is only about 42 per cent. of the benefits assessed. This assessment of benefits on the lands of respondent was reduced by the verdict from 7,438.76 dollars to 1,337.00 dollars and forty-two per cent of this latter sum would make out respondent's share of the cost of construction, assuming the cost equal to the estimate to be 561.54 dollars as against 3,124.25, which would follow the finding of the commissioners. This was quite an extraordinary cut in the respondent's assessment of benefits and must require a corresponding increase in the assessment of other members of the drainage district or defeat the drainage project by a showing that the cost of construction would exceed the benefits to be derived from such construction.

“Keeping in mind that a public purpose is essential to support all taxation and that in addition to this a benefit at least equal to the amount of his tax must accrue to the owner of property before he can be charged with a special assessment in these proceedings, we can better understand the nature of the statute which requires that the whole cost of construction to be found, and the total benefits accruing to each parcel of land affected and which also provides that in case the cost exceeds these benefits no drainage district shall be established. The establishment of a drainage district properly made by the court, therefor, conclusively establishes that all the lands included will be benefited to the amount found and adjudicated and that this benefit exceeds the cost of construction. It is not contemplated that assessments should be collected up to the amount of the benefits derived except where absolutely necessary to complete the public improvement. The order creating the district is final and conclusive on the propositions that the proposed drainage district is a public improvement, that the public welfare and health will be advanced by its creation, and that it is established under the law as a drainage district. In the establishment of this district and in the ascertainment of cost of construction and the amount of benefits, the circuit court exercised an equitable jurisdiction over the proceeding.

The statute requires that the damages to the land caused by the construction of the improvement and the benefits flowing from such construction are questions which may be tried before a jury. But after the district is established or where no objection is made to the establishment of the district, the ascertainment of damages and benefits must be on the hypothesis that the total benefits are as reported and that the total cost of construction is as reported. The learned circuit judge excluded testimony offered by the commissioners tending to explain the difference between the assessments for construction and the assessment of benefits and refused an instruction requested to the effect that the assessment of benefits upon which the jury was required to pass, constituted the basis upon which the assessment for cost of construction should be apportioned and in no manner indicated the amount which the respondent might be required to pay toward such cost of construction. Instead of that he instructed the jury as follows: "These questions must be determined entirely apart from and uninfluenced by the matter of cost of construction of the proposed drains and ditches, which is not for consideration in this case whatever."

"We think these rulings were erroneous and probably accounted for the remarkable difference in the estimate of benefits by the commissioners and by the jurors. In reviewing the judgment of the commissioners as to the amount of benefits, the jury should have before it as near as possible all the data upon which the commissioners acted. An expensive, well constructed system of drainage backed by ample resources for its construction and up-keep might confer greater benefits on adjacent lands than one not so complete. Besides benefits in such cases, like values may be proven not only by opinion, but by relevant instances. If other tracts of land bore the same or substantially the same relation to this public improvement as did the lands of the respondent, the benefits assessed to the former lands and acquiesced in by the owners thereof, would have some probative force on the inquiry. In condemnation proceedings when we seek to ascertain the market value of land taken, proof of the price at which other similar tracts were sold within a reasonable time prior to the taking is considered competent.

