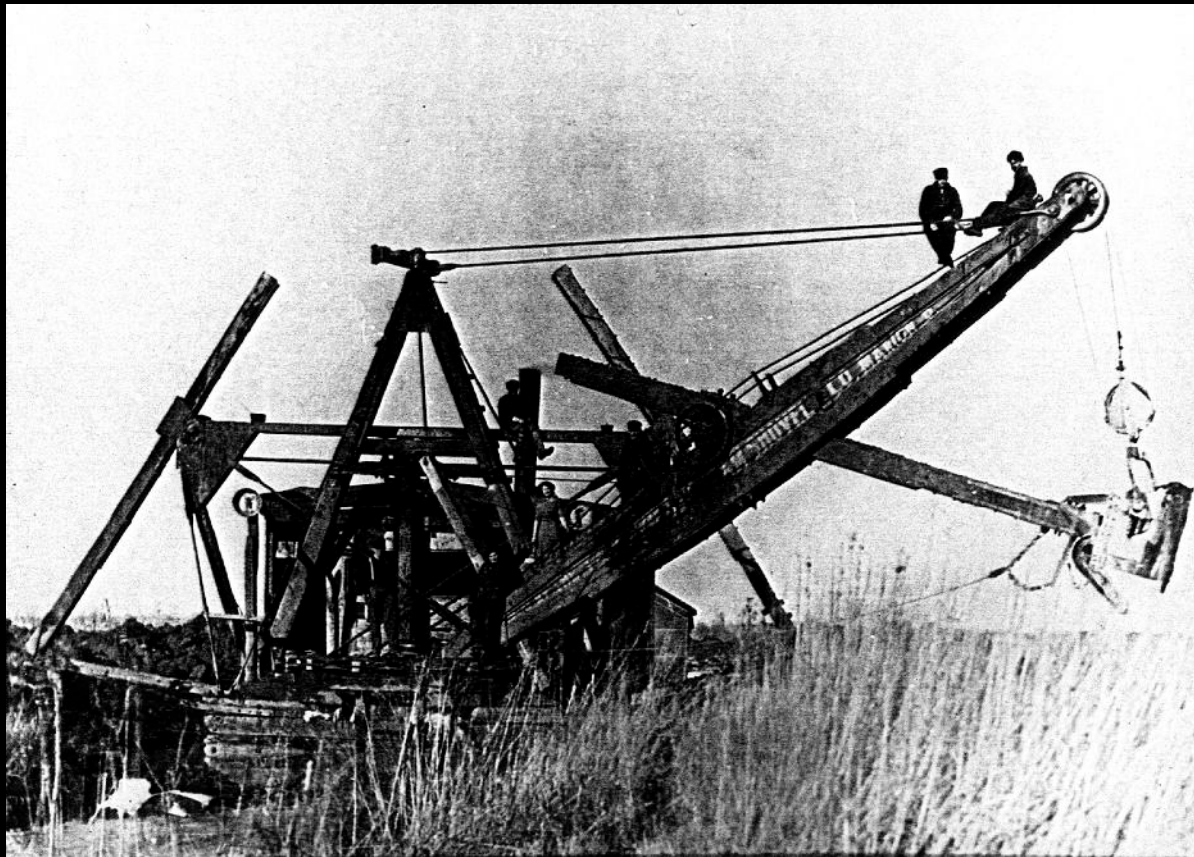


A History of Wetland Drainage...*How they pulled the plug*©



Draining the inlet swamp in Lee County, Illinois, 1888

Thomas R. Biebighauser

tombiebighauser@gmail.com

www.wetlandrestorationandtraining.com































*When water stands in a field for any length of time
it is a sure sign that the land needs drainage*

Figure 7. Farm Drainage. 1948.



Drainage was critical for the harvest of crops





Trying to farm wetland in the early 1900's

Ayres and Coates (1928)

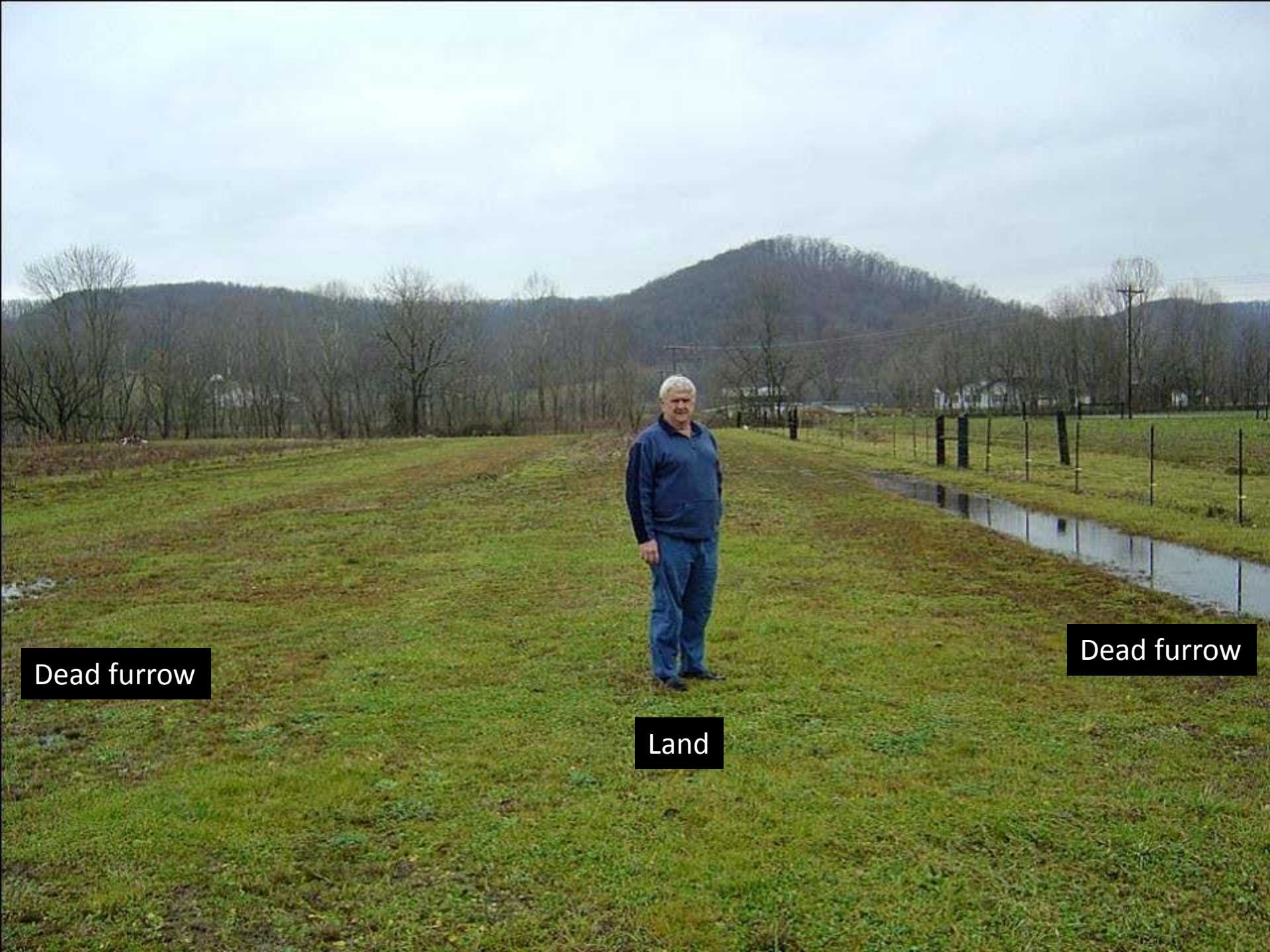
Farming in *Lands*



dead furrow

land

dead furrow



Dead furrow

Dead furrow

Land



Land

Land

Dead furrow







Primehook Creek, Delaware-widening main ditch near the bay



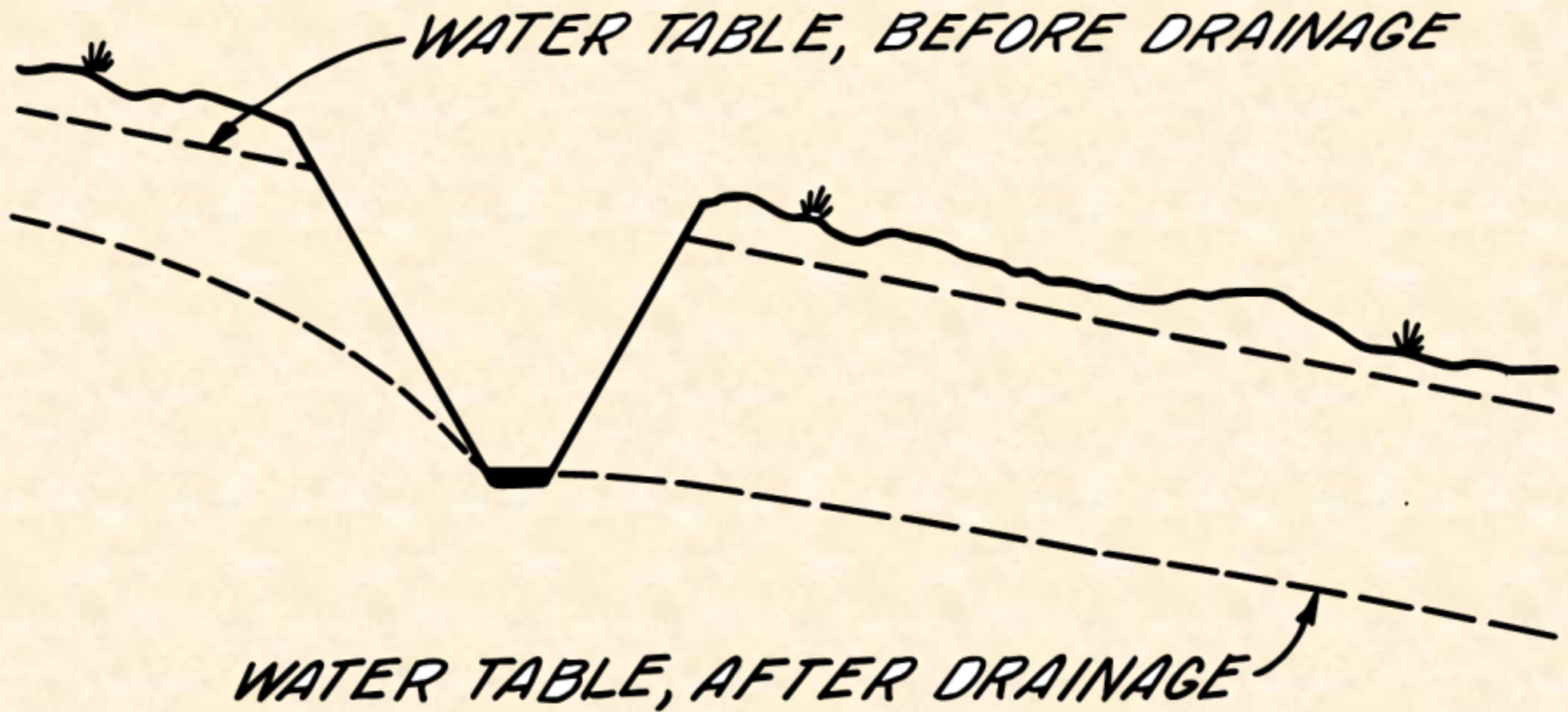




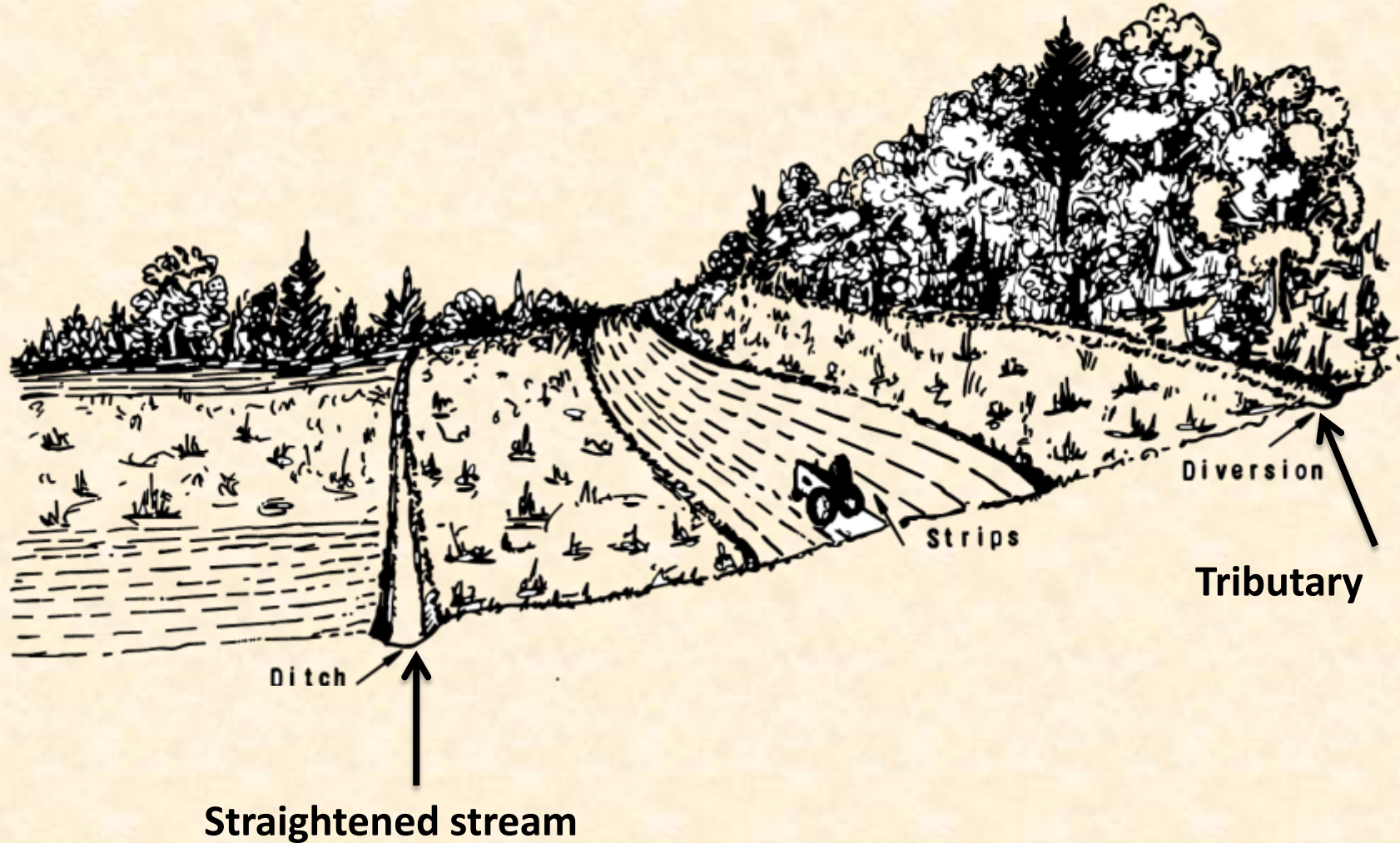


Ann Vileisis photo

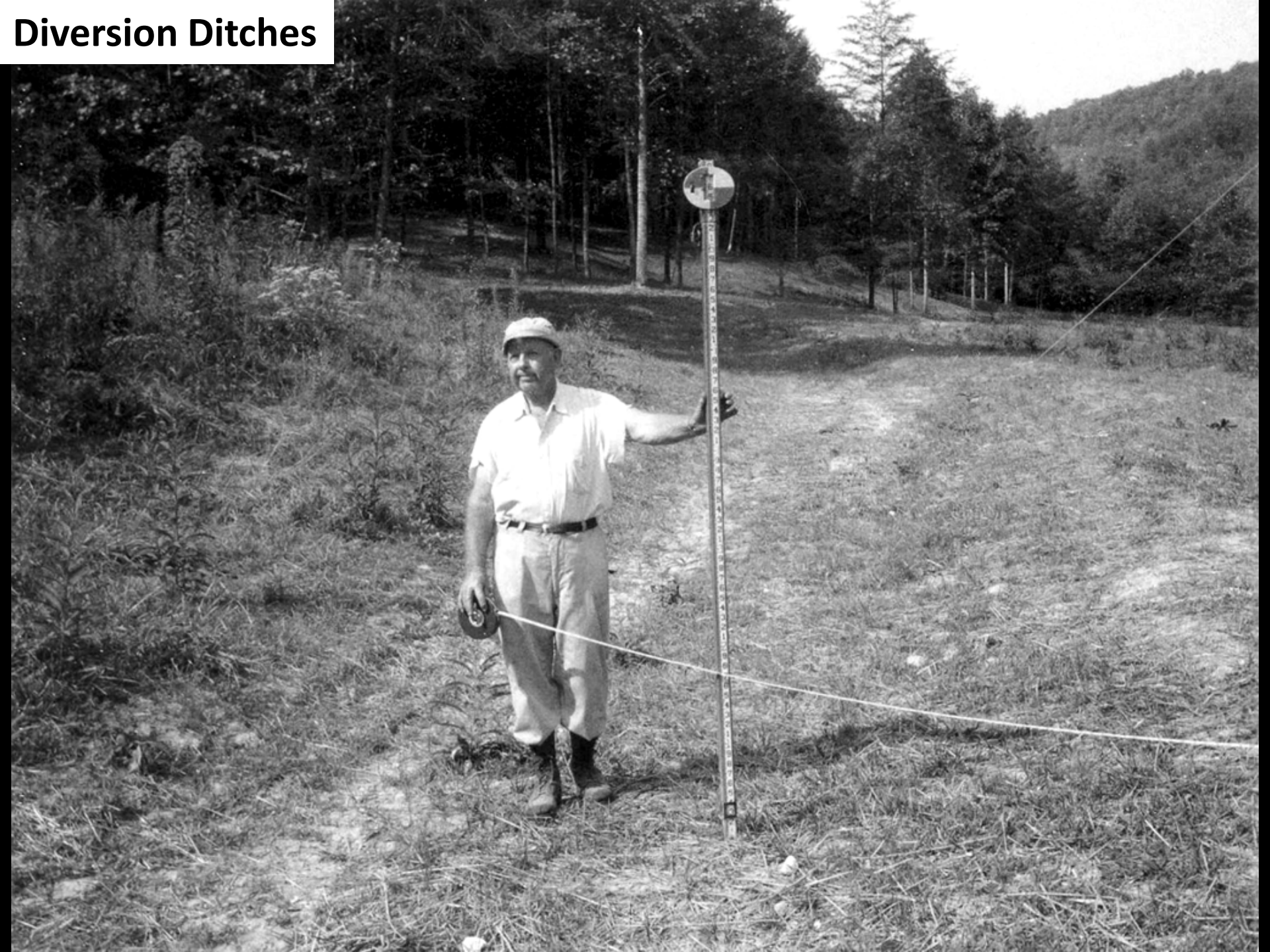
A ditch eliminates standing water & lowers the elevation of groundwater

