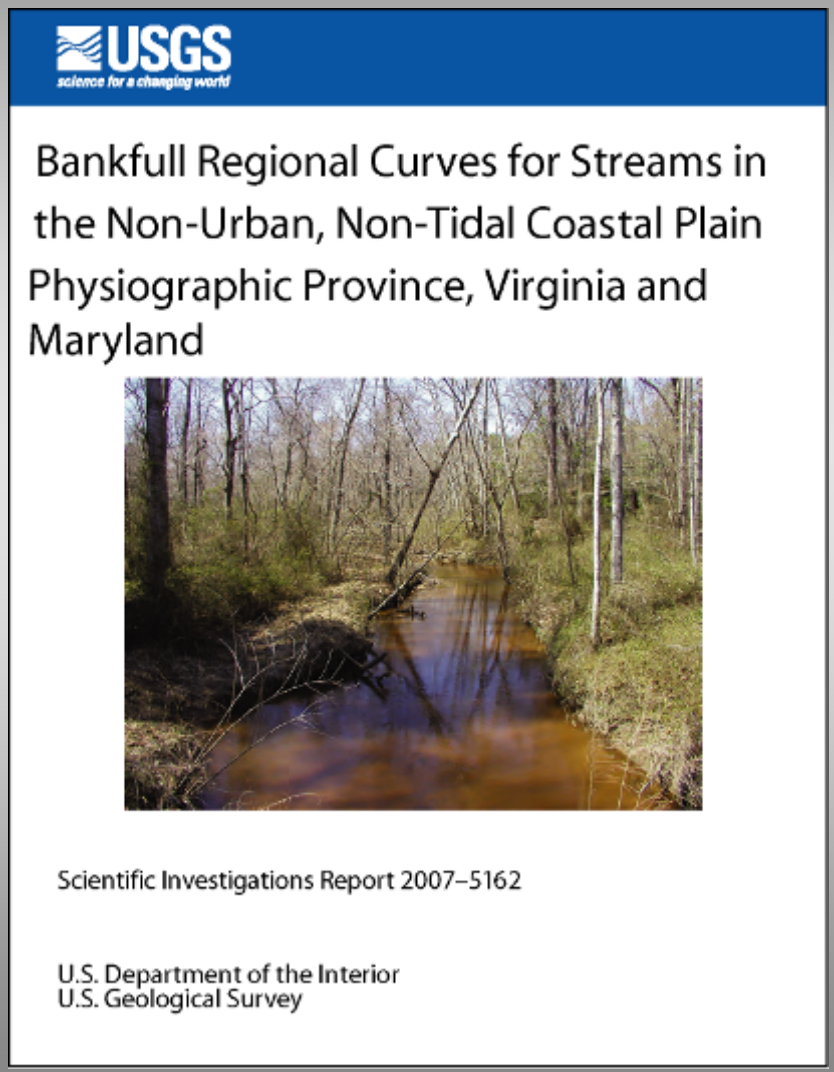
Understanding and Applying Bankfull Regional Curves in the Coastal Plain



Virginia Coastal Zone MANAGEMENT PROGRAM

DCR Department of Conservation & Recreation
CONSERVING VIRGINIA'S NATURAL & RECREATIONAL RESOURCES

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NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

