



LIDER ENGINEERING PLLC

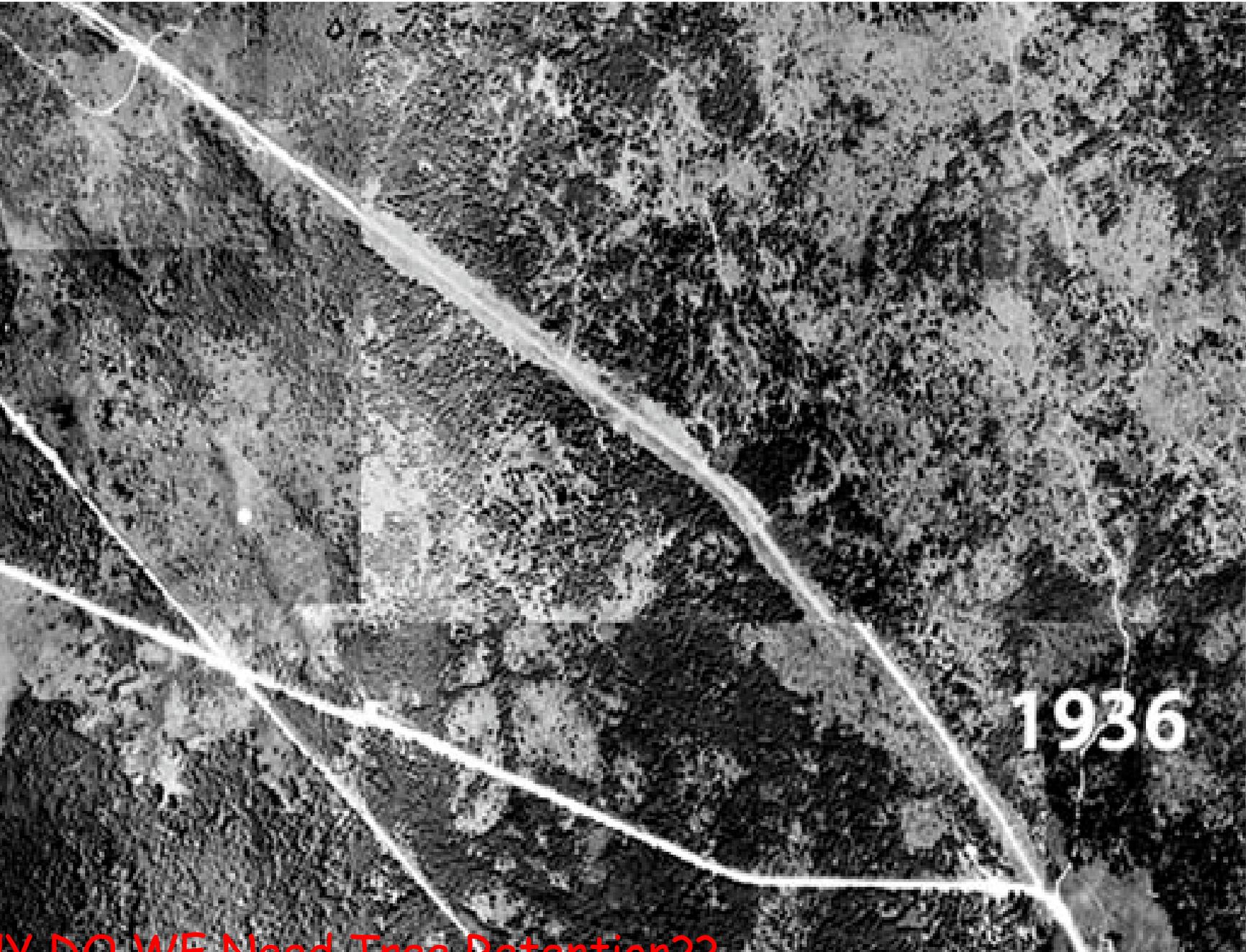
Low Impact Development Engineering Resources
Stormwater and Erosion Control Engineering

WILLIAM M LIDER, PE, CESCL

STORMWATER CONTROL and TREE RETENTION

By: William Lider PE, CESCL

Prepared for:
City of Lake Forest Park
November 6, 2016



1936

DO WE Need Tree Retention??