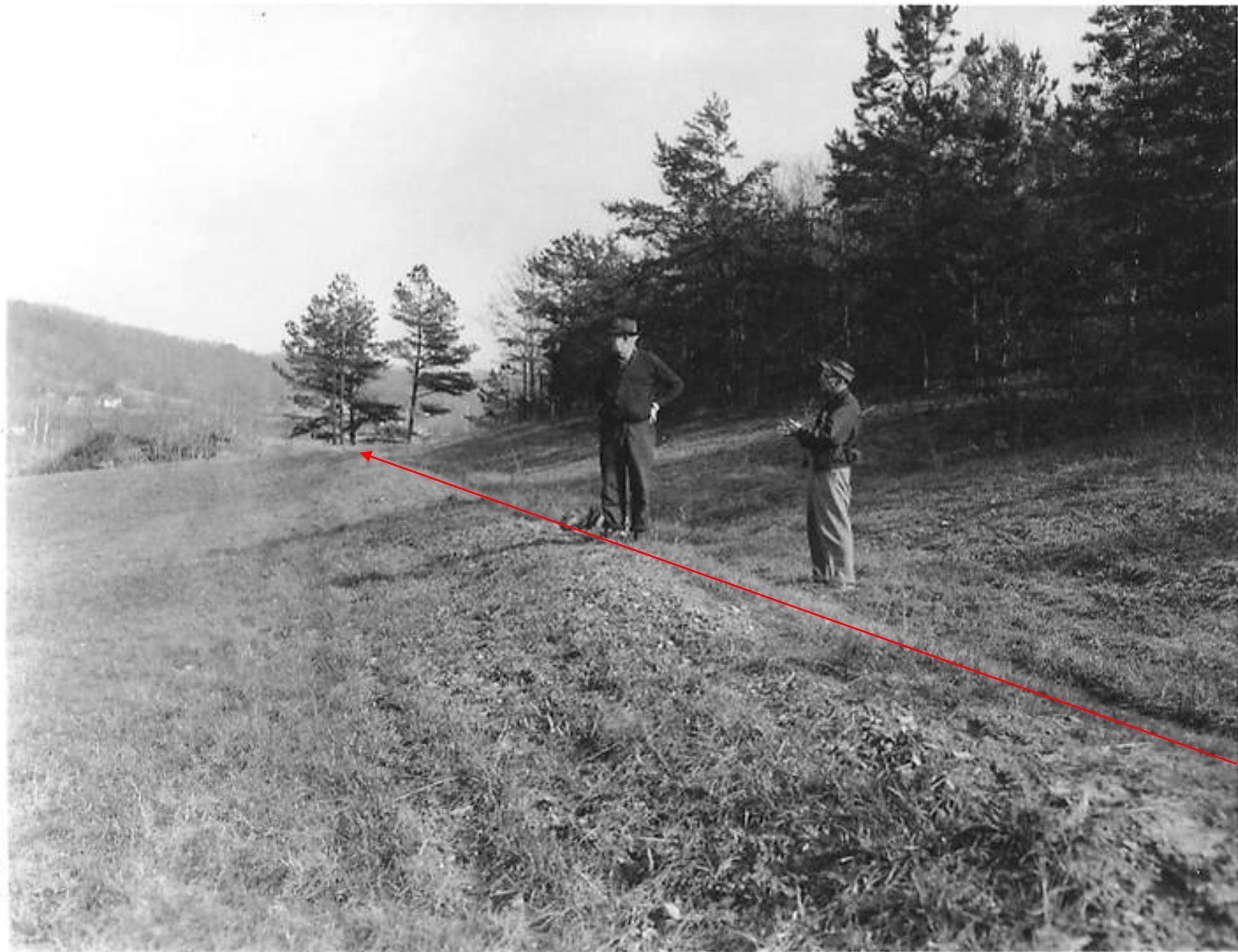


Where ditches should be placed to drain wetland



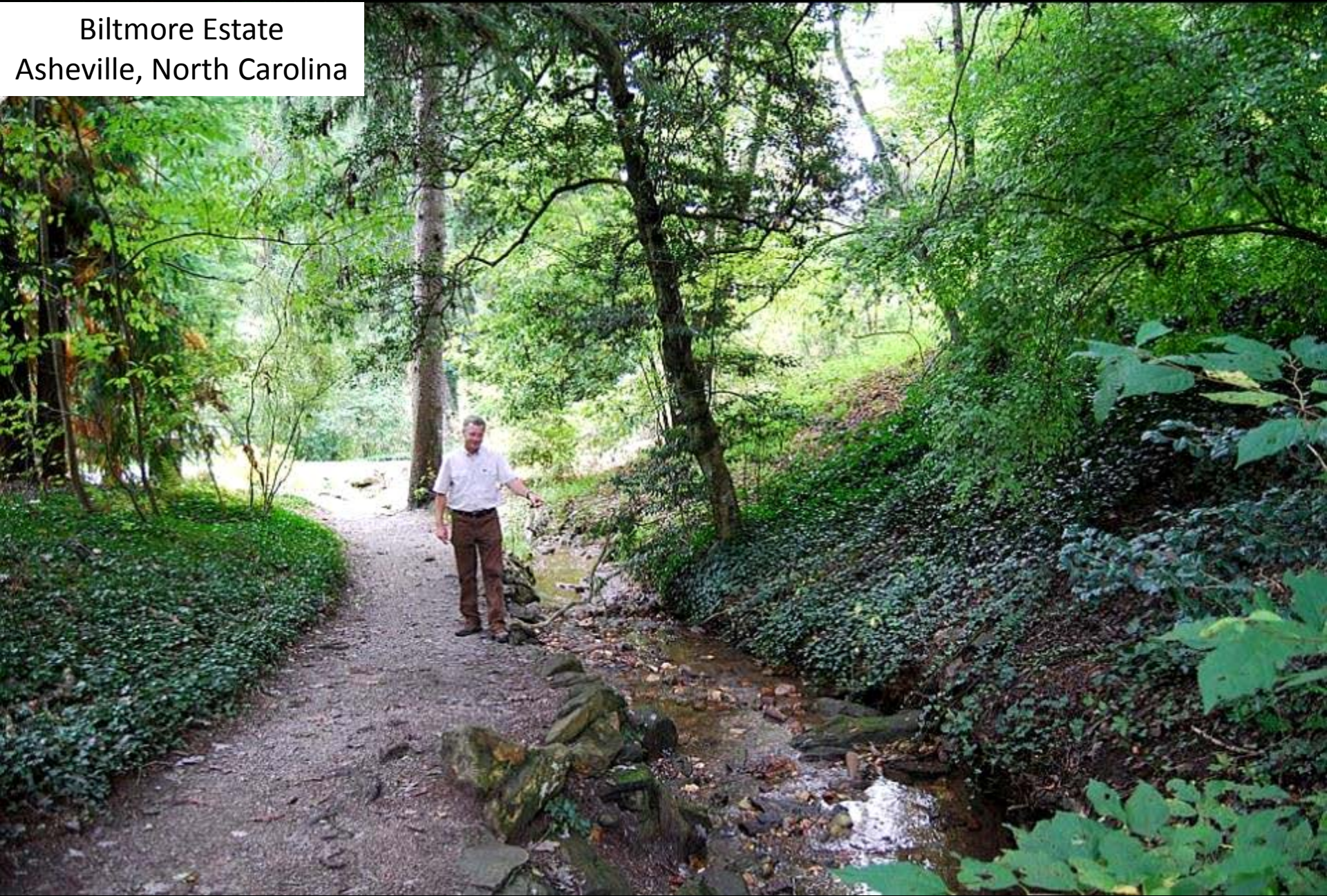
Diversion Ditches







Biltmore Estate
Asheville, North Carolina

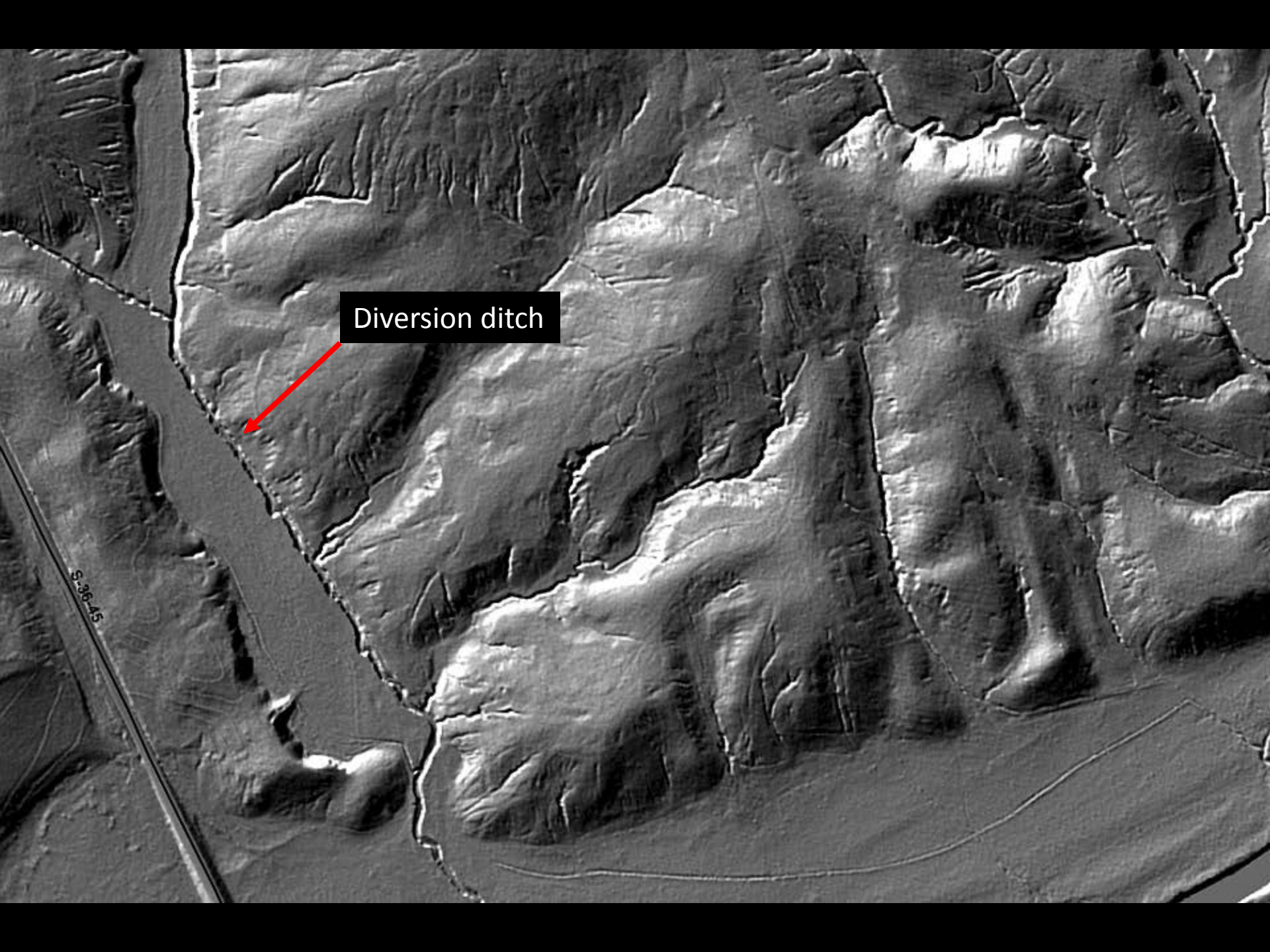








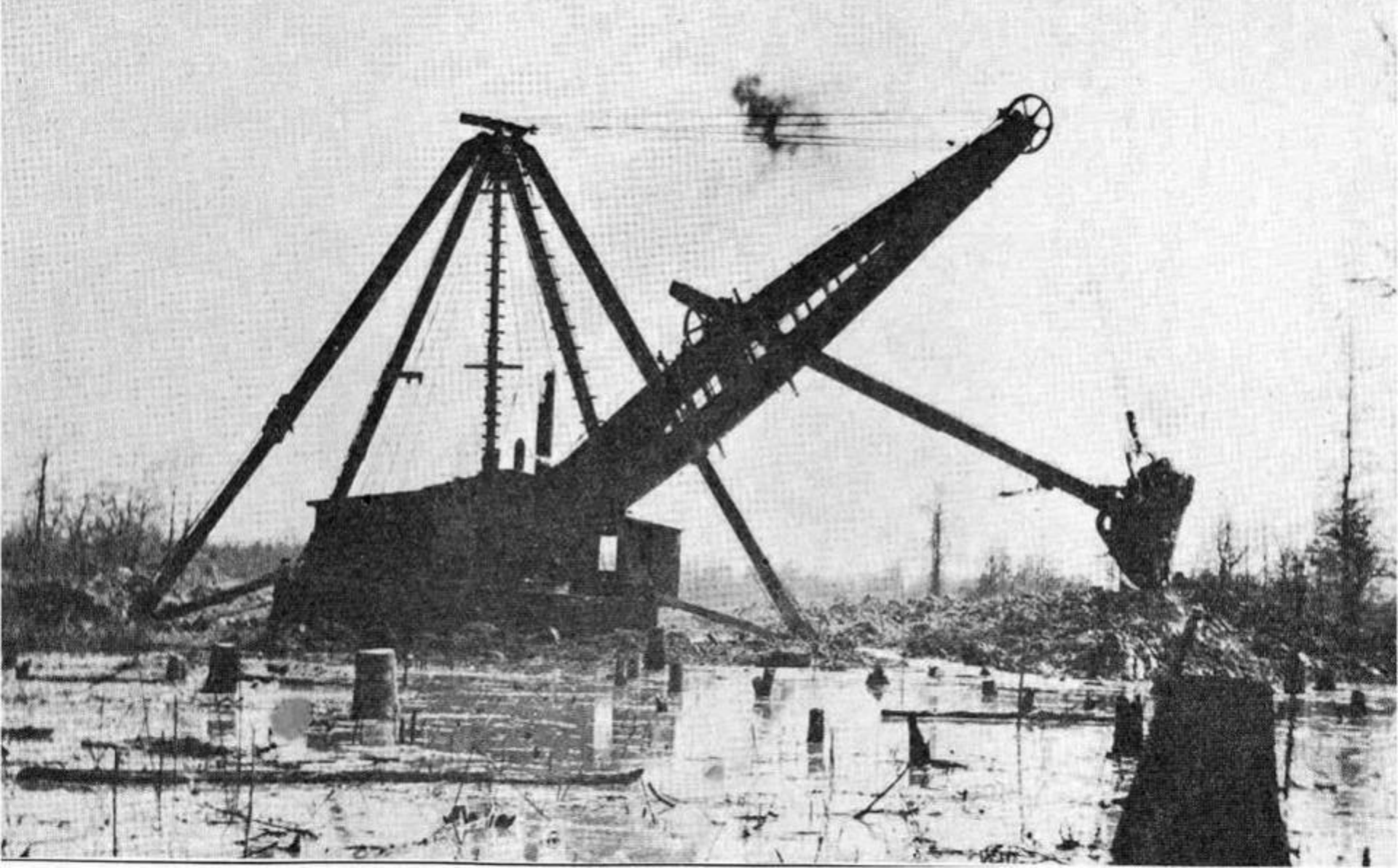
Diversion ditch
Lazo Marsh



Diversion ditch

S 36 45

Straightening & Channeling Streams



Stillwater Creek, Wolf County, KY
December 14, 1956



*The writer has known of cases where a deep open drain
has dried out marshes and swamps through which it passed,
for a distance of more than one mile on each side of its banks.
Allen Boyer McDaniel B. Drainage of Farm Lands. 1879*

