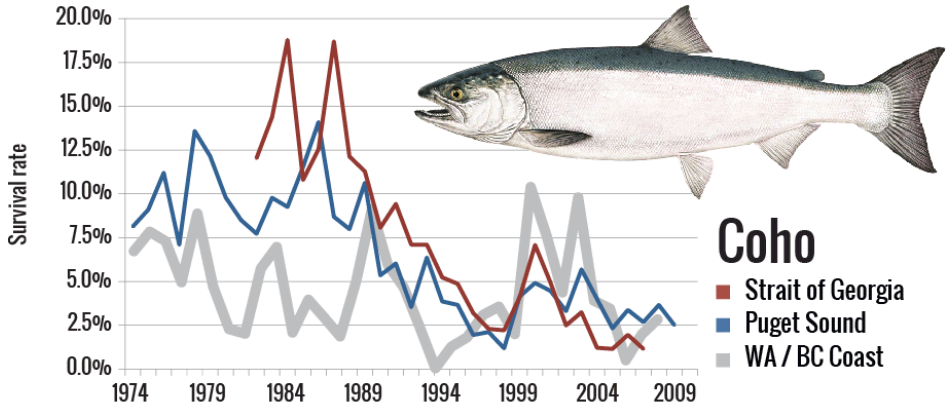
Watershed Approach to Recovering Urban Streams:

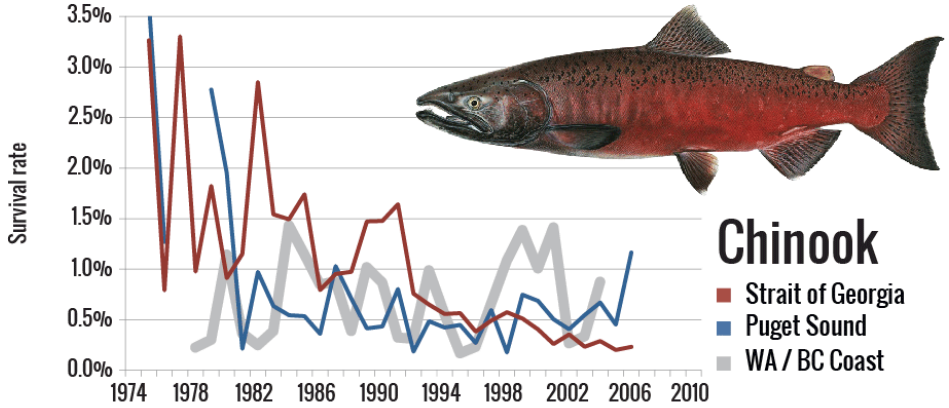
Developing and Implementing a Watershed Management Plan

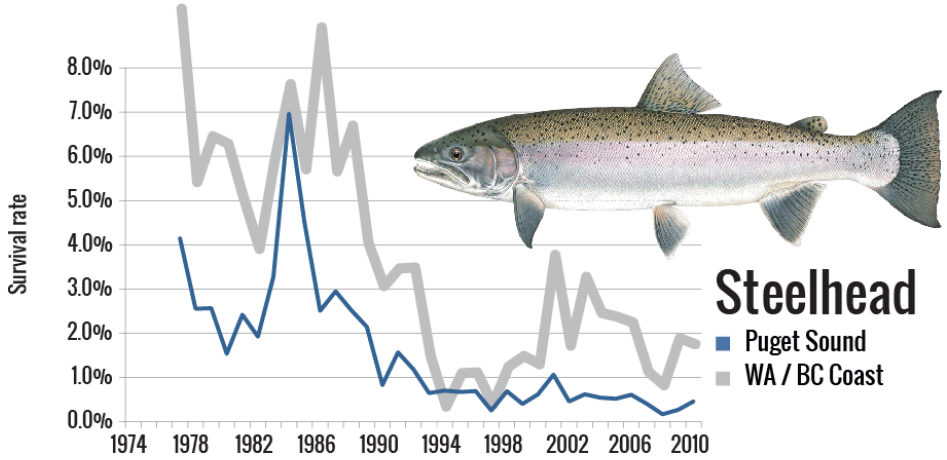
STEVE HITCH, PE – CITY OF REDMOND

CityofRedmond
WASHINGTON

Puget Sound Salmon







Credit: Michael Schmidt, Long Live the Kings

Puget Sound Salmon

Healthy aquatic habitat where people live and work is almost gone.

Bellevue Stream Team

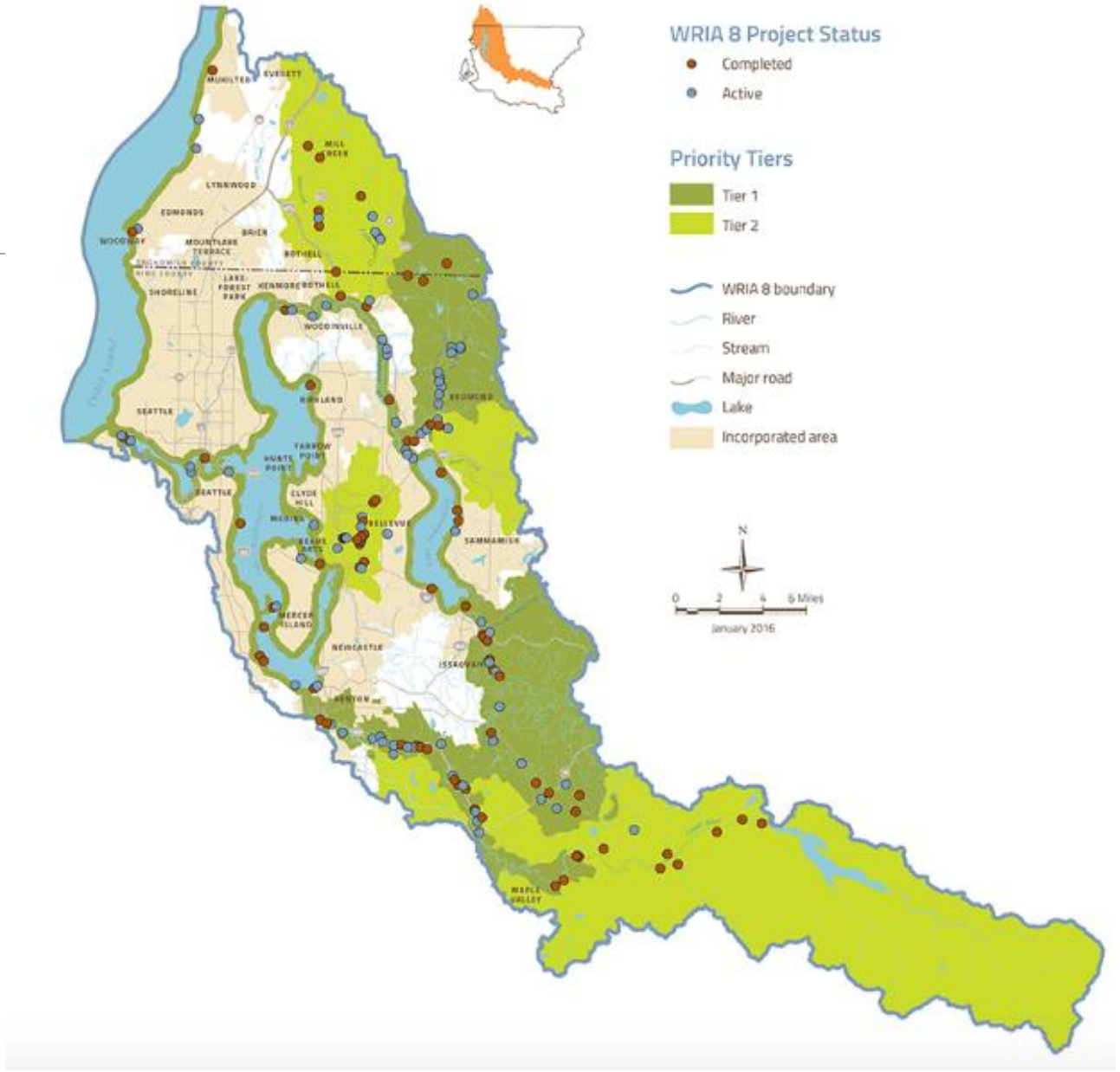
Stormwater Management

Development prior to 2013 is not equipped with sufficient stormwater controls.

