Review on how AGWA works:

GIS and hydrologic modeling

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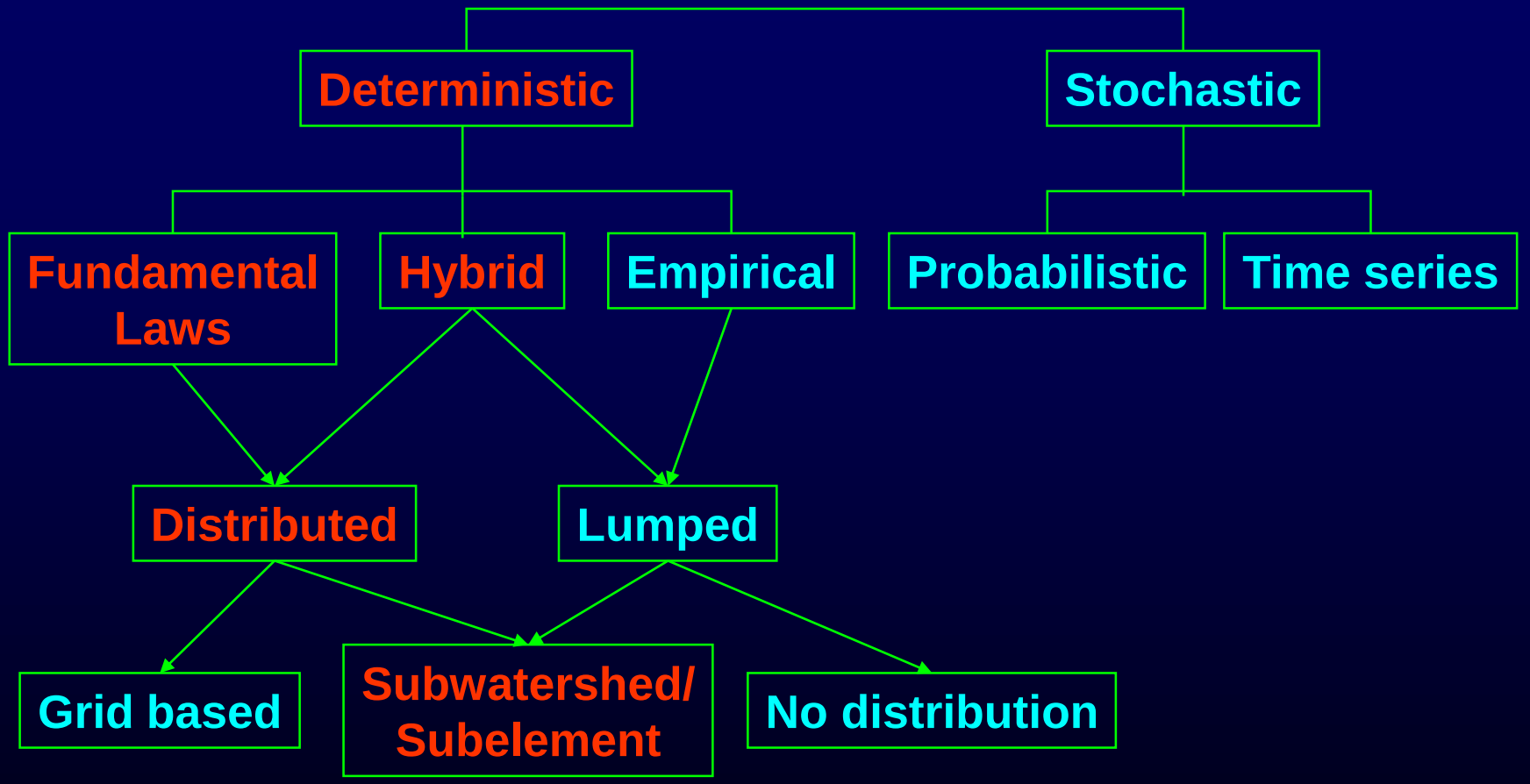
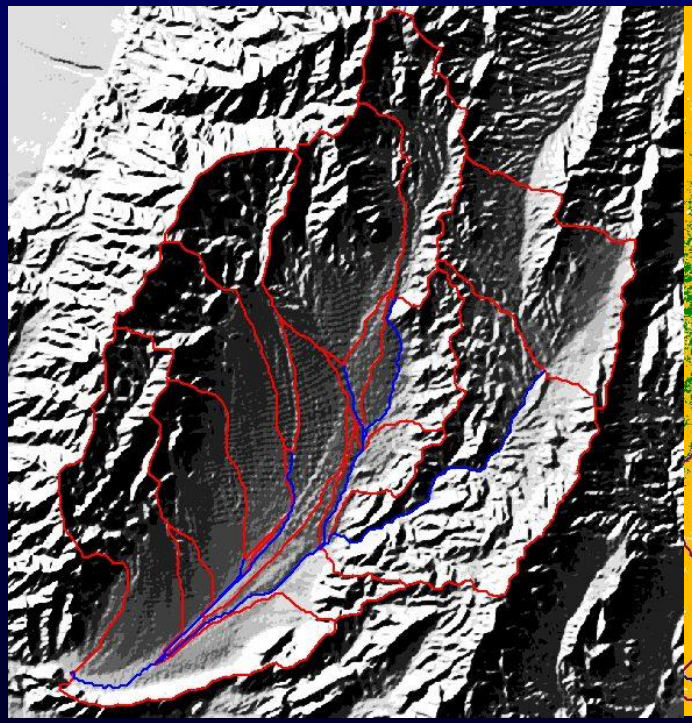
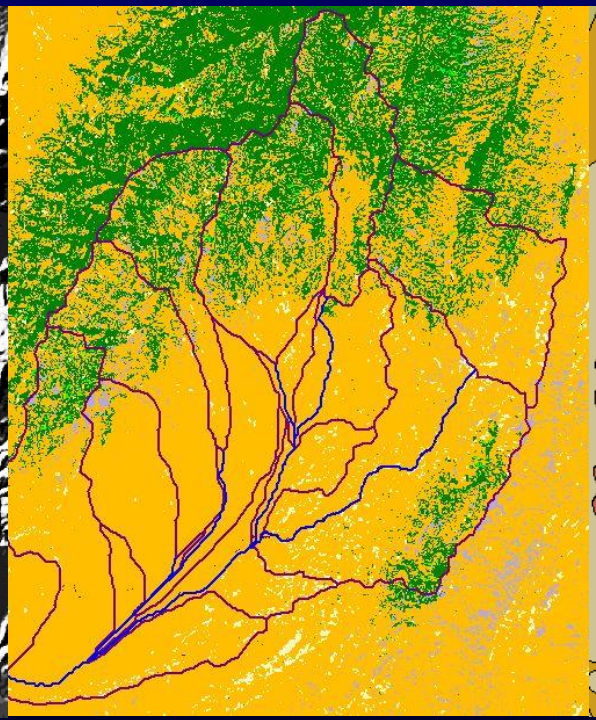
SedHyd