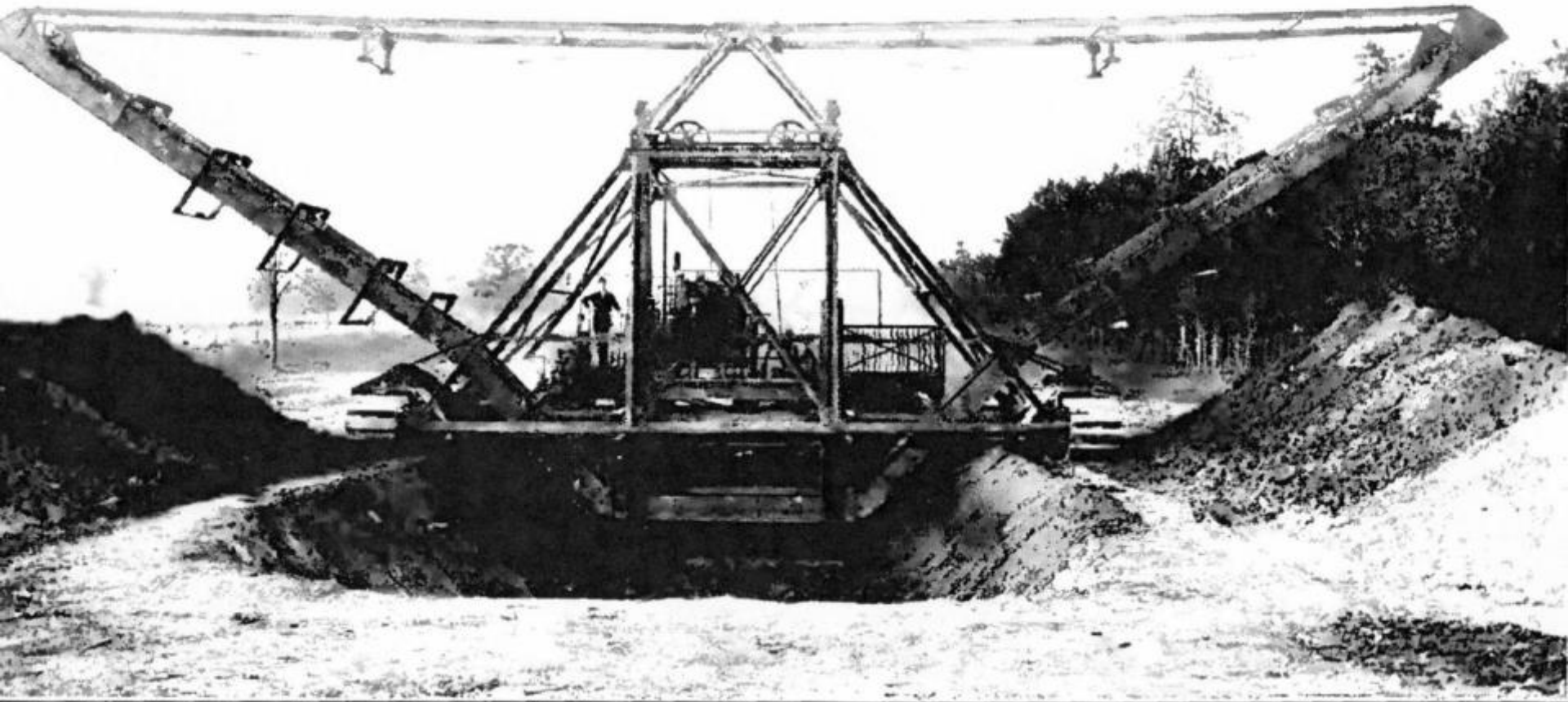


Fig. 8. A Dry Land Dredge or Excavator Constructing a Wide Bottom Drainage Ditch.

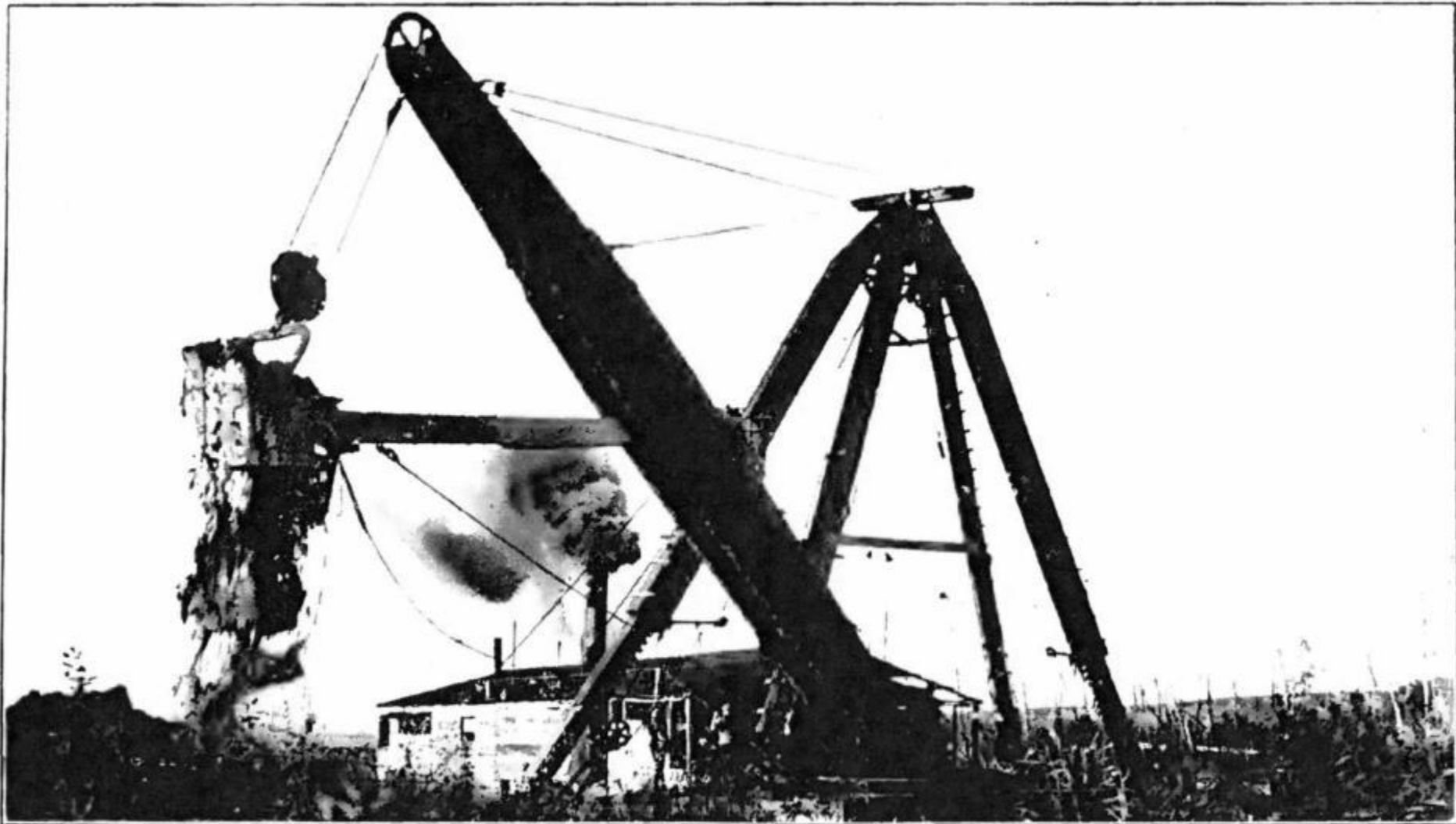


Fig. 11. View of Clay Creek Ditch, Clay and Yankton Counties, South Dakota—Dredge in Operation.

A large, swampy piece of land is a blot on the landscape, a source of ill health, and perhaps a calamity to the people in adjacent communities.

Allen Boyer McDaniel B. Drainage of Farm Lands. 1879

Greenbrier Inn
White Sulphur Springs, WV



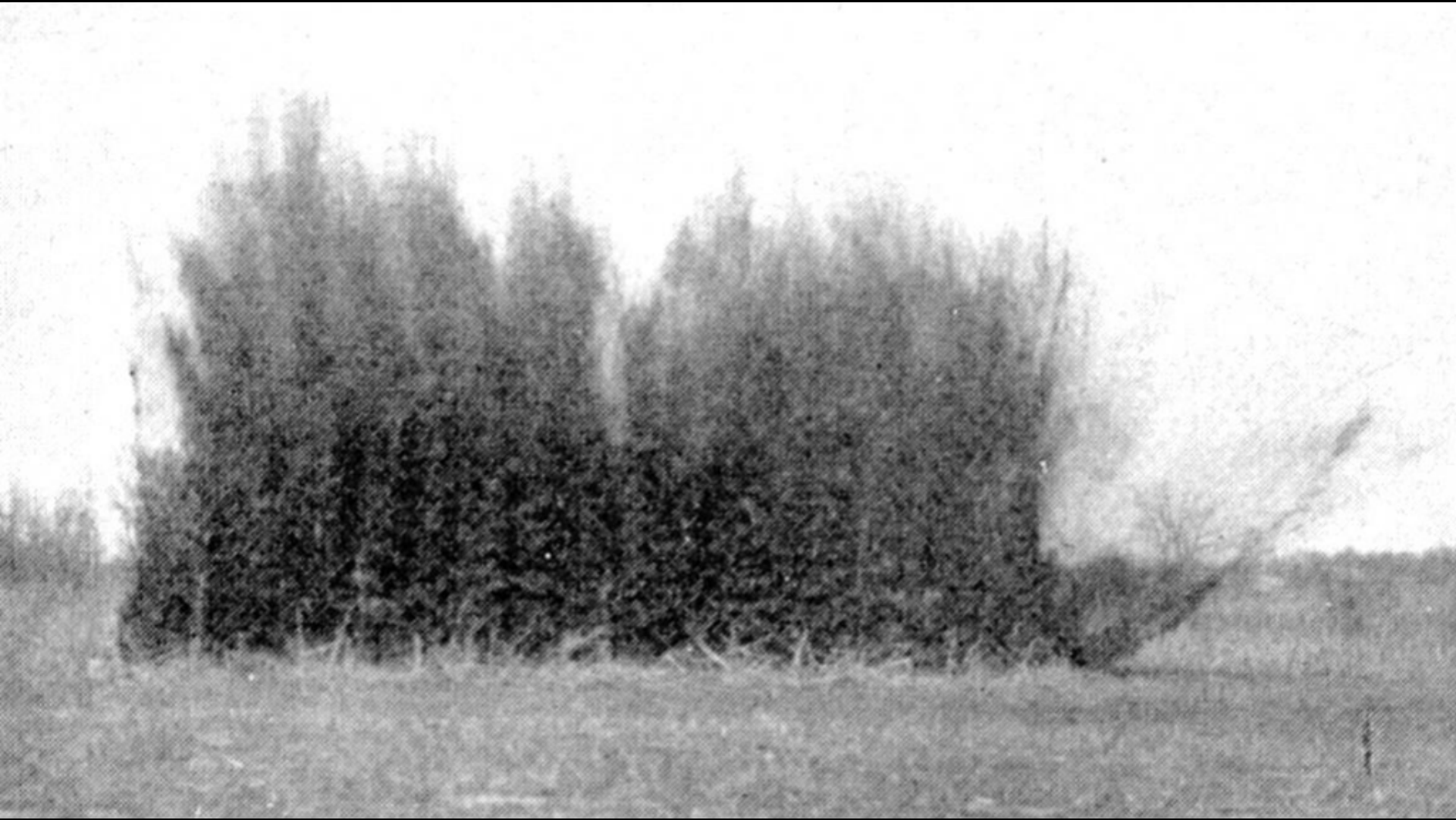


Howard's Creek, Greenbrier Inn

**A majority of these straightened streams were once a series of connected wetlands.
The water flowing in the channels once maintained wetlands on the surface**



