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# NRCS Conservation Practice Standards

## *Saturated Buffer*

*Presented by:*

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Natural Resources Conservation Service

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## Agenda

- ▶ NRCS conservation practice standards
- ▶ Saturated Buffer and related standards
- ▶ Resources for Saturated Buffer planning and design



## Why have standards?

- ▶ Projects that will perform and last as expected
- ▶ Science based
- ▶ Used by many – not just on NRCS projects
- ▶ Setting the bar for use of taxpayer funds for technical and financial assistance
- ▶ Sometimes even used by regulators



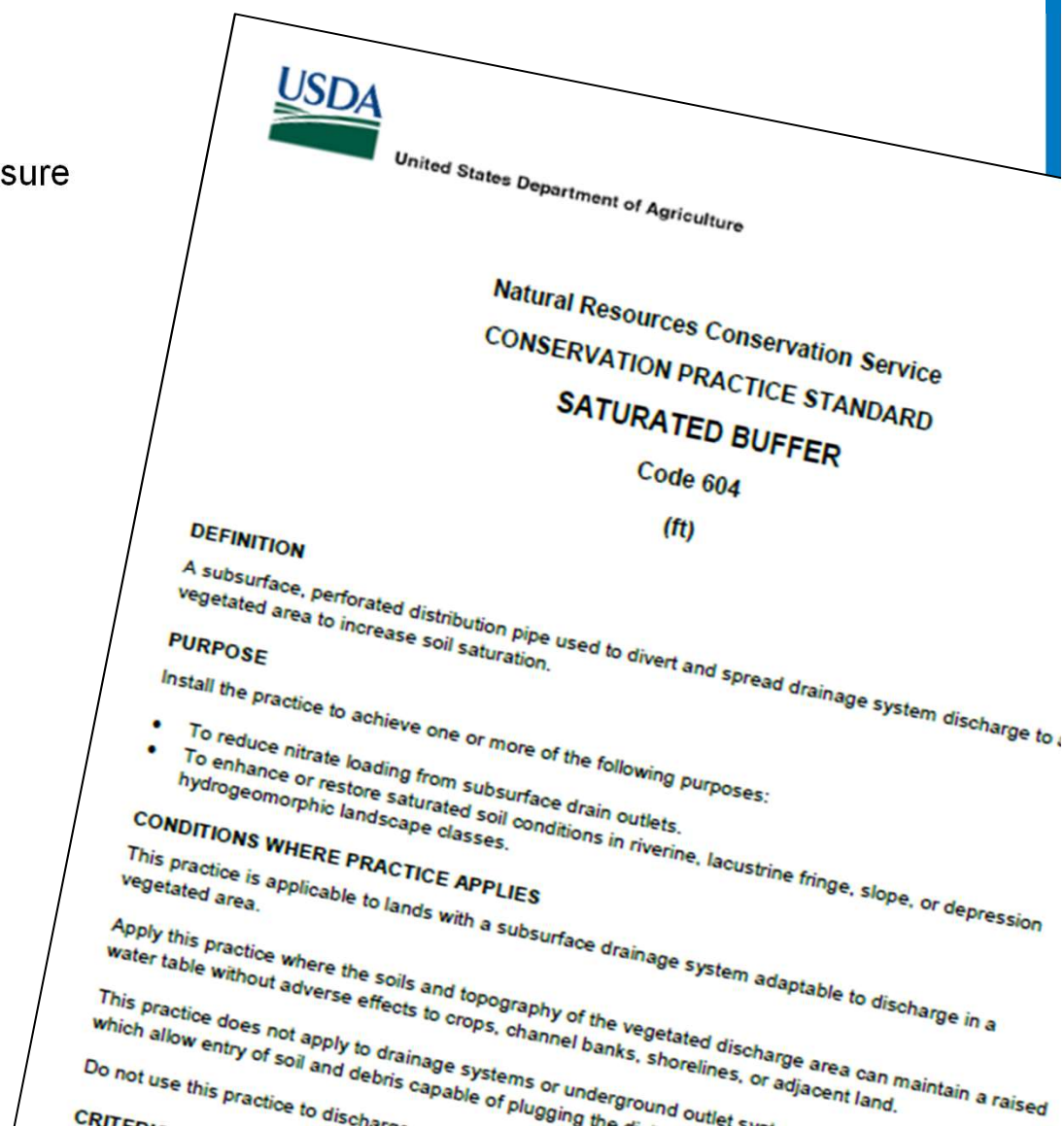
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# Content of an NRCS Standard