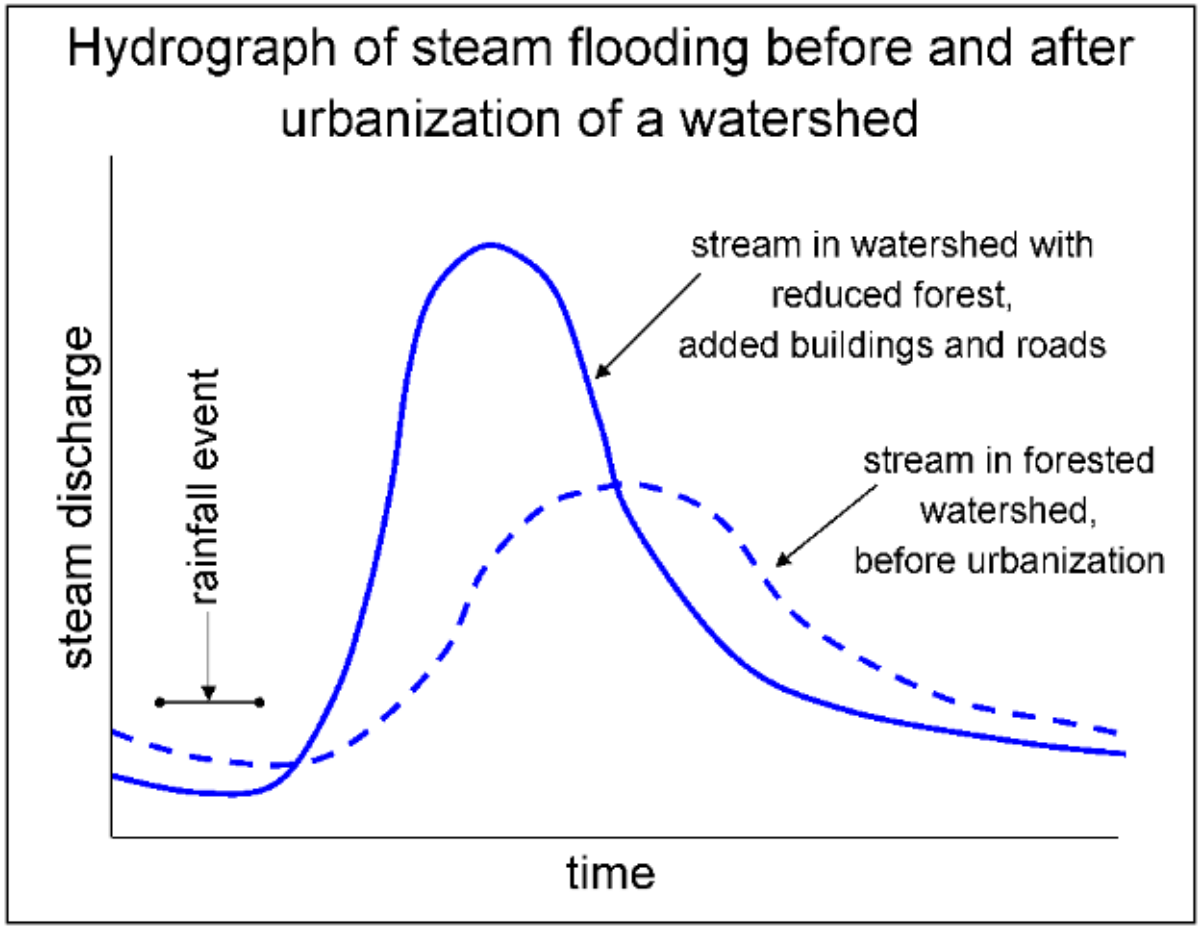
The Dilemma

Washington Municipal Stormwater Permit

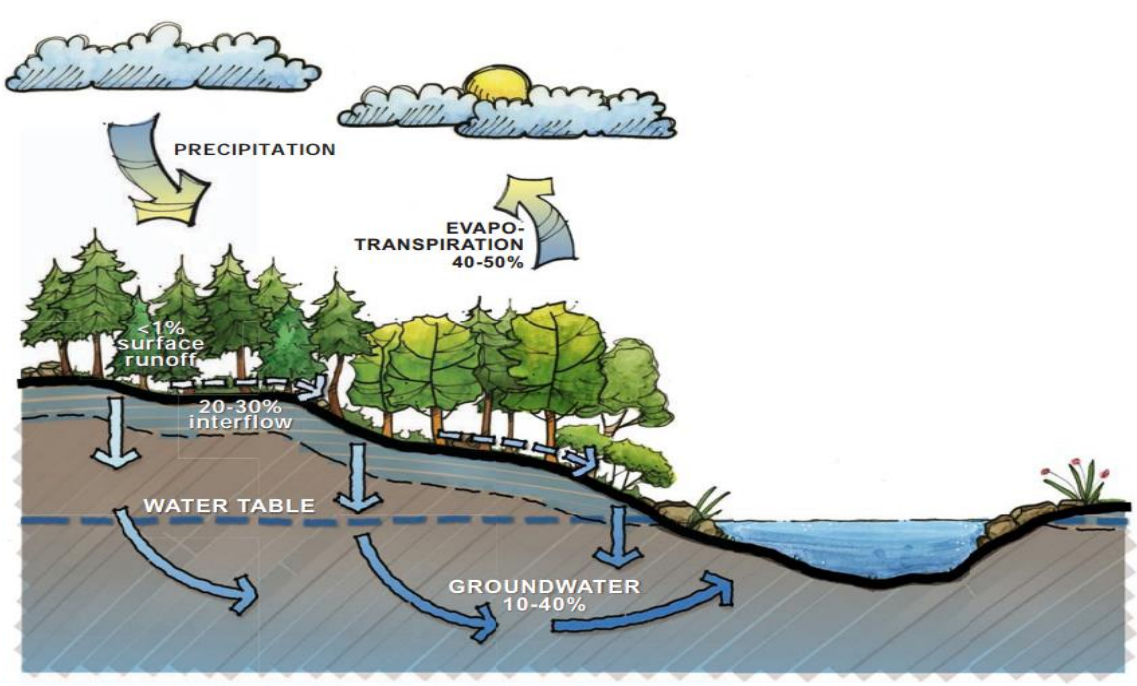
- Tied to new development and redevelopment
- Treatment designed to improve conditions relative to existing conditions
- New requirements for LID
- <u>Does not specifically target areas of ecological importance</u>

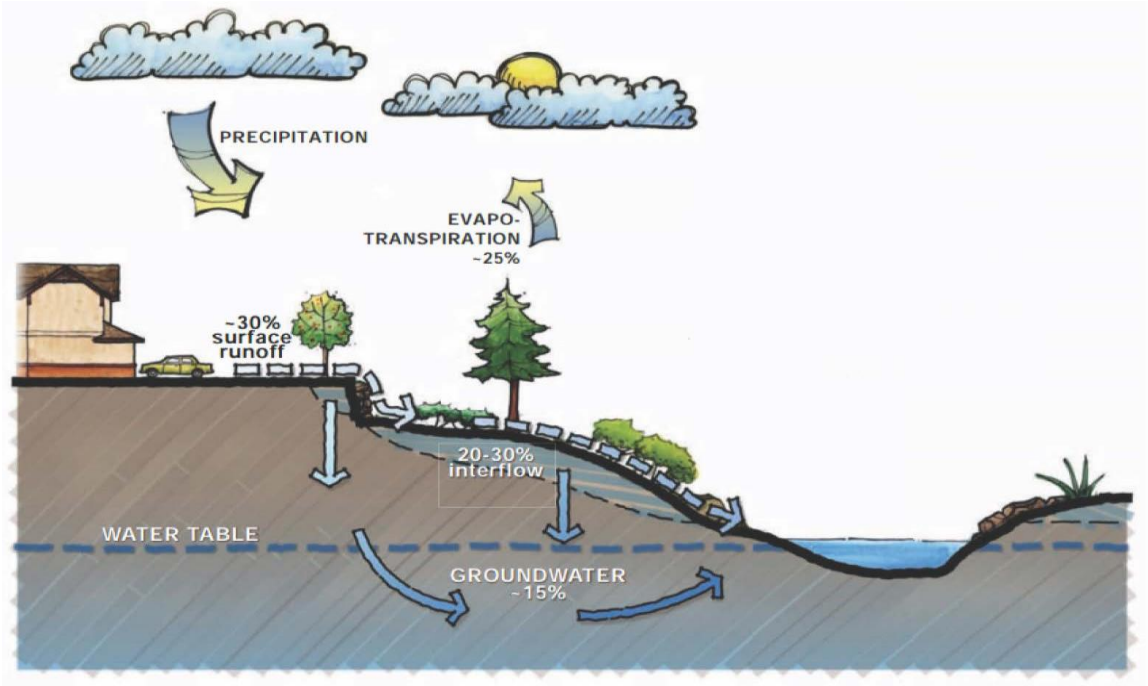


Hydrology


Hydrograph of steam flooding before and after urbanization of a watershed
steam discharge
rainfall event
stream in watershed with reduced forest, added buildings and roads
stream in forested watershed, before urbanization
time