Muncie, Indiana

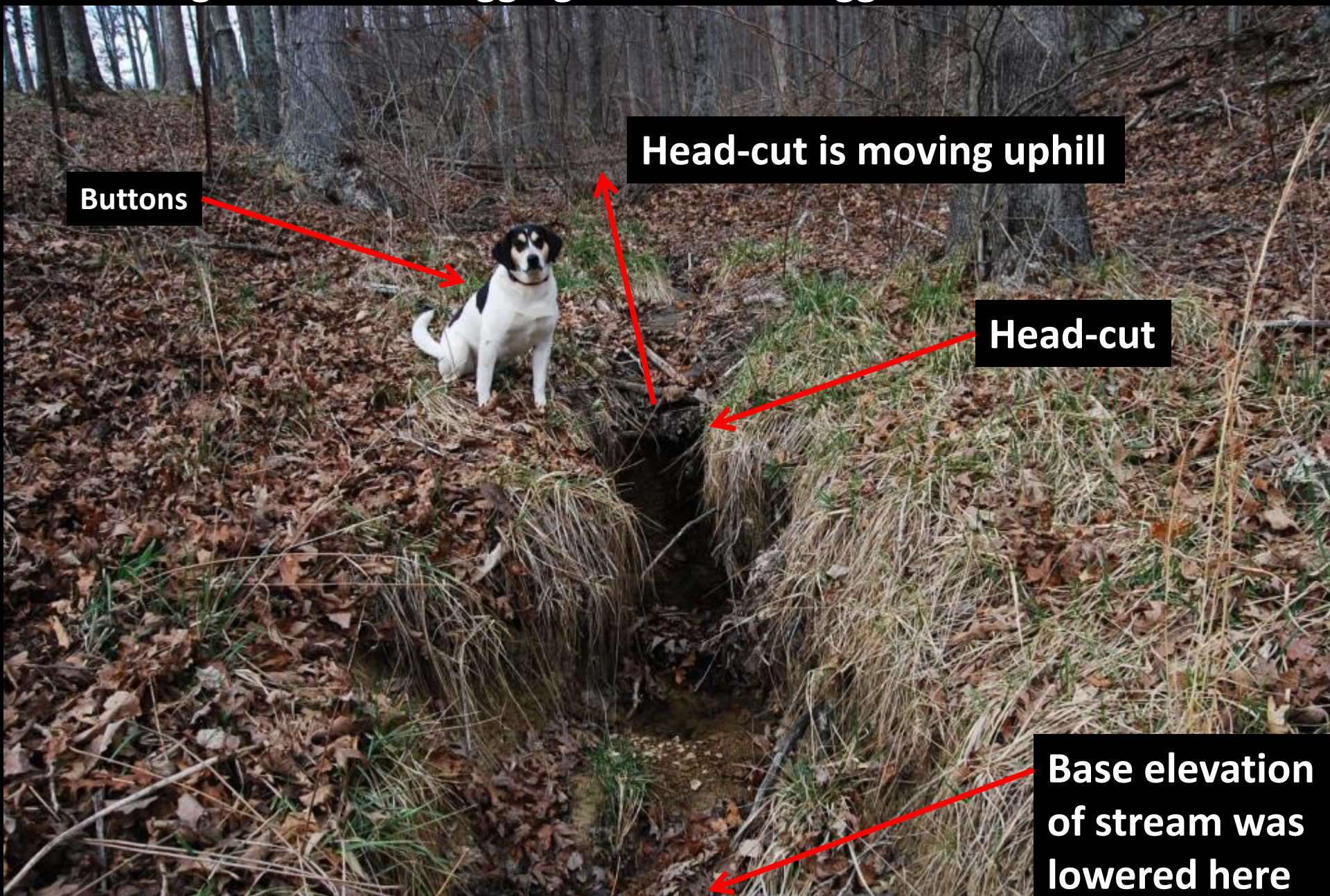


Using World War I surplus dynamite





Moving a stream or digging a ditch will trigger head-cuts to form



Buttons

Head-cut is moving uphill

Head-cut

Base elevation of stream was lowered here



Head-cut



Narrow stream with low banks

Head-cut is advancing upstream

Advancing head-cut leaves a deeper and wider channel behind



Head-cut

Stream



Head-cuts have moved through this alluvial fan





Diverted stream has eroded down to bedrock

Head-cut destroys wet-meadow wetland example

Uphill



Year 1

Forest with many trees roots

Ditch/Stream



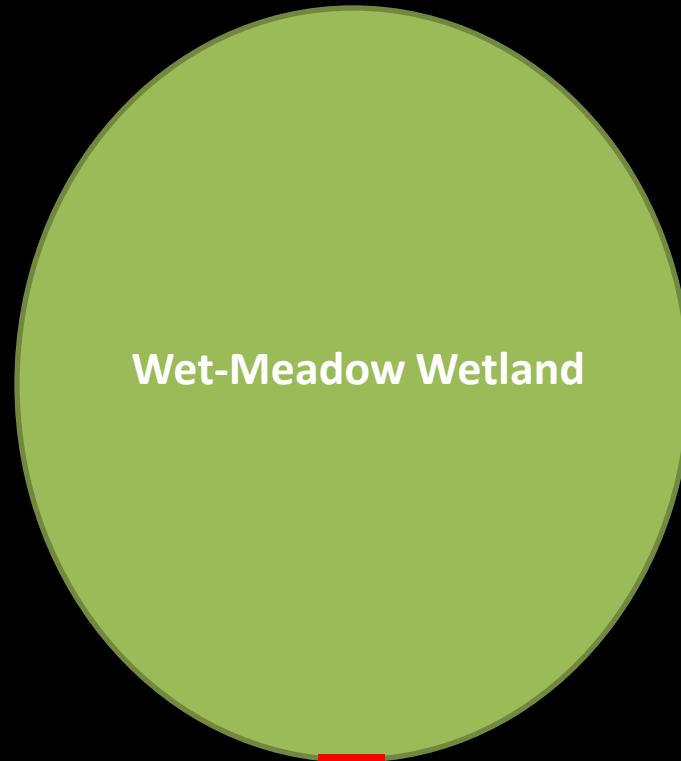
Head-cut

Downhill

Road

Culvert

Year 20

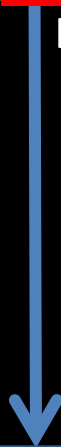


Wet-Meadow Wetland

Head-cut

Dry Forest

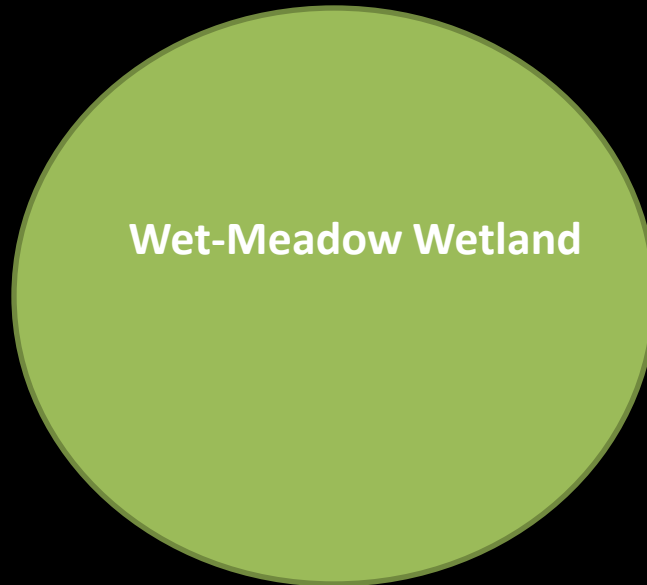
Ditch/Stream



Road

Culvert

Year 21



Head-cut

Dry Forest

Ditch/Stream



Road

Culvert

Year 22



Head-cut

Dry Forest

Ditch/Stream



Road

Culvert

Year 23

Head-cut



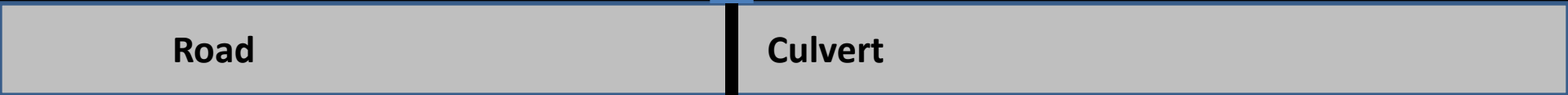
Dry Forest



Ditch/Stream

Road

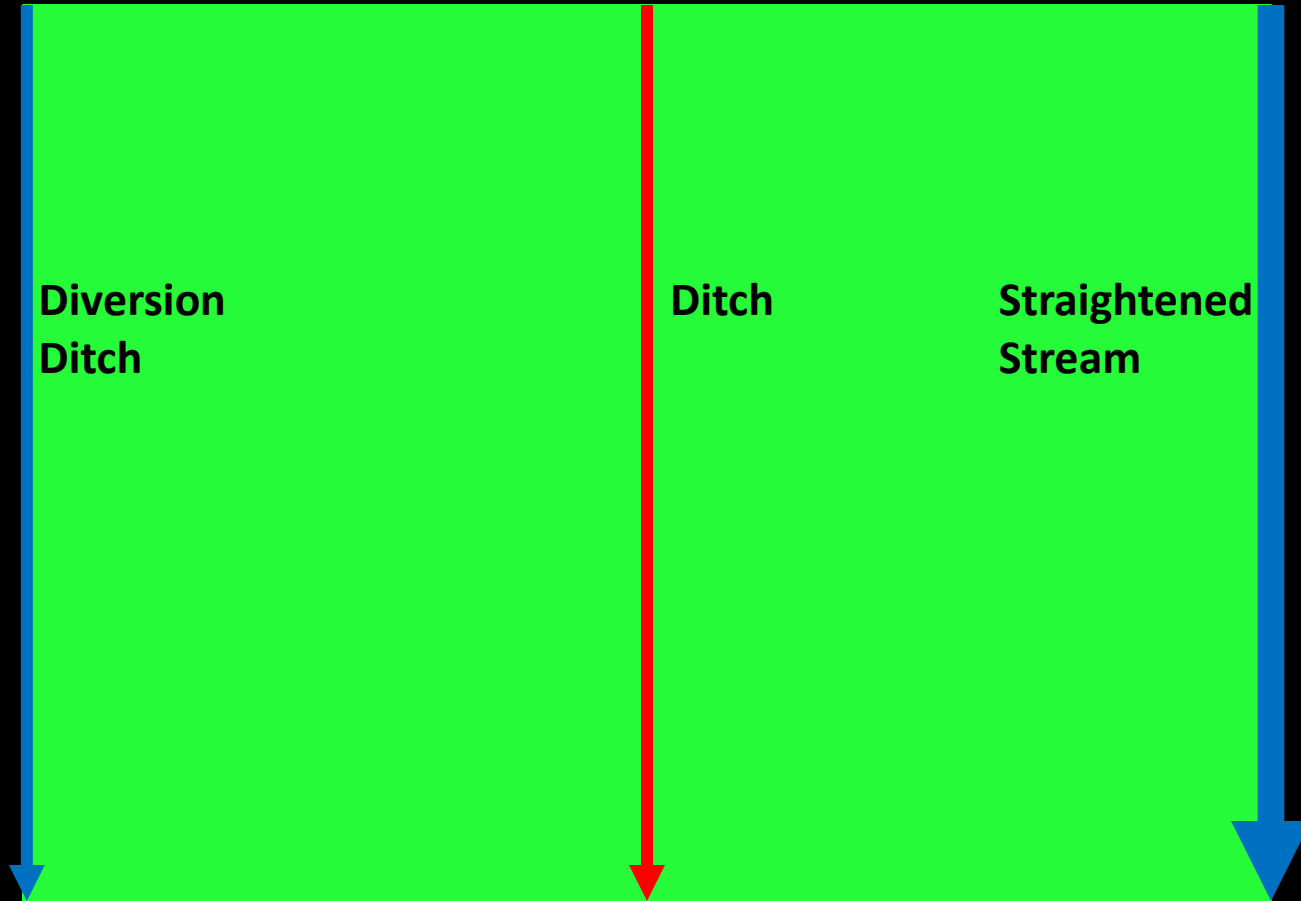
Culvert



Problems with ditches



A ditch separates one field into two fields





Beaver dam blocking drainage ditch



Beaver dam blocking diversion ditch



Ditch with head-cut and erosion

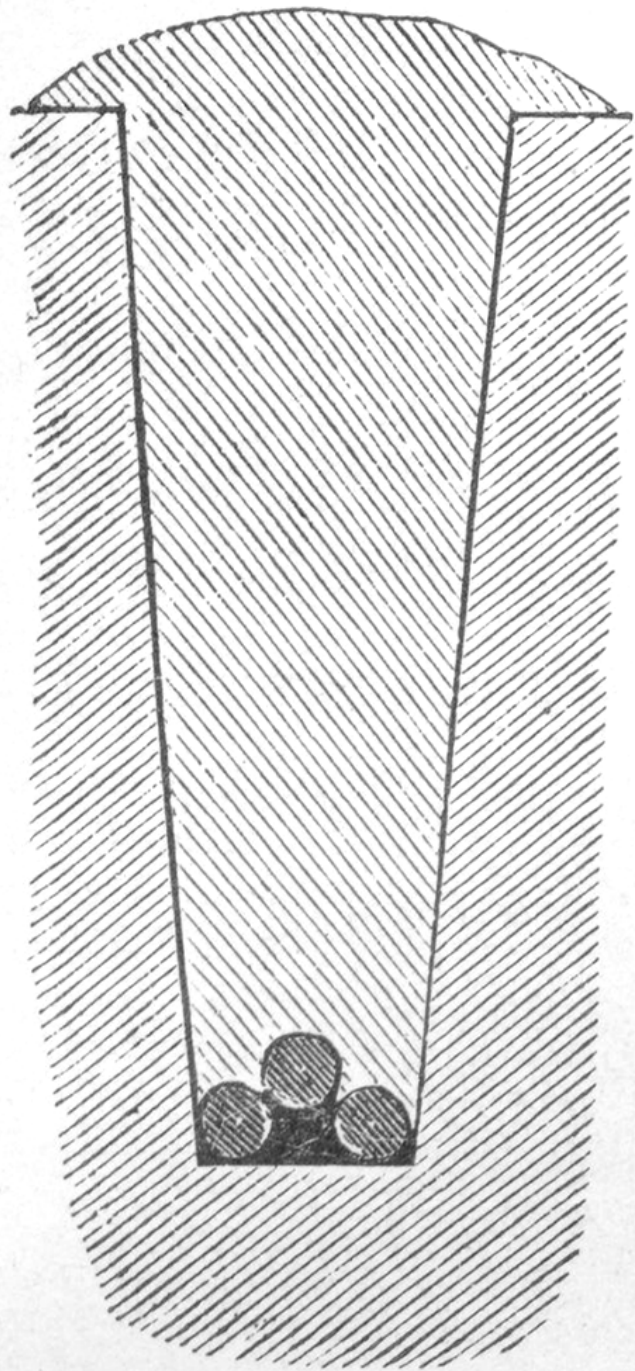




Fleming County, Kentucky



Menifee County, Kentucky





Dix River
Lincoln County, Kentucky







Bear Creek
Boyd County, Kentucky





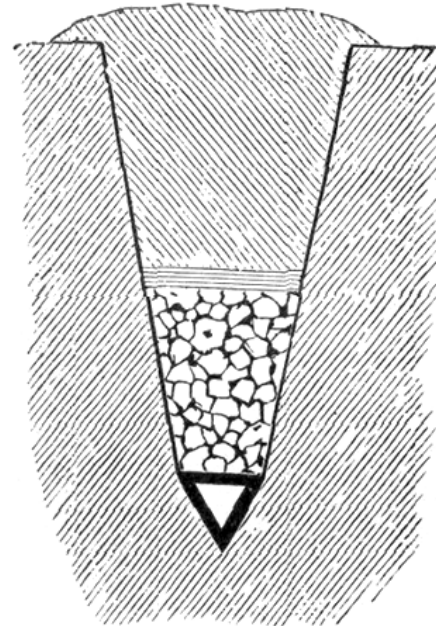
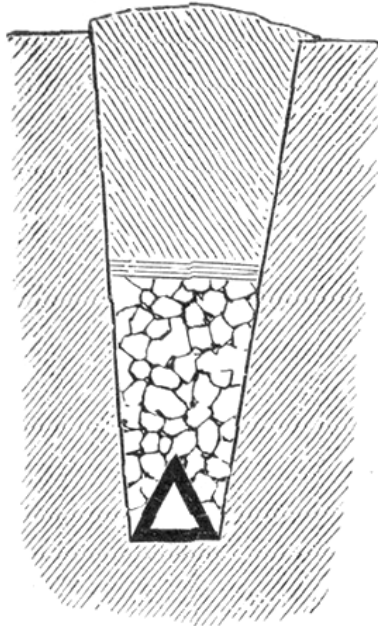
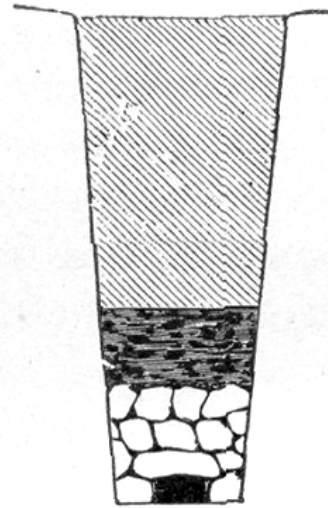
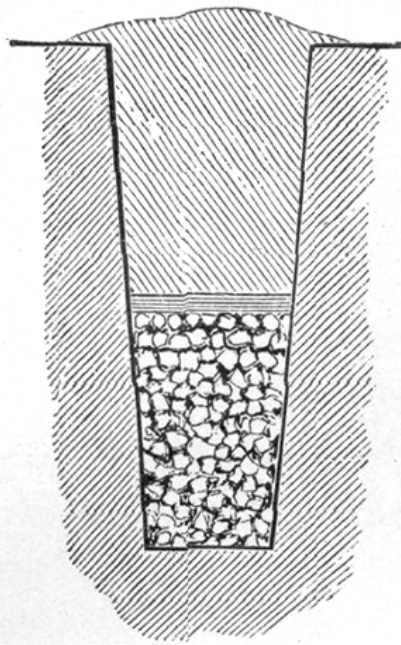
Duncan, British Columbia





Rock Drains

Henry French 1903





**Lost Creek
Carter County, Kentucky**



**Hector
New York**



**Victoria
British Columbia**



Rock drain

Duncan
British Columbia



Rock drain

Duncan
British Columbia



Flat rock cover

Two rows of bricks

New York

John Johnston





Geneva, New York

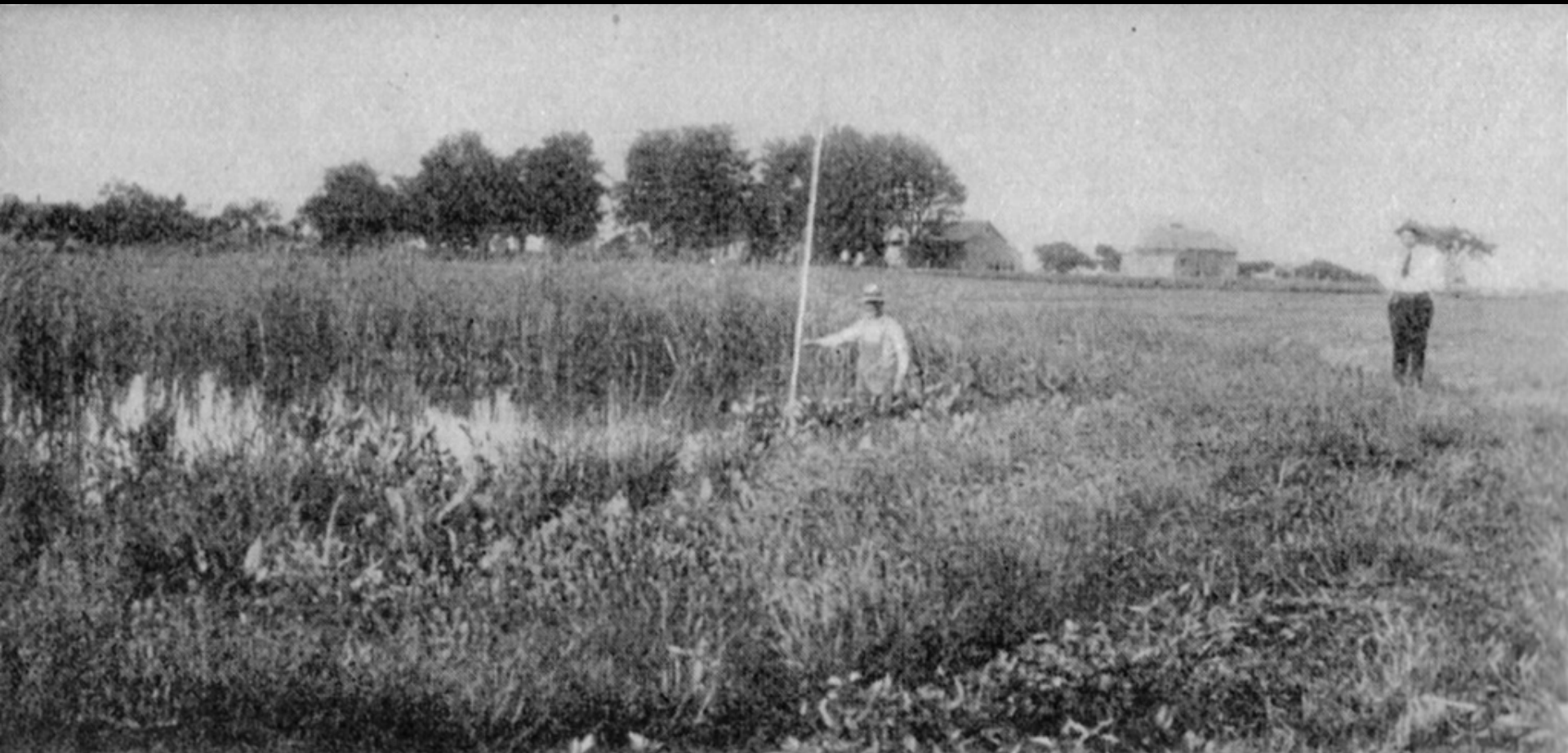




002 Pattern Tile

One of two tiles imported by John Johnston from Scotland in 1835, as patterns to guide B.F. Whartenby, Waterloo, N.Y., in making tile. The other pattern tile is in the Weaver Collection at the Henry Ford Museum, Dearborn, Michigan.

Donated by Jennie Whartenby



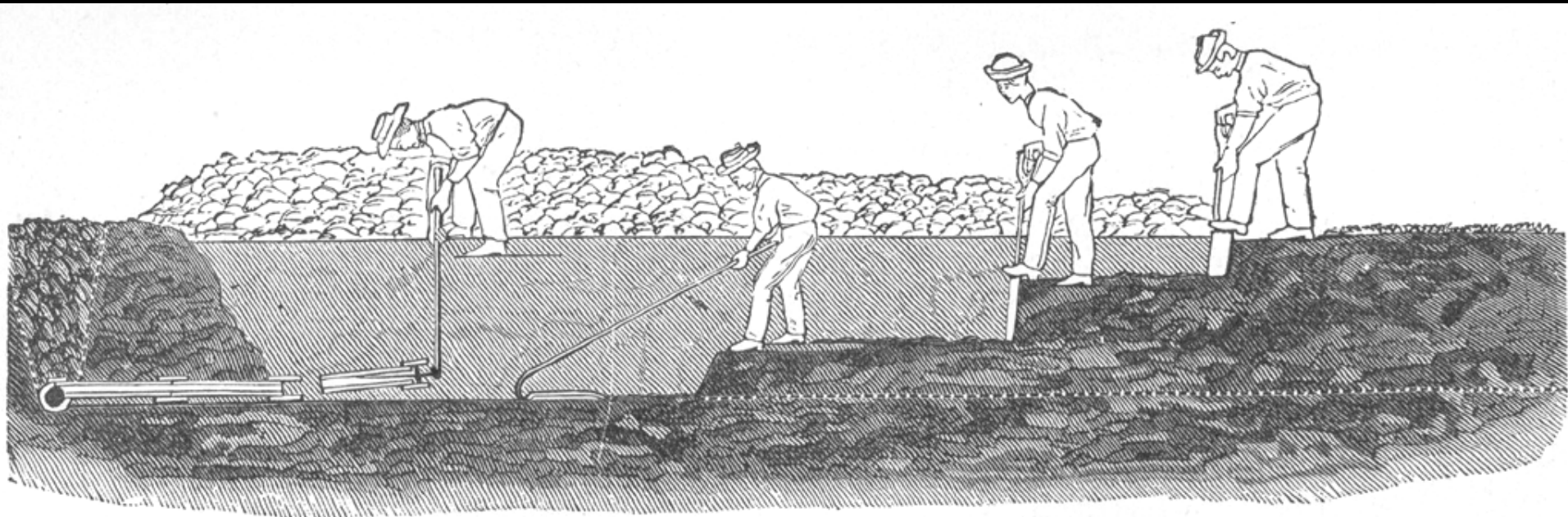


Fig. 65.—OPENING THE DITCH AND LAYING THE TILES.