- ▶ Practice name, code, and unit of measure
- ▶ Definition
- ▶ Purpose
- ▶ Conditions where practice applies
- ▶ Criteria
  - ▶ General (for all purposes)
  - ▶ Additional (for particular purpose)
- ▶ Considerations
- ▶ Plans and specifications
- ▶ Operation and maintenance
- ▶ References





# NRCS Standard: Saturated Buffer



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604-CPS-1

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

## SATURATED BUFFER

Code 604

(ft)

### DEFINITION

A subsurface, perforated distribution pipe used to divert and spread drainage system discharge to a vegetated area to increase soil saturation.

### PURPOSE

Install the practice to achieve one or more of the following purposes:

- To reduce nitrate loading from subsurface drain outlets.
- To enhance or restore saturated soil conditions in riverine, lacustrine fringe, slope, or depression hydrogeomorphic landscape classes.

### CONDITIONS WHERE PRACTICE APPLIES

This practice is applicable to lands with a subsurface drainage system adaptable to discharge in a



## Conditions Where Practice Applies

- ▶ Land with subsurface drainage (that can be adapted to discharge into a buffer)
- ▶ Where a raised water table can be maintained without adversely affecting banks, neighbors
- ▶ Does NOT apply to any system with surface inlets!
- ▶ Not to be used for septic effluent or animal waste



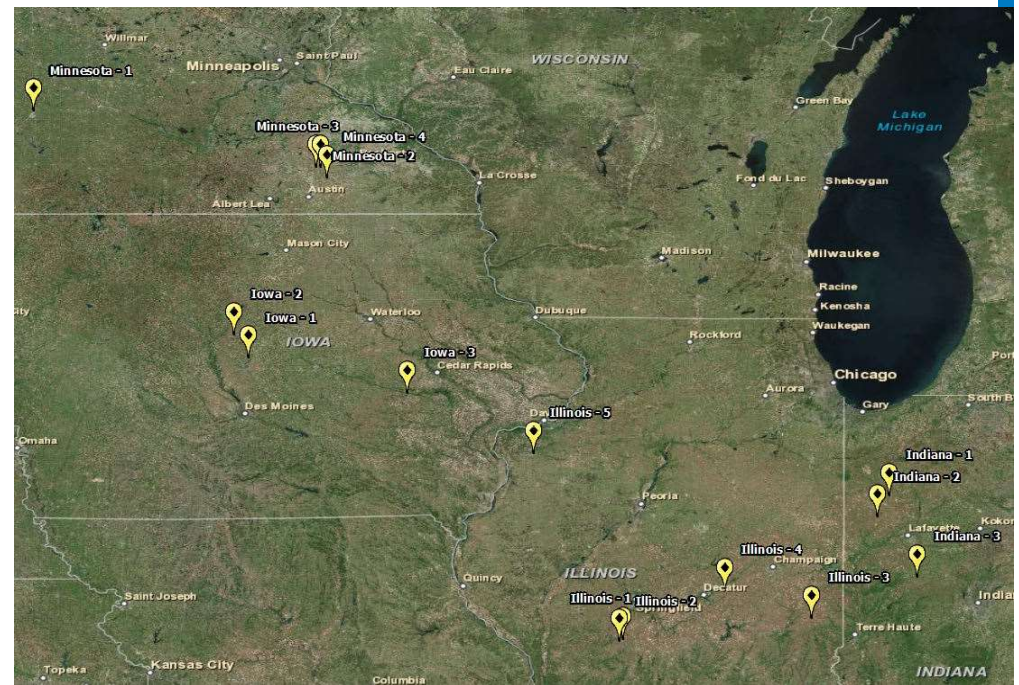


## Criteria Development

Results	Number of Sites
Substantial nitrate removal	4
Promising in at least one year (2013-2015)	3
Insufficient data	3
Failure – did not remove nitrate	5

### Several reasons for the failures:

- Coarse soil layers (couldn't maintain a water table)
- Inadequate soil carbon (no energy source for denitrifying bacteria)
- Improper design or installation
- High water levels in ditch