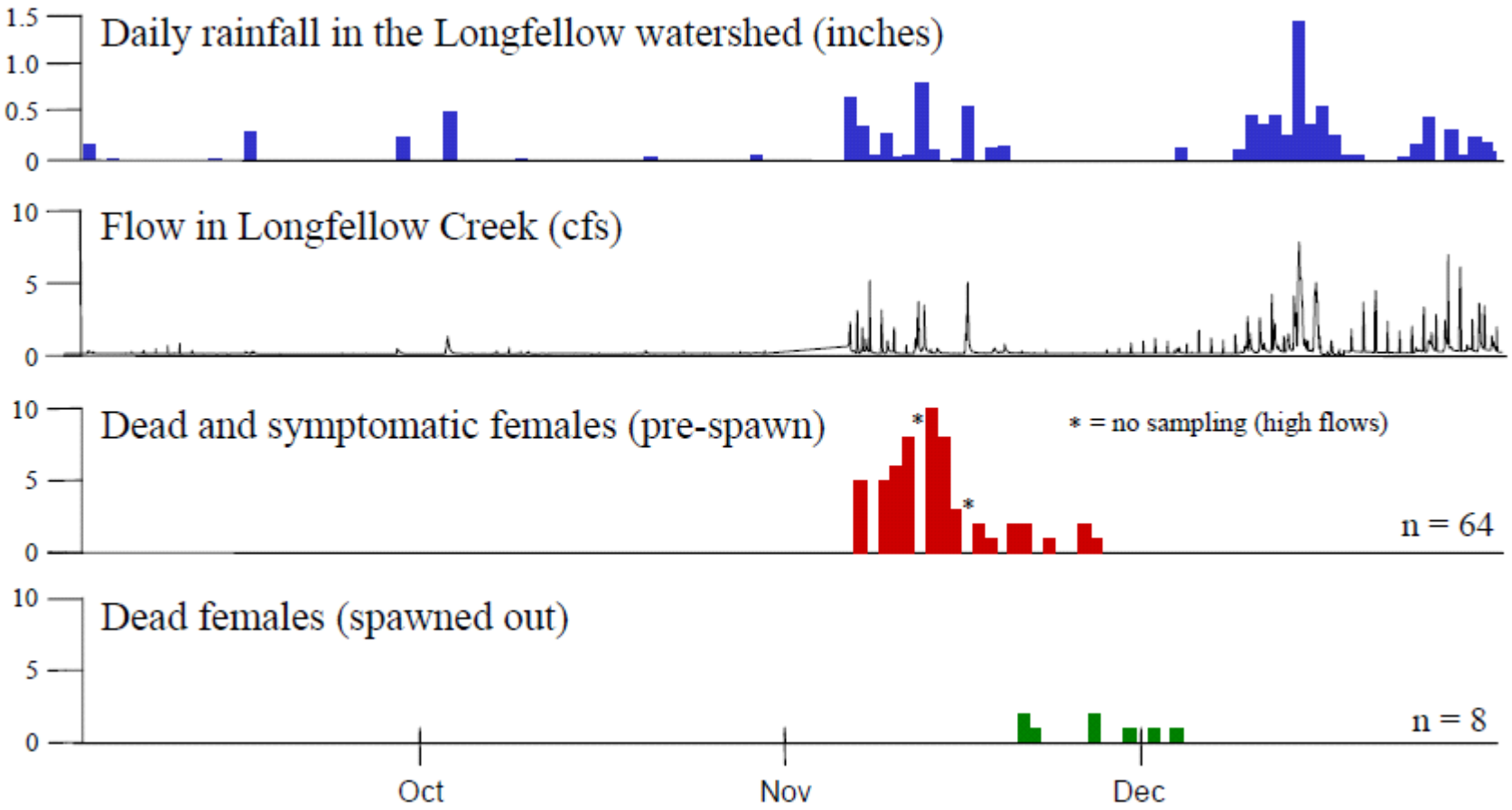
Hydrology


PRECIPITATION
EVAPO-
TRANSPIRATION
40-50%
<1%
surface
runoff
20-30%
interflow
WATER TABLE
GROUNDWATER
10-40%


PRECIPITATION
EVAPO-
TRANSPIRATION
~25%
~30%
surface
runoff
20-30%
interflow
WATER TABLE
GROUNDWATER
~15%

Water Quality

Water Quality



Impacts of Stormwater Runoff on Coho Salmon in Restored Urban Streams, Sarah McCarthy

Accommodating Growth

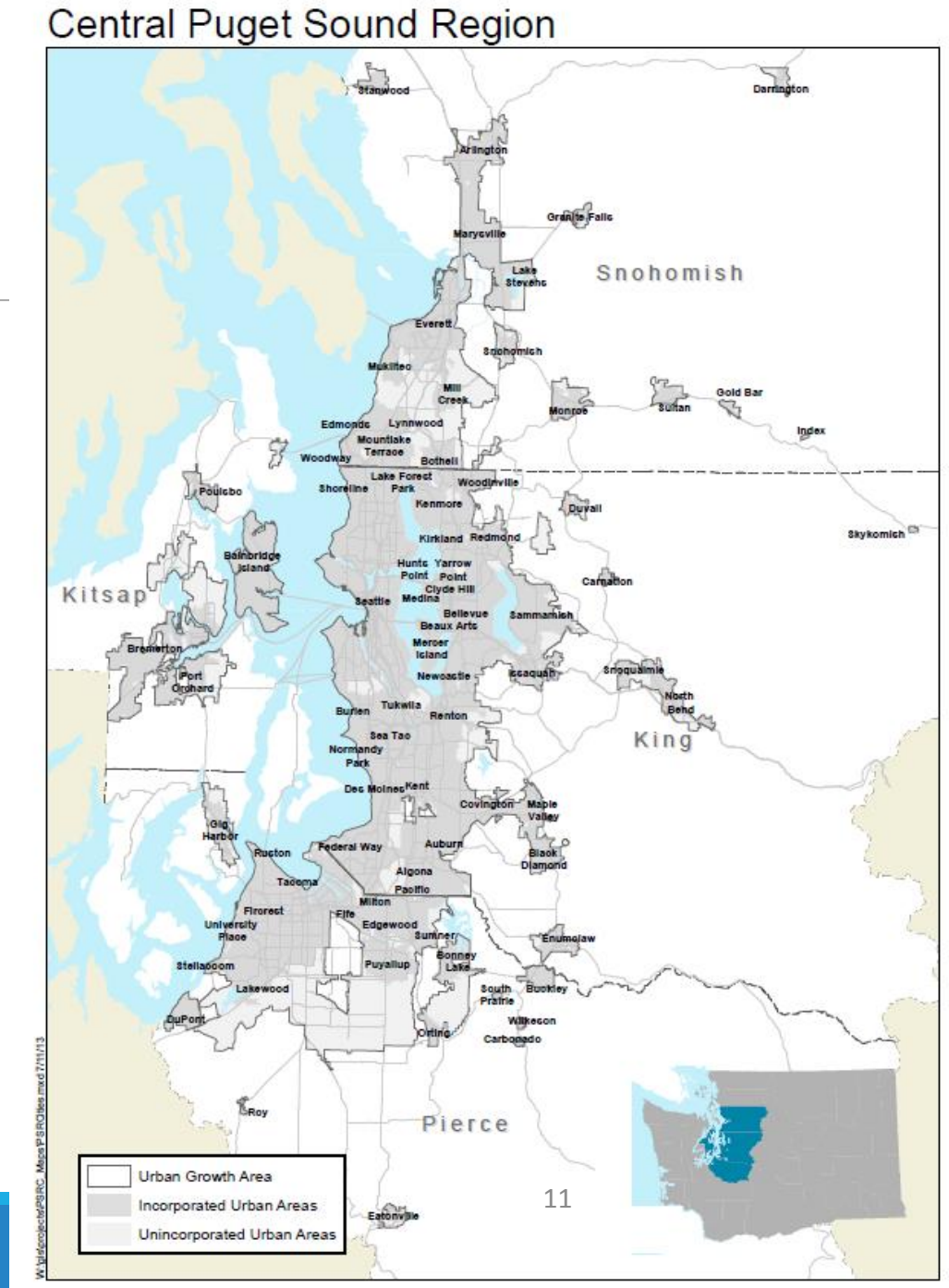
Population Growth

Two more Seattles

and

two more Tacoma's

by 2040!

