Introduction

SCS hydrology uses the empirical CN parameter as a part of calculating runoff volumes based on landscape characteristics such as soil type, land cover, imperviousness, and land-use development. Areas characterized by saturated or poorly infiltrating soils, or impervious development, have higher CN values, converting a greater portion of rainfall volume into runoff. The principle data sources used to develop CN values for the Lower Des Plaines River DWP are the NRCS soil data for Cook County and the 2001 NIPC land-use mapping for Cook County. The below subsections discusses the procedure used to develop a CN grid for use in hydrologic modeling for the Lower Des Plaines River Watershed and the assumptions inherent in this procedure.

Approach

CN values are dependent on a number of factors, including the soil infiltration characteristics and condition, as well as land cover characteristics such as directly connected impervious area and cover type. Therefore both soil data and land-use data are required to estimate CN. The best available soil and land-use data for Cook County are the NRCS soil data and NIPC land-use data. Table C1 lists curve numbers based on combinations of land-use data and soil data for small urban watersheds.

TABLE C1
Curve Number Generation for Small Urban Watersheds

Cover Type and Hydrologic Condition	Average % Impervious Area	Curve Number by Hydrologic Soil Group			
		A	B	C	D
Fully developed urban areas (vegetation established)					
Open Space (lawns, parks, golf courses, cemeteries, etc.)					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50 to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious Areas					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western Desert Urban Areas					
Natural desert landscaping (pervious areas only)		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin barriers		96	96	96	96
Urban Districts					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93

Cover Type and Hydrologic Condition	Average % Impervious Area	Curve Number by Hydrologic Soil Group			
		A	B	C	D
Residential Districts by Average Lot Size					
1/8 acre or less	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing Urban Areas					
Newly Graded Areas (pervious areas only, no vegetation)		77	86	91	94

Notes: Average runoff condition, and Ia = 0.2S. Source: *TR-55: Urban Hydrology for Small Watersheds* (U.S. Department of Agriculture [USDA], 1986)

A slightly modified version of this table will be used for curve number generation in the Lower Des Plaines River DWP, shown in Table C2. Both the soil data and the land use data require preprocessing before generating curve numbers using the lookup table.

TABLE C2
Modified Curve Number Generation for Lower Des Plains River DWP

Description	Average % Impervious	Curve Number by Hydrologic Soil Group				Typical Land Uses
		A	B	C	D	
Residential (High Density)	65	77	85	90	92	Multi-family, Apartments, Condos, Trailer Parks
Residential (Med. Density)	30	57	72	81	86	Single-Family, Lot Size ¼ to 1 acre
Residential (Low Density)	15	48	66	78	83	Single-Family, Lot Size 1 acre and Greater
Commercial	85	89	92	94	95	Strip Commercial, Shopping Centers, Convenience Stores
Industrial	72	81	88	91	93	Light Industrial, Schools, Prisons, Treatment Plants

Source: http://gis2.esri.com/library/userconf/proc00/professional/papers/PAP657/p657.htm Data is for average AMC II- dormant season (5-day) rainfall averaging from 0.5 to 1.1 inches and growing season rainfall from 1.4 to 2.1 inches

NRCS Soil data

NRCS soil data representative of 2005 conditions was obtained for Cook, DuPage, and Will Counties in Illinois. There are several areas where soil data are not mapped within the study area. These areas include the City of Chicago and portions of nearby communities that consist primarily of urban land forms. These urban land forms were assumed to be HSG C.

The NRCS soil data includes hydrologic soil group, representing the minimum infiltration rate of the soil after wetting. Table C3 summarizes the hydrologic soil groups.

TABLE C3
Hydrologic Soil Groups

Hydrologic Soil Group	Description	Texture	Infiltration Rates (in/hr)
A	Low runoff potential and high infiltration rates even when wetted	Sand, loamy sand, or sandy loam	> 0.30
B	Moderate infiltration rates when wetted	Silt loam or loam	0.15 – 0.30
C	Low infiltration rates when wetted	Sandy clay loam	0.05 – 0.15
D	High runoff potential and very low infiltration when wetted	Clay loam, silty clay loam, sandy clay, silty clay, or clay	0 – 0.05

Source: *TR-55: Urban Hydrology for Small Watersheds* (U.S. Department of Agriculture [USDA], 1986)

NIPC Land Use Data

A 2001 land use inventory for the Chicago metropolitan area was received from CMAP in GIS format. The data was used to characterize existing conditions land use within the LDPR River Watershed. The data include 15 land use classifications for summarizing land use.

Generation of CN

Table C4 describes the input data used to develop the CN values throughout the watershed.

TABLE C4
Description of Curve Number Input Data

Variable Used to Determine CN	Approach for Definition of Variable for Lower Des Plaines River Watershed Hydrologic Modeling
Ground cover	CMAP 2001 land use inventory (v.1.2 2006) was used to define land use. A lookup table was developed to link CMAP categories to CN values and soil types.
Soil type	The NRCS publishes county soil surveys that include a hydrologic classification of A, B, C, or D.
Antecedent moisture condition	AMC reflects the initial soil storage capacity available for rainfall. For areas within Northeastern Illinois, it is typical to assume an AMC of II.

The subbasin curve numbers were determined based on existing land use and soil types. The NRCS soil maps were imported into ArcGIS. The CMAP 2001 land use data was imported into ArcGIS. The USGS raster data was converted to a polygon file. The soil type polygons and land use polygons were intersected in ArcGIS to end up with polygons with consistent land use and soil type in each polygon. Based on the land use and soil type in these polygons, a curve number was assigned to each polygon. The land use/soil type/curve number assignment was based on *TR-55: Urban Hydrology for Small Watersheds* (U.S. Department of Agriculture [USDA], 1986). The Spatial Analyst extension was then used to calculate the average curve number for each subbasin.

Table C5 shows the curve number by land use type used in the Lower Des Plaines River DWP.

TABLE C5
Curve Number by Land Use Type

NIPC 2001 Land Use Code	Land Use Description	A	B	C	D
11	Open Water	100	100	100	100
21	Developed, Open Space	37	58	70	76
22	Developed, Low Intensity	51	67	76	81
23	Developed, Medium Intensity	58	71	79	83
24	Developed, High Intensity	78	84	87	88
31	Barren Land	72	81	85	86
41	Deciduous Forest	29	52	67	73
42	Evergreen Forest	29	52	67	73
43	Mixed Forest	29	52	67	73
52	Shrub/Scrub	29	46	62	69
71	Grassland	37	58	70	76
81	Pasture/Hay	29	55	67	74
82	Cultivated Crops	64	74	81	85
90	Woody Wetlands	46	64	73	79
95	Emergent Wetlands	65	75	82	85