1970

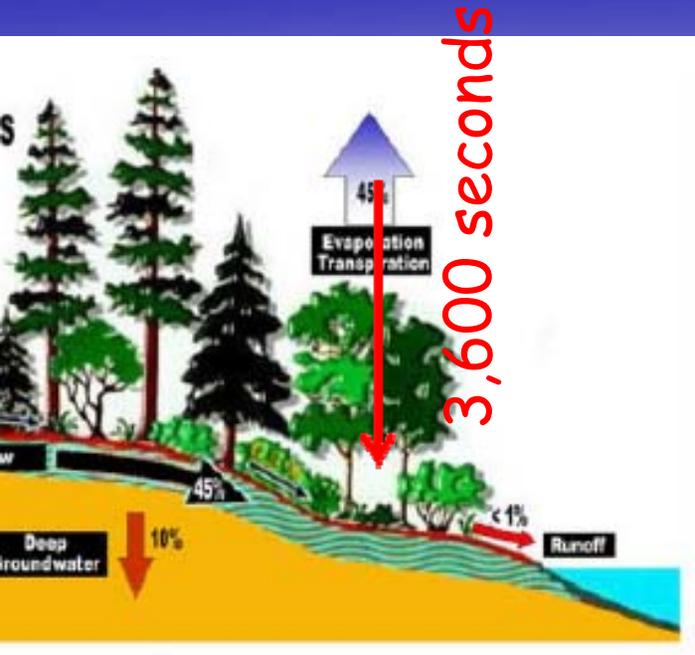


Ecological Tree Equation

PEOPLE + TREES = NO TREES



Why We Need Tree Retention Ordinances



Interception

Runoff Happens!

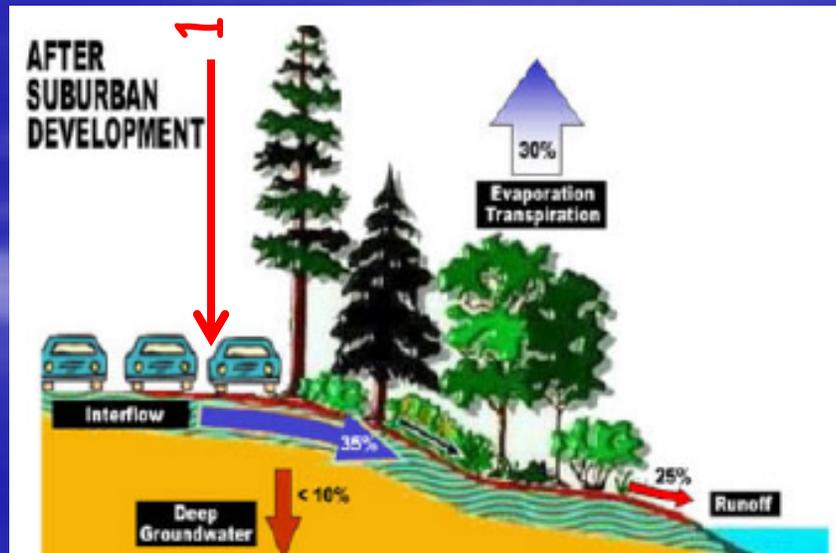


Table 2.3.2
Runoff Curve Numbers for Selected Agricultural, Suburban, and Urban Areas

(Sources: TR 55, 1986, and Stormwater Management Manual, 1992. See Section 2.1.1 for explanation)