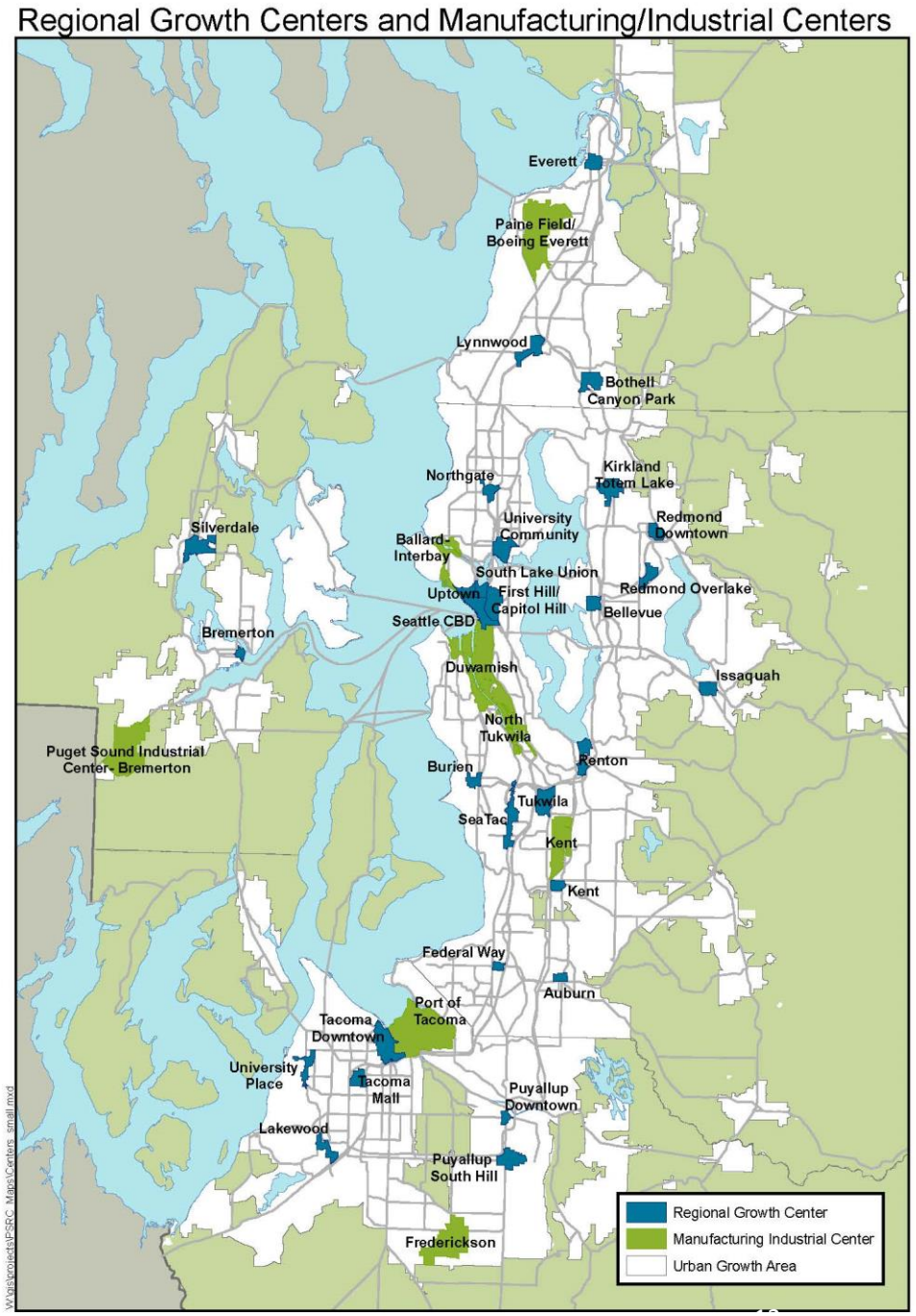


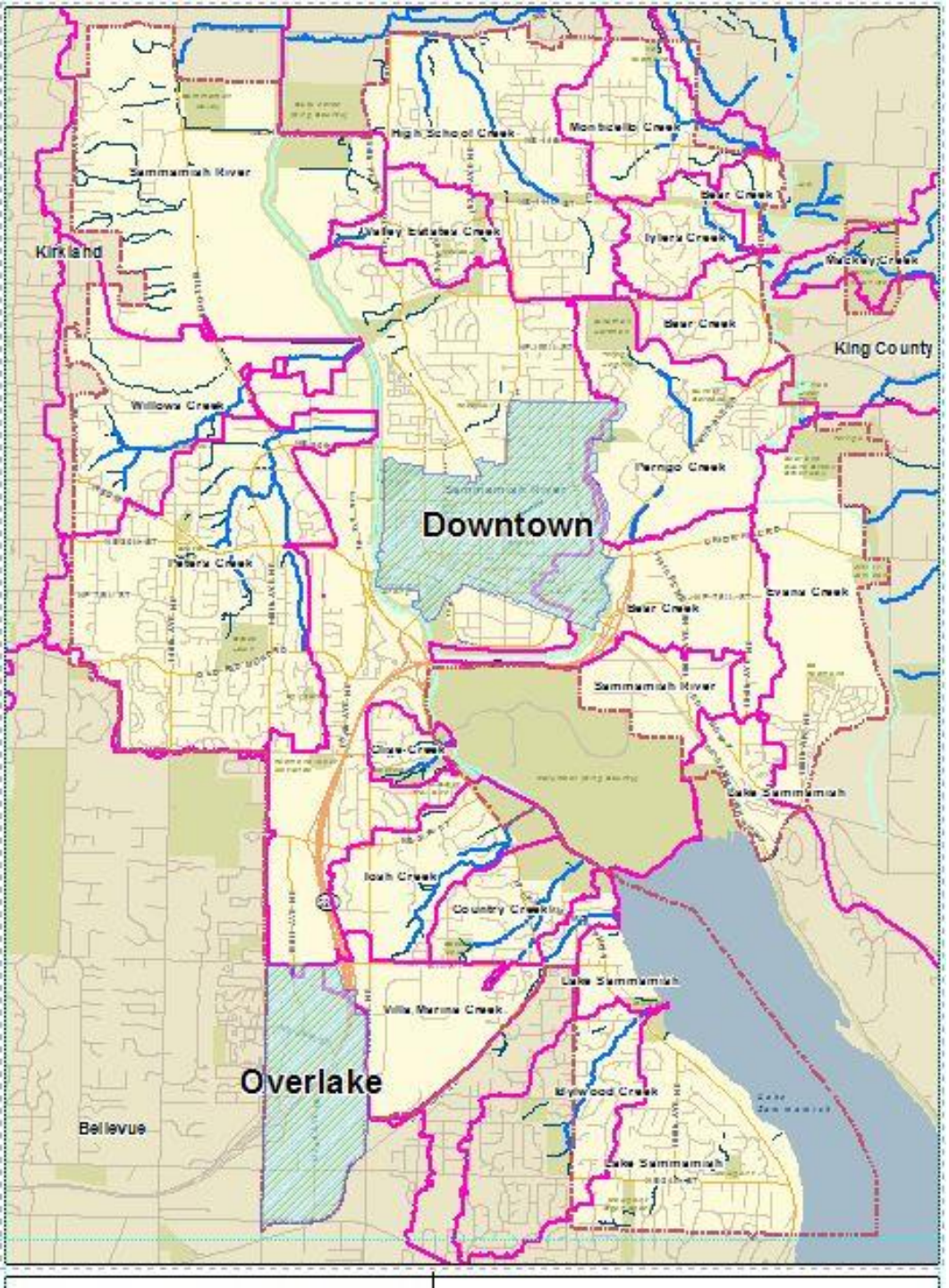
Vision 2040

Accommodate population growth in designated centers linked by transit:

29 Regional Growth Centers
- 2.6% of total UGA (≈26 sq mi)
- Currently 30% of region's jobs

8 Manufacturing/Industrial Centers
- 3.7% of total UGA area





City of Redmond

- 17 Square Miles
- 60,000 residents
- 85,000 employed
- Built out in the 70's-90's
- Committed to Restoring Streams
- Rapid redevelopment in urban centers

