PROPOSED REVISION OF NRCS CURVE NUMBERS

CWEA Storm water Committee

MITAGS

Linthicum Heights MD

Dec 2017

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Co-Chair ASCE-NRCS Task Group

- In 1989 ARS/SCS group was established to
  - Determined if there was data available to reestablish the original documentation.
  - If there was data available to establish curve numbers to develop curve numbers for
    - the cultivation new practices.
    - Regional values
    - Monthly values

- In 2004 the work group report indicated
  - The Ia/S should be less than 0.2
  - The asymptotic method should be used to determine CN
  - There is limited data to support regional curve numbers
  - There is some data to support monthly curve numbers

- Given the findings of the ARS/SCS curve number work group the next step was the revision of the various chapter of NEH-630 Hydrology

- Natural Resource Conservation Service (NRCS) signed a Cooperative Agreement with the American Society of Civil Engineering (ASCE) in Sept 2105.

- An ASCE Task Group was formed.

- With the expressed purpose of developing proposed revisions to Chapters 8, 9, 10 and 12 of NRCS National Engineering Handbook Part 630, Hydrology. (NEH 630)

- The effort involved engineers, researchers, and scientists from across the United States all outside NRCS.

- The CN Task Group provided NCRS via ASCE drafts of each chapter by the end of September.
- It is my understanding the copies of the chapters furnished NRCS are available on the ASCE Collaborate internet site.

CHANGES

- Ia =0.05S from Ia =0.20S
- This is based on the analysis of data from over 300 small watersheds in the United States and research from other countries

CHANGES

- A system or equation was developed to convert the CN_{20} to CN_{05} values.

- The conversion equation is $CN_{05} = CN_{20}/(1.42 - 0.0042CN_{20}$

- ***The original CNs can not be used with the new runoff equation***

- $Q = (P-0.0S_{05})^2/(P+0.95S_{05})$ for $P > 0.05S_{05}$, $Q = 0$ otherwise

CHANGES

- The method to determine Curve Number (CN) from rainfall runoff data was modified in two ways. The first way was how to select the data to plot

    - Use of ordered or frequency based data rather than natural data.
        - Ordered data is matching the largest runoff with the largest rainfall
        - Natural data is matching runoff with the causing rainfall
   - This is the way the initial curve numbers were determine

CHANGES

- The second change is how to obtain the CN for a particular soil-cover complex

CHANGES

- The current method is to plot P versus Q
  - The annual events using natural were used.
  - The median value was selected.