Cover type and hydrologic condition	CNs for hydrologic soil group			
	A	B	C	D
Curve Numbers for Pre-Development Conditions				
Pasture, grassland, or range-continuous forage for grazing:				
Fair condition (ground cover 50% to 75% and not heavily grazed).	49	69	79	84
Good condition (ground cover >75% and lightly or only occasionally grazed)	39	61	74	80
Woods:				
Fair (Woods are grazed but not burned, and some forest litter covers the soil).	36	60	73	79
Good (Woods are protected from grazing, and litter and brush adequately cover the soil).	30	55	70	77
Curve Numbers for Post-Development Conditions				
Open space (lawns, parks, golf courses, cemeteries, landscaping, etc.)¹				
Fair condition (grass cover on 50% - 75% of the area).	77	85	90	92
Good condition (grass cover on >75% of the area)	68	80	86	90
Impervious areas:				
Open water bodies: lakes, wetlands, ponds etc.	100	100	100	100
Paved parking lots, roofs ² , driveways, etc. (excluding right-of-way)	98	98	98	98
Permeable Pavement (See Appendix C to decide which condition below to use)				
Landscaped area	77	85	90	92
50% landscaped area/50% impervious	87	91	94	96
100% impervious area	98	98	98	98
Paved	98	98	98	98
Gravel (including right-of-way)	76	85	89	91
Dirt (including right-of-way)	72	82	87	89
Pasture, grassland, or range-continuous forage for grazing:				
Poor condition (ground cover <50% or heavily grazed with no mulch).	68	79	86	89
Fair condition (ground cover 50% to 75% and not heavily grazed).	49	69	79	84
Good condition (ground cover >75% and lightly or only occasionally grazed)	39	61	74	80
Woods:				
Poor (Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning).	45	66	77	83
Fair (Woods are grazed but not burned, and some forest litter covers the soil).	36	60	73	79
Good (Woods are protected from grazing, and litter and brush adequately cover the soil).	30	55	70	77
Single family residential³:	Should only be used for subdivisions > 50 acres	Average Percent impervious area ^{3,4}		
Dwelling Unit/Gross Acre				
1.0 DU/GA		15		Separate curve number shall be selected for pervious & impervious portions of the site or basin
1.5 DU/GA		20		
2.0 DU/GA		25		
2.5 DU/GA		30		
3.0 DU/GA		34		
3.5 DU/GA		38		
4.0 DU/GA		42		
4.5 DU/GA		46		
5.0 DU/GA		48		
5.5 DU/GA		50		
6.0 DU/GA		52		
6.5 DU/GA		54		
7.0 DU/GA		56		
7.5 DU/GA		58		
PUD's, condos, apartments, commercial businesses, industrial areas & subdivisions < 50 acres	%impervious must be computed	Separate curve numbers shall be selected for pervious and impervious portions of the site		

For a more detailed and complete description of land use curve numbers refer to chapter two (2) of the Soil Conservation Service's Technical Release No. 55, (210-VI-TR-55, Second Ed., June 1986).

¹ Composite CN's may be computed for other combinations of open space cover type.

² Where roof runoff and driveway runoff are infiltrated or dispersed according to the requirements in Chapter 3, the average percent impervious area may be adjusted in accordance with the procedure described under "Flow Credit for Roof Downspout Infiltration" (Section 3.1.1), and "Flow Credit for Roof Downspout Dispersion" (Section 3.1.2).

³ Assumes roof and driveway runoff is directed into street/storm system.

⁴ All the remaining pervious area (lawn) are considered to be in good condition for these curve numbers.

grassland, or range-continuous forage for grazing: Condition (ground cover 50% to 75% and not heavily grazed).	49	69	79	84
Condition (ground cover >75% and lightly or only occasionally grazed)	39	61	74	80

woods are grazed but not burned, and some forest litter covers the soil).	36	60	73	79
woods are protected from grazing, and litter and brush adequately cover the soil.	30	55	70	77

Curve Numbers for Post-Development Conditions

lawn (lawns, parks, golf courses, cemeteries, landscaping, etc.) ¹ Condition (grass cover on 50% - 75% of the area).	77	85	90	92
Condition (grass cover on >75% of the area)	68	80	86	90