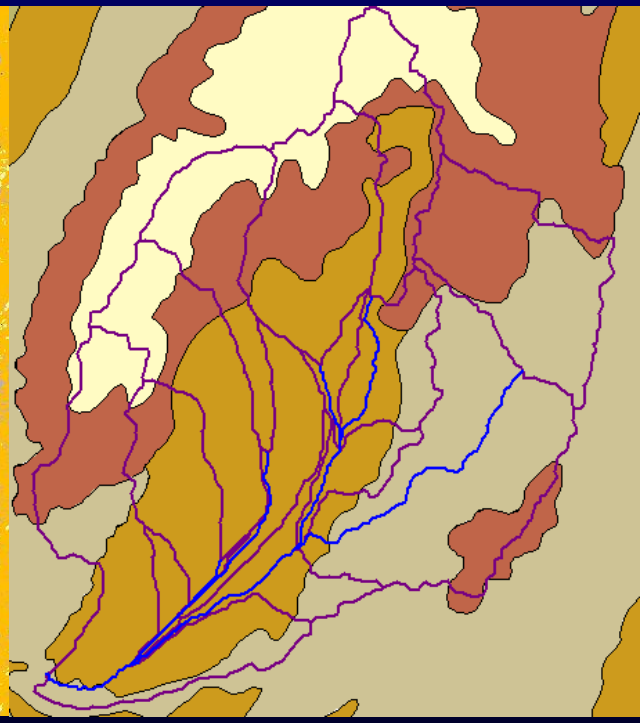
Classification of Hydrological Models



Characterizing the Watershed







complex topography land cover/use soils

high spatial variability

complex watershed response

GIS Background: Flow Direction

Original Surface

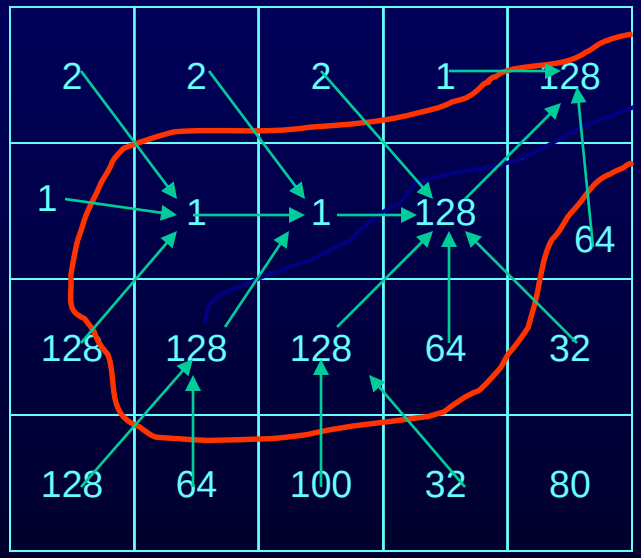
100	100	100	100	94
100	97	96	95	100
100	98	99	100	100
100	100	100	100	101