226 Ordered and Natural rainfall-runoff events for a 11.3 acre ARS watershed located at Riesel, TX (WS42040, 1969-1981)
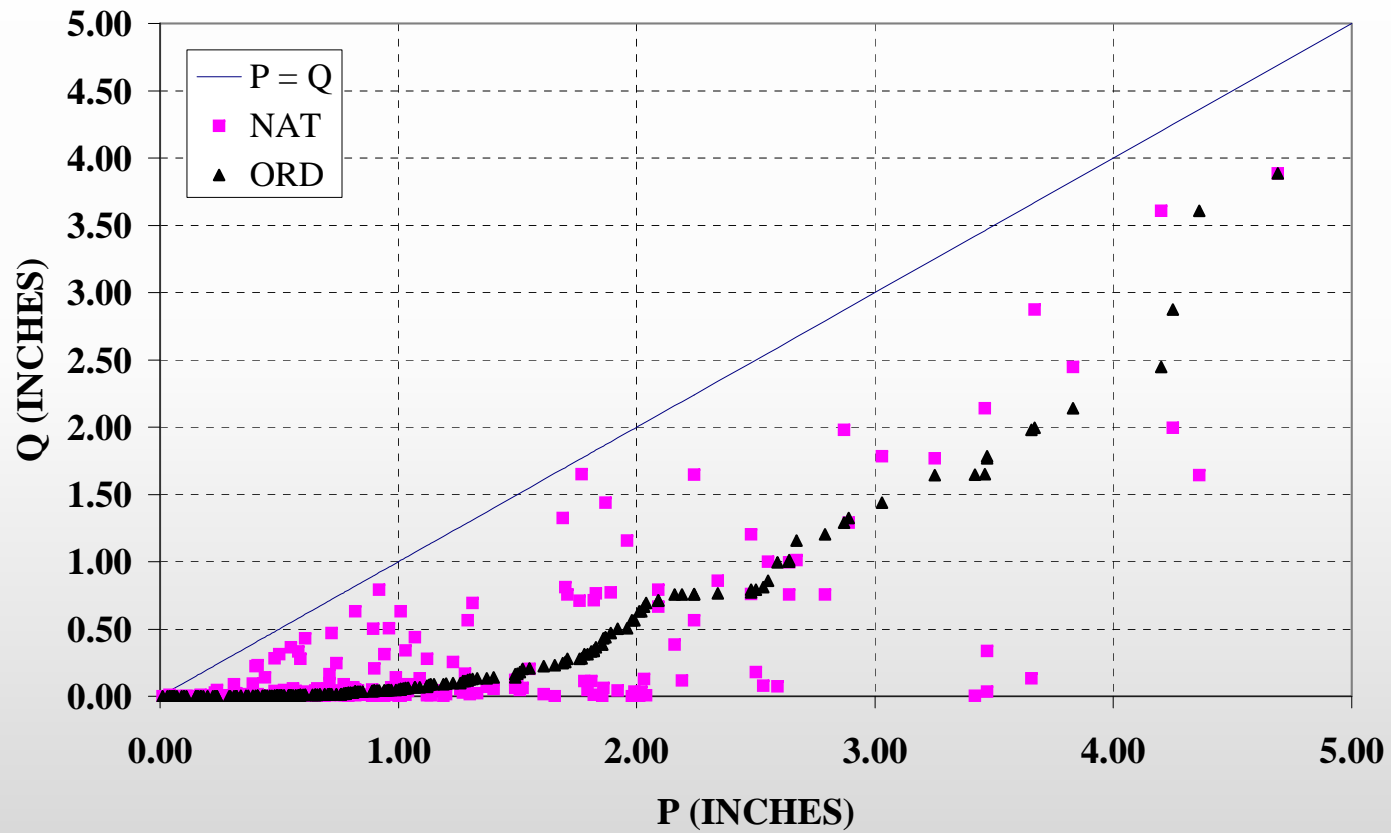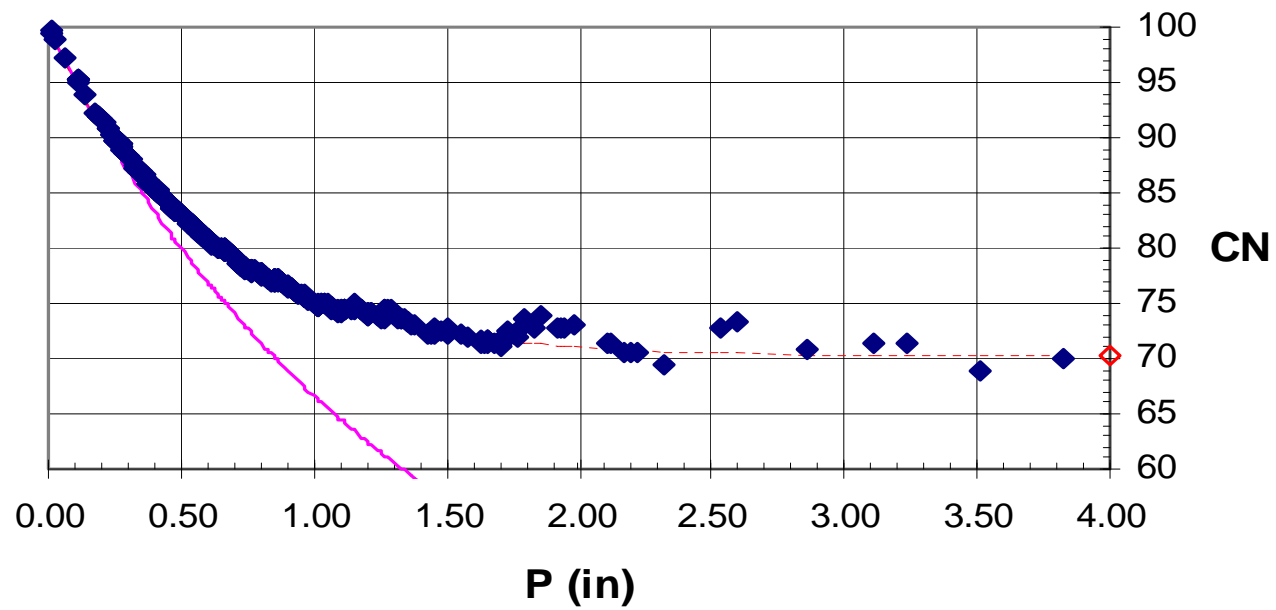
CHANGES

- The proposed method is to plot CN versus P for all events

- Either ordered or natural events can be used.

- An analysis indicated that there was not a significant difference between order or natural data in the computed CN.

- The Technical Group (TG) recommends using ordered data.

- This procedure is known as the asymptotic approach

Coshocton, Ohio
#26004 pasture
1939-1986

CHANGES

- An equation has been developed to define the curve shown in the prior slide
- The equation has the form
- $CN(P) = CN_{\infty} + (100 - CN_{\infty})\textbf{exp}(-kP)$
- Which is normally fitted by trial and error
- The new chapter 9 provides detail procedures for determining k
- This procedure tends to make the selection of the representative CN very easy.