"We are also of opinion that the court erred in its instruc-

tions relative to general benefits. There was no such question in controversy. The inquiry was how much were these lands benefited by the construction of the drains in question. To say to the jury that they were not to consider any general benefits caused by the proposed ditches and drains but only to take into consideration and assess upon the lands of the remonstrant such actual special benefits, if any, as they might find from the evidence, were caused to the land of remonstrant, had a tendency to suggest to the jury that the lands in question must have received special benefits over and above all other lands in the drainage district. To say to the jury that general benefits are such benefits as the owner of the land in question enjoys in common with the public at large and special benefits are such direct and actual benefits as are received exclusively by the land in question and not by the public or lands generally, is inappropriate to the question before the jury. The public or lands generally at an earlier stage of the proceeding were excluded from consideration and to interpose this question and lay it before the jury at the trial had a tendency to mislead. We are of the opinion that the court erred in rejecting the evidence offered by the commission as to the cost of underdraining Ward's lands to connect with the completed drains of the district and in giving the instructions on this subject. The court instructed the jury: 'Whether Mr. Ward shall connect with the proposed drainage system by his own underdrainage is entirely for him to say - - - There has been some evidence of a plan of internal drainage which might be used by remonstrant in draining or improving his lands. - - - But in assessing benefits you should not take into consideration any increase in market value, if any, which would be caused by any drains so put in by remonstrant, for that would be the result of the expenditure of his own money, - - -' The question of the cost to remonstrant in adopting a system of internal drainage by underdraining his land in connection with the general drains of the district is material in ascertaining what the amount of the benefits, if any, would be to remonstrant. If underdrainage is necessary to obtain beneficial results from the drainage scheme, then the cost thereof is relevant and a material item in ascertaining whether the land owner has any benefits above his damage. Such cost is an item of expense to the land owner to secure the

beneficial result from the drainage system and has evidential value in determining the question of benefits. The evidence was improperly excluded from the case.

“The court gave the following instruction: ‘Benefits are determined by the difference in fair market value of the lands in question June 25th, 1913, without the proposed drainage system, and with it completed, without regard to cost of construction of the general system, cost to the remonstrant of connecting therewith, if he chooses so to do, or damages, if any, resulting to remonstrant by reason of the construction of the proposed drainage system in and upon his lands.’

Generally speaking the error of the circuit court seems to have been in regarding the distinction between general and special benefits, sometimes highly proper, as applicable to the questions before the jury on this special proceeding and in considering that benefits could only be estimated or arrived at by the very narrow and technical process of considering only evidence bearing directly upon the point when he should have thrown open the case for the widest investigation based on all data available to the commissioners in fixing the amount of benefits.”

THE TRIAL OF BENEFITS BY THE COURT WITHOUT A JURY*

I now desire to discuss briefly the change in the manner of trying appeals from assessments of benefits by the court without a jury.

Two questions probably present themselves to your mind, (1) Would such change promote justice in the assessments? (2) Would it be constitutional to take the assessments of benefits from the jury.

First. If the amounts paid by the various lands in the district are to be proportional and just the benefits must be proportional because the assessments for construction are apportioned upon the benefits. Anything that renders the benefits assessed against any lands, disproportionate to the actual benefits that the lands

*Brief by B. M. Vaughan before the Committee on Judiciary of the 1915 Legislature.

will receive from the drainage, at the same time renders the general assessment of the district unjust.

Drainage districts usually contain anywhere from 100 to 1,000 separate descriptions of land that must be assessed benefits. To assess these lands justly, requires much thought in adopting the standards for the assessment and much care in applying those standards to the different tracts. The commissioners, if they do their duty, must go upon every tract in the district and examine it as to soil, subsoil, location with reference to source of water, drains, distance from markets and all other facts that bear on its present value and will bear on its ultimate value after drained and must compare all lands in the district with reference to these facts. To do that justly requires much time and care, and careful comparison of the different tracts. This is an impossibility for a jury in a trial. If they go on the land at all, they usually spend but a few minutes to each forty that they go upon, walking across it once perhaps, and they cannot intelligently compare it with the rest of the district because much of the district they do not see. They usually have no standards in mind on which they can estimate the value of the land after drained and not enough facts before them to enable them to adopt any such standards. If oral evidence is presented to the jury, in proof of what will be the benefits, several days are often required on one trial, and the jury is wholly unable to carry, sift and digest the evidence and adopt standards or apply standards adopted by the commissioners.

Often several land owners contest assessments and the result is several independent jury trials. No two juries use the same standards in measuring benefits and the result is, that as between the contesting lands, the benefits usually are far out of proportion, and as between the contesting lands and the other lands in the district, the disproportion is even greater.