Flow Direction Surface

2	2	2	1	128
1	1	1	128	64
128	128	128	64	32
128	64	64	32	80

GIS Background: Flow Accumulation

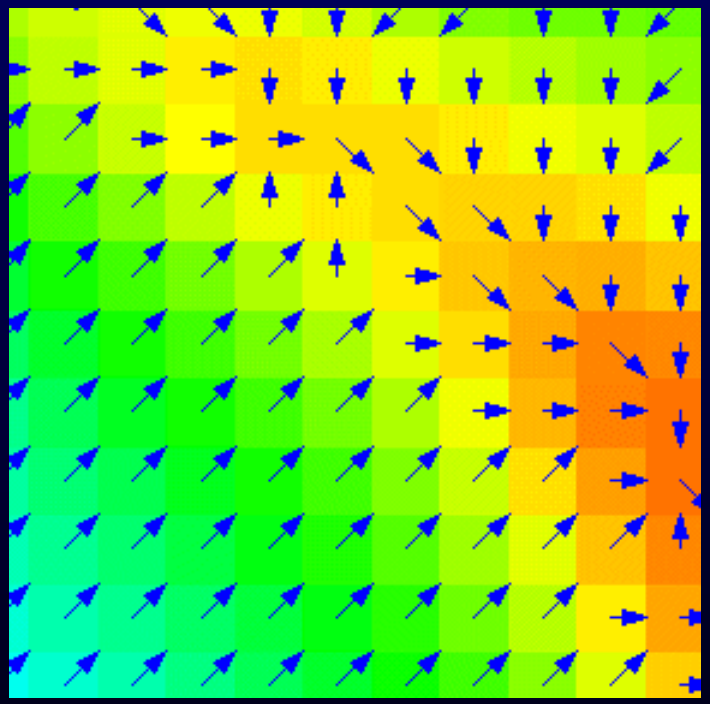
Flow Direction Surface

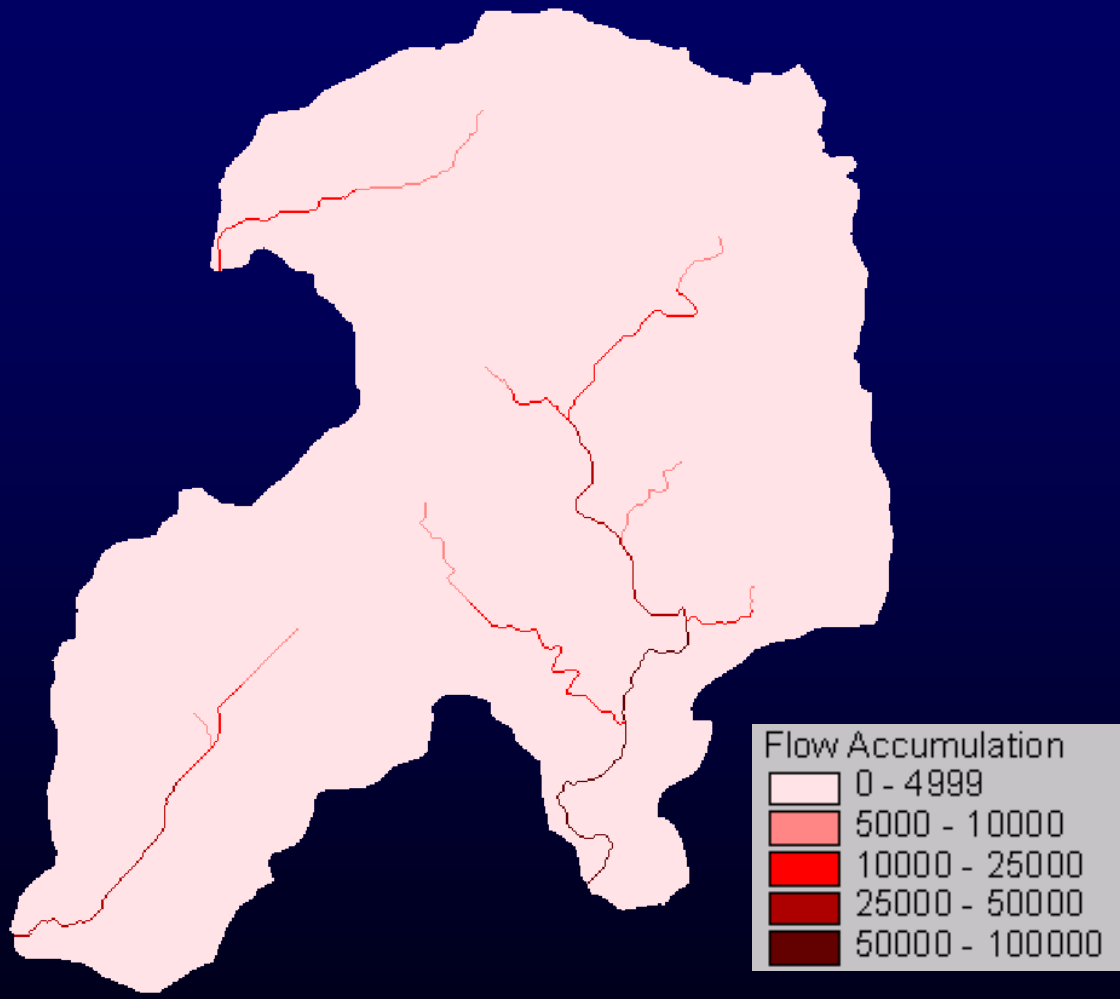


Flow Accumulation Surface

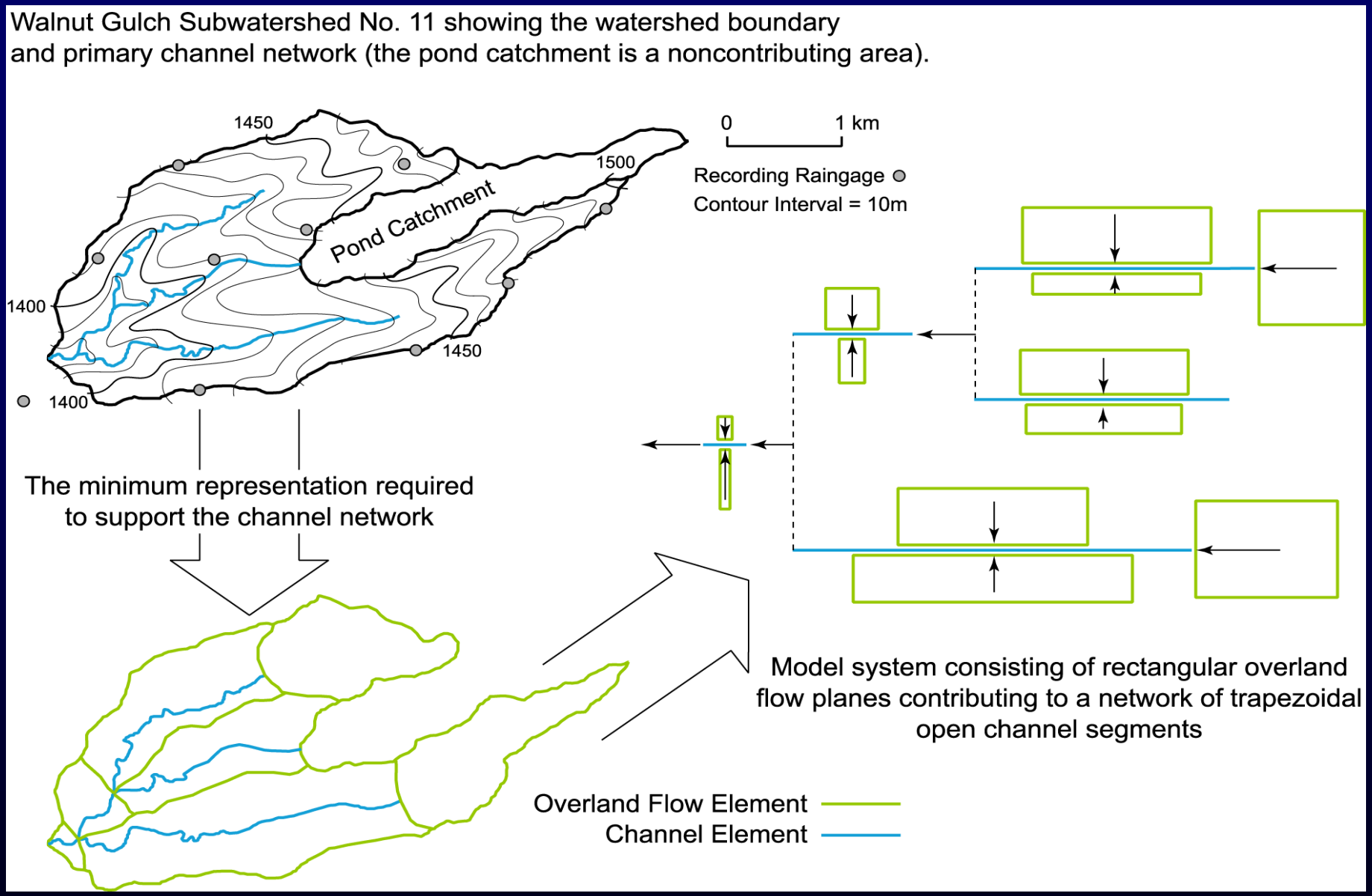
GIS Background: Flow Accumulation

DEM → Flow Direction
→ Flow Accumulation





Flow Accumulation Surface



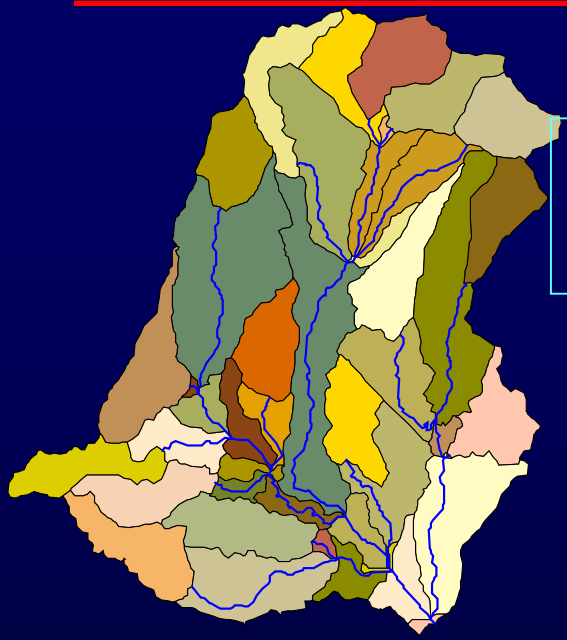
Example of watershed discretization for parameterizing KINEROS. Model parameters are averaged for each overland flow and channel element.