CHANGES

- Analysis of many watersheds has lead to the conclusion that there are basically three types of watershed based on their responses.
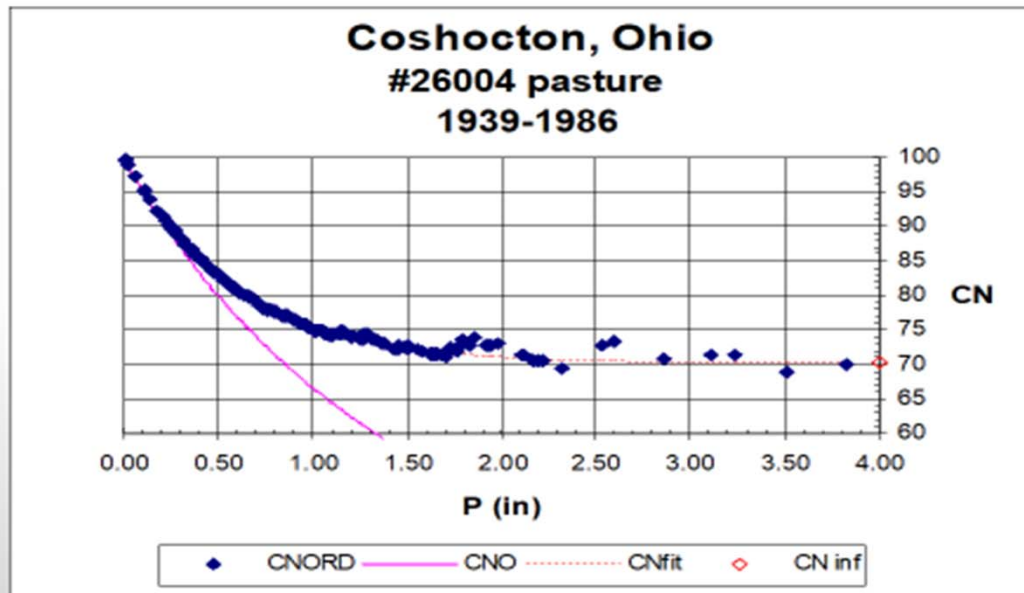
- Complacent
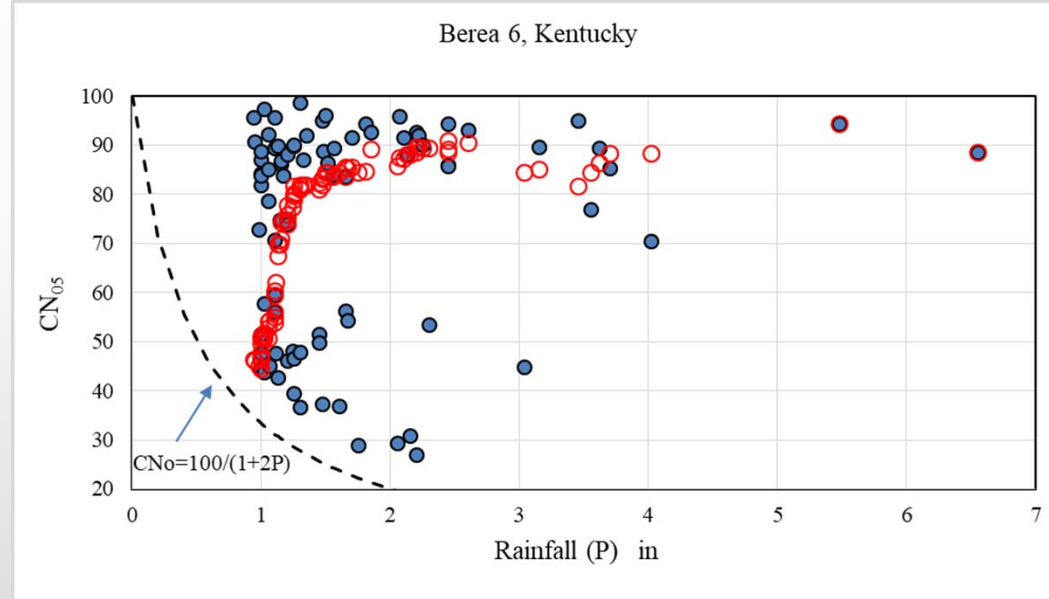
Complacent