How tile drainage improves fields



Before



After



Not Drained

Drained



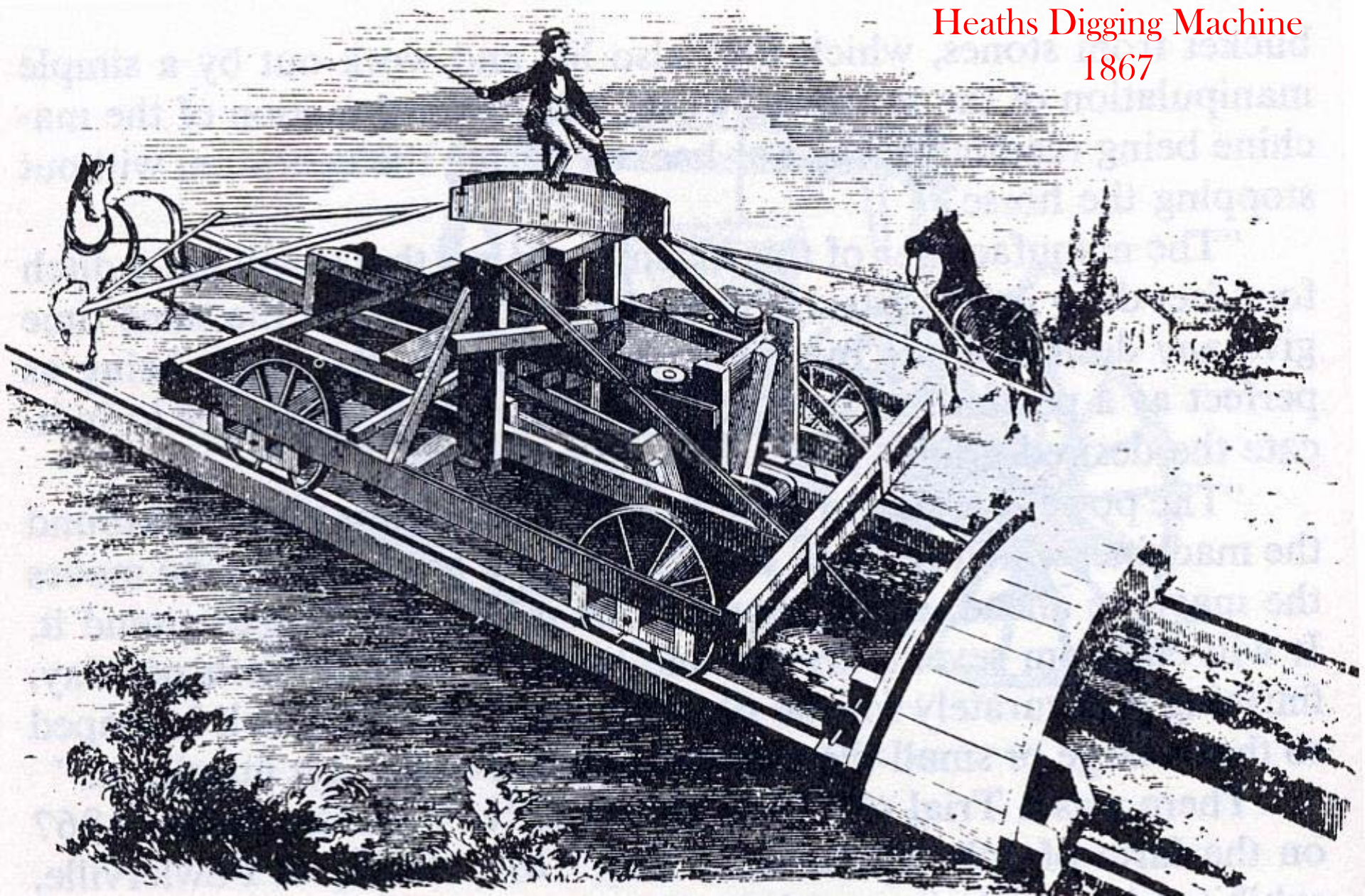


Buried drain lines remove water from a wetland much like the hole in the bottom of a flower pot, only the field is much larger!





Heaths Digging Machine
1867



B.F. Whartenby Clay Tile Factory Waterloo, NY

Tiles made:

1838 = 3,000

1848 = 180,000

1849 = 840,000



By 1871 there were 10-factories manufacturing clay drain tile in Waterloo!

John Johnston Farm
72 miles of buried clay tiles installed on 320-acres



The Commercial

WILMINGTON, DE. WEDNESDAY, MAY 31, 1851.

The Commercial Press

Published for the Proprietor by
J. B. BROWN, at the
Commercial Press, No. 10
South Second Street, Wilmington, Delaware.

Subscription Price
\$1.00 per Annum in Advance.

Advertisements
\$1.00 per Square for the First Week.

Advertisements
\$1.00 per Square for the First Week.

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Waterloo Advertiser.

MAY 31, 1851.

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LEE & LOGAN
DEALERS IN
DRIED GOODS,
SPICES & CHESTNUTS.

FLAX-SEED.

RAW LOGS.

500 Pine,
400 Oak, and
200 White-wood



FARM AND



RESIDENCE

- OF -

JOHN JOHNSTON
1791-1880

EMINENT FARMER WHO
HERE ORIGINATED
TILE UNDERDRAINAGE
IN AMERICA IN 1835
AND THEREBY BECAME AN
OUTSTANDING CONTRIBUTOR
TO HUMAN WELFARE

HONORED BY
THE AMERICAN SOCIETY OF
AGRICULTURAL ENGINEERS
1935

ERECTED BY
STATE EDUCATION DEPARTMENT

Mike Weaver
DRAIN TILE MUSEUM

Home of John Johnston
"Father of Tile Drainage in America"

FOR ADMISSION PROCEED TO ROSE HILL MANSION
4/10 MI. NORTH ON 96A





Geneva, New York





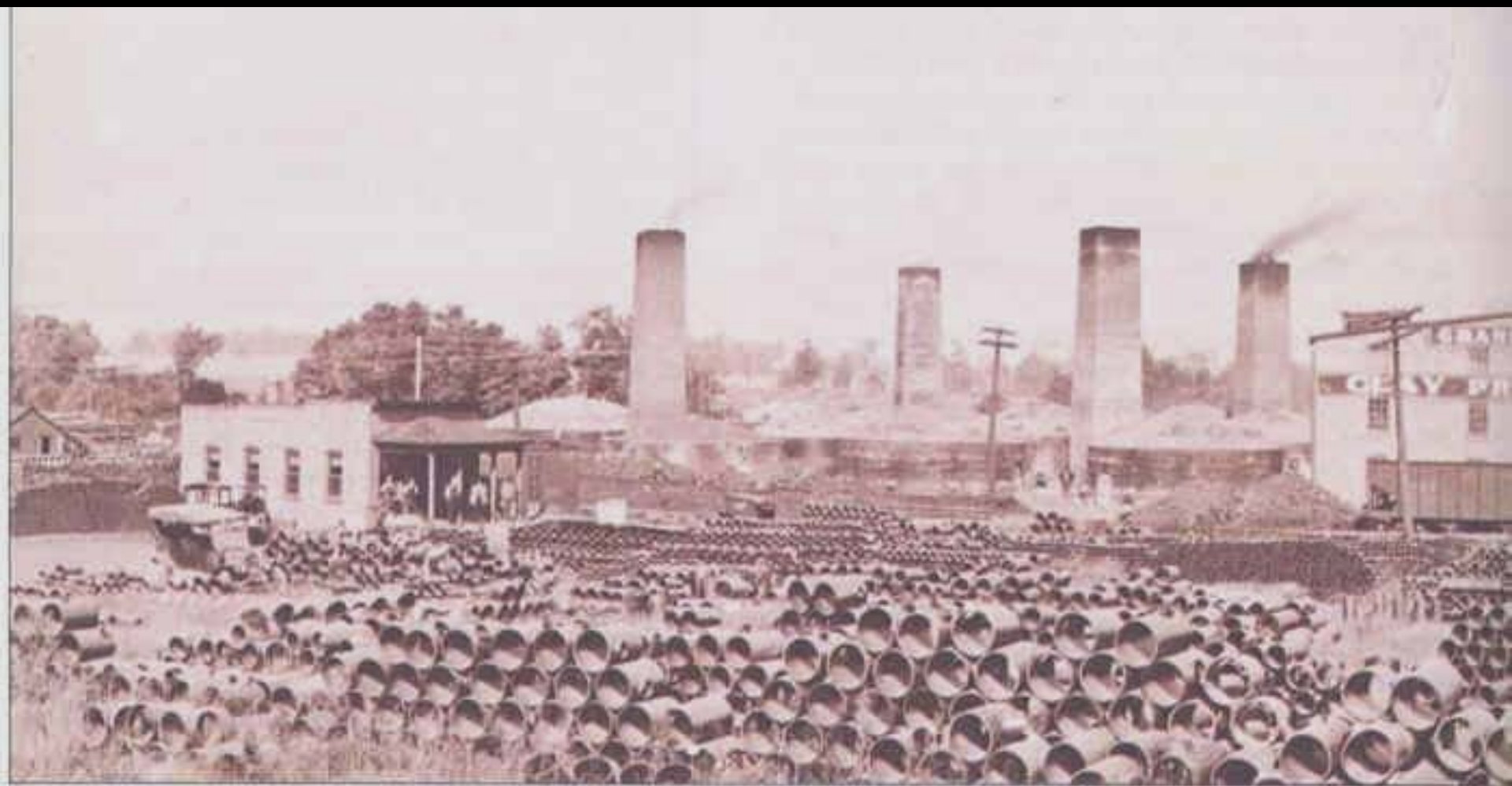




Before installation of buried clay tile

After installation





1,140 Factories manufacturing clay tile in US by 1882!

DRAIN THE WET LAND



INTERNATIONAL HARVESTER COMPANY
INCORPORATED
AGRICULTURAL EXTENSION DEPARTMENT
HARVESTER BLDG. CHICAGO

Wetland drainage techniques were advanced and shared

FARM DRAINAGE

in
10 Easy Lessons



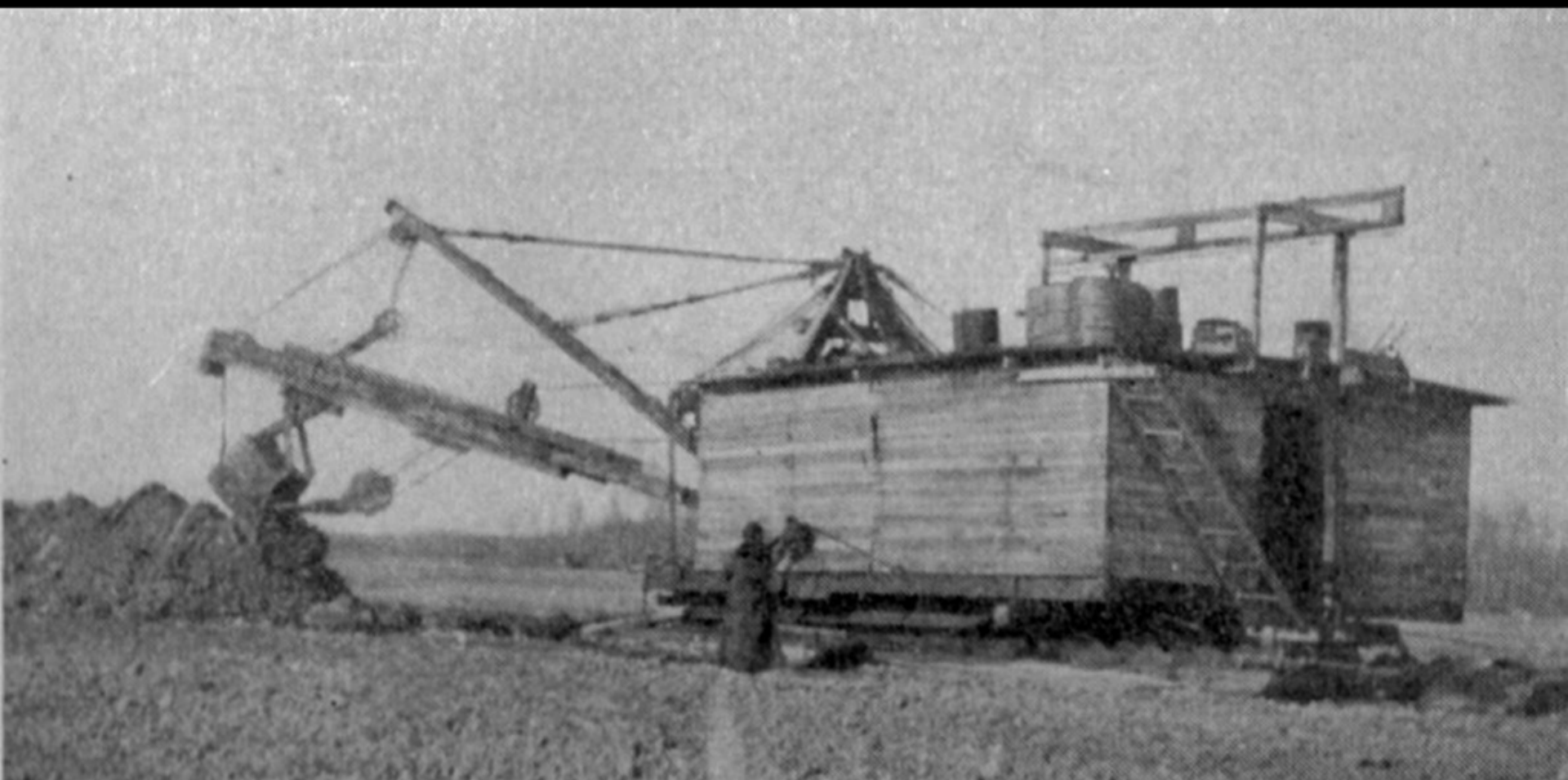
*Farm Drainage
Handbook*

PURDUE UNIVERSITY
Agricultural Extension Service
Lafayette, Indiana

Drainage Districts were formed to create the outlets needed for buried drain lines

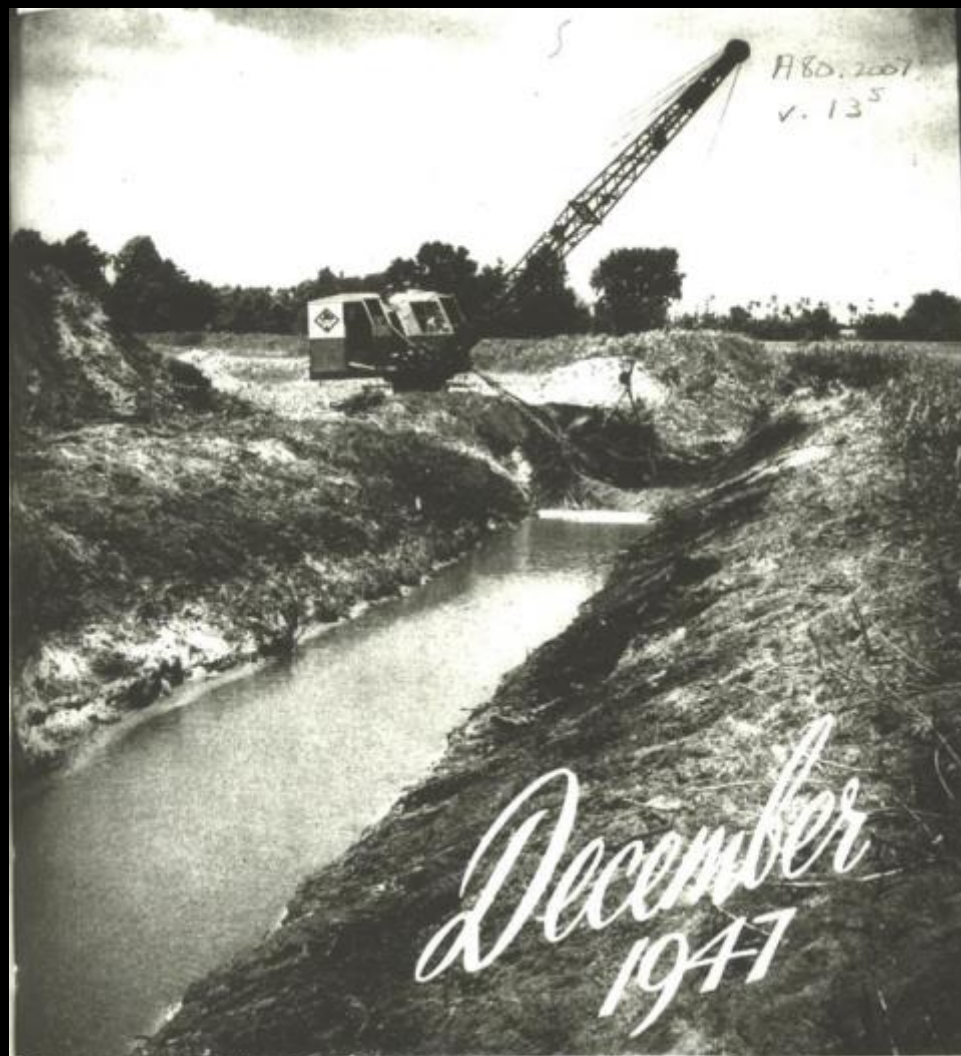


This straightened stream provides the deep outlet needed for buried drain lines









SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.