Typical Urban Streams

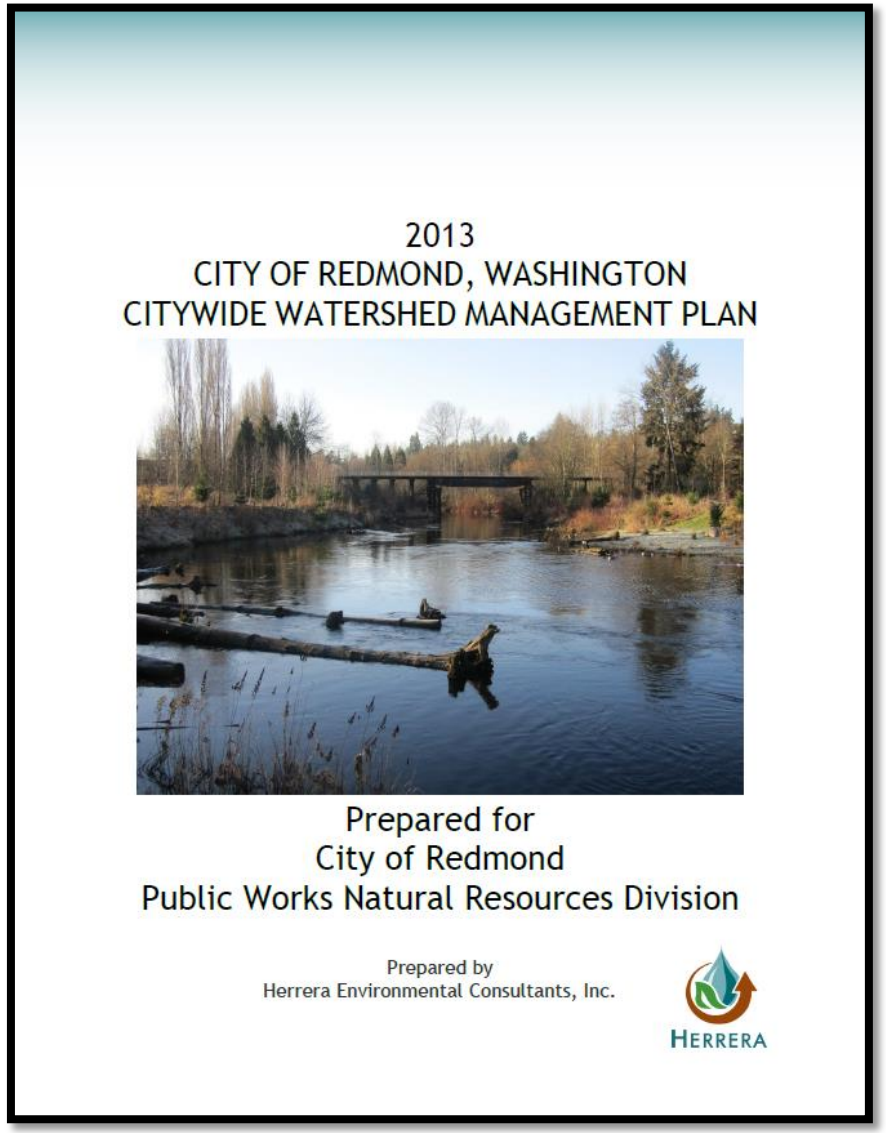
- Erosion
- Incision
- Poor Water Quality
- Low Base Flows

Redmond Citywide Watershed Plan

Approved in February 2014

Goals

- Provide baseline of scientific information evaluating watershed rehabilitation potential
- Prioritize a subset of watersheds with greatest potential to respond to rehabilitation efforts
- Identify specific tools to rehabilitate highest priority watersheds by 2060



Watershed Planning Guiding Principles

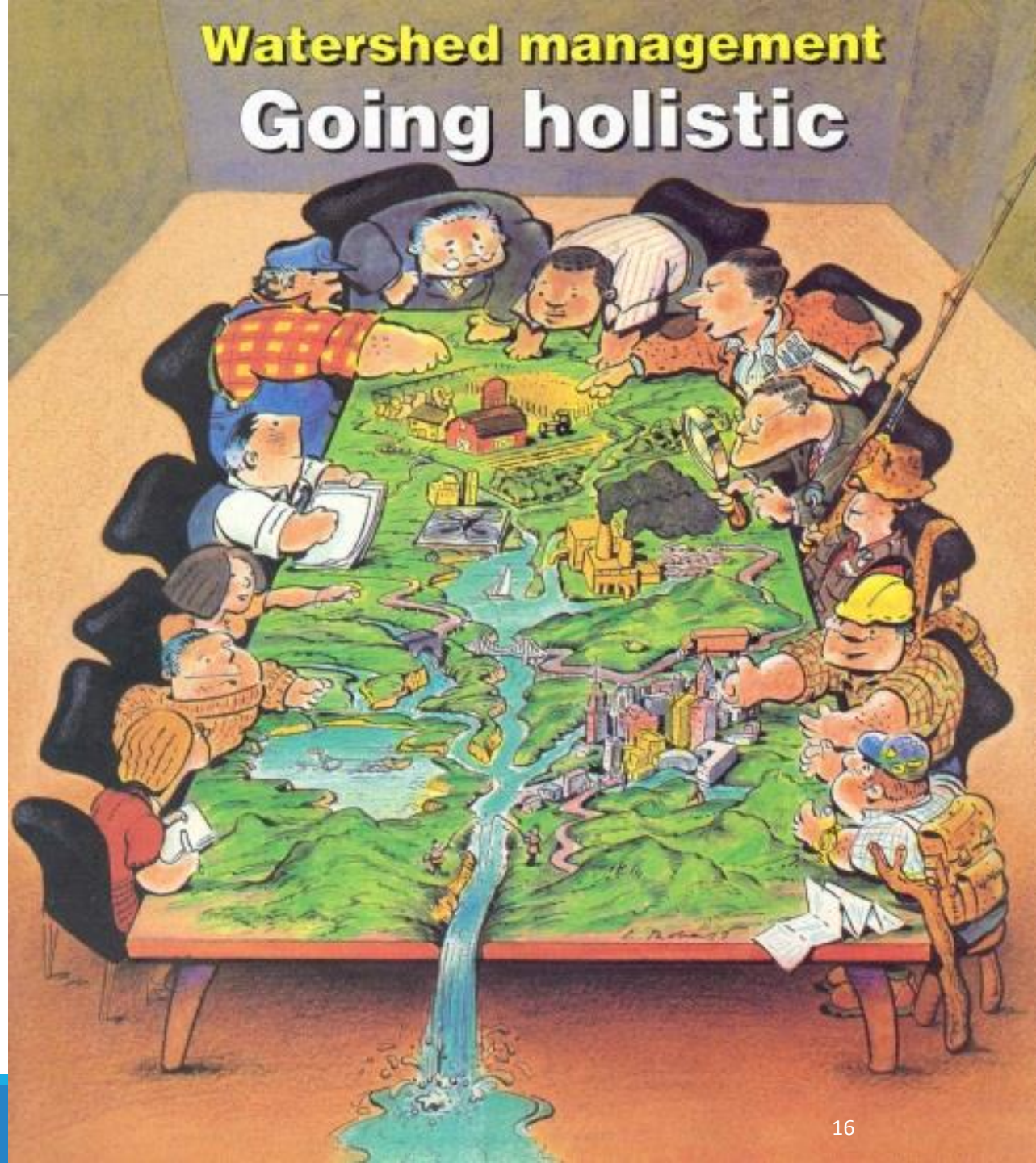
Address multiple regulations with one effort (TMDL, NPDES, ESA)

Prevent NEW stormwater impacts everywhere

Focus improvements to existing stormwater impacts where it makes sense (benefit)

Create a citywide plan that addresses stormwater and environmental asset needs

Make participation optional to developers (and capital projects)