USGS

Study Design and Assumptions

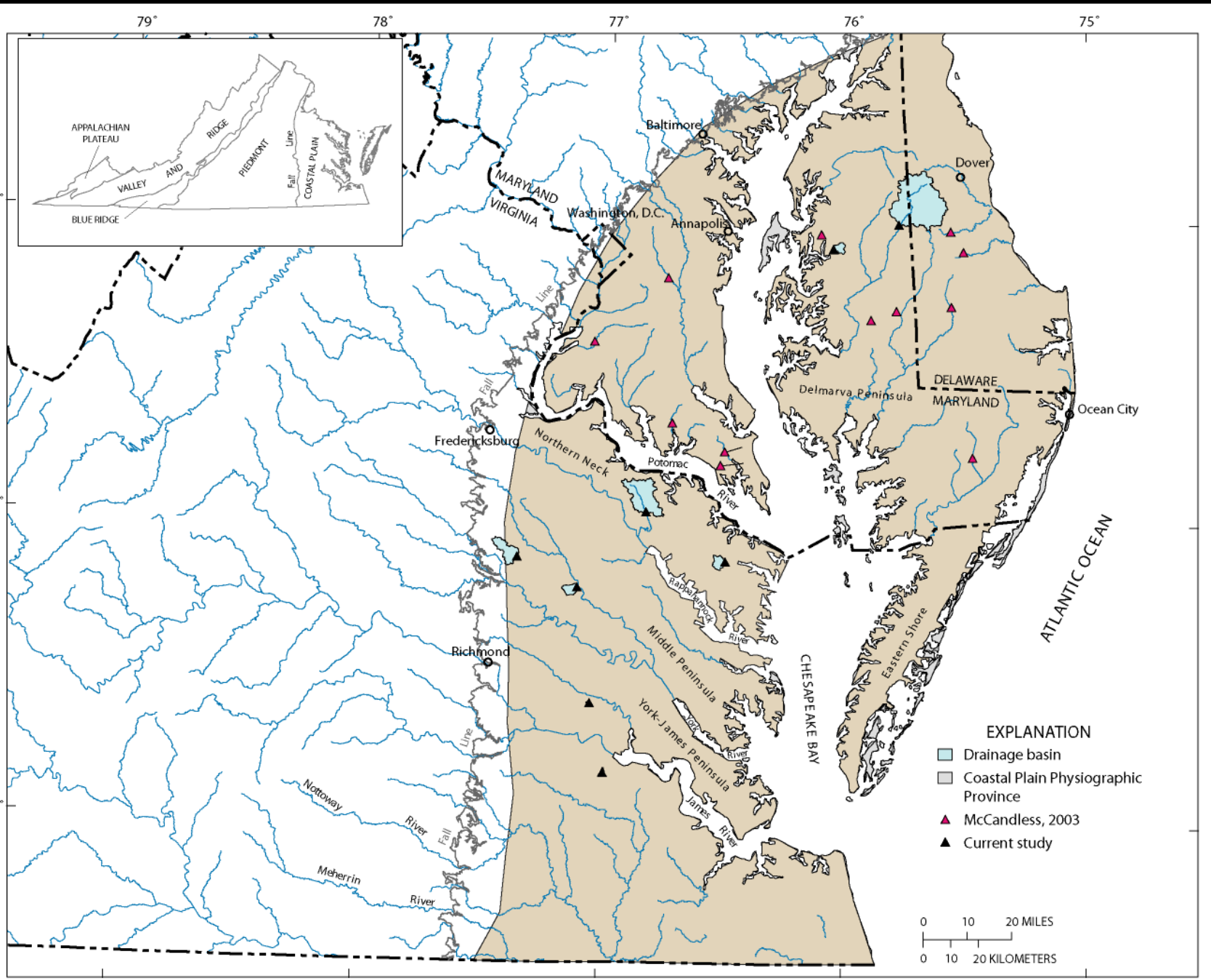
- Natural Channel Design
  - Natural-channel design involves rebuilding a channel with the dimensions, slope, and plan-view pattern that is expected to transport water and sediment without excessive aggradation or degradation while maintaining habitat and aesthetics consistent with unimpaired reaches subjected to similar hydrologic conditions (Rosgen, 1996).

- Bankfull Discharge
  - The flow that represents, or is a surrogate for, the full range of flows forming the bankfull channel.

Products: Regional Regressions

- Regression equations
  - $y = a(DA)^b$
  - These bankfull regional curves are one-variable ordinary least-squares regressions.

    - DA drainage area
    - CSA bankfull cross-sectional area
    - W bankfull width
    - D bankfull mean depth
    - Q bankfull discharge


79°
78°
77°
76°
75°
39°
38°
37°
APPALACHIAN PLATEAU
VALLEY AND RIDGE
BLUE RIDGE
PIEDMONT
Fall Line
COASTAL PLAIN
MARYLAND
VIRGINIA
Baltimore
Washington, D.C.
Annapolis
Dover
Fredericksburg
Richmond
Northern Neck
Potomac River
Rappahannock River
Middle Peninsula
York-James Peninsula
York River
James River
Nottoway River
Meherrin River
Fall Line
Delmarva Peninsula
DELAWARE
MARYLAND
Ocean City
Eastern Shore
ATLANTIC OCEAN
CHESAPEAKE BAY
EXPLANATION
Drainage basin
Coastal Plain Physiographic Province
McCandless, 2003
Current study
0 10 20 MILES
0 10 20 KILOMETERS