The jury often pays practically no attention to testimony. An illustration occurred in the trial of a benefit issue in the Wood County Drainage District. Six witnesses who were familiar with the forty and had farmed such land, both before and after drained, put the benefits at \$18.00 to \$20.00 per acre. One witness who had never farmed such lands and had never seen this forty but once and then had only driven along a road on one side

of it, swore that he did not think it would be benefited. The owner of the land did not even come to the court room on the trial, and no other evidence bearing on benefits was presented, and the jury did not see the forty. The jury found "no benefits."

One jurymen, who had just been discharged from trying a drainage benefit issue, when the jury had not seen the lands, was asked what evidence there was to sustain the verdict. He frankly said "none" and further said: "You couldn't have piled up evidence enough to make us put benefits on that land when the owner didn't want the drain." Another juror on another trial said: "I never have and never will find for a corporation against a farmer."

In the Kert Creek Drainage District the jury found "no benefits" and \$1,700.00 damage against a fraction less than 60 acres of land, and the owner of the land within two years thereafter admitted that the tract had been benefited by the drainage more than \$2,500.

Five forties lying together and on the same drain and as near alike in all respects as five forties of land could well be, were, by different juries at the same term of court assessed as follows: Forties No. 1, 2 and 3 benefits of \$1,100.00, \$5,500.00 and \$2,632.60 respectively; and forties No. 4 and 5 were each awarded heavy damages, although there was no evidence of damages other than the taking of one half of a ditch right of way. Six intelligent witnesses, who knew the lands, and had worked similar lands in their vicinity testified that each of the five forties would be benefited equally and places such benefits at \$18.00 to \$22.00 per acre. Three witnesses in each case testified that there would be no benefits and placed the damages at the amount awarded by the jury to the two forties. The testimony bearing on benefits and damages was almost word for word the same in the three trials, and the three juries varied in the benefits from \$2,632.20 per forty to nothing per forty.

One circuit judge, who has presided at the trial of contests on benefits assessed on nearly 100 tracts of land in drainage district, stated in my presence, that juries had no standards on which to base their judgment in those matters, and that scarcely

any two verdicts in the whole number rendered before him were proportional to the benefits assessed in the rest of the district.

The circuit judge who presided at the trial of a considerable number of contests in the matter of the Cutler Drainage District, when a motion was made by the commissioners to cut down the whole assessment of benefits in the district so that they would be as near proportional as possible to the average of the juries' verdicts, in his opinion refused to grant the motion because the assessments of benefits should be the actual benefits. But in his opinion he said "The injustice of allowing certain land owners to get off by paying about one fifth of what is an equitable share of the taxes is fully appreciated."

It is a notorious fact that jury verdicts, where benefits are concerned are almost invariably compromises, and on those compromises one or two stubborn jurors often "swing the jury." I have been connected with contests over benefits on 78 tracts of land personally examined by me, and on but one of those tracts was the jury's assessment of benefits proportional to the benefits assessed and confirmed against the lands of the rest of the district in which they were located. There is no more reason for assessing benefits against lands in drainage proceedings by jury than there is for assessing property for the general state, county, town and school tax by jury. A court can take more time, can determine whether the commissioners' assessments are just, and if unjust can correct such as are unjust.

It may be said that the benefits assessed by the commissioners against all lands in the district are sometimes too high, and that thereby the lands are liable to be confiscated. If that is true, all of the assessments should be cut down, not some particular one. The court can make such cut as justice to the entire district requires. The jury are confined to cutting the benefits against the particular land under contest.

Drainage proceedings are essentially equitable and as an instrument to administer equity the jury is and always has been a failure.

On the constitutional question I will say that the three lawyers on the committee that drafted Bill No. 157 S (1915) spent the greater part of three days in the State Law Library examining that question, and believe that they have found all reported cases

in which that question has been decided in the U. S., and in no case found has a law providing for trial of *benefits* in special assessment proceedings, without a jury, been declared unconstitutional. Decisions raising the constitutionality of the law, where trial by jury was not provided for, sustaining law providing trial of *benefits* without a jury, are found in the following states,—Rhode Island, Indiana, Illinois, Oklahoma, Missouri and North Dakota.