CNo=100/(1+2P)
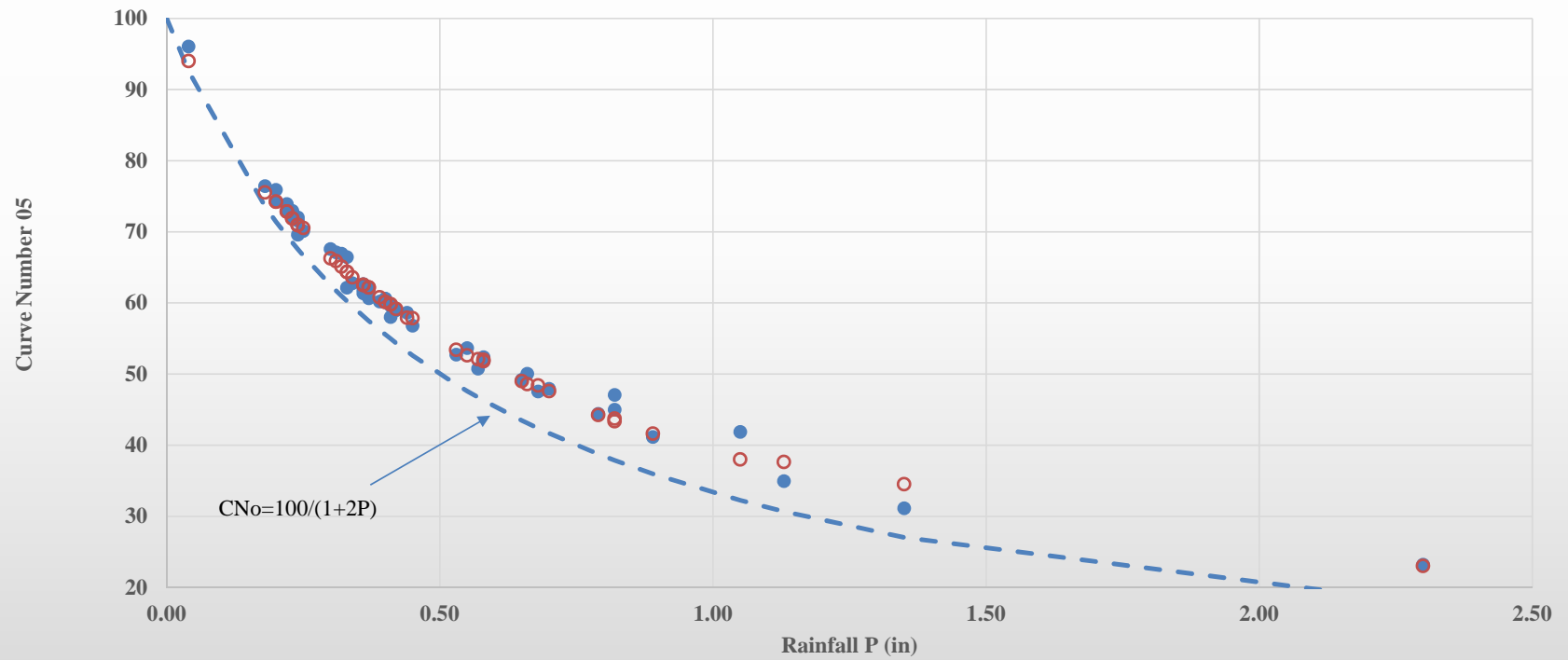
- In a complacent watershed the major source of runoff is the channel flow or it has very depth porous soils
- There is no apparent asymptotic value

Standard

Coshocton, Ohio
#26004 pasture
1939-1986

- These are the normal Midwest agricultural watersheds that were investigation in the beginning.
- These watersheds occur in many places in the world.

Violent

Berea 6, Kentucky

- These watershed have an initial response like classic watershed or even a complacent watershed and then major runoff occurs.

- These would be shallow soils with impervious sublayer

- Such as
  - Green roofs
  - Porous pavement
  - Steep forested watershed with a shallow soil profile

CHANGE

- The chapters will add information on
    - Forested watersheds
        - **Curve Numbers do not work in some cases**
    - National Land Classes Data (NLCD)
        - Curve Numbers have been added for a nation wide classification system
    - How to determine Curve Numbers for all three types
    - Selected Urban Curve Numbers have been added

CHANGES

- It has been recommended that the chapters be reordered
    - Chapter 10 curve number science
    - Chapter 9 actual curve numbers
    - Chapter 8 land use and class information
    - Chapter 12 Influences of and treatment

- It is my understanding the NRCS will complete the field review of the proposed chapters by Feb 2018

- The next step will to decide if the chapters should be used with NRCS comments or rejected.

- If accepted it will require revision of the standard NRCS computer programs Win TR-20, WinTR-55, EFM2, SITES.

- Other computer programs using the new CN procedure will also need to be reprogramed to use the new equations and CN values.