Selection Criteria

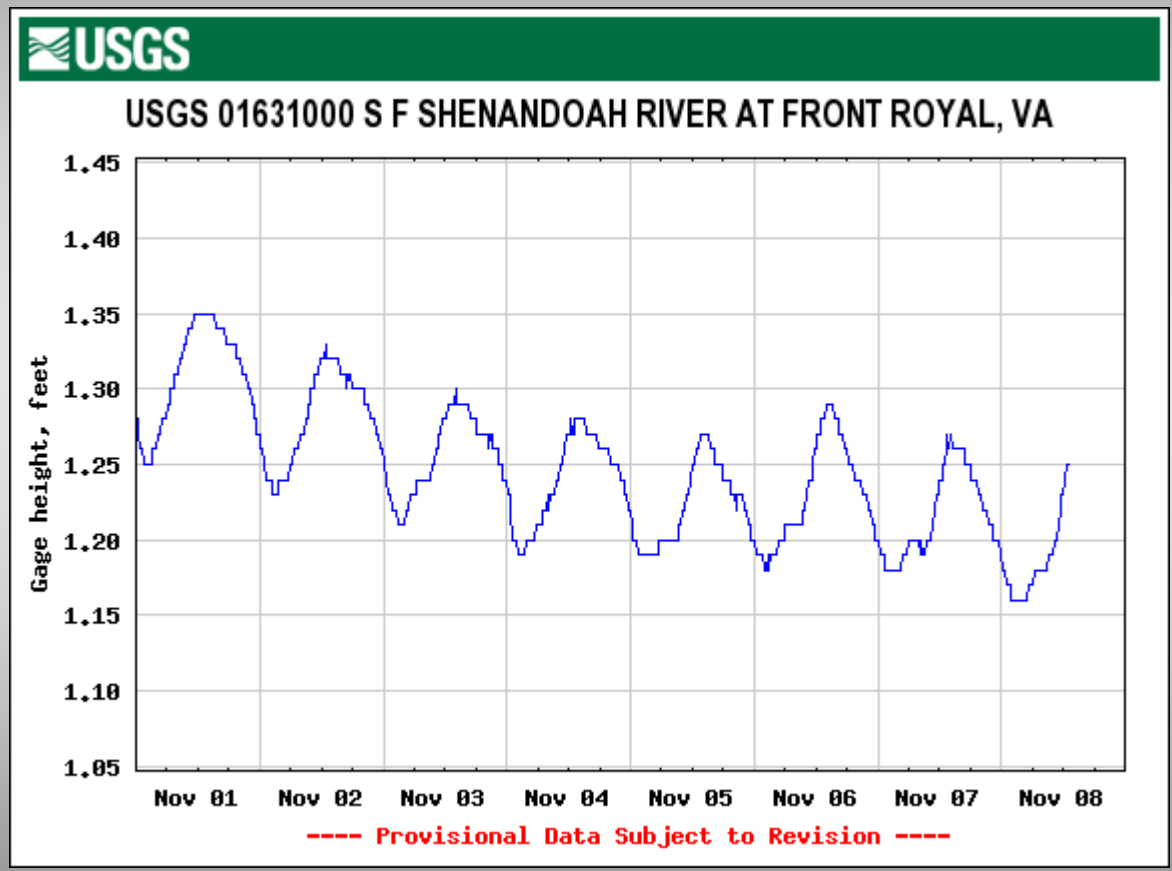
- At least 10 years of peak-flow data,
- Recoverable benchmarks referenced to staff gage elevations
- Drainage area <250 mi^2
- Drainage basin land use less than 20 percent urban
- Flow regulated from less than 10 percent of the drainage area
- Non-tidal flow conditions
- Stream reach exhibiting consistent bankfull features over a length of approximately 20 bankfull channel widths