Following is a brief statement of those cases and in most cases of the constitutional provision of the state on which the case turns where a constitutional provision is involved.

ILLINOIS.

Art. 2 Sec 5, Ill. Const. of 1870 is as follows: "The right of trial by jury as heretofore enjoyed shall remain inviolate * * * but the trial of civil cases before justices of the peace by a jury of less than 12 men may be authorized by law.

Art. 2 Sec. 13, Ill. Const. is as follows: "Private property shall not be taken or damaged for public use without just compensation. Such compensation when not made by the state shall be ascertained by a jury as shall be prescribed by law."

In the case of *Briggs vs. Drainage District 29, N. E. 721 (Ill.)* which was a case where the court ordered the commissioners to assess *benefits*, the question was raised whether, under either of two sections of the statute the assessments must not be made by a jury. The court on appeal held that "the assessment was made in strict conformity to the statute and unless the statute is in conflict with some provision of the constitution it must be sustained. No provision of the constitution has been pointed out in the argument which prohibits the legislature from enacting a law authorizing an assessment of this kind to be made by the commissioners and we are aware of no such provision.

"The right of trial by jury guaranteed by the constitution has no bearing on a question of this character. Nor is an assessment like the one involved, a taking or damaging of property within the meaning of that clause of the constitution which provides that 'private property shall not be taken or damaged for the public use without just compensation. Such compensation when not made by the state shall be ascertained by a jury.'"

Stack vs. People 75 N. E. 347, 217, Ill. 220, holds (and cites other cases that hold) that requiring assessments of benefits without a jury is *not* unconstitutional, but statutes requiring that an award of damages in *Illinois* be made without a jury are unconstitutional.

Trigger vs. Drainage District No. 161 N. E. 1114 (Ill.) holds that the right of trial by jury guaranteed by the constitution has no bearing on a question of this character and cites and quotes to that effect *Briggs vs. Drainage District 140* Ill—, 53. N E. 721.

INDIANA.

Ross vs. Davis et. als. 97 Ind. 79, is a drainage case. The statute of Indiana provides for the trial of the questions of fact by the court without a jury, and it was contended that such is contrary to the provision of the Indiana constitution requiring that "In all civil cases the right of trial by jury shall remain inviolate." On appeal it was held not in conflict with that provision, citing *Anderson vs. Caldwell*, 91 Ind. 451. (46 Am. R. 613.)

Anderson vs. Caldwell 91 Ind. 451 (46 Am. R. 613) is a proceeding for drainage under the Indiana Drainage law (§4273 R. S. 1881). The commissioners reported in favor of the work and assessed the benefits and damages. The act in question provides that "questions of fact shall be tried by the court without a jury" which was claimed to be in violation of Sec. 20, Art. 1 of the constitution of Indiana, which provides that "In all civil cases the right of a trial by jury shall remain inviolate." This was held on appeal to be no violation of that provision, and to be constitutional. The same holding was reaffirmed in another drainage case in Indiana. See *Indianapolis and Cumberland Gravel Road Co. vs. Christian*, 93 Ind. 360.

In the case of the *B. & O. and C. R. R. Co. vs. Keating et. als.* 122 Ind. 5, it was held that a drainage proceeding is not a common law action "but is of purely statutory origin" and the court says, "It has frequently been ruled by this court that in all such proceedings the legislature may prescribe the mode of trial and extend or withhold the right of trial by jury, at its pleasure, and that the constitutional provision to which our at-

tion has been called is only applicable to that class of common law actions wherein the right of trial by jury existed when the constitution was adopted," citing several Indiana cases.

MASSACHUSETTS.

In the case of *Esles Howe et. als. vs. City of Cambridge*, 114 Mass. 389, where the mayor and council of Cambridge were authorized to spread special assessments for side walks and curbing without a jury, and no appeal to a jury was given,—it was held that this is an exercise of the power of taxation and that this method of assessment is not repugnant to the constitutional provision guaranteeing a jury trial. But the court suggests that if the right of eminent domain was involved a jury trial might be necessary.