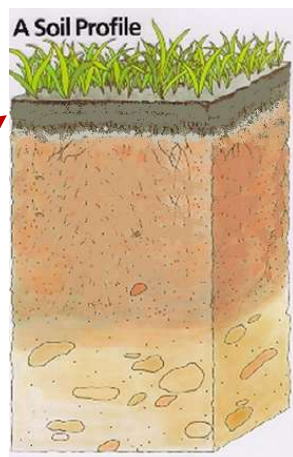


## Unsuitable Site

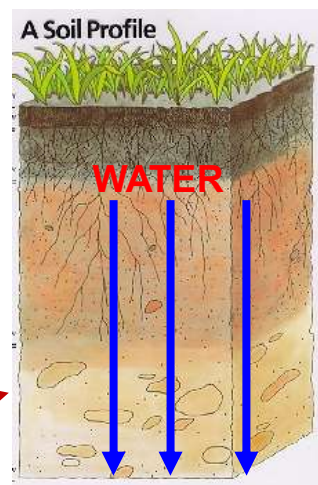
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## Suitable Site

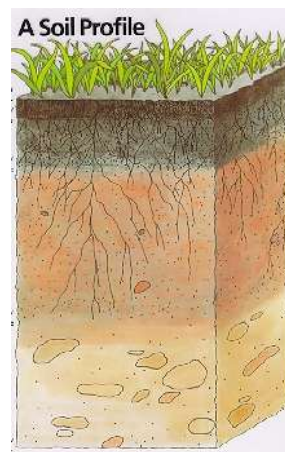
Not much  
organic  
matter



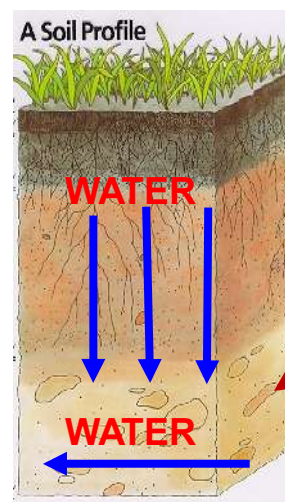
Coarse  
gravel layer



At least 1.2%  
O.M. in top  
2.5 feet



Clay or  
moderately  
impermeable  
layer





## Preplanning - Soil

- ▶ Presence of Organic Matter
- ▶ Capable of holding a water table
  - ▶ Poorly or somewhat poorly drained
  - ▶ Absence of sandy or gravelly layers?
- ▶ Hydraulic properties
  - ▶ Ksat
  - ▶ Drainable porosity

Soil Physical Properties
Bulk Density, One-Third Bar
Organic Matter
Saturated Hydraulic Conductivity (Ksat)
Water Content, One-Third Bar
Soil Qualities and Features
Drainage Class

*Prepare for the site specific geologic investigation*

<http://websoilsurvey.sc.egov.usda.gov>



## Criteria – Geologic/Soil Investigation

- ▶ Possible to hold a water table
- ▶ At least 1.2% organic matter in top 2.5 feet
- ▶ Abandoned pipes or tile?



*...and visual observation*



## Criteria – Buffer Zone

- ▶ Minimum width of vegetated buffer zone 30 feet



- ▶ *Defined as the area between the distribution pipe and the receiving channel on which permanent vegetation is maintained.*



## Criteria - Location

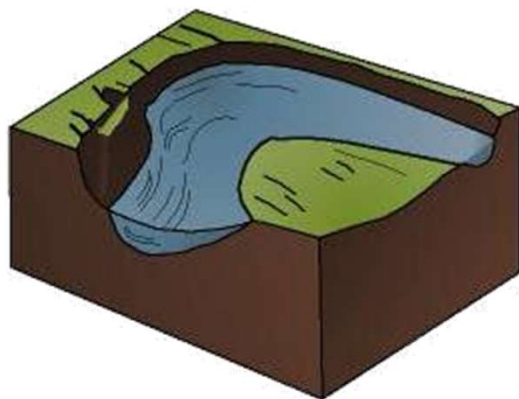
- ▶ Maximize amount of subsurface drainage water routed to distribution line  
*(locate so you can treat as much subsurface drainage water as possible)*
- ▶ No adverse impacts to neighbors





## Criteria - Bank and Channel Stability

- ▶ Incised >8 ft? Avoid or analyze.
- ▶ Bank issues
- ▶ Dencutting channel
- ▶ Lateral migration potential?