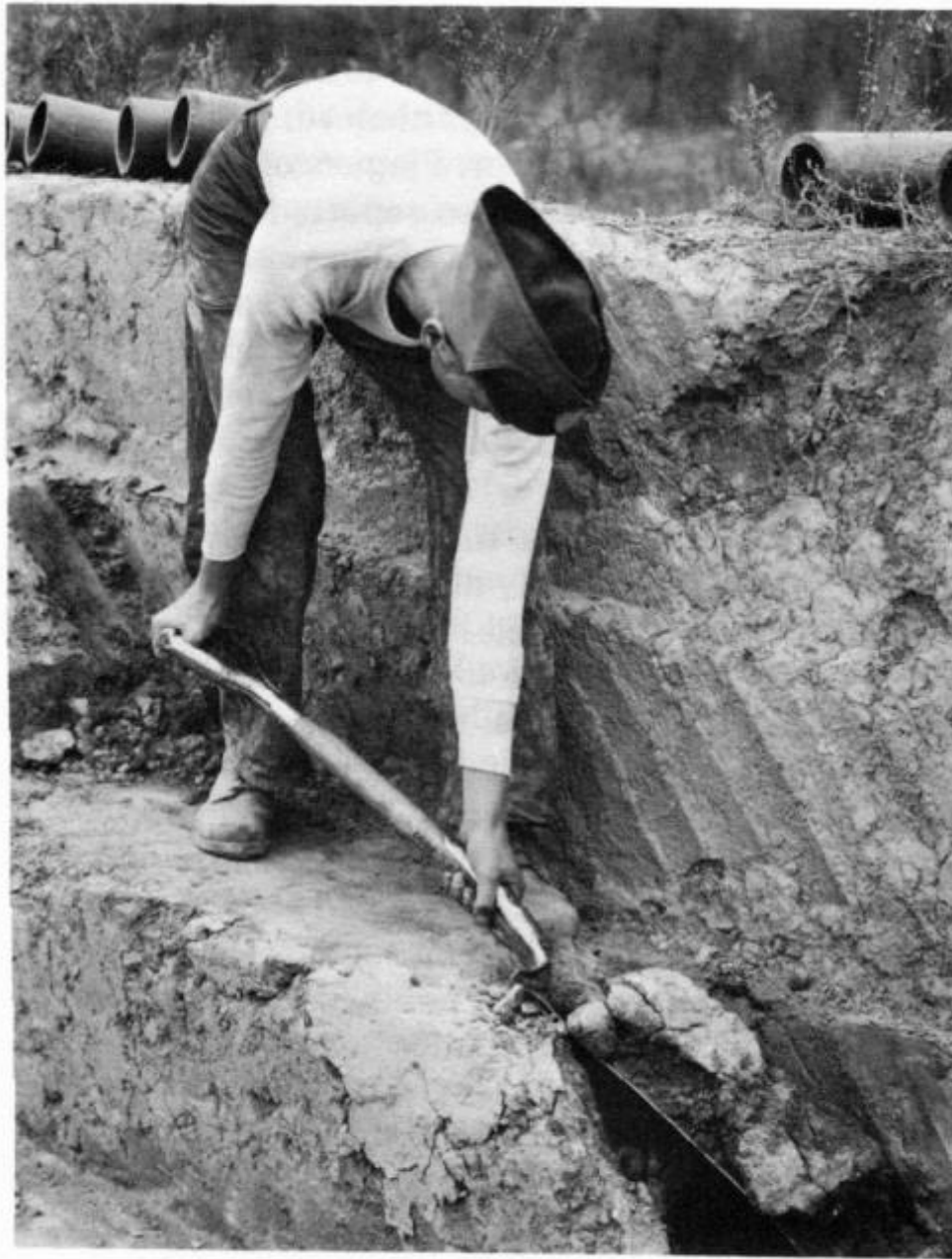
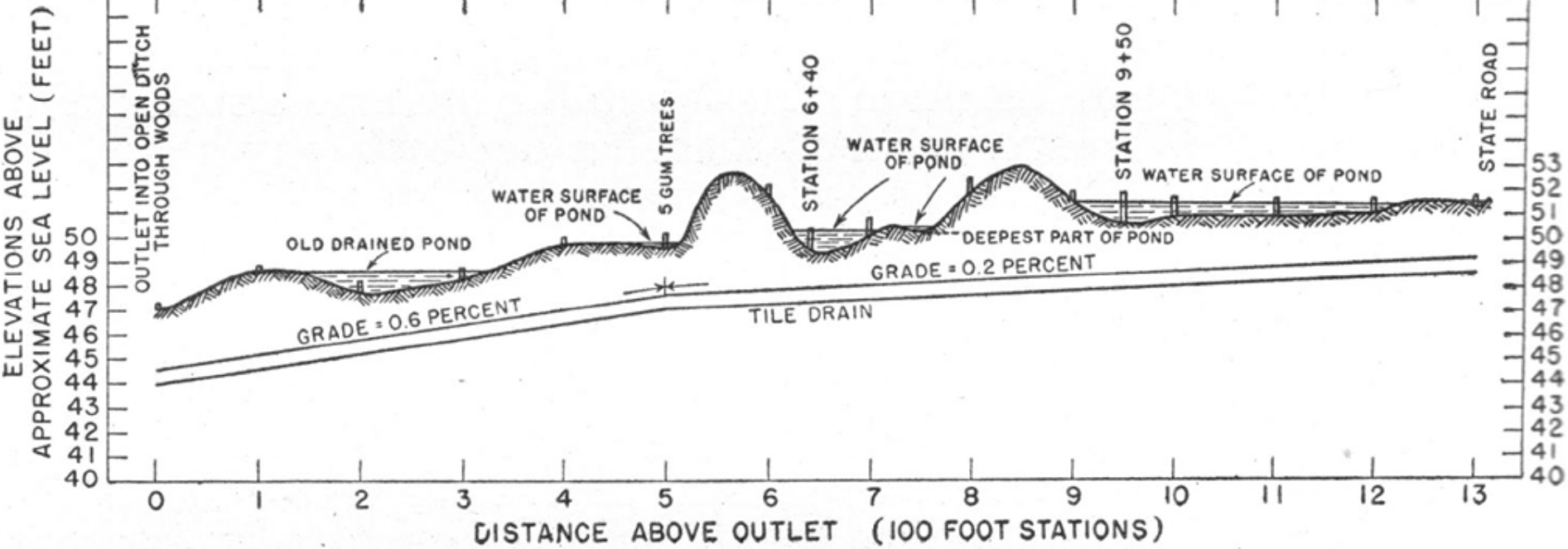


Figure 2-2—Drainage rehabilitation work occurred during the Depression thanks in part to the Civilian Conservation Corps.









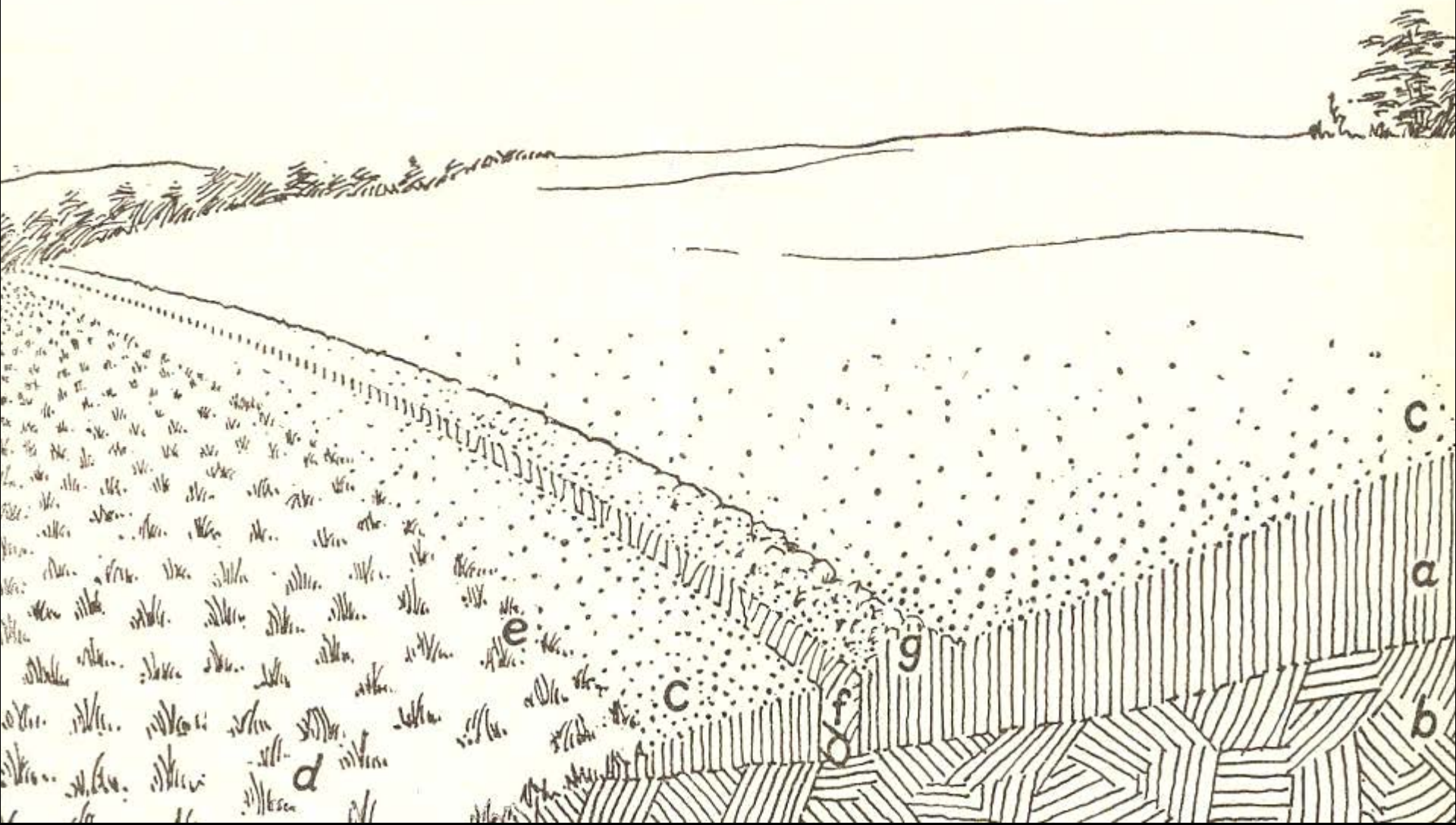














Surface inlet for buried drainage system





Surface inlet the day it rained



Surface inlet one day after rain



Surface inlet two-days after rain



Surface inlet three-days after rain

U. S. DEPARTMENT OF
AGRICULTURE

FARMERS' BULLETIN No. 805

THE
DRAINAGE
OF IRRIGATED
FARMS



Irrigated land in the
West and Southwest
was drained using
buried drain lines

1937

Filling of Wetlands





Morehead, Kentucky



Creston, British Columbia

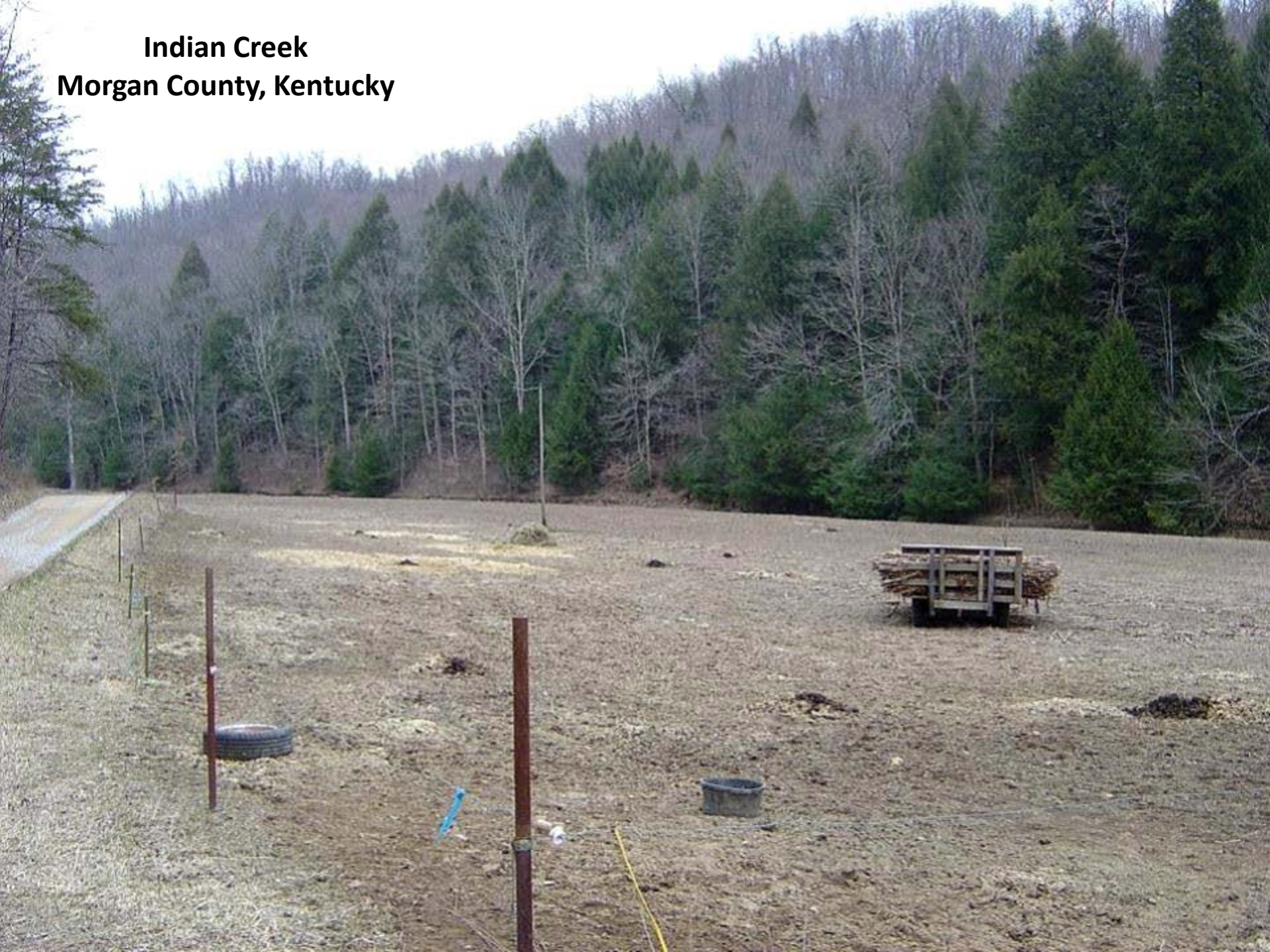


Powell County, Kentucky





**Indian Creek
Morgan County, Kentucky**





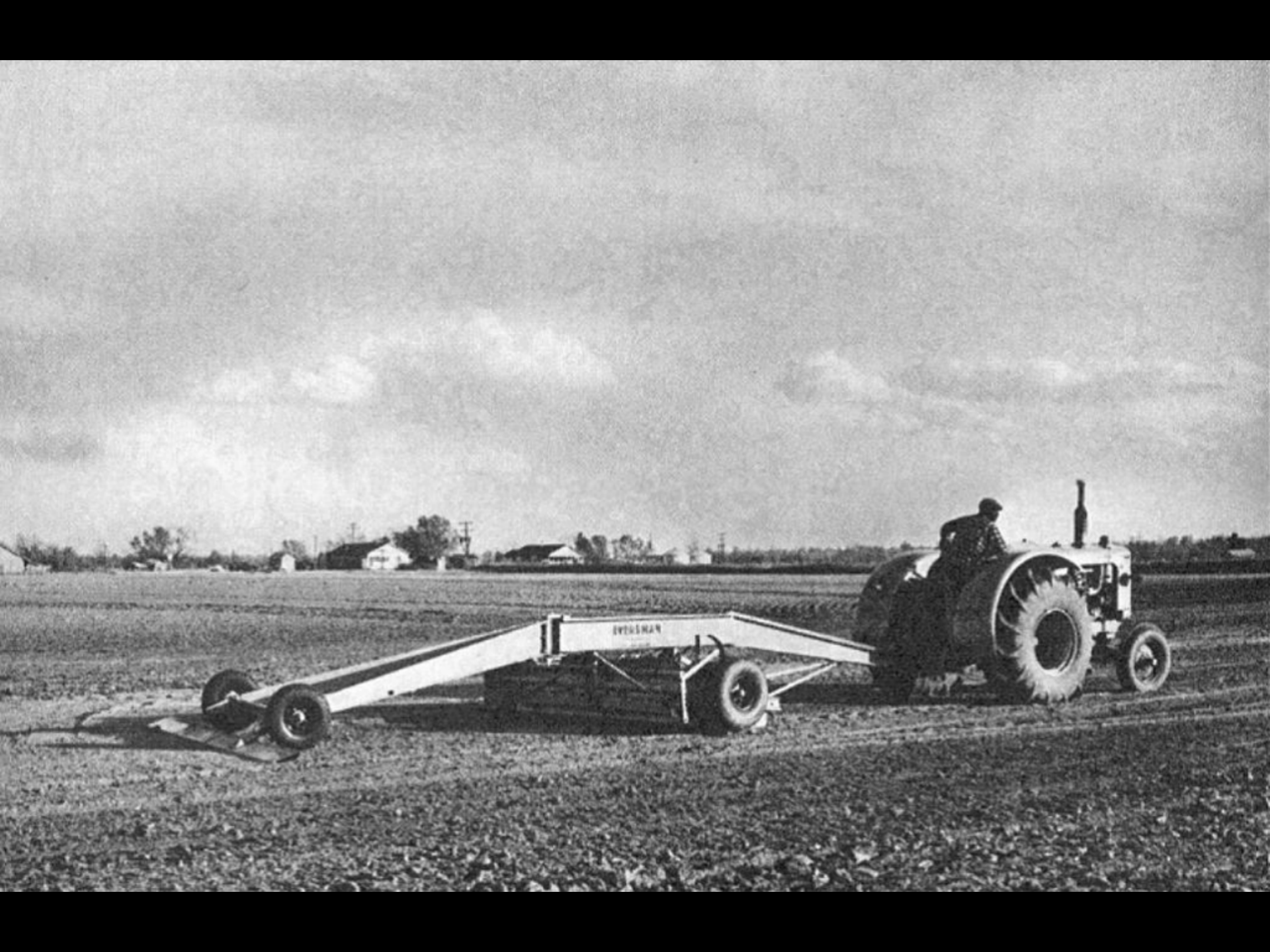






Outlet









A major sign showing where wetlands have been leveled



The fields do not contain pits and mounds



This root mass
was
4.5 meters high!