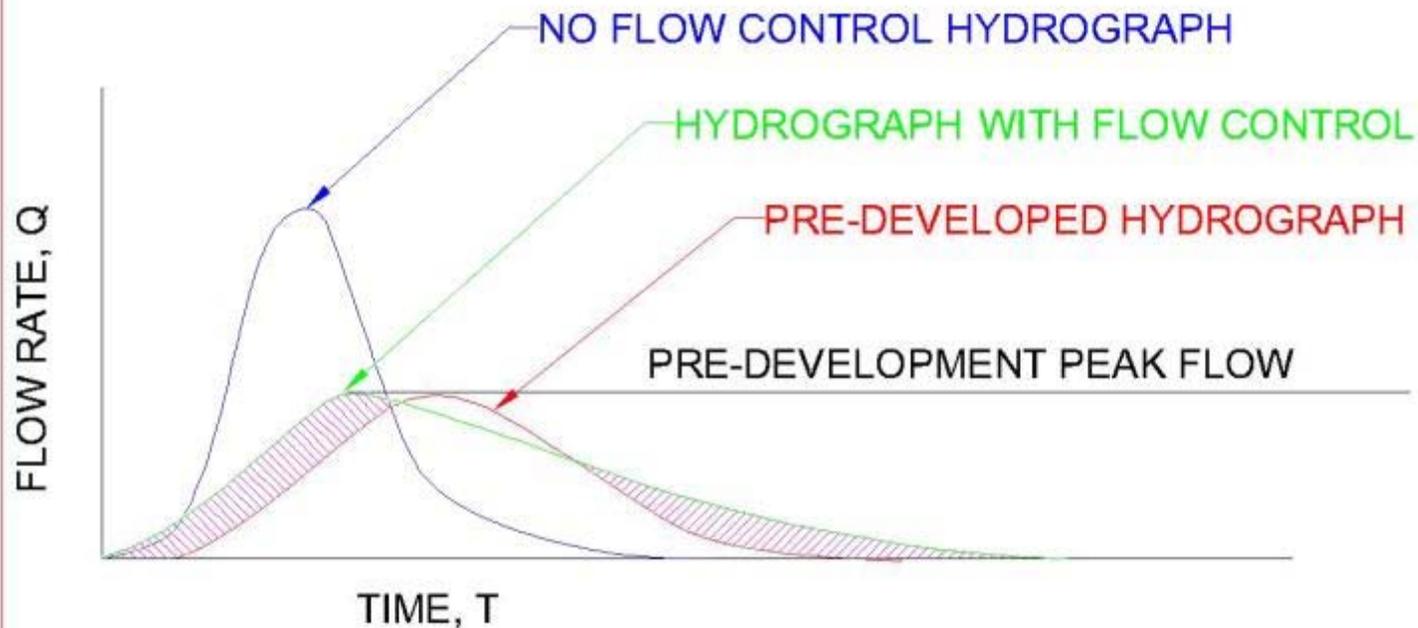
Water bodies: Water bodies: lakes, wetlands, ponds etc.	100	100	100	100
Impervious surfaces: Parking lots, roofs ² , driveways, etc. (excluding right-of-way)	98	98	98	98

Impervious Pavement (See Appendix C to decide which condition below to use)				
Unsealed area	77	85	90	92
Sealed area/50% impervious	87	91	94	96
100% impervious area	98	98	98	98
Impervious area (including right-of-way)	76	85	89	91
Impervious area (excluding right-of-way)	72	82	87	89

grassland, or range-continuous forage for grazing: Condition (ground cover <50% or heavily grazed with no mulch).	68	79	86	89
Condition (ground cover 50% to 75% and not heavily grazed).	49	69	79	84
Condition (ground cover >75% and lightly or only occasionally grazed)	39	61	74	80