Three Ways to Characterize a Watershed

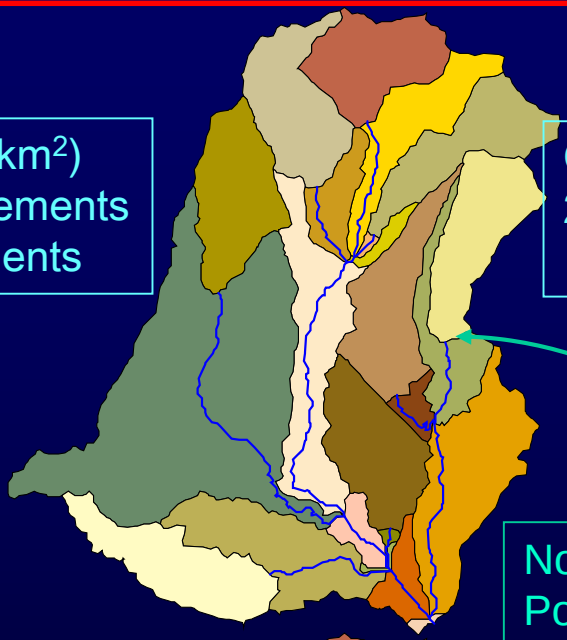
- Contributing Source Area (CSA threshold)
  - Area need to start a channel
- Flow Length (FL threshold)
  - Maximum length of a hillslope
  - Important for Erosion Modeling
- Use Stream Network
  - NHD Stream Lines – locate end of channels
  - Used to define the outlet for zero order basins
  - Channels are still defined based on DEM