How can you tell where wetlands have been filled & drained?





Think of a fashion model, no one can naturally look this perfect

Fields are retouched wetlands, just like glamour photos!

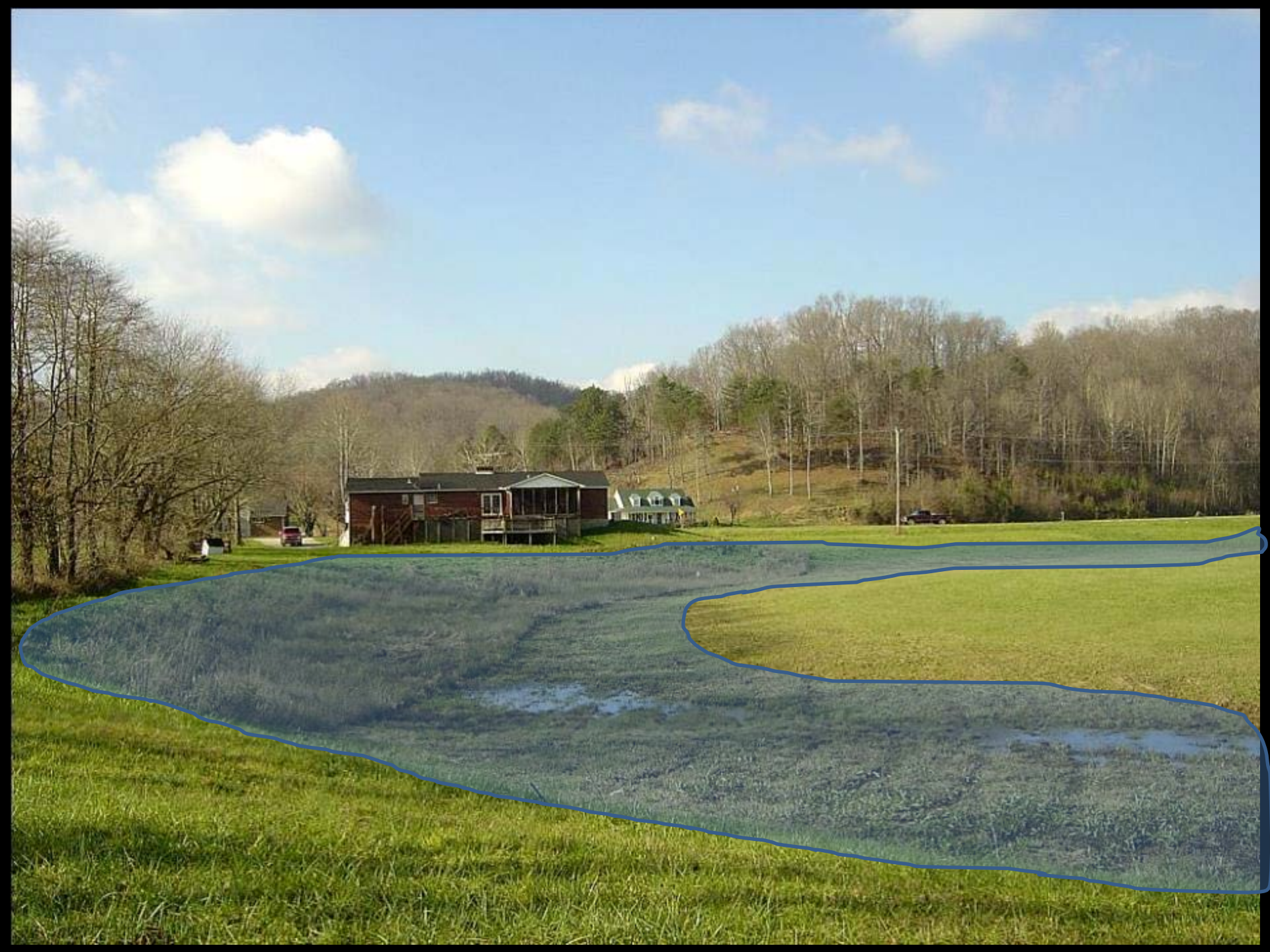


Can you find the historic wetlands?