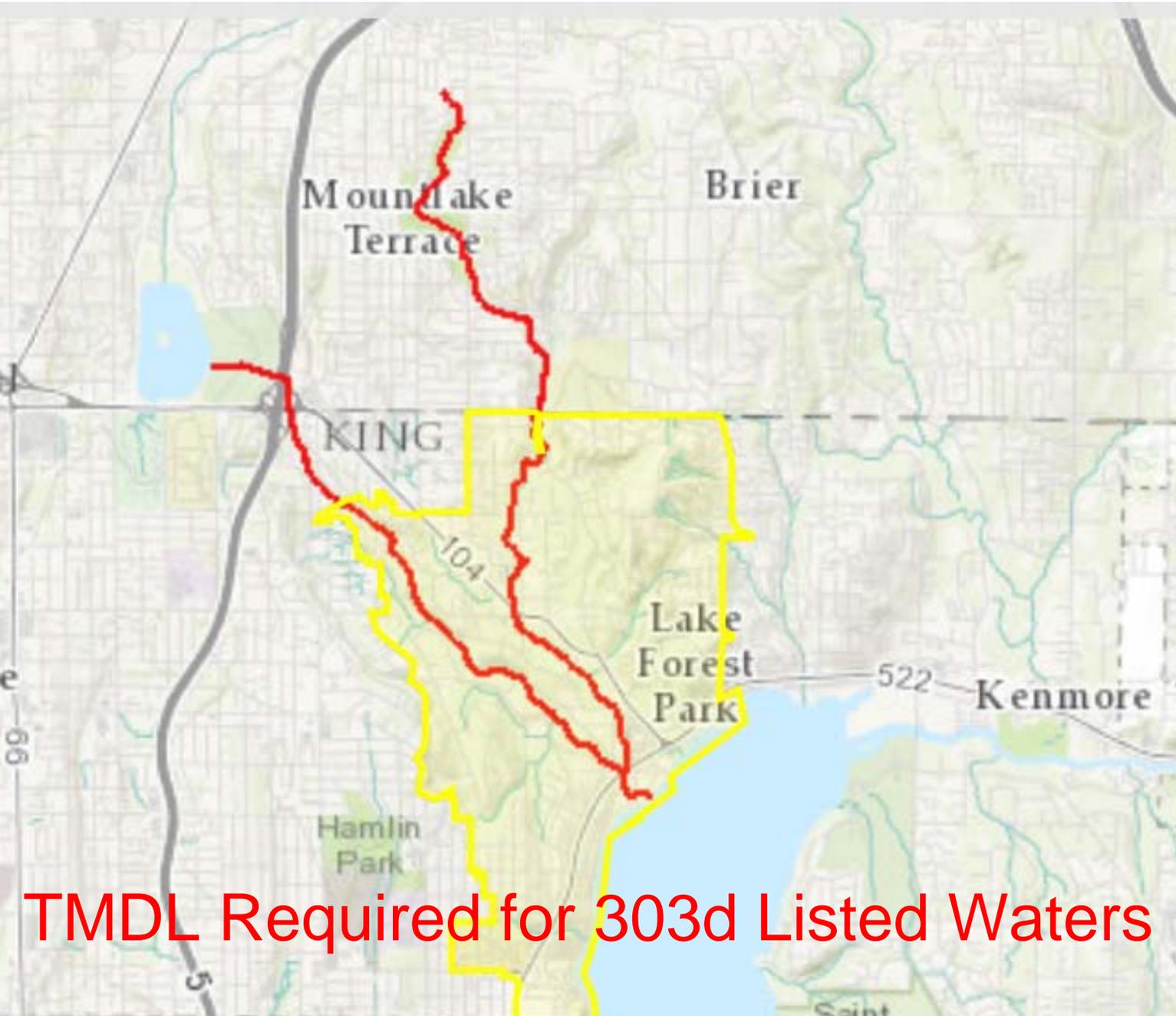
woods (forest litter, small trees, and brush are destroyed by heavy grazing or regular burning).	45	66	77	83
woods are grazed but not burned, and some forest litter covers the soil).	36	60	73	79
woods are protected from grazing, and litter and brush adequately cover the soil).	30	55	70	77

Family residential³:	Should only be used for subdivisions > 50 acres	Average Percent impervious area ^{3,4}		
DU/GA		15	Separate curve number shall be selected for pervious & impervious	
DU/GA		20		
DU/GA		25		



TYPICAL DEVELOPMENT HYDROGRAPHS

Ponds Became Much Larger to Match
Pre-Development Hydrograph



TMDL Required for 303d Listed Waters

TMDL – TOTAL MAXIMUM DAILY LOAD

The amount of a pollutant that a waterbody can receive and still meet water quality standards”

Clean Water Act requires states to set water quality standards for surface waters to protect the public and environmental health.

Streams and lakes not providing these beneficial uses are placed on a list of impaired waterbodies—the 303(d) list.