That case is followed and approved, as to special assessments, in the case of *Chapin vs. Worcester* 124 Mass. 464, also a sidewalk case.

OKLAHOMA.

In *Catron vs. Deep Fork Drainage District* 130 Pacific Rep. 263 (Okl.) appeal was taken from the report of viewers appointed to assess the benefits and damages in drainage proceedings. Here it was alleged by appellant *Catron* that the damages were inadequate and benefits excessive. The damages were stricken out and benefits confirmed by the board having the matter in charge. Appeal was taken by *Catron* to the supreme court, on the ground that he should have been allowed a jury trial on his appeal in the lower court on the question of benefits.

The Oklahoma statute is as follows, "Any person aggrieved may appeal from the order of the commissioners and upon such appeal there may be determined either or any of the following questions: First, Whether just compensation has been allowed for property appropriated; second, whether proper damages have been allowed for property prejudicially affected by the improvements; and Third, Whether the property for which an appeal is prayed has been assessed more than it will be benefited or more than its proportionate share of the costs of the improvements." p. 264.

The statute further says "the case (appeal) shall stand for trial and be heard and determined as other appealed cases are tried in the district court." The statute further provides that such drainage appeals "shall be determined *de novo* as other appealed cases are tried in the district court." Plaintiff Catron insisted that the issue of benefits be tried in district court by a jury.

The Oklahoma constitution Article 2, Sec. 19 provides "The right of trial by jury shall be and remain inviolate." The appellate court (p. 264 Pac. Rep.) says that this constitutional provision does not give the right of trial by jury, because the right so declared only means the right as it existed in the territory at the time of the adoption of the constitution, and was not intended to extend the right of trial by jury to the issue of the question of benefits in cases of this kind; and the court cites Page & Jones on Taxation and Assessment §272. And in sec. 272 p. 419 of 2 Page & Jones on Taxation etc., cited above, is the following: "Property owners have, as has been said before, no constitutional right to jury in determining the question of the amount and apportionment of benefits. It is therefore within the power of the legislature to provide that damages shall be assessed by a jury and benefits by drain commissioners." Citing *Ross vs. Prantee* (N. D.) 115 N. W. 833; and *Martin vs. Tyler*, 60 N. W. 392 (N. D.).

NORTH DAKOTA.

Ross vs. Prantee (N. D.) 115 N. W. R. 833, is an appeal in a drainage proceeding from a judgment fixing the benefits and damages. Under the North Dakota law *damages* had been "assessed" by the jury. The Commissioners then were about to assess the benefits caused by the drain to appellant's lands. Appellant insisted on a jury trial of the issue on benefits and was overruled. Held, on appeal, that the matter of benefits may be assessed by the commissioners and damages assessed by the jury without the constitutional right of trial by jury being violated. The court further says, in discussing the question of submitting the matter of benefits to the jury. "if the jury were to consider the benefits applicable to one owner alone, as would be necessary in a case like the one in question, it would have to know

the requirements necessary to carry off the water from the particular tract, and ascertain the size of the drain, its slope and its length, the requirements of all of the other tracts affected and many other facts which it is utterly impracticable to present to a jury, but which the board of drain commissioners and their legal assistants, some of whom must be experts, can much more easily ascertain. Of these things no jury can arrive at an intelligent and practical idea in the short time necessary to the trial of the action in court. Each parcel of land would have to be treated independently of the other tracts affected, whereas we construe the law as attempting to provide for a general scheme of benefits in which the whole territory affected and all of the elements mentioned must be taken into consideration."

In *Martin vs. Tyler* (N. D.) 60 N. W. 392, which was a drainage proceeding, and the compensation (damages) to the land owner under the state was awarded without a jury, the court (p. 399 N. W.) says, "We do not think that the manner in which compensation is ascertained under the statute is any violation of section 14 of the constitution providing for trial by jury."

So it will be seen that some states provide that even damages need not be awarded by jury, or appeal to a jury given.

MISSOURI.