Automated Watershed Characterization

- the influence of CSA on watershed complexity

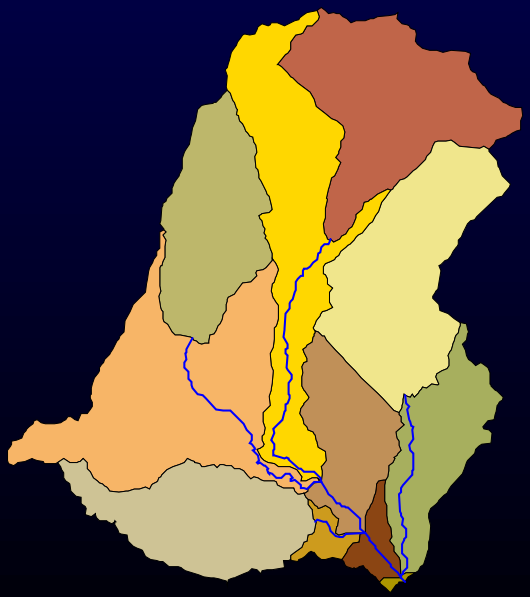


CSA: 2.5% (6.9 km^2)
44 watershed elements
29 channel elements

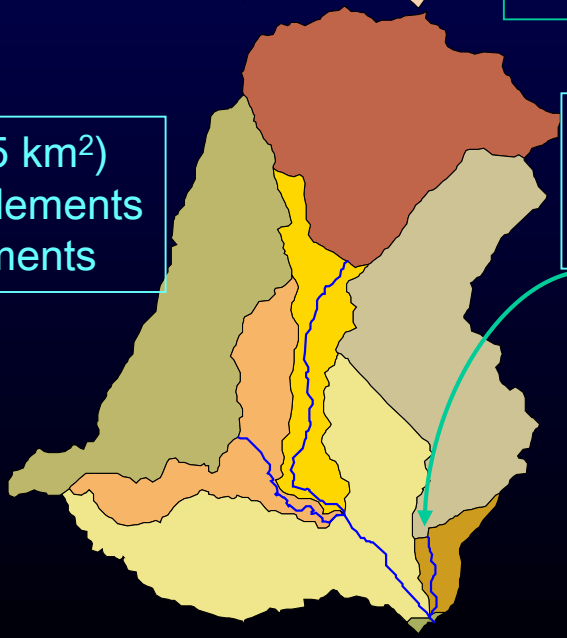


CSA: 5% (13.8 km^2)
23 watershed elements
15 channel elements

Note channel initiation
Point changing with CSA



CSA: 10% (27.5 km^2)
11 watershed elements
7 channel elements

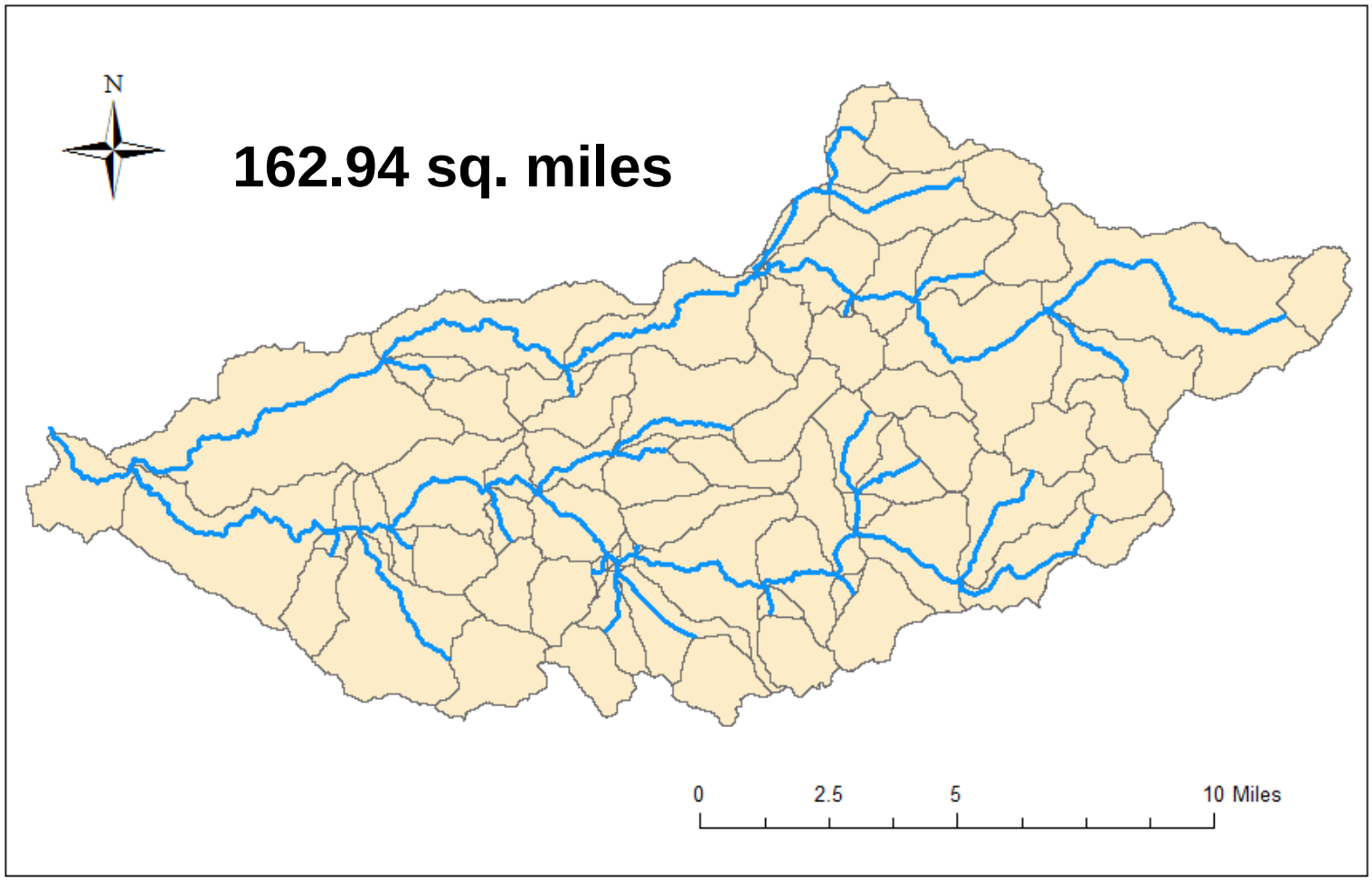


CSA: 20% (55 km^2)
8 watershed elements
5 channel elements

N

0 5 10 km

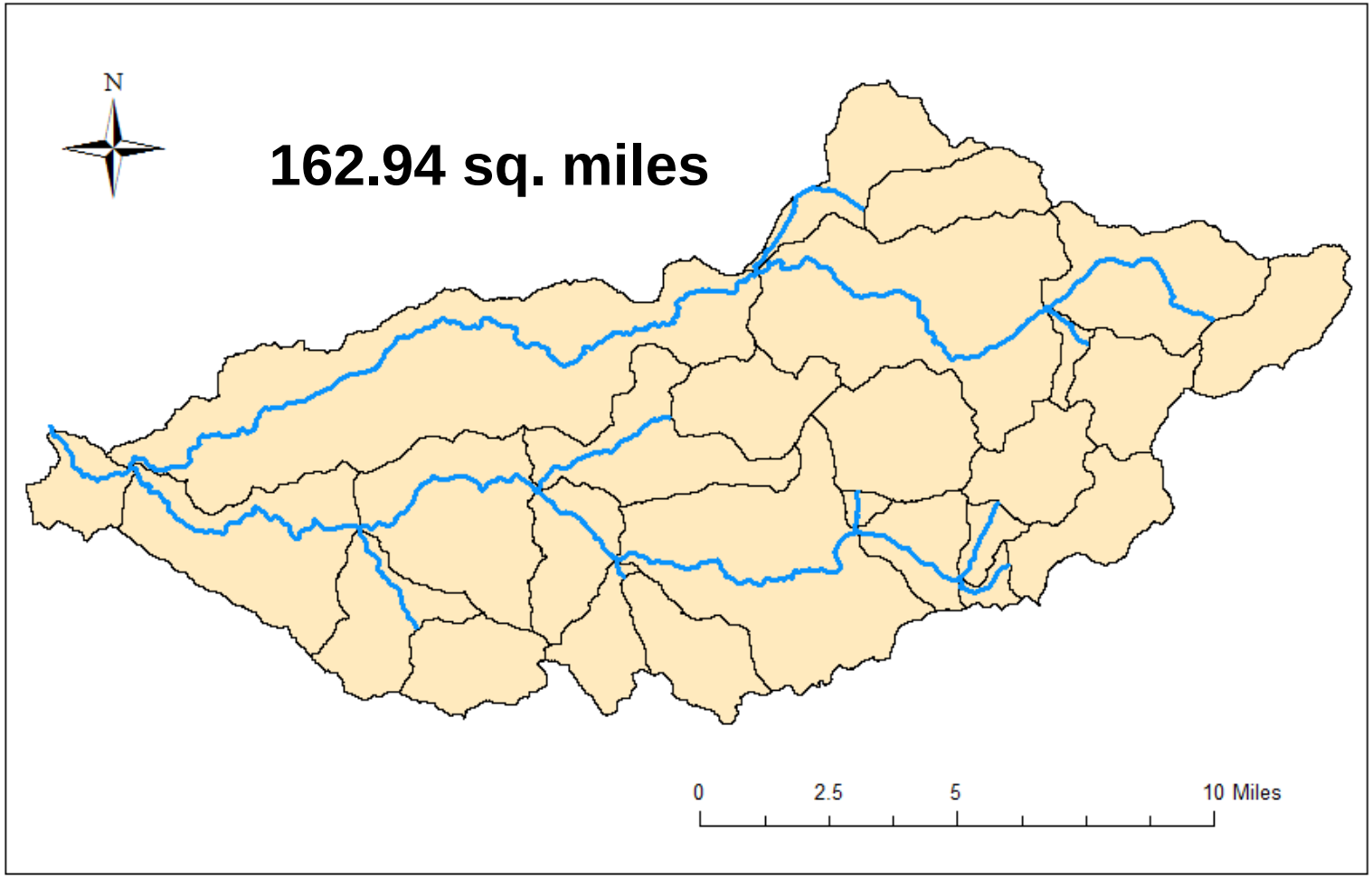
CSA 1%



Stream Length = 103.14 miles

Average Element Size = 1.32 square miles

CSA 2.5%



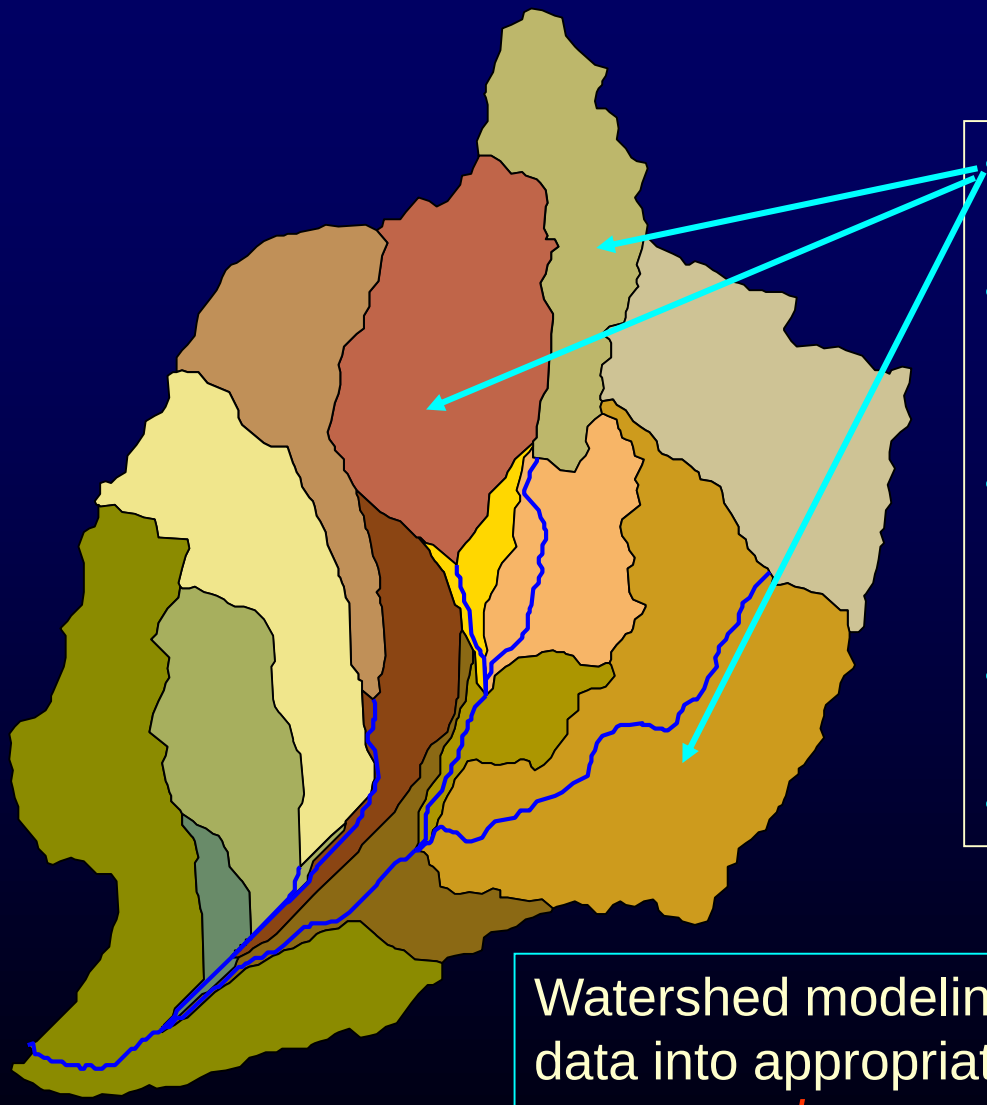
Stream Length = 71.83 miles

Average Element Size = 3.79 square miles

Effects

- The Smaller Modeling Element the Greater the Channel Length
  - Ephemeral Channels – Decrease in Runoff
    - Higher Transmission Losses
  - Perennial Channels – Increase in Runoff