Elements of the Plan

Build Partnerships – yes, even with Ecology

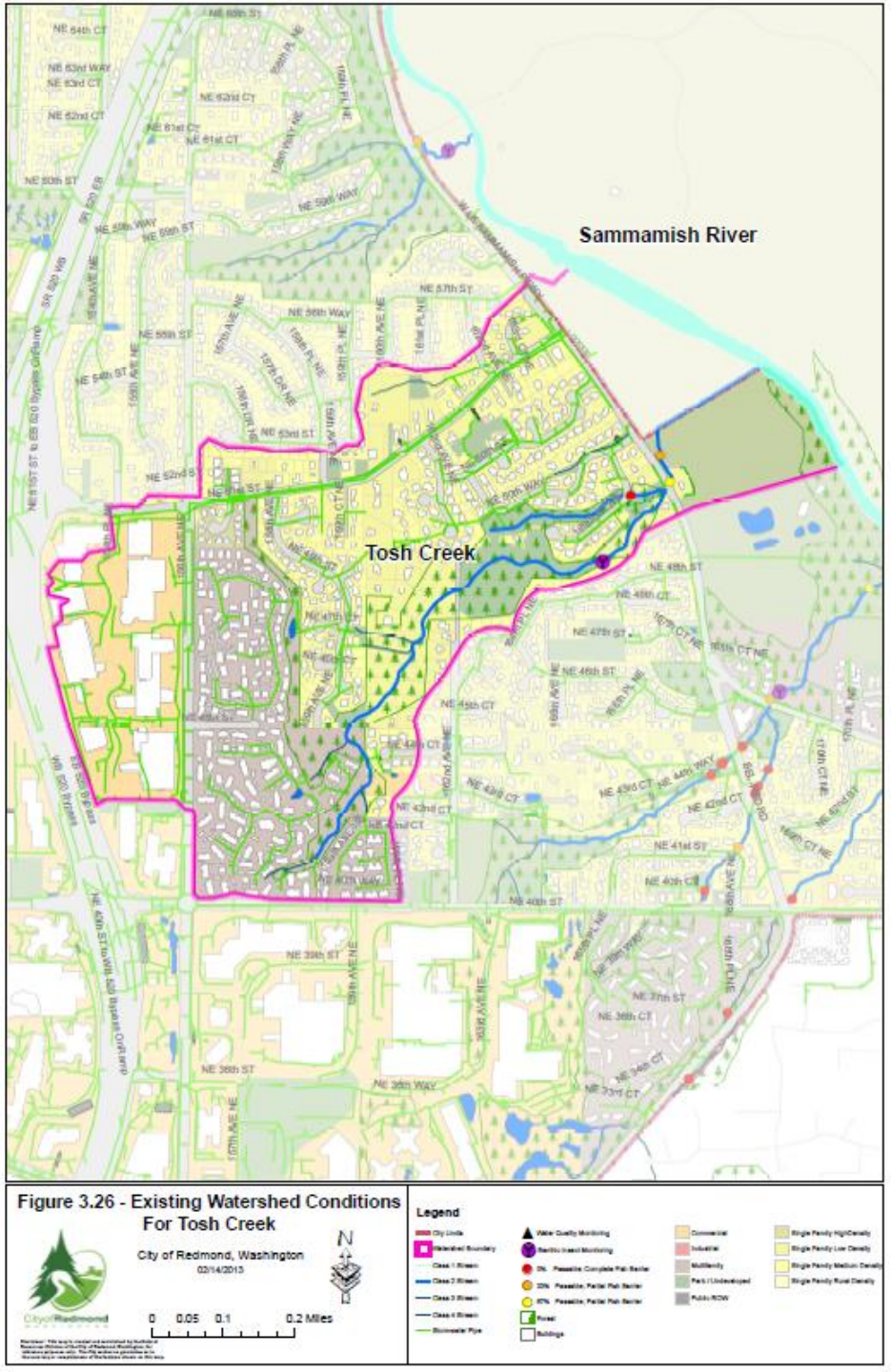
Characterize Watersheds

Set goals for future desired conditions

Implementation Plan

Performance Measurement

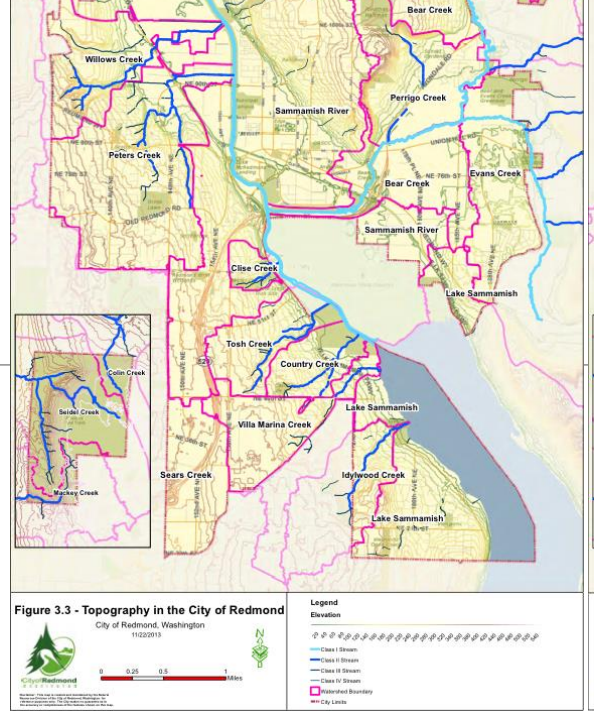
Adaptive Management

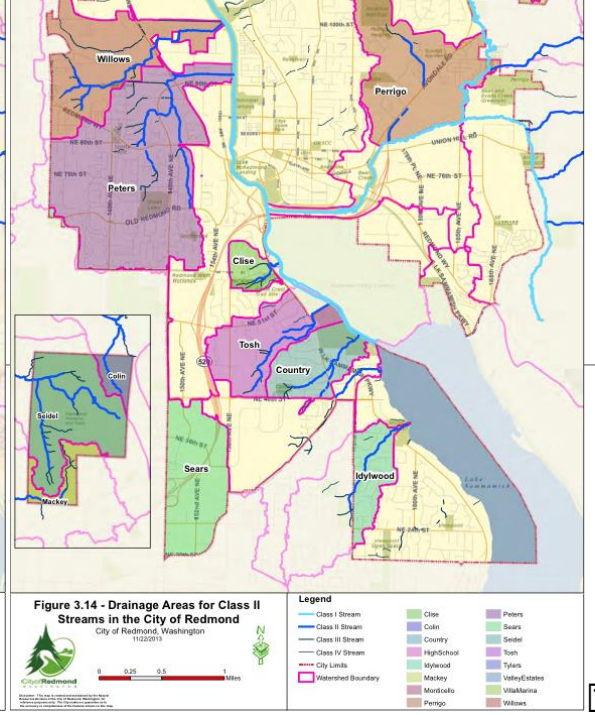


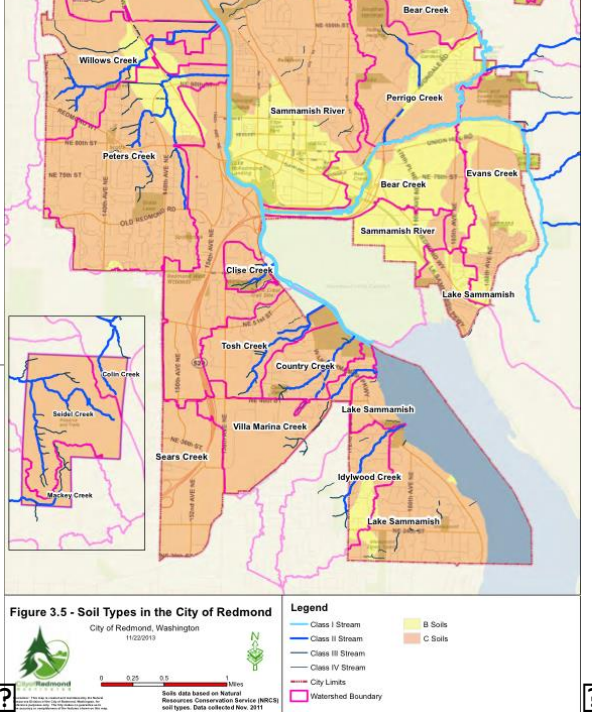
Lots to Learn

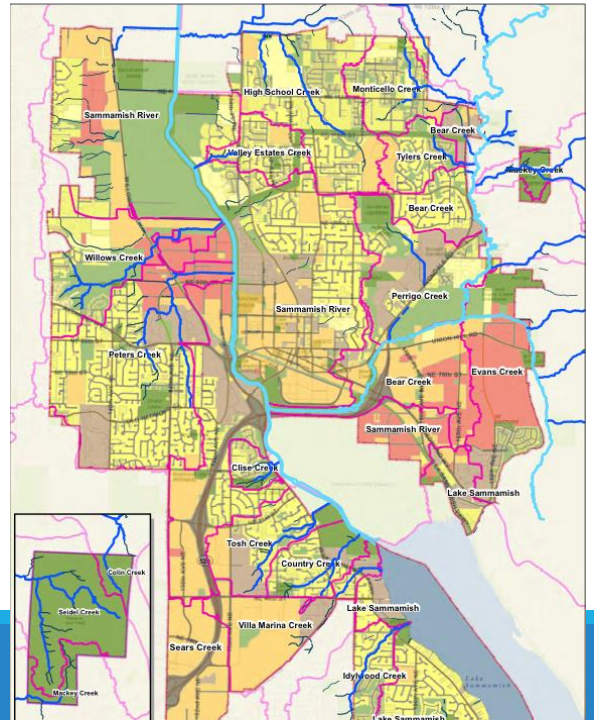
- Topography
- Soil Types
- Stream Maps
- Land Use
- Wellhead Protection Zones
- Presence of stormwater facilities

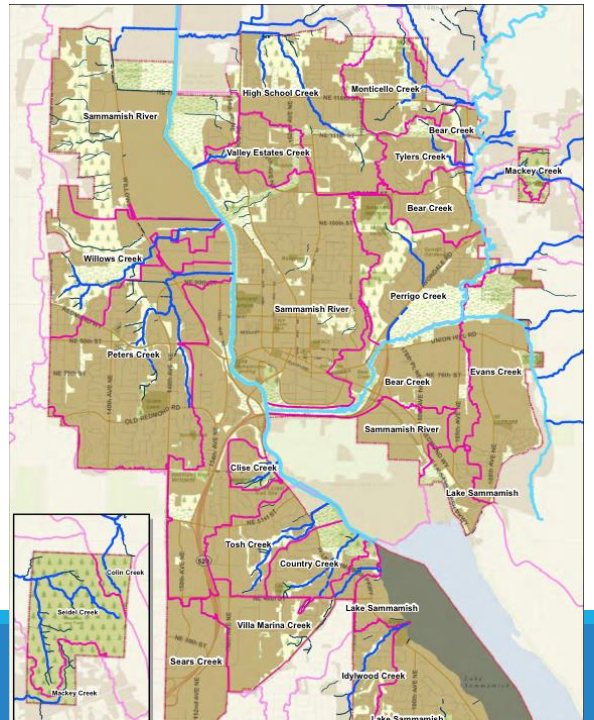
- Water Quality data
- Fish presence
- B-IBI Data
- Flow characteristics