In the case of the *Little Tarkio Drainage District No. 1 vs. Richardson et. als.* 139 S. R. (Mo.) 576. The court p. 582 says that the statute in the first instance gives the commissioners the right to review and pass on them in a summary manner.

A demand for jury trial of these benefits and damages on appeal was made by the land owners. The court held that the power to assess benefits is a taxing power and to assess damages is an exercise of the power of eminent domain. The court p. 582 says "When the exception to the report of the commissioners comes on for hearing before the circuit court it must discriminate between the two classes of assessments complained of. If the assessment was made under the taxing power of the state for benefits which will result to the property in consequence of the improvements then the circuit court may try the exceptions filed. But if the land owner challenges the assessment of the

cash value of the land to be taken for the right of way for the ditches and drains, or the damages that will be done thereto by reason of the improvements under the power of eminent domain, then the court must grant a jury trial when demanded by the land owners . . . under the Missouri constitution. Several Missouri cases are cited as sustaining this, among which are *Land & Stock Co. vs. Miller*, 94 S. R. 727; S. C. 70, S. W. 721; and S. C. 60 L. R. A. 190.

Many courts hold that there is no common law right to trial by jury on *damages* in eminent domain and condemnation proceedings, but we do not ask for that change in this bill.

WHAT DRAINAGE MEANS

ED REICHENBACH

Drainage Engineer and Contractor, Jefferson, Wisconsin

TEXT: Large crops on little tile drains grow,
Rich virgin soil runs deep and low,
Whole fields alive with stock and grain,
Net surplus funds the farmers' gain.

Seekers for fairer climes usually come back to Wisconsin and say "Wisconsin is good enough for me." Blessed with liberal sunshine, well supplied with good water, and built upon a strong soil, her agriculture has prospered.

The bountiful resources of the virgin soil yet remaining uncultivated still await the hand of the younger generation to render still further prosperity among farmers.

The marvelous growth of the dairy industry, and the vast production of clover, corn, and alfalfa, as well as the numerous herds of high class cows and prize winning sheep, are gradually and surely bringing the state into general prominence.

Although Wisconsin is scarcely as old as the average eastern state, her recognized prominence in agricultural pursuits was accomplished by developing but a part of her vast resources. Many

hundred thousand acres of virgin soil still remain waiting for the plowman to turn the first furrow. And foreclosure of farm mortgages is quite unusual.

DRAINAGE SHOULD BE ENCOURAGED.

Among the native resources capable of profitable development the drainage of wet land deserves more encouragement than is accorded it by farmers. Agricultural meetings conducted by some of the more progressive class of farmers who meet to learn and teach improved methods, have exemplified numerous practical demonstrations of profitable results derived from tile drainage on their own farms. And the marked advantages thereby created are the legitimate profits acquired as ample reward for judicious foresight and dilligent devotion to a practical cause.

Usually the soil requiring drainage is the most fertile, and is particularly adapted to grow corn and clover, the prime feed for dairy stock. And since several thousand miles of tile drains are laid in Wisconsin, evidence to sustain the claims made for drained land may readily be obtained. The drains work day and night and even during the winter when necessary. Frost does not injure them and the cost of their maintenance is nearly nothing.

To encourage the introduction of tile drainage among farmers who are unfamiliar with the subject, practical examples of successful results are necessary. Ample opportunities exist for personal observation where various systems of drainage have been in successful operation long enough to demonstrate their utility as a permanent improvement.

FRUGALITY AND ENERGY ESSENTIAL.

To those of the present generation who decline frugal economy and fear hard work, the essential energy and patience required to reclaim wild land seems an irksome task. Vain ambition to obtain something for nothing is a bad form of idle purpose. Primitive methods of the pioneers combined with more irksome toil and cheaper living than the present generation would tolerate, proved successful in the long run. And although human modes have changed and land values advanced and the younger genera-

tion needs and obtains advanced education, the merits of old time diligence and frugality are good as ever. Education and modern machinery tend toward making farming a comparatively pleasant occupation. And with knowledge of possible results the reclaiming of new land becomes interesting. The independence and healthfulness of country life should be considered as an important feature in the results desired. While farming does not afford sudden chances to leap from poverty to great wealth, as an occupation it affords a gradual and sure advance and often permanent prosperity.