## Slope Stability

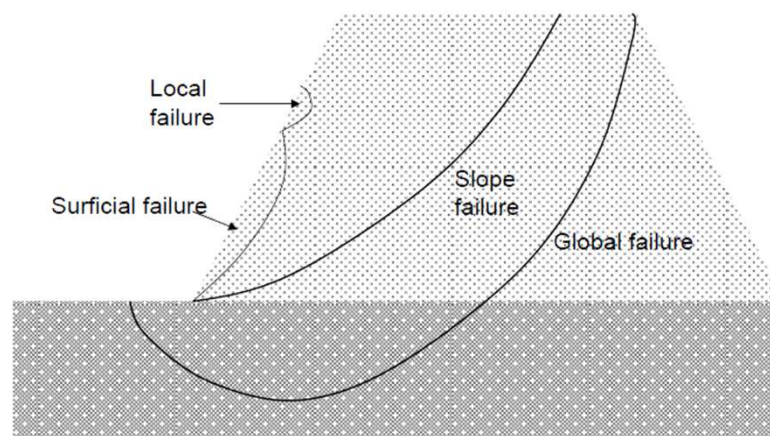
- ▶ Clay soils with Plasticity Index (PI) = 30 to 40 are stable on ~ 3:1 slopes
- ▶ Natural streambanks typically stable at 4:1 to 7:1
- ▶ Clays with  $PI > 80$  need more like 6.5:1



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## So, what now?

- ▶ Geotechnical engineering is beyond the scope of this session.
- ▶ If you have a site with banks  $> 8\text{ft}$  and our triage indicates you might have a problem, consider one of these options:
  - ▶ Find a different site or pick a different conservation drainage option
  - ▶ Lay the bank back at a more stable slope (set the distribution line far enough back)
  - ▶ Stabilize the site first (CPS 580 – Streambank and Shoreline Protection)
  - ▶ Involve a geotechnical engineer
  - ▶ Use visual assessment option



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# Slope Stability Visual Assessment



- ▶ No visual slope instability

Remember: saturating the banks may change the current condition

- ▶ Adequate slope and vegetation cover
- ▶ No recent lateral shifting in floodplain
- ▶ Beware – if restrictive layer is significantly higher than stream baseflow



## Criteria - Flow

- ▶ Minimum design flow 5% of max capacity of drainage system
  - ▶ Or as much as is practical based on available length of vegetated buffer
- ▶ How to determine if the buffer has adequate capacity
  - ▶ Use soil saturated hydraulic conductivity and hydraulic gradient





# Determining Drainage System Capacity

1. Mainline configuration (*tile size, type, grade*  
→ capacity of outlet main)
2. Drainage Coefficient ( $Q = DC \text{ inches/day} \times$   
acres drained)
3. Modeling
  - ▶ Library of DRAINMOD runs for typical soil textures
  - ▶ Site specific modeling