Flood Plain Wetlands

Average: 4 percent basin LU

Streams Connected to Flood Plains

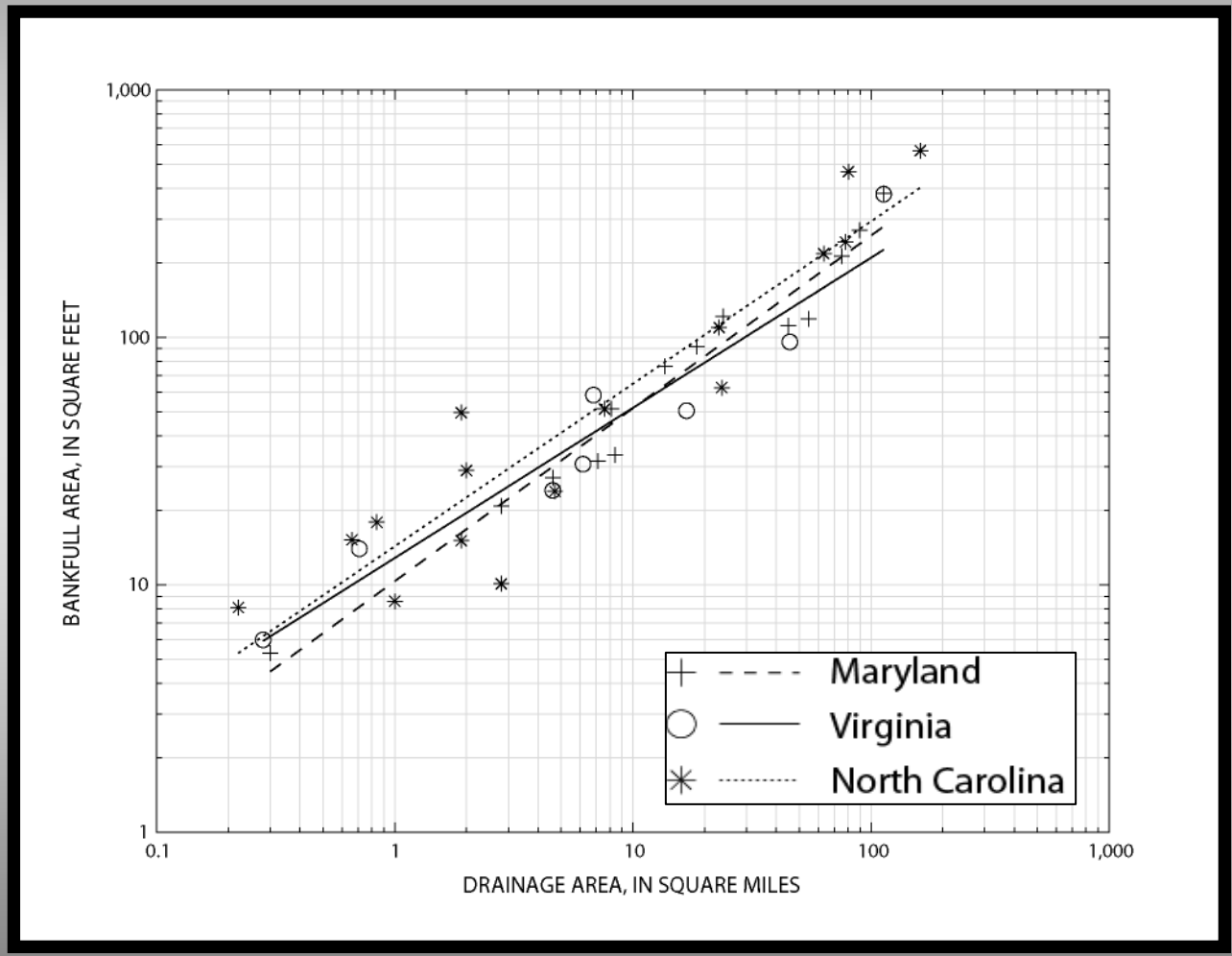
- Evapotranspiration
- Daily changes in stage 0.12 ft
- Storage



VA Regional Curves with MD and NC Data?

- Are the datasets from Virginia, Maryland, and North Carolina significantly different from each other?
- Are the site-selection criteria and survey methodologies similar for each state?