DRAINAGE WARMS THE SOIL.

The removal of excess water from the soil is followed by penetration of fresh air into the open pores of the soil vacated by the soil water. This action repeated renders the soil porous and mellow and warmer, and hence the change is conducive to vigorous plant growth. This result is a prime factor contributing merit to the theory of drainage. The roots of ordinary farm crops cannot thrive without air; and without thrifty roots plants can not attain mature growth. Neither can roots of cultivated crops survive continued contact with stagnant water. Try the experiment of planting farm seeds in a jar filled with soil; seal the surface air tight after the plants extend above the jar. Or keep the ground constantly saturated with water.

In northern climates early warmth of the soil is essential to timely growth of leading farm crops, and by thorough drainage this result can be accomplished in wet land. Early in the planting season in the north, when field work is in active operation, tile drained soil is about thirteen degrees warmer than the soil water three feet below the surface in similar soil. The difference is greater as the season advances. The soil water retains a cool temperature longer than the air in spring.

During the winter and early in spring when the ground freezes and thaws alternately, tile drainage prevents the surface from heaving. And therefore prevents destruction of plant roots. Clover roots penetrating below the point of frequent thawing are torn apart by the surface heaving, while the lower ends of the roots are held fast by the frozen ground.

TILE DRAINAGE 200 YEARS OLD.

Tile drains were laid in England before our grandfathers were born. Underdrainage with tile was first introduced in the United States about seventy-five years ago, the tile being imported from England. At the present time there are more than two thousand tile factories in operation in this country. And what does this mean? Who buys the vast product of so many factories? And what does it signify? If such investments were unprofitable, persons thus engaged could not continue half a life time in their business. And while these historical facts stand as a public exhibit of great magnitude, many farmers whose land requires drainage would not take the trouble to investigate the valuable results accomplished.

In southern Wisconsin the present market value of many wet marshes, with the cost of drainage added, is less than half the estimated value of adjacent improved farms. Numerous actual examples proclaim the merits of tile drainage as a permanent investment. Well burned tile properly laid will endure forever, with reasonable care.

Any other improvement on a farm is of temporary duration and requires repairs or renewal occasionally, owing to natural causes. Tile drains properly laid directly increase the value of the land in proportion to the increased yield of the soil. Besides it is gratifying to observe the improved appearance of the land.

DEPTH, SIZES AND PLANS.

If the water table or surface of the soil water remains within three feet of the surface of the land during the growing season, then the land requires underdrainage. The requisite distance between drains depends upon the character of the soil, and also the extent of thoroughness desired. If the surface is two to three feet above the normal height of the outlet, good results can be accomplished. Deep drainage is generally best. But shallow drainage is much better than none. If you cling to the theory of great depth, perhaps you may find much of your land situated too low to enable you to put your theory into practice. And further, you may observe successful results from numerous soils drained shallower.

The cost of construction is materially affected by greater depth when the lower strata is composed of gravel, stones, or wet loose sand. If obstructions at greater depth are numerous, then drains laid nearer together and at less depth are commendable.

STUDY LIVING EXAMPLES.

To those interested in the drainage or purchase of wet land, I would suggest communication with prominent farmers who have extensive systems of tile drains laid in accordance with approved plans under competent supervision. Their advice based upon actual experience will help to guard against error. Personal visit to drained farms are most impressive. The interest on the usual cost of tile drainage per year is about \$1.80 an acre.

Forward march, advance in line,
Drain your land and work it fine,
Sound the word that thrift will win,
Till the soil to fill your bin.





Proper Drainage Insures Good Crops

**PROPER DRAINAGE WILL
GREATLY INCREASE THE
VALUE OF YOUR LAND**

The land can be worked easier and with less expense, and a great deal earlier in the season. The increased amount of products raised per acre makes drainage a good investment. The use of our cement drain tile in farm drainage is real economy.

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