TMDL (continued)

Water bodies on the 303(d) list must have a TMDL developed for them to correct the impairment, and

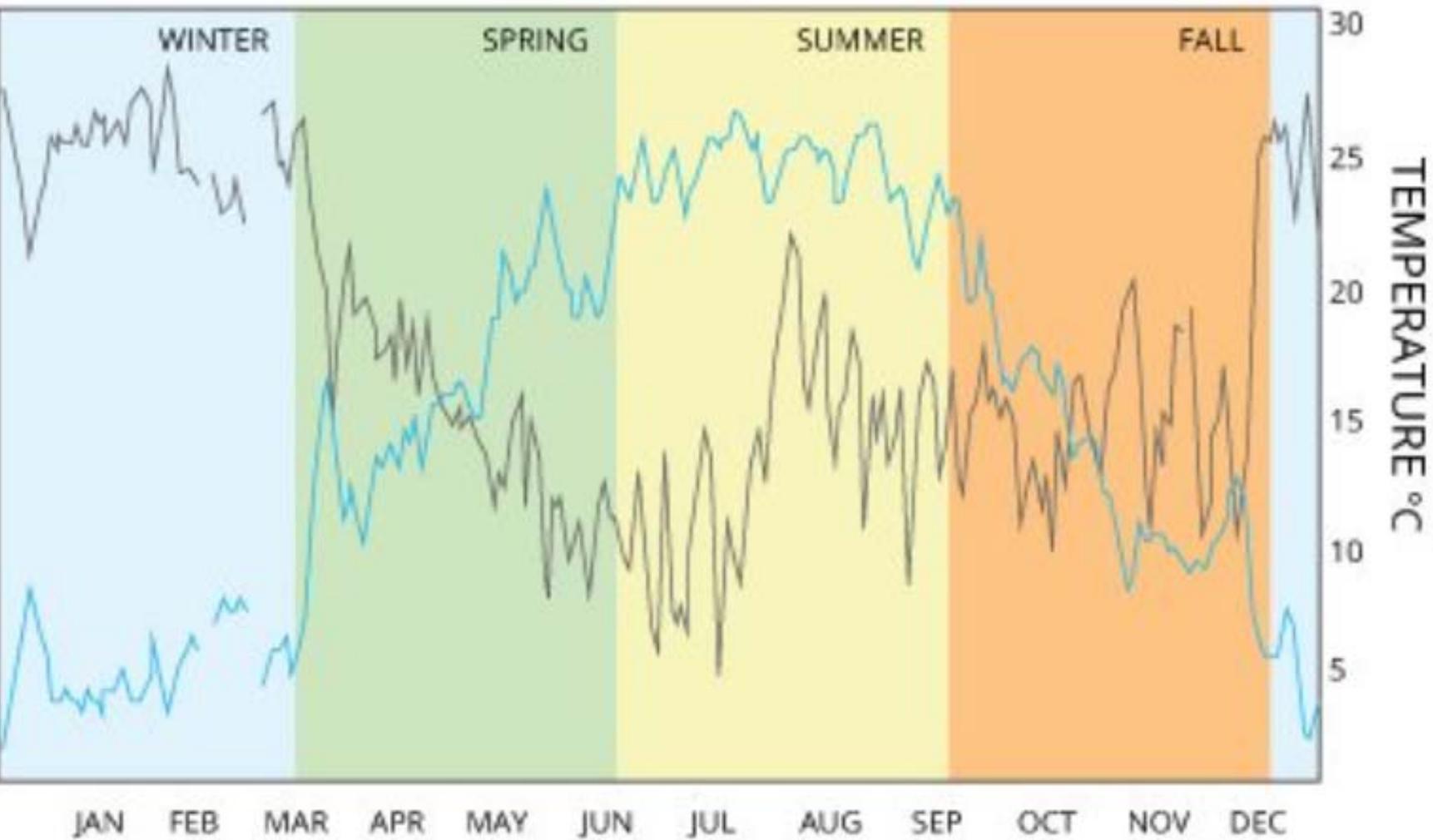
Municipalities not implementing a TMDL plan can be sued under the Clean Water Act.

303(d) Category 5 Issues in the City*

- > Dissolved Oxygen
- > Temperature
- > Bacteria
- > Bioassessment

Category 5 polluted waters require a TMDL or other WQI project, listed as an impaired water body under Section 303(d) of the Clean Water Act.

