III. WATERSHED DRAINAGE AREA TO VOLUME RATIO
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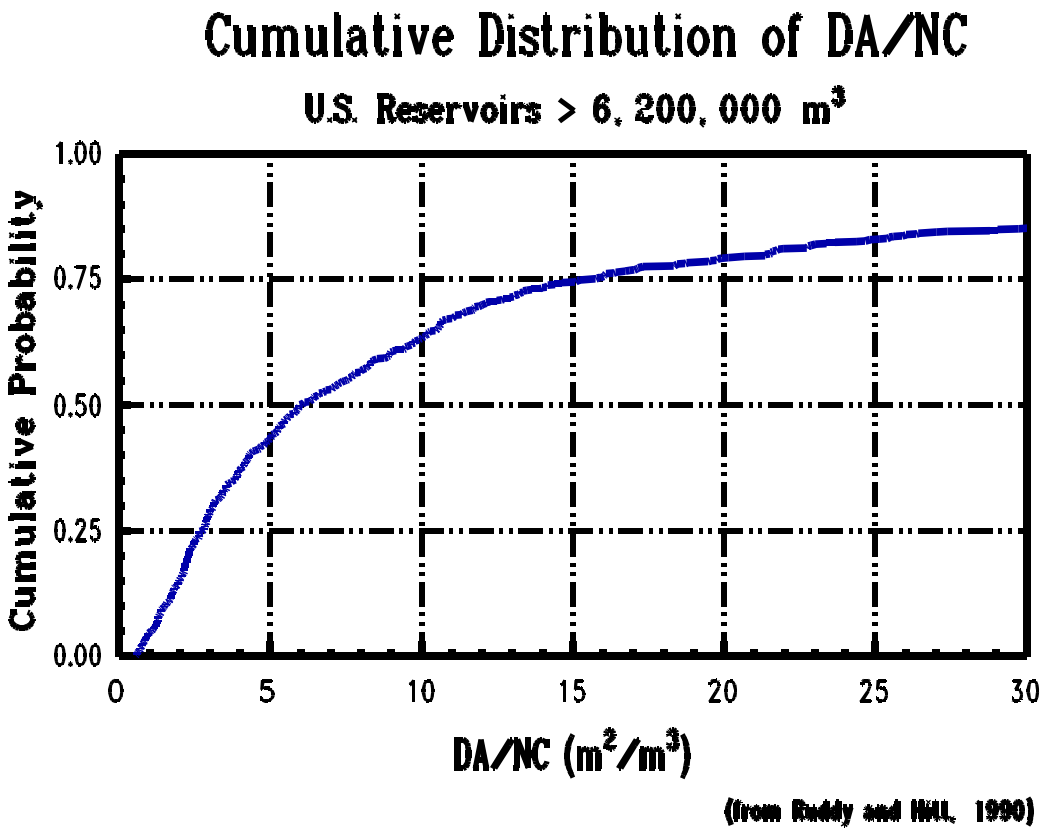
OPP has conducted an assessment of the drainage area to normal capacity volume ratio (DA/NC) for reservoirs across the United States used for water supply. The assessment was conducted under the premise that the DA/NC ratio is one watershed property to characterize reservoir vulnerability. This assessment is necessary to gauge the relative vulnerability of index reservoirs when compared to the DA/NC ratio assumed in the aquatic exposure assessment and to other reservoirs in the United States. (Additionally, the 1997 SAP agreed with OPP that an assessment of DA/NC ratios was needed to evaluate the level of conservatism of the DA/NC ratio in current aquatic exposure scenario (i.e., the farm pond) prior to OPP fully adopting a crop area factor (CAF) model refinement.)

The OPP/EFED surface water modeling scenarios using GENEEC and PRZM-EXAMS are based on a 10-hectare field that generates surface runoff which is routed into a 1-hectare surface water body (*e.g.*, farm pond) that is 2-meters deep. The resulting drainage area to water volume ratio is 5 m^{-1}, or 100,000 square meters (m^2) divided by 20,000 cubic meters (m^3). This assessment utilized published surface water reservoir data (Ruddy and Hitt, 1990) to determine the distribution of drainage area to water volume ratios for water supply reservoirs constructed prior to 1988. Ruddy and Hitt (1990) summarized selected characteristics for 2,708 large reservoirs and natural lakes in the contiguous United States and Puerto Rico. The large reservoirs data were obtained from a U.S. Army Corp of Engineers database (approximately 66,000 structures) with the published database selected for reservoirs that have normal capacities of at least 5,000 acre-feet or maximum capacities of at least 25,000 acre-feet.

This assessment evaluated the 578 large reservoirs which had water supply listed as a primary or secondary use (Internet data source: http://water.usgs.gov/lookup/getspatial?reservoir). The drainage area data in square miles were converted to m^2 and the normal capacity data in acre-feet were converted to m^3. The ratio (m^{-1}) of drainage area to normal capacity (DA/NC ratio) was calculated and statistical analysis and computer mapping (GIS) applied to analyze the numerical and spatial distributions.