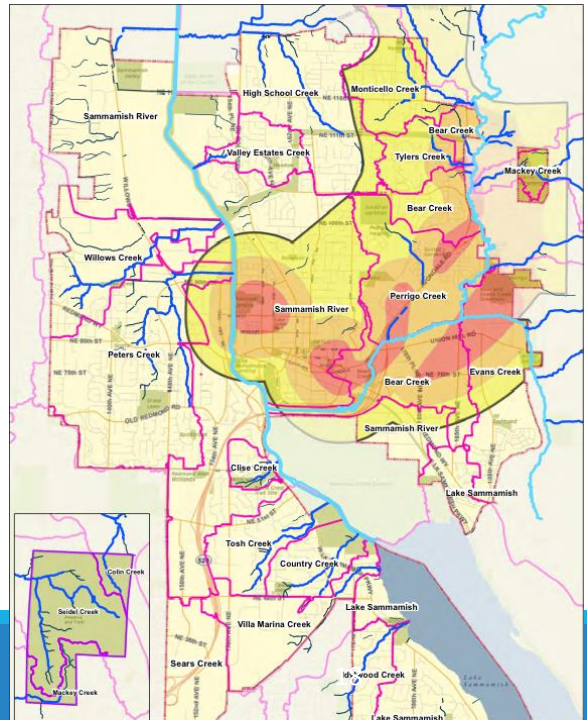


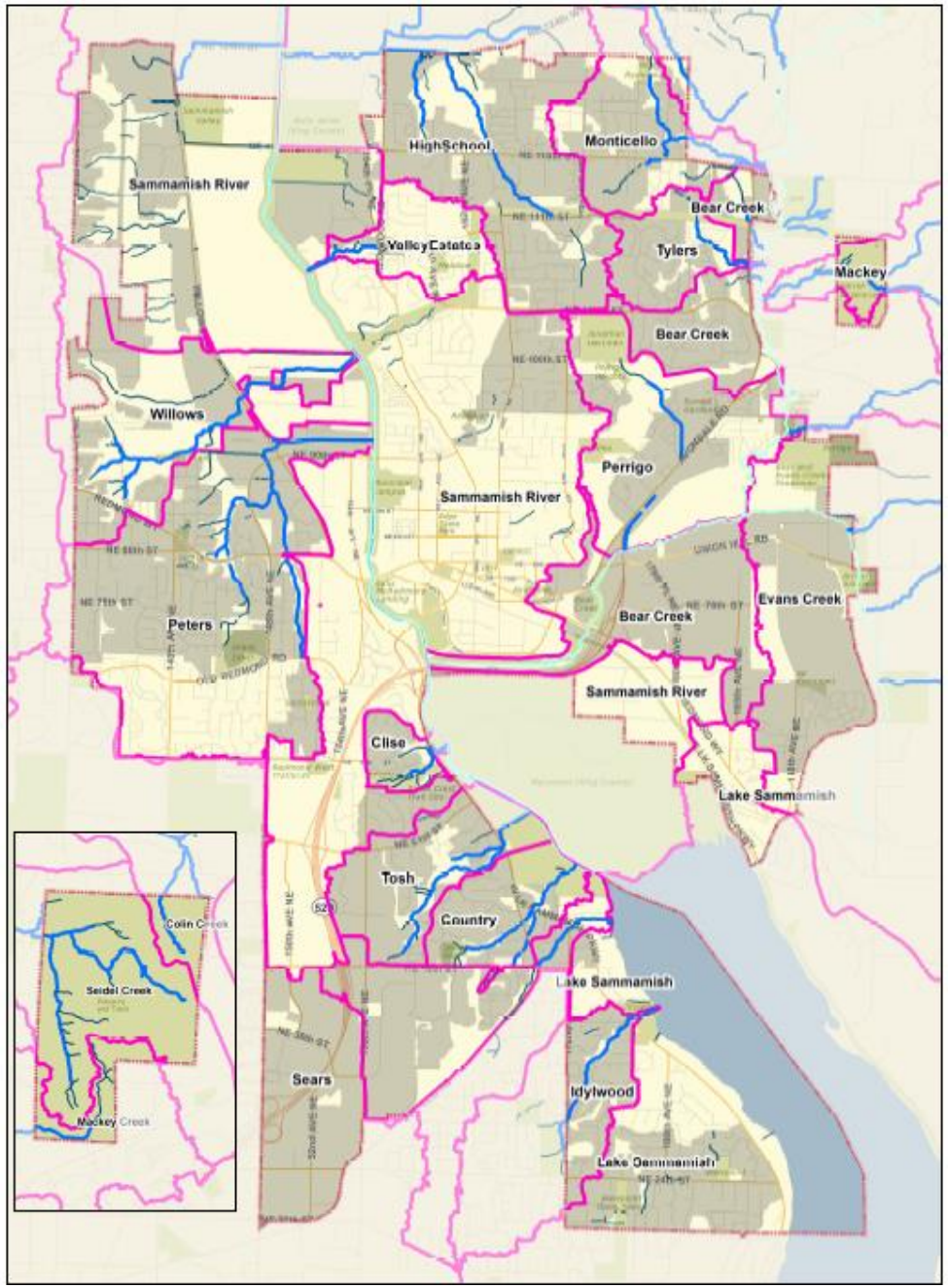




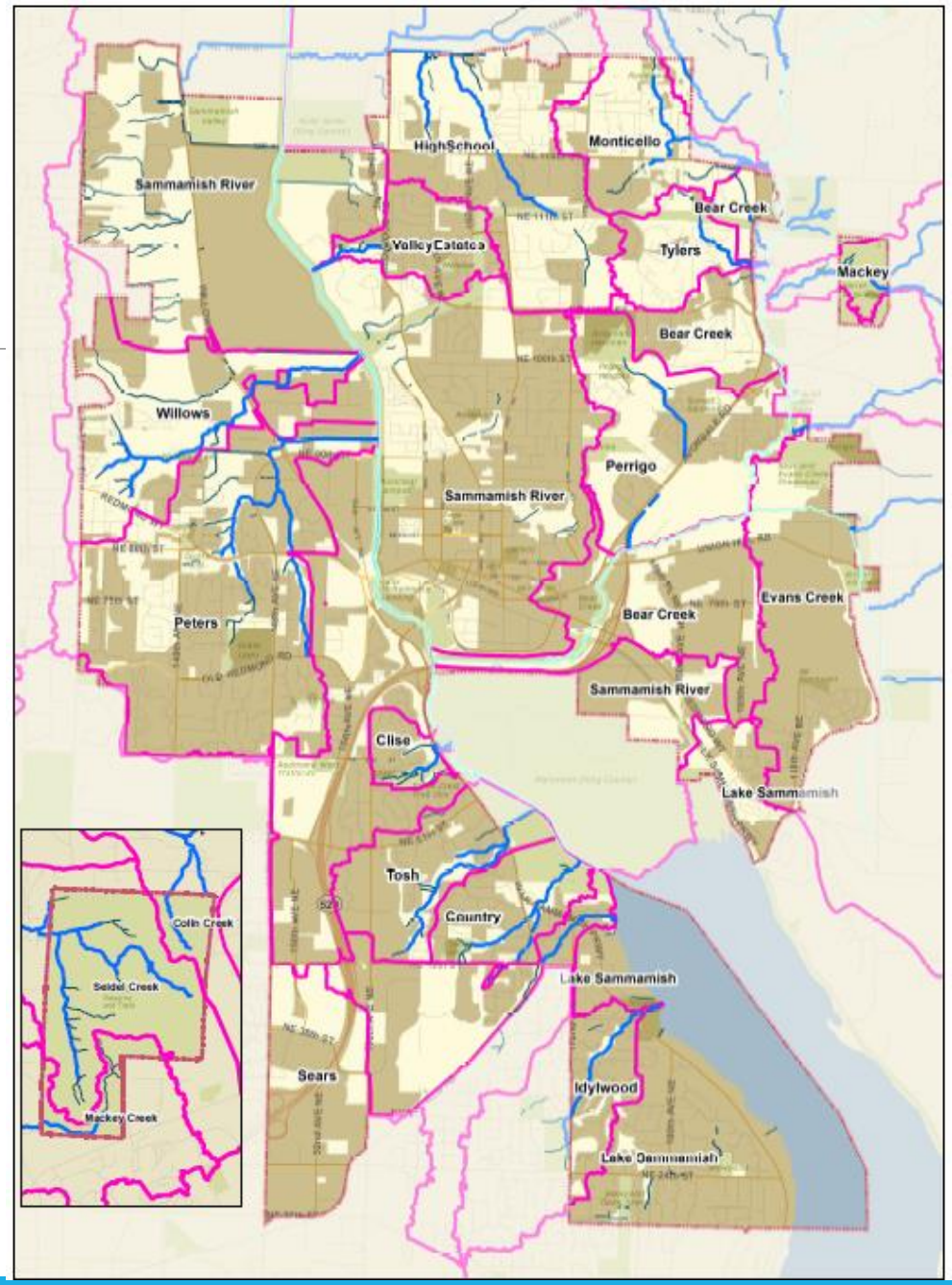








Room to Improve!