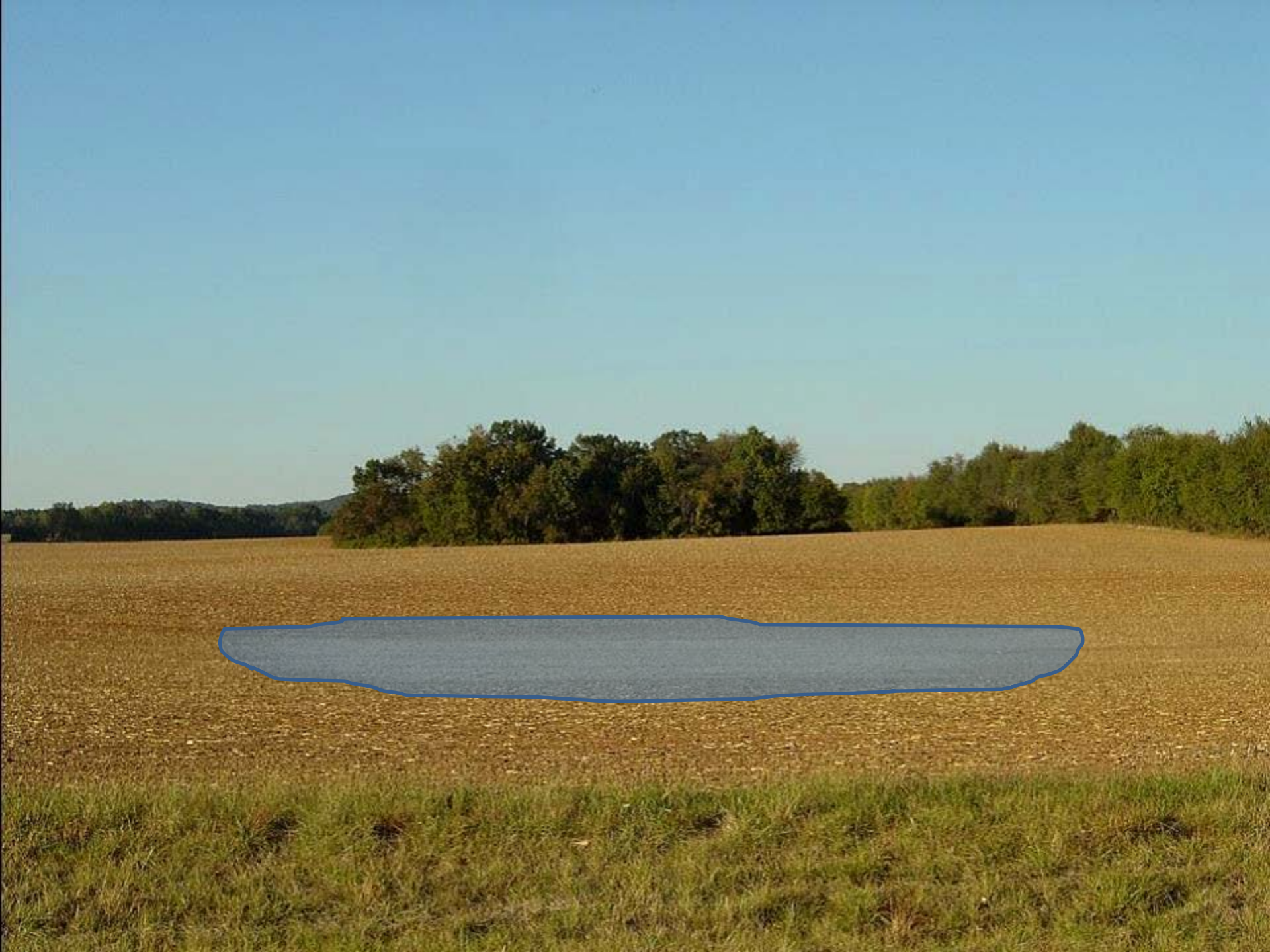










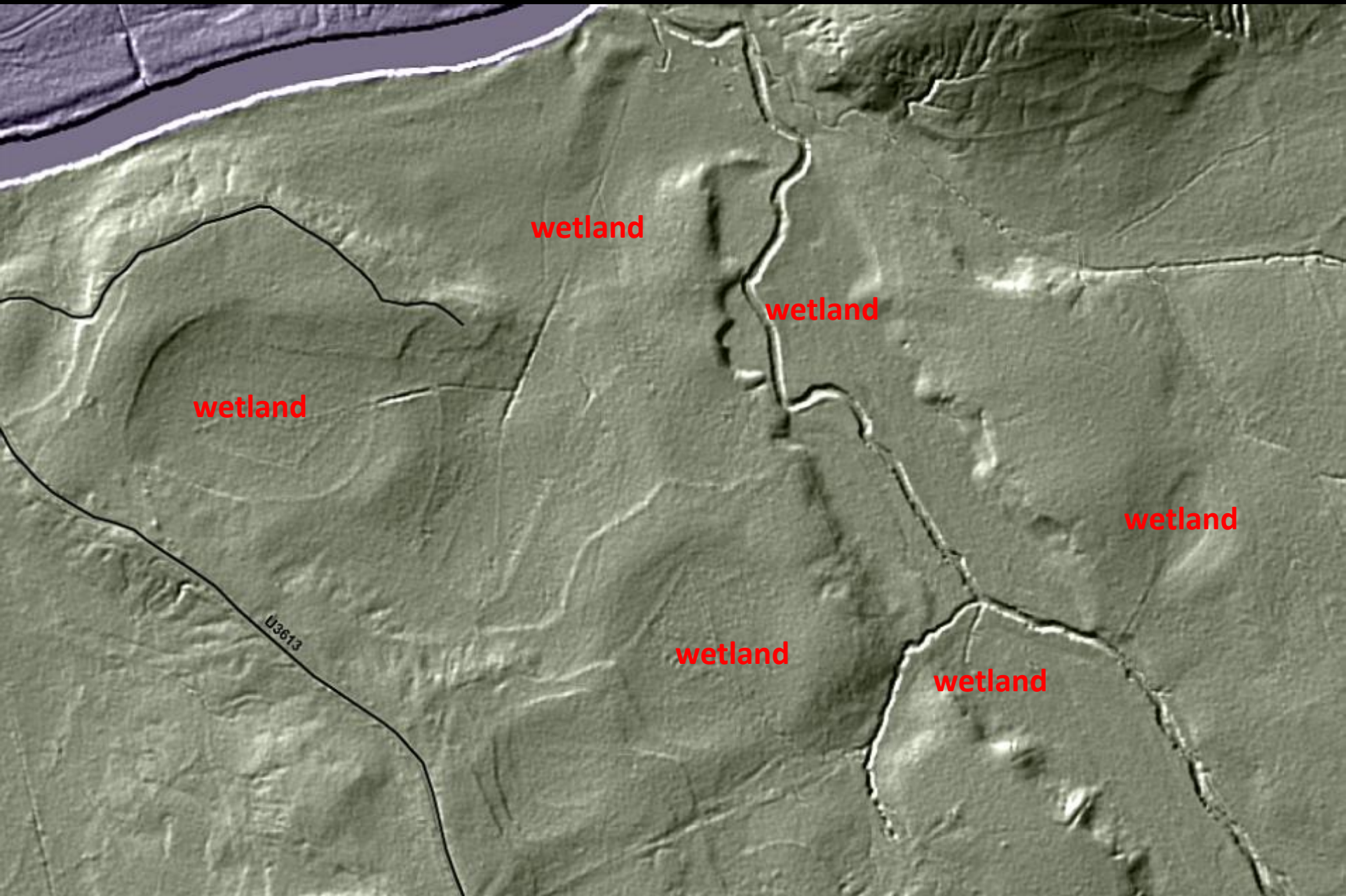








U3613



wetland

wetland

wetland

wetland

wetland

wetland

U3613













Dead furrow

Land





Buried drain lines

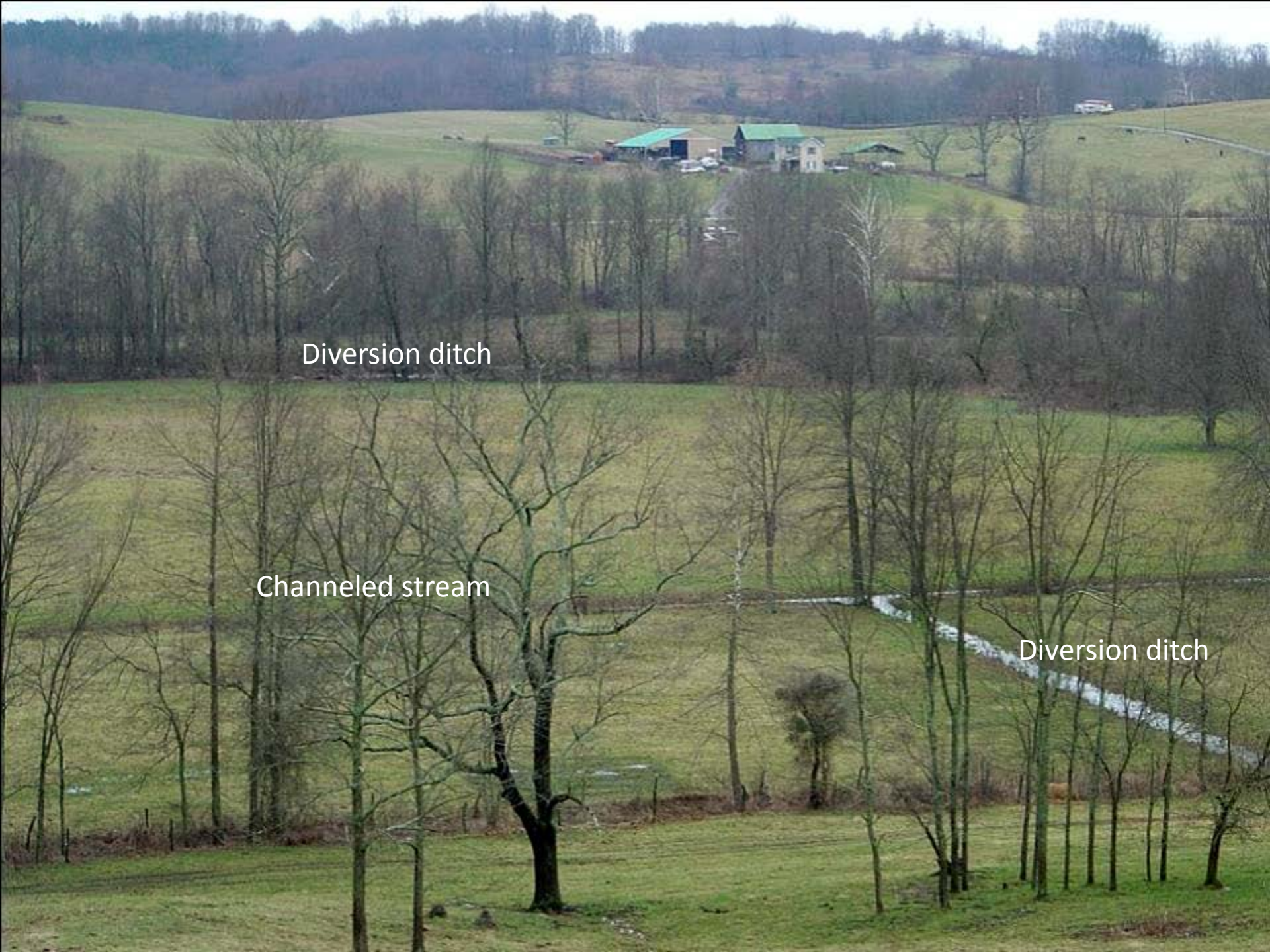
Filled dead furrow

Channeled stream

Filled dead furrow

Moved stream





Diversion ditch

Channeled stream

Diversion ditch





Dead furrow

Land

Dead furrow





Diversion Ditch

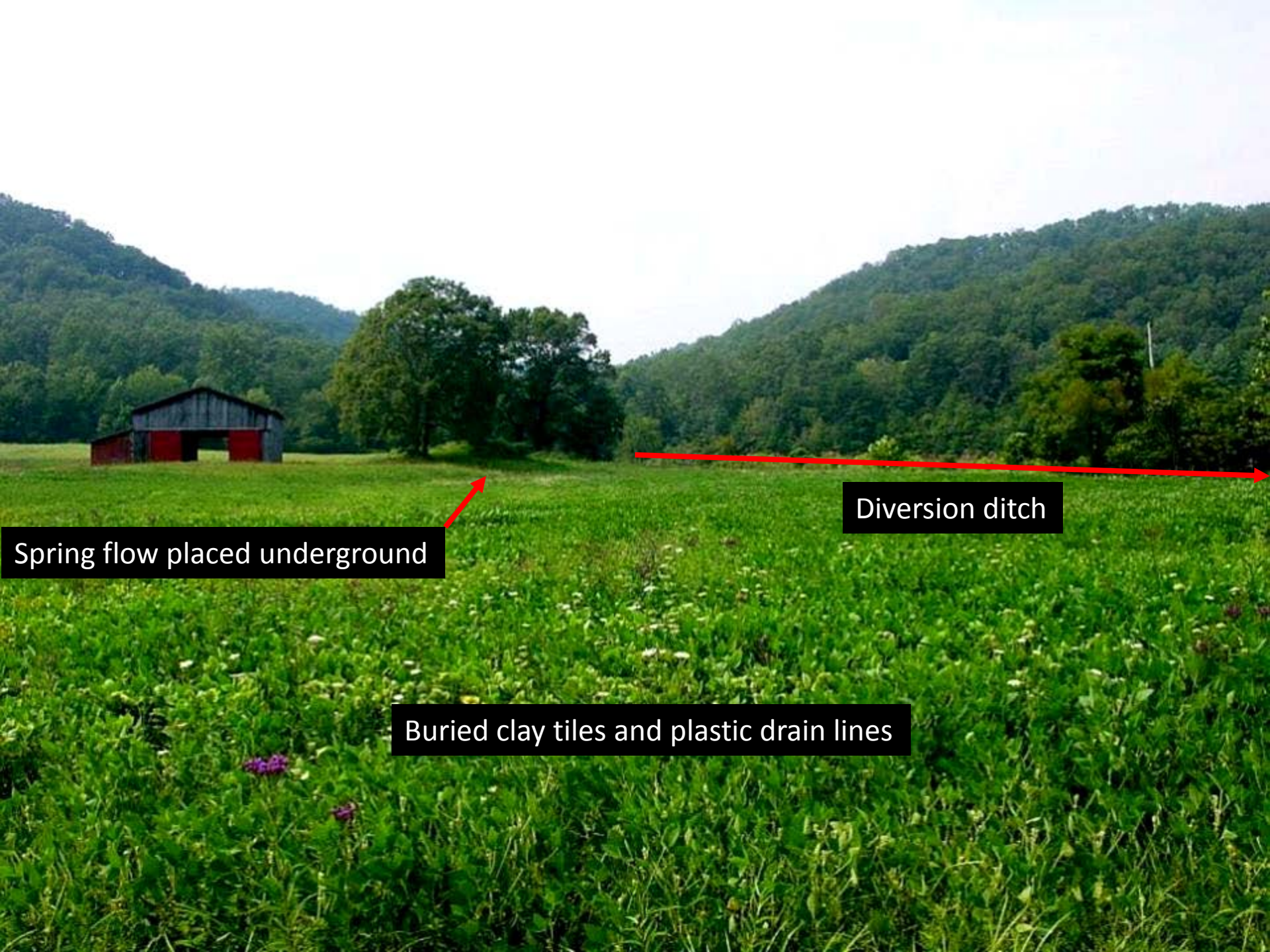




Filled wetland

Surface inlet





Spring flow placed underground

Buried clay tiles and plastic drain lines

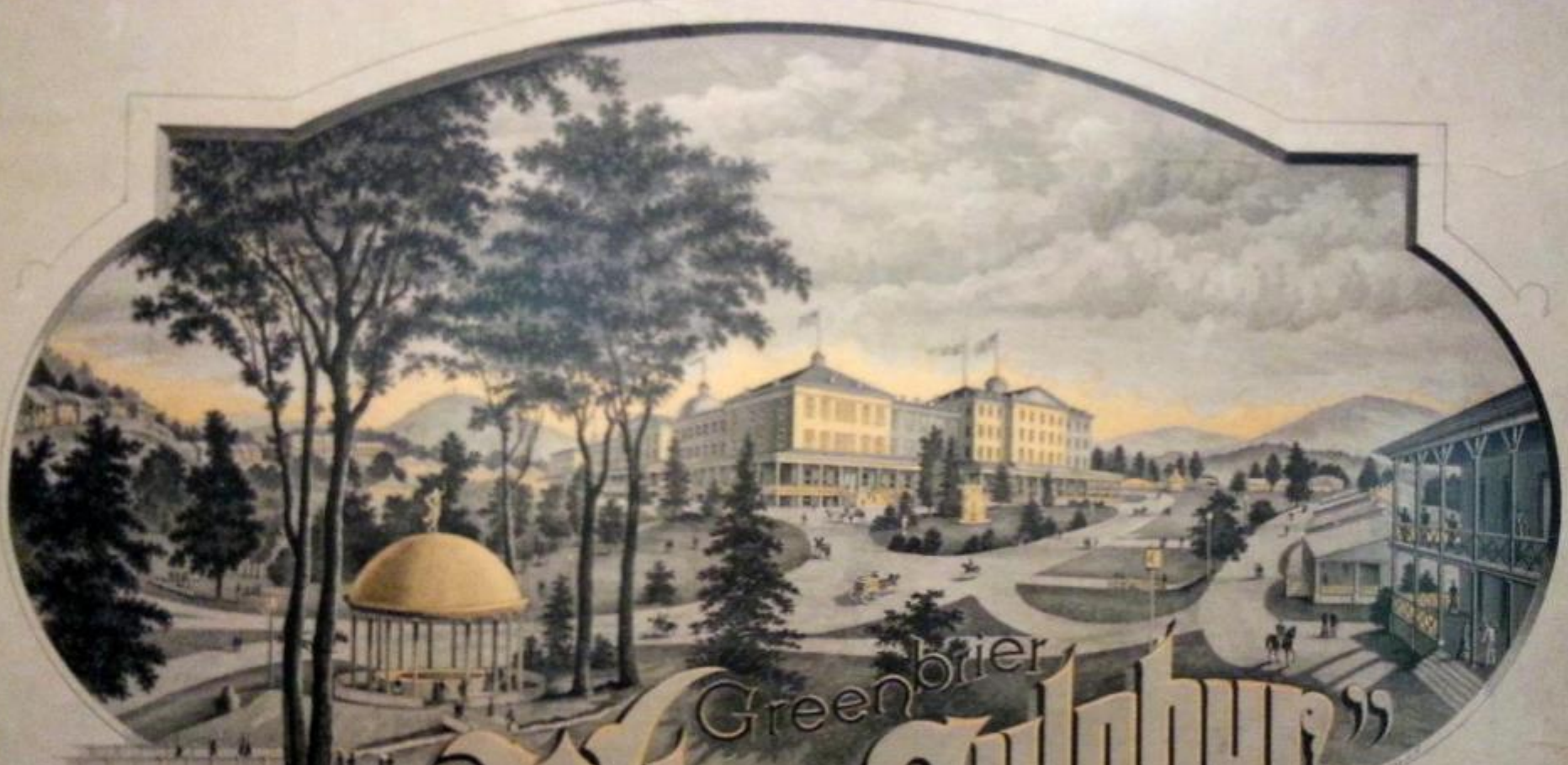
Diversion ditch



Many wetland “creation” projects are actually wetland restoration projects, where someone has done an A+ job draining the wetland



Greenbrier Inn
White Sulphur Springs, West Virginia



Greenbrier

"White Sulphur Springs"

on THE
CHESAPEAKE & OHIO R'Y. W. Va.

Harrison Phoebus
PROPRIETOR HYGEIA HOTEL OLD POINT COMFORT, VA.
Lessee



Drain pipes



Trees growing in deepest part of wetland

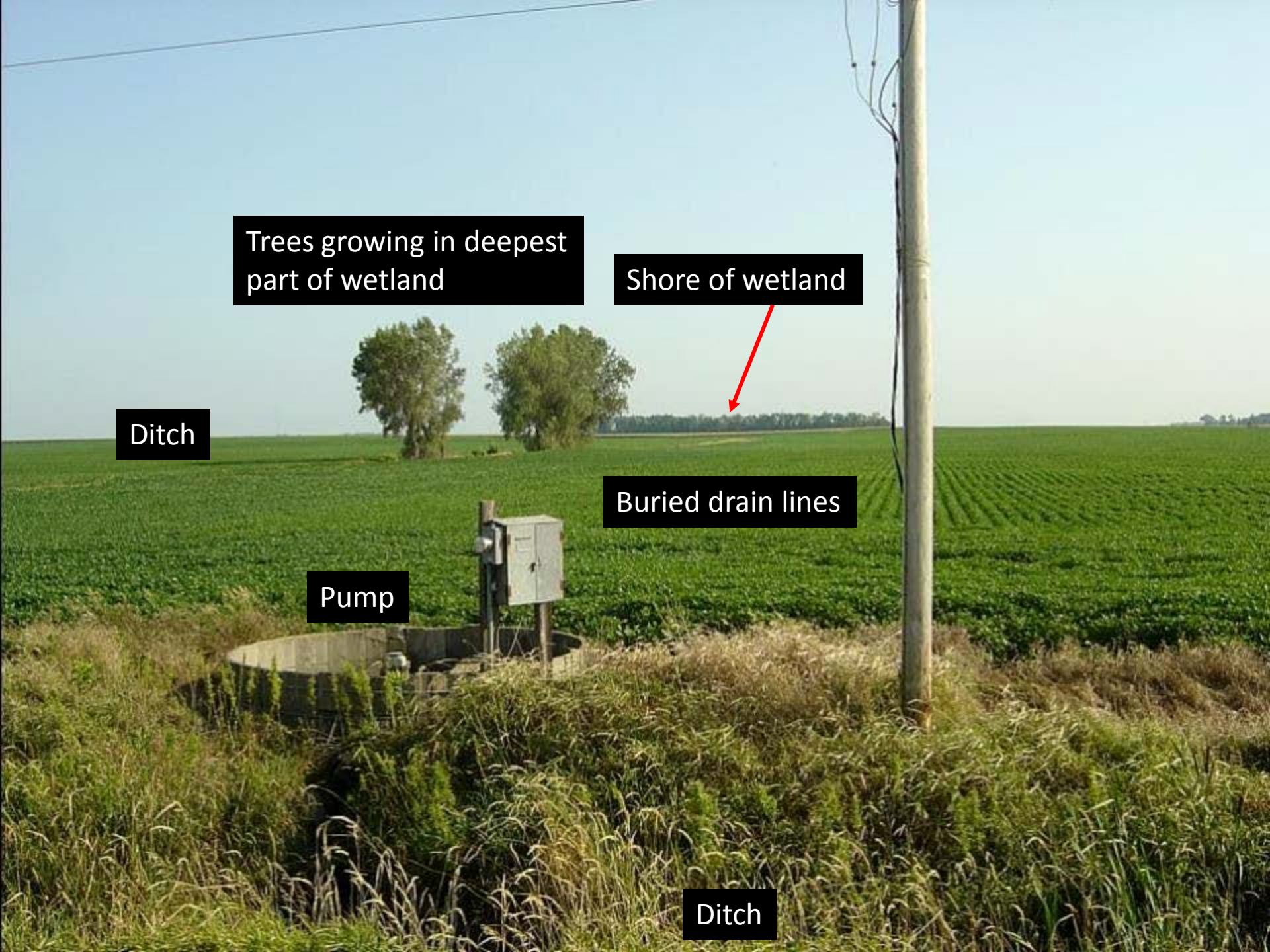
Shore of wetland

Ditch

Buried drain lines

Pump

Ditch







Diversion ditch at base of hill

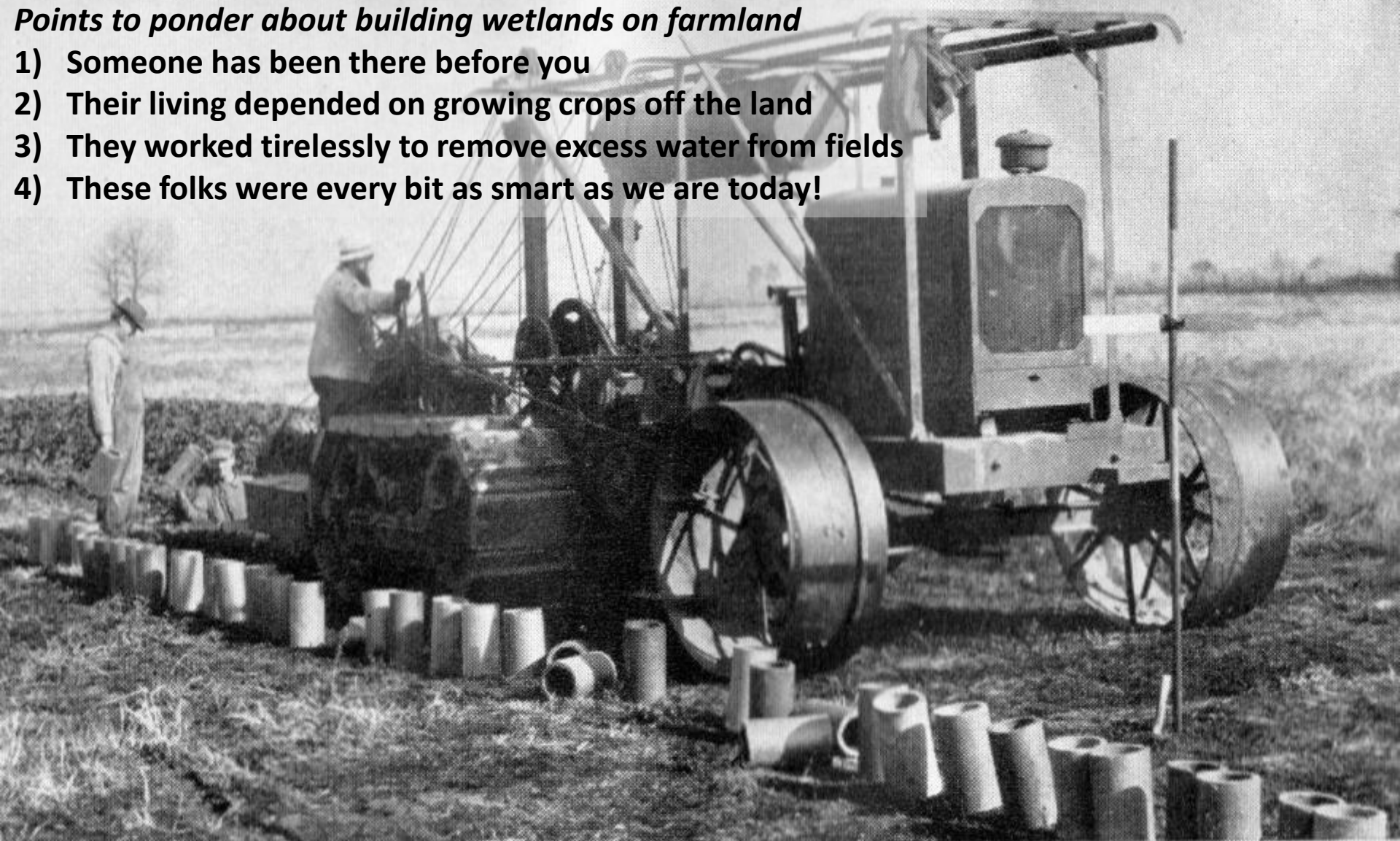
Buried drain lines & leveled field

outlet

Straightened stream

Points to ponder about building wetlands on farmland

- 1) Someone has been there before you**
- 2) Their living depended on growing crops off the land**
- 3) They worked tirelessly to remove excess water from fields**
- 4) These folks were every bit as smart as we are today!**













Wetland and stream restoration projects should take action to disable historic drainage practices to be successful



Attempting to build a wetland without addressing historic drainage is like trying to cure cancer with a Band-Aid







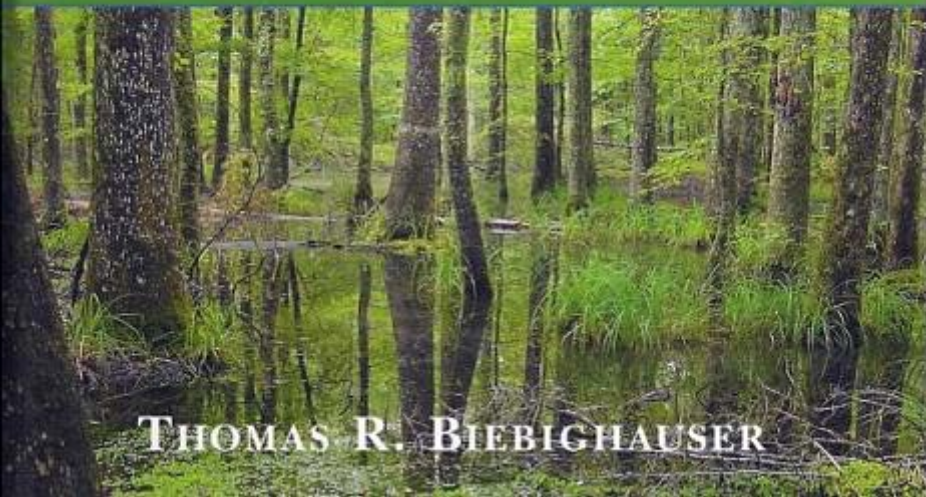








WETLAND DRAINAGE, RESTORATION, AND REPAIR



THOMAS R. BIEBIGHAUSER



WETLAND RESTORATION AND CONSTRUCTION

A Technical Guide



THOMAS R. BIEBIGHAUSER



**A History of Wetland Drainage...How They Pulled the Plug©
tombiebighauser@gmail.com
www.wetlandrestorationandtraining.com**