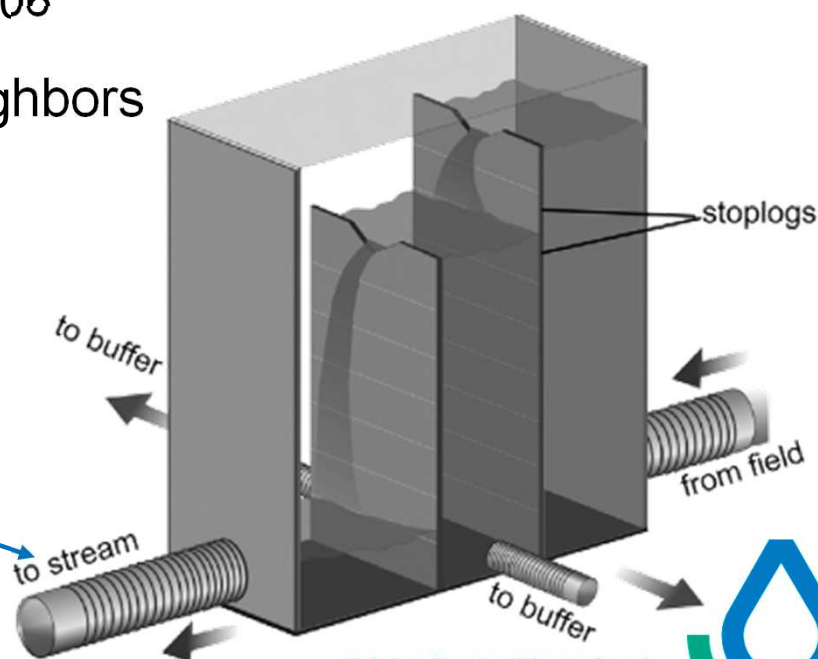




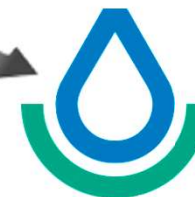
## Criteria - Water Control Structure

- ▶ Water control structure (CPS 587)
- ▶ Nonperforated pipe for overflow
  - ▶ Avoid draining saturated soil zone
  - ▶ Comply with velocity criteria in CPS 606
- ▶ Remember: no adverse effect on neighbors

*nonperforated at least 20'*



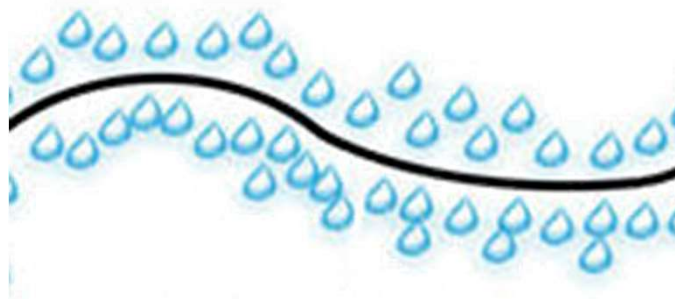
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## Criteria - Distribution Pipe

- ▶ Meet criteria for CPS 606 – Subsurface Drain
- ▶ Minimum 2 feet of cover over the pipe
- ▶ Target is flow uniformity – add structures as needed  
*(3' max elevation difference between structures)*
- ▶ The limitation needs to be flow through the soil, not flow through the pipe.

*Make the pipe large enough that it is not the limitation.*





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## Criteria - Vegetation

- ▶ Use Critical Area Planting (342) or Conservation Cover (327)
- ▶ If you're in an existing filter strip, check to see what the revegetation requirements are.

**CAUTION**

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## Additional Criteria *to reduce nitrate loading*

- ▶ Maintain water table within 12" of ground surface @ structure  
(during the management period)
- ▶ Maintain design level except when lowering for:
  - ▶ Crop root zone
  - ▶ Field work trafficability
  - ▶ Adverse weather conditions
  - ▶ System maintenance





## Considerations

- ▶ Systems approach (*nutrient management, drainage water management, etc*)
- ▶ Target at least 15 acres of drainage area
- ▶ Observation ports may be useful
- ▶ There may be less surface water infiltration
- ▶ Wildlife and pollinator habitats
- ▶ Anti-seep collar
- ▶ Root plugging in distribution lines







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## Plans and Specifications

- ▶ Plan view
- ▶ Profiles: existing drain, distribution pipe, outlet channel
- ▶ Structural details
- ▶ Vegetation establishment requirements
- ▶ Construction specs

See the  
Statement of Work  
for more details.





## Operation and Maintenance



- ▶ Management information (water levels and timing)
- ▶ Inspection and maintenance requirements (both SB and contributing drainage system)
- ▶ Periodic removal of invasive trees/shrubs to reduce plugging
- ▶ Performance monitoring (if planned)
  - ▶ Demonstrate system performance
  - ▶ Improvements needed

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ILLINOIS OPERATION AND MAINTENANCE

### SATURATED BUFFER

Follow the operation and maintenance plan below to keep your saturated buffer functioning as intended:

Saturated buffers that are designed to be kept at the same setting year round, the settings (if applicable): \_\_\_\_\_ inches below the top of the structure