DAILY DO CONCENTRATION



Lake Forest Park is a Phase II Municipality

Currently uses King County's 2009
Drainage Manual

Has the option of adopting the Ecology
Manual or one of the Phase I
Municipalities Manuals (e.g. King County)

Required to Adopt the 2014 Manual
December 31, 2016

Clean Water Act/NPDES Permit
Drives the Adoption of 2014
SWMMWW

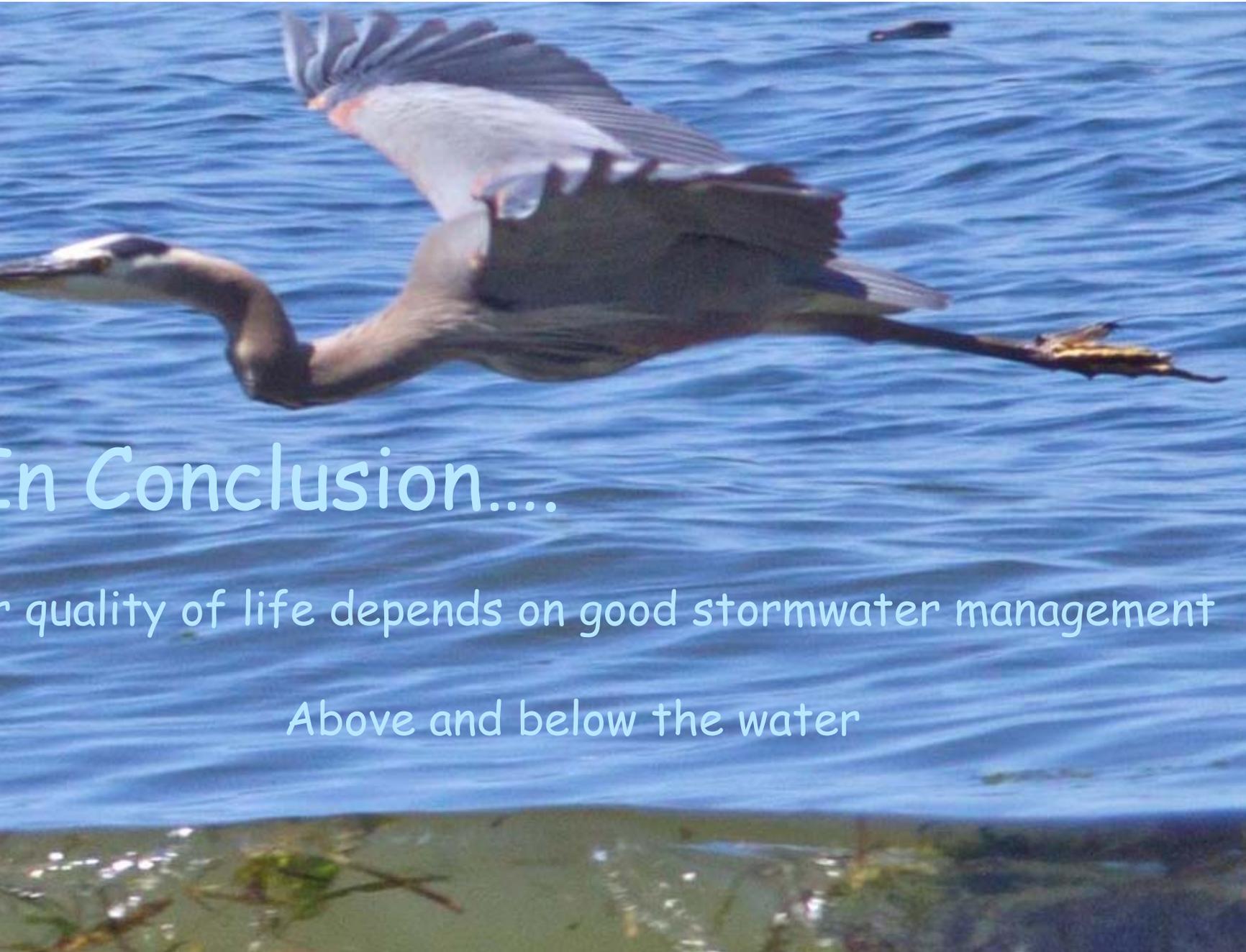
Lake Forest Park will be out of
compliance on January 1, 2017 if
it does not adopt a stormwater
manual equivalent to Ecology's
2014 *Stormwater Management
Manual for Western Washington!*



VESTING!!



Trackhoe at Alderwood Mall



In Conclusion....

Quality of life depends on good stormwater management

Above and below the water



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Low Impact Development Engineering Resources
Stormwater and Erosion Control Engineering

WILLIAM M LIDER, PE, CESCL

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