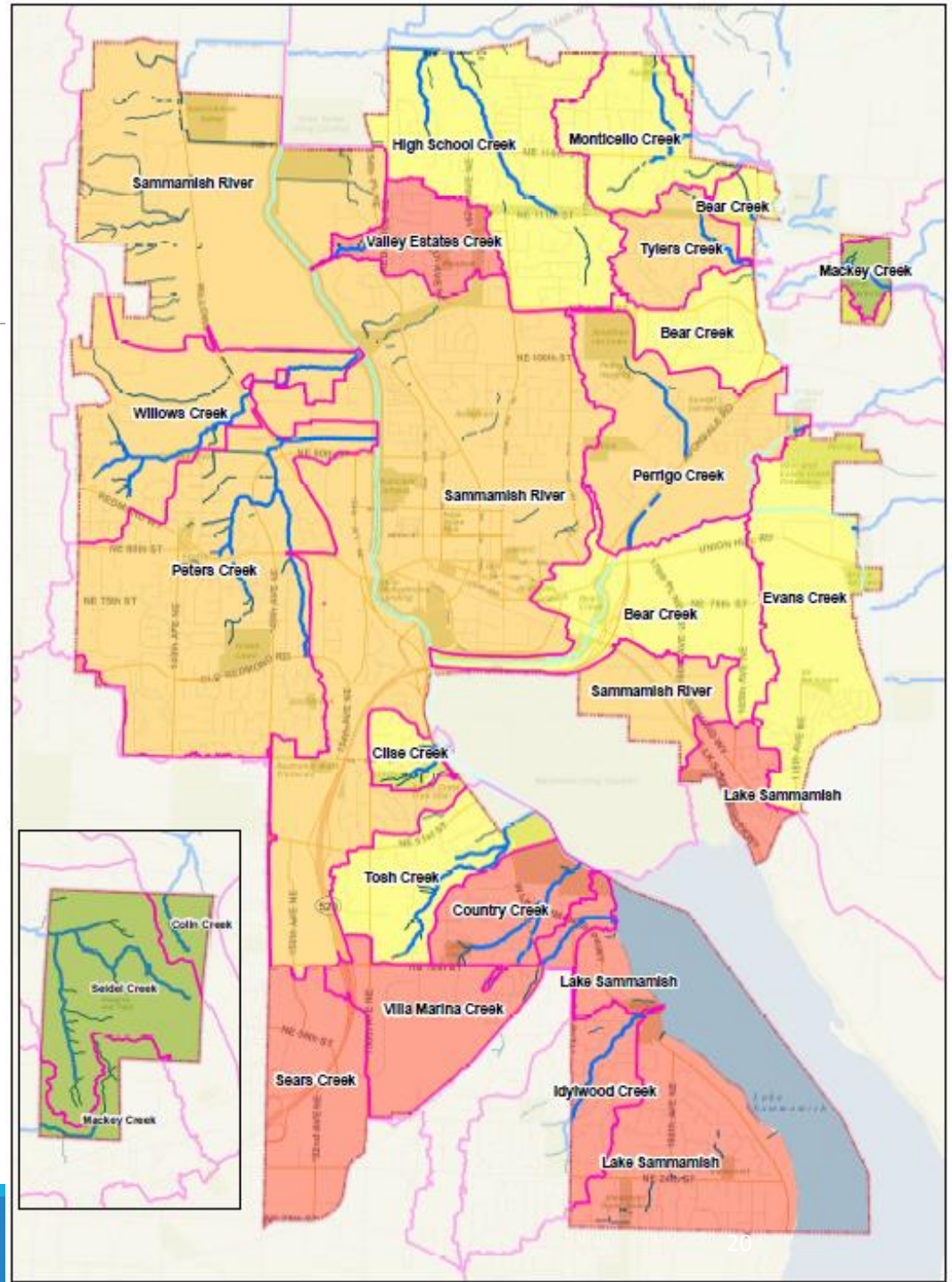
Inadequate Flow Control

Inadequate Treatment

Prioritizing Watersheds

Management Matrix for Restoration & Protection of **Water Flow**

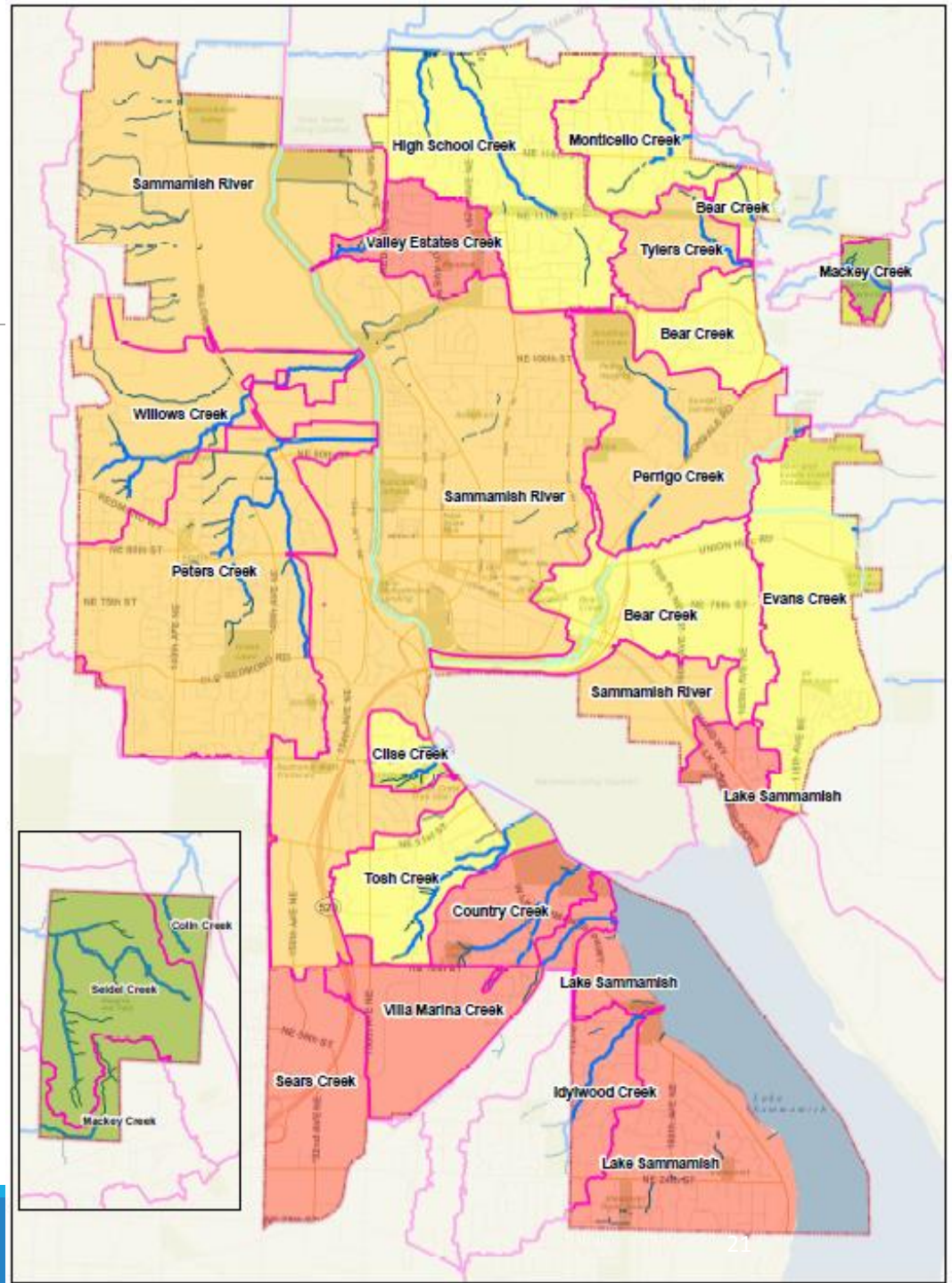
Level of Importance	Level of Degradation: Low	Level of Degradation: High
High	Highest Protection	Highest Restoration
	Protection	Restoration
	Protection Conservation	Restoration Development
Low	Conservation	Development Restoration