\_\_\_\_\_ inches below the top of the structure

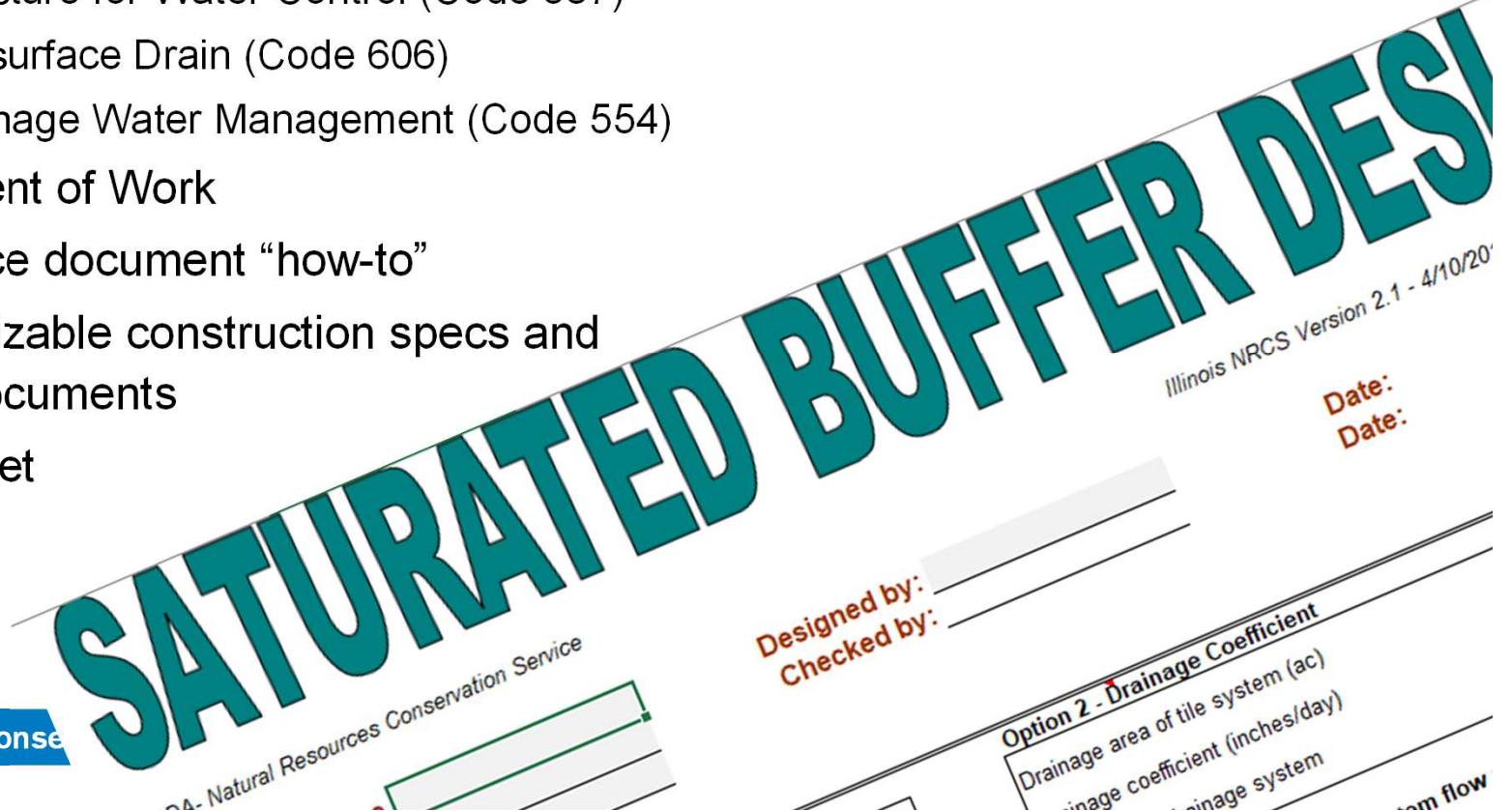
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## NRCS Resources

- ▶ Field Office Technical Guide
  - ▶ Standards
    - ▶ Saturated Buffer (Code 604)
    - ▶ Structure for Water Control (Code 587)
    - ▶ Subsurface Drain (Code 606)
    - ▶ Drainage Water Management (Code 554)
  - ▶ Statement of Work
  - ▶ Guidance document “how-to”
  - ▶ Customizable construction specs and O&M documents
  - ▶ Info sheet
- ▶ NRCS-IL Engineering website
  - ▶ Standard drawings
  - ▶ Spreadsheet planning/design tool





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