  - More efficient routing – more channels
    - Higher Peak Discharge
    - Higher Sediment Yield (channel erosion)
  - More spatial variability
    - Weighted averaging a smaller area
    - The affect of “rare” types retained.
  - Longer processing times

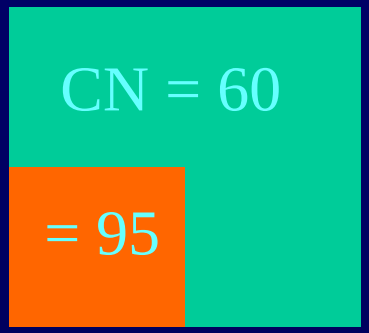
Characterizing the Watershed



- Homogeneous planes
- Hydrologic parameters represent intersections of topo., cover, soil
- Information loss as *f* (geometric complexity)
- Scaling issues
- Assigned the weighted average

Watershed modeling relies on condensing spatial data into appropriate units for representing processes

leaves plenty of room for error!



What would be the runoff from a 1” rainfall event?

CN =77.5

Arithmetic Average

Runoff = 0.053”

CN =68.75

Weighted Average

Runoff = 0.002”

AGWA uses a weighted average to assign values to subwatershed?

CN = 60

Majority

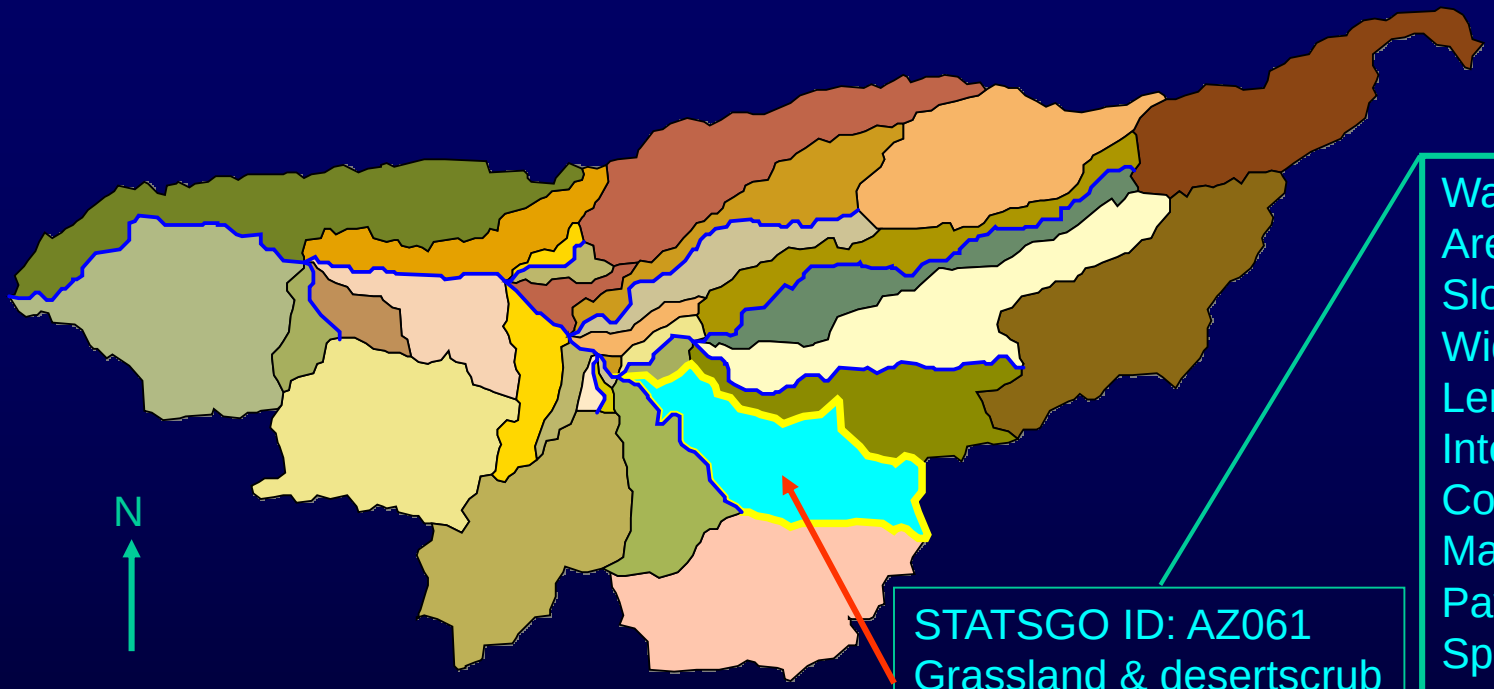
Runoff = 0.000”