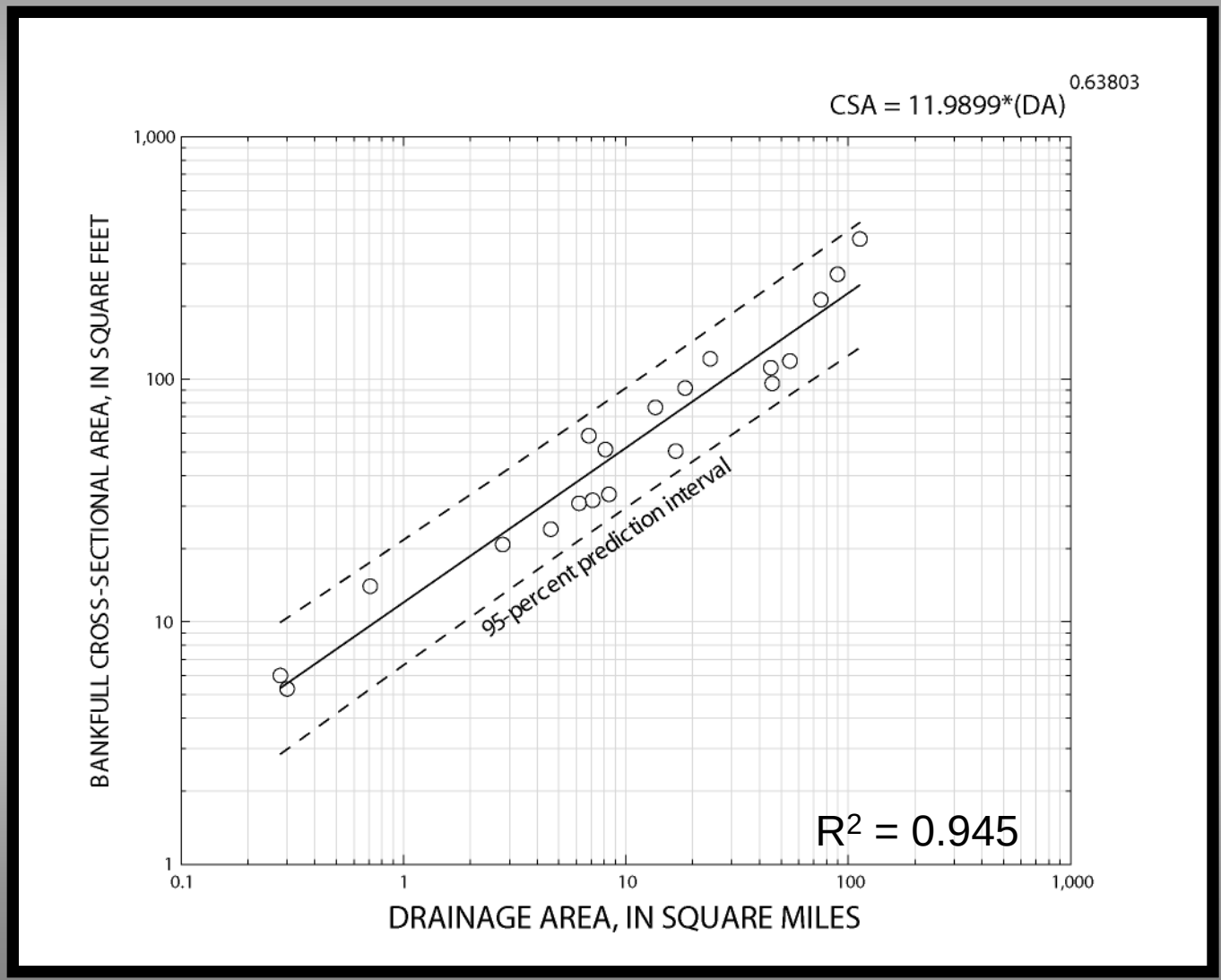
Are the datasets from VA, MD, NC significantly different from each other?



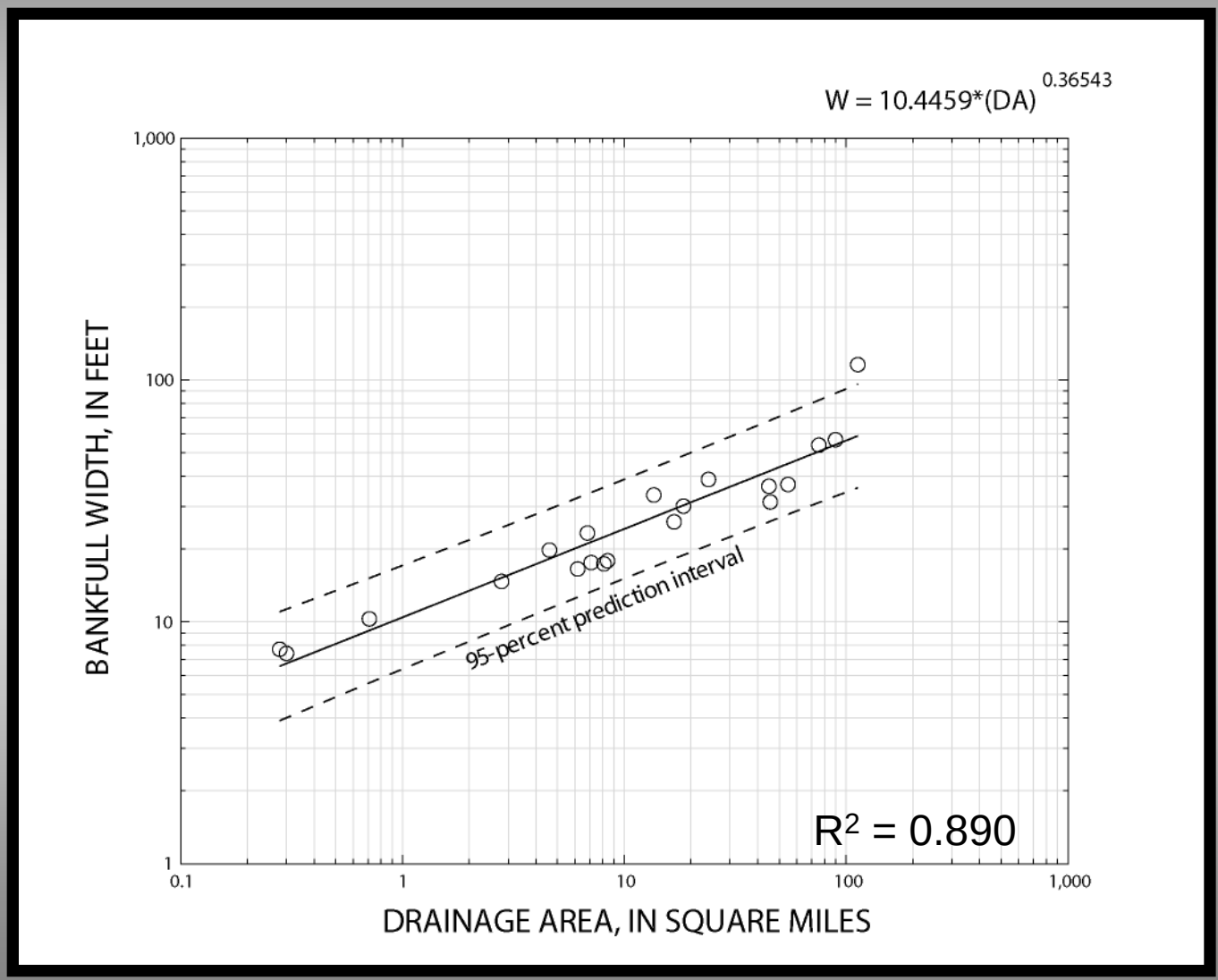
Site-Selection Criteria and Results

- Study sites located on reaches with USGS streamflow-gaging stations?
  - McCandless (2003)
    - Yes— 20/20 sites at gages
    - Cross-section surveys in riffles
  - Doll and others (2003)
    - No— 9/16 not at gages
    - Cross-section surveys in riffles and runs
- Verification of results?
  - McCandless (2003) yes
  - Doll and others (2003) no

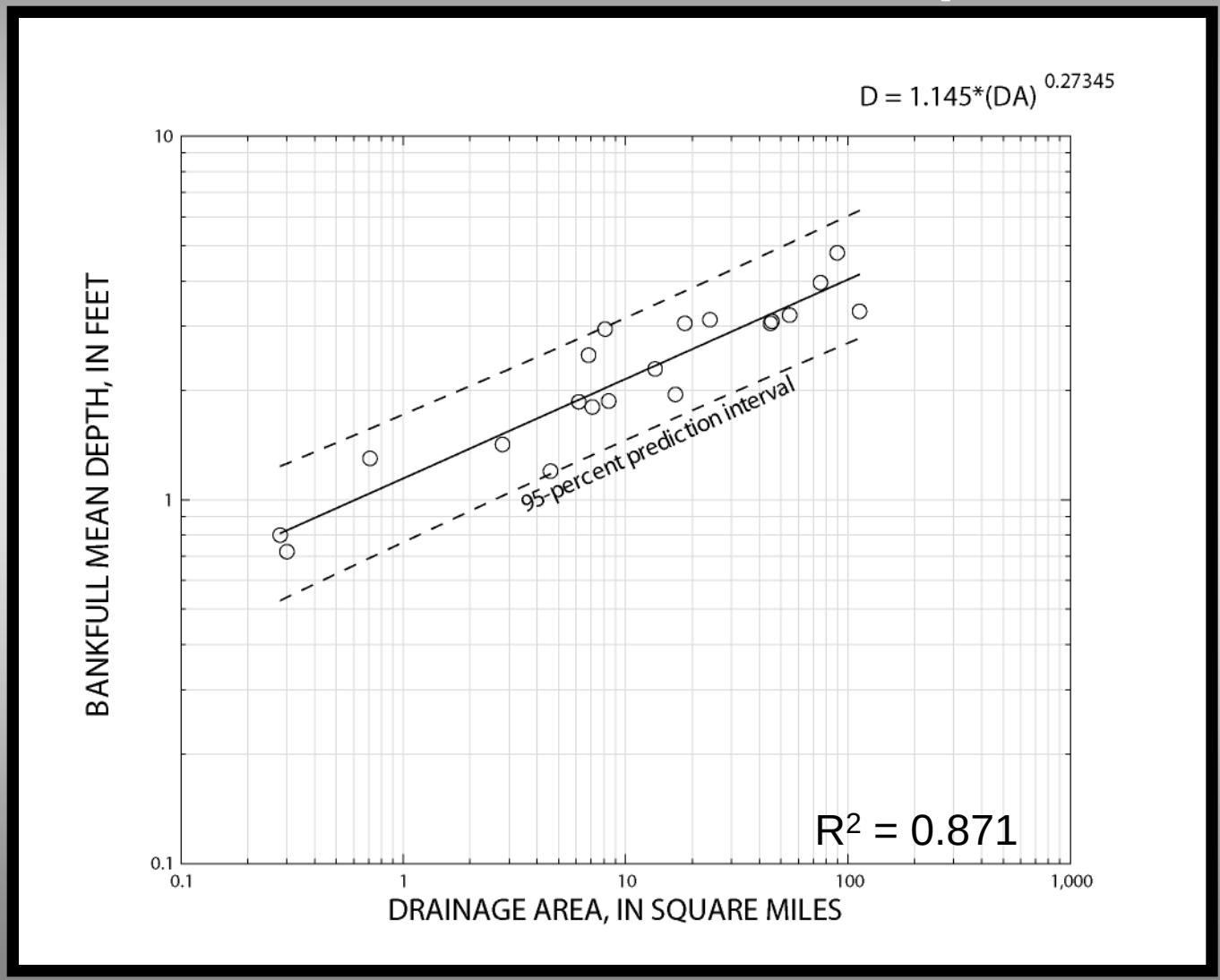
Bankfull Regional Curves: VA & MD Cross Sectional Area



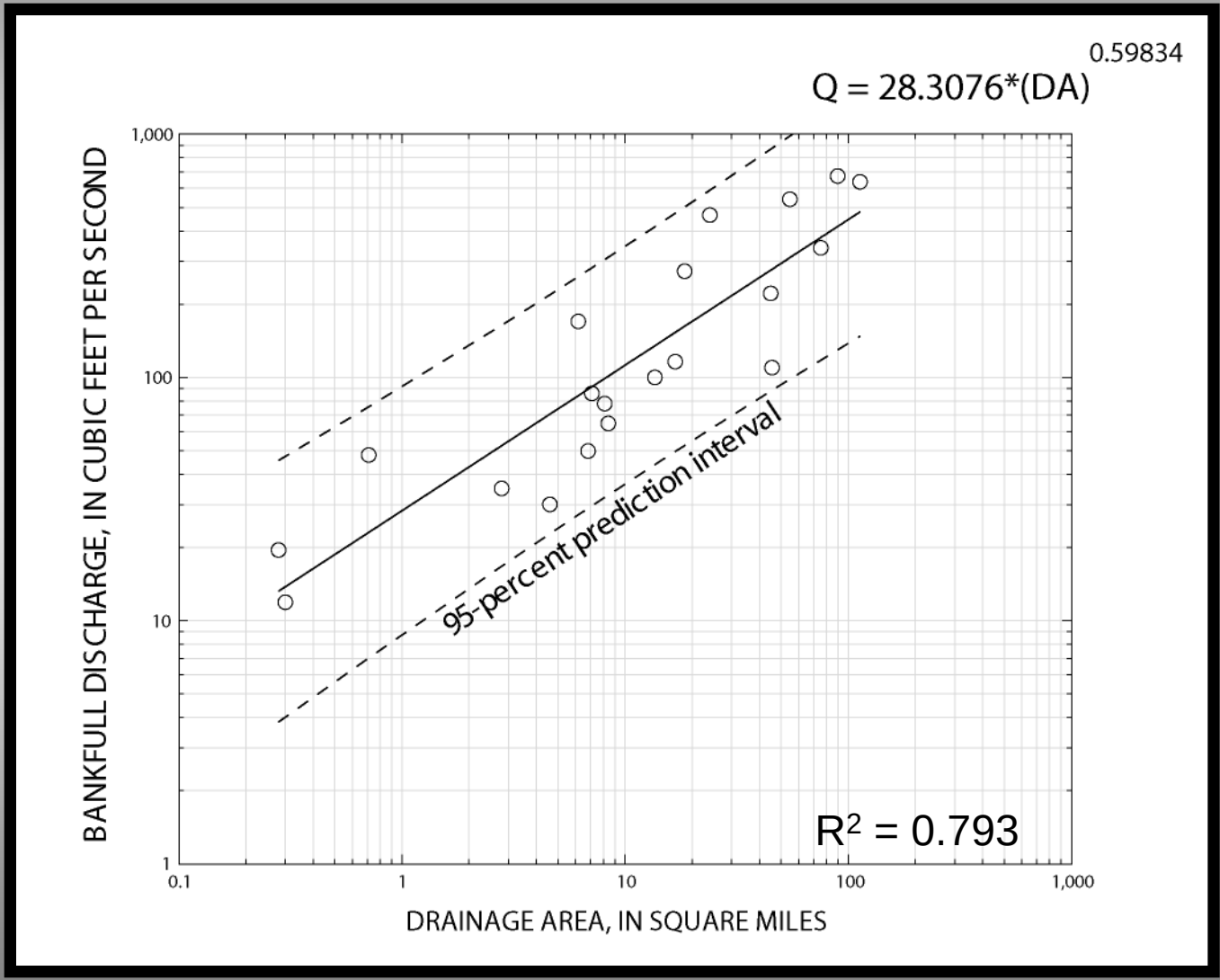
Bankfull Regional Curves: VA & MD
Bankfull Width



Bankfull Regional Curves: VA & MD
Bankfull Mean Depth



Bankfull Regional Curves: VA & MD
Bankfull Discharge



Limitations

- Streams often transition between swamps with no defined channel geometry to areas of slightly higher gradient with defined channel geometry
- 55-percent stream type E and 45-percent stream type C
- Seventy-five percent of mean elevations for each basin were higher than the mean elevation of the Coastal Plain.
- Streams do not represent reference reach conditions

Future Work

- State-Wide or Eastern Region Curves?

  http://wmc.ar.nrcs.usda.gov/technical/HHSWR/Geomorphic/

- Application of Curves in Urban Areas

Piedmont Update

- Russ Lotspeich (rlotspei@usgs.gov)
- 8 surveys completed, 1 more by the New Year
- On schedule, going smoothly
- Field volunteers are welcome

Thank you

- Report is available on-line: http://pubs.usgs.gov/sir/2007/5162/
- In printed form today
- Thanks to our Cooperators

USGS