Table 1 lists the summary statistics for the 578 water supply reservoirs. The DA/NC ratio rang es from approximately 0.5 to 5,270 m^{-1} with a median of 6 m^{-1} and mean of 47 m^{-1}. The modeling scenario DA/NC ratio of 5 m^{-1} represents approximately 250 water supply reservoirs of at least 5,000 acre-feet normal capacity or 25,000 acre-feet maximum capacity (Figure 1). The spatial distribution of the water supply reservoirs classified by the ratio of drainage area to normal capacity is shown in Figure 2.



Revised Figure 1. Cumulative Distribution of the Ratio of Drainage Area to Normal Capacity for Water Supply Reservoirs. The graphed range for the ratio was specified from 0 to 20 m^{-1}.

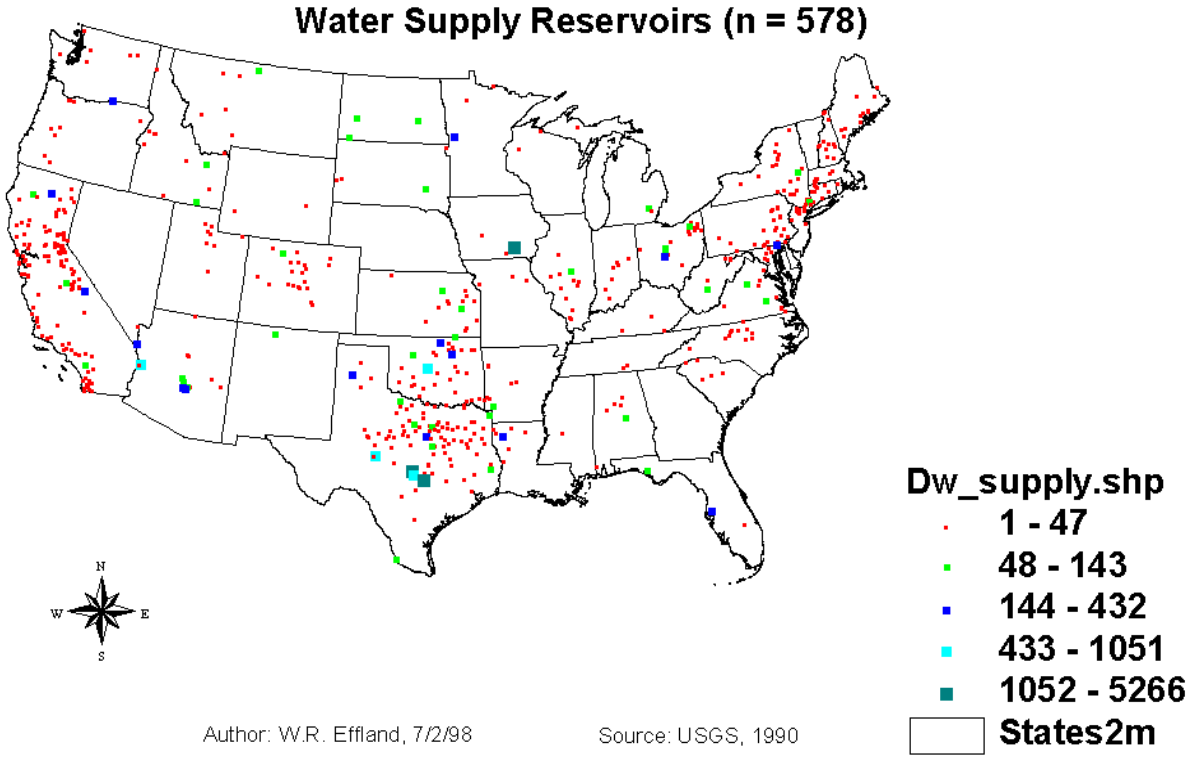
Table 1. Summary Statistics for Water Supply Reservoir Assessment

n = 578	Drainage Area (m^2 x 1000)	Normal Capacity (m^3 x 1000)	DA/NC Ratio (m^{-1})
Minimum	5180.00	956.35	0.55
Maximum	5.54 E+8	3.49 E+7	5,270
Median	2.90 E+5	4.00 E+4	5.95
Mean	8.36 E+6	3.19 E+5	47.45

Figure 2

Drainage Area to Normal Capacity Ratio

Water Supply Reservoirs (n = 578)



Author: W.R. Effland, 7/2/98 Source: USGS, 1990

References

Ruddy, B.C. and K.J. Hitt. 1990. Summary of Selected Characteristics of Large Reservoirs in the United States and Puerto Rico, 1988. U.S. Geol Surv. Open-File Report 90-163, Denver CO.