CN = 95

Maximum

Runoff = 0.563”

Sample Configuration - KINEROS



STATSGO ID: AZ061
Grassland & desertscrub
Moderate relief

Contributing Source Area: 2000 acres
- *~5% of total watershed area*

33 planes
- *7 upland elements*
- *25 lateral element*

19 channels

Watershed ID: 73
Area: 7.45 km2
Slope: 3.53 %
Width: 945 m
Length: 7876 m
Interception: 2.60 mm
Cover: 13.70 %
Manning's n: 0.052
Pavement: 0.00 %
Splash: 24.91
Rock: 0.43
Ks: 6.67 mm/hr
Suction: 115 mm
Porosity: 0.459
Max saturation: 0.93
Cv of Ks: 0.95
Sand: 50 %
Silt: 33 %
Clay: 17 %
Distribution: 0.30
Cohesion: 0.006

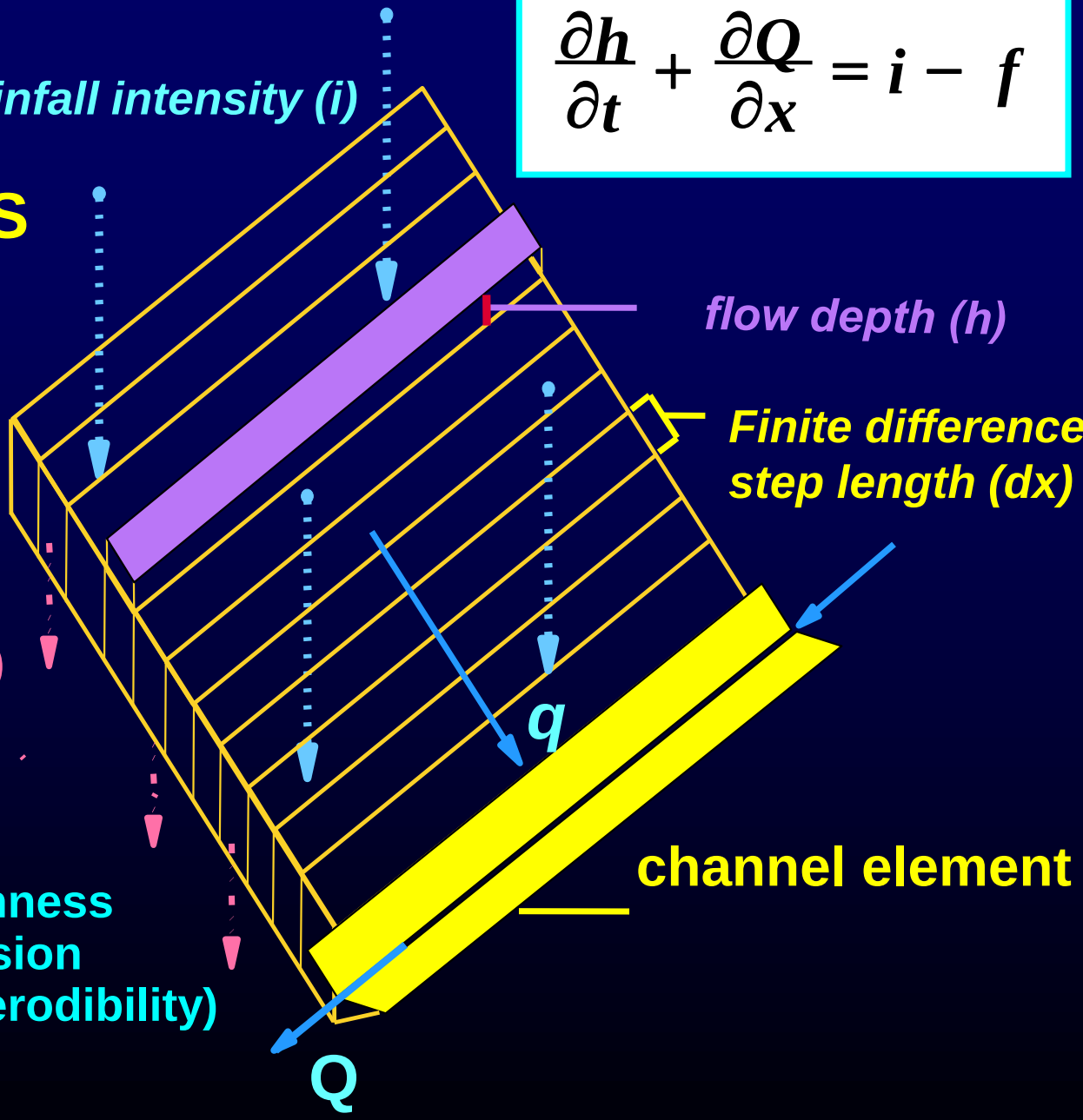
Channel Parameters

- Channel Parameterization
  - Width-Depth (Regional Geomorphic Relationships)
  - Hydraulic Conductivity (Transmission Losses)
    - Recommend Zero for Perennial Streams
  - Roughness (Manning's n)
  - Armoring (Erodability)
  - Compound Channel (Natural Riparian)
  - Each channel reach can have unique parameters
- Set a Constant Baseflow

Excess Runoff From a Plane

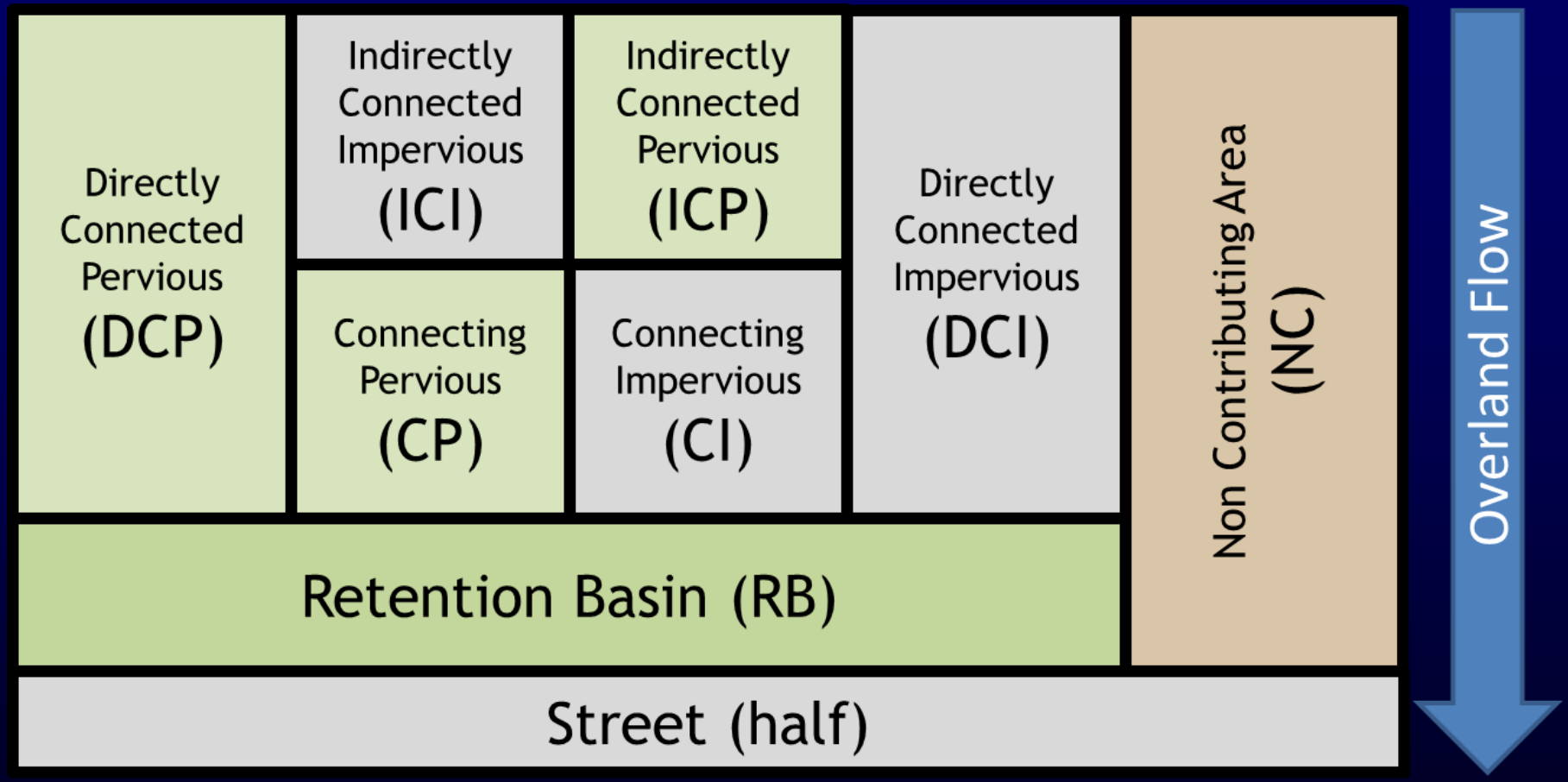
$$\frac{\partial h}{\partial t} + \frac{\partial Q}{\partial x} = i - f$$

- KINEROS



Other Factors

- interception
- hydraulic roughness
- rain splash erosion
- soil cohesion (erodibility)


Directly Connected Pervious (DCP)
Indirectly Connected Impervious (ICI)
Indirectly Connected Pervious (ICP)
Connecting Pervious (CP)
Connecting Impervious (CI)
Directly Connected Impervious (DCI)
Non Contributing Area (NC)
Overland Flow
Retention Basin (RB)
Street (half)

KINEROS Parameter Look-Up Table

Attributes of ws2k

WS#	Mann_n	Pave	Splash	Rock	Ks	G	Por
61	0.050	0.11	20.46	0.43	5.15	143.92	0
62	0.052	0.00	24.91	0.43	6.67	114.97	0
63	0.053	0.00	24.91	0.43	6.67	114.97	0
71	0.052	0.01	24.42	0.43	6.50	118.14	0
72	0.054	0.01	24.61	0.43	6.57	116.95	0
73	0.052	0.00	24.91	0.43	6.67	114.97	0
82	0.051	0.00	24.91	0.43	6.67	114.97	0
83	0.034	0.00	24.91	0.43	6.67	114.97	0

BEGIN PLANE
ID = 71, LEN = 1303.0, AREA = 10783378.3
SL = 0.029, MAN = 0.052, X = 593519.0, Y =
CV = 0.92, PRINT = 1
KS = 7.94, G = 118.14, DIST = 0.3, POR = 0.459, ROCK = 0.43
FR = 0.49, 0.33, 0.17, SPLASH = 24.42, COH = 0.006, SMAX = 0.93
INTER = 2.56, CANOPY = 0.133, PAVE = 0.00
END PLANE

BEGIN PLANE
ID = 72, LEN = 765.0, AREA = 4357163.9
SL = 0.043, MAN = 0.054, X = 591637.8, Y = 3507025.3
CV = 0.93, PRINT = 1
KS = 7.77, G = 116.95, DIST = 0.3, POR = 0.459, ROCK = 0.43
FR = 0.49, 0.33, 0.16, SPLASH = 24.61, COH = 0.006, SMAX = 0.93
INTER = 2.85, CANOPY = 0.112, PAVE = 0.00
END PLANE

BEGIN PLANE
ID = 73, LEN = 945.0, AREA = 7405044.9
SL = 0.038, MAN = 0.052, X = 593864.3, Y = 3507560.5
CV = 0.95, PRINT = 1
KS = 8.19, G = 114.97, DIST = 0.3, POR = 0.459, ROCK = 0.43
FR = 0.5, 0.33, 0.16, SPLASH = 24.91, COH = 0.006, SMAX = 0.93
INTER = 2.6, CANOPY = 0.137, PAVE = 0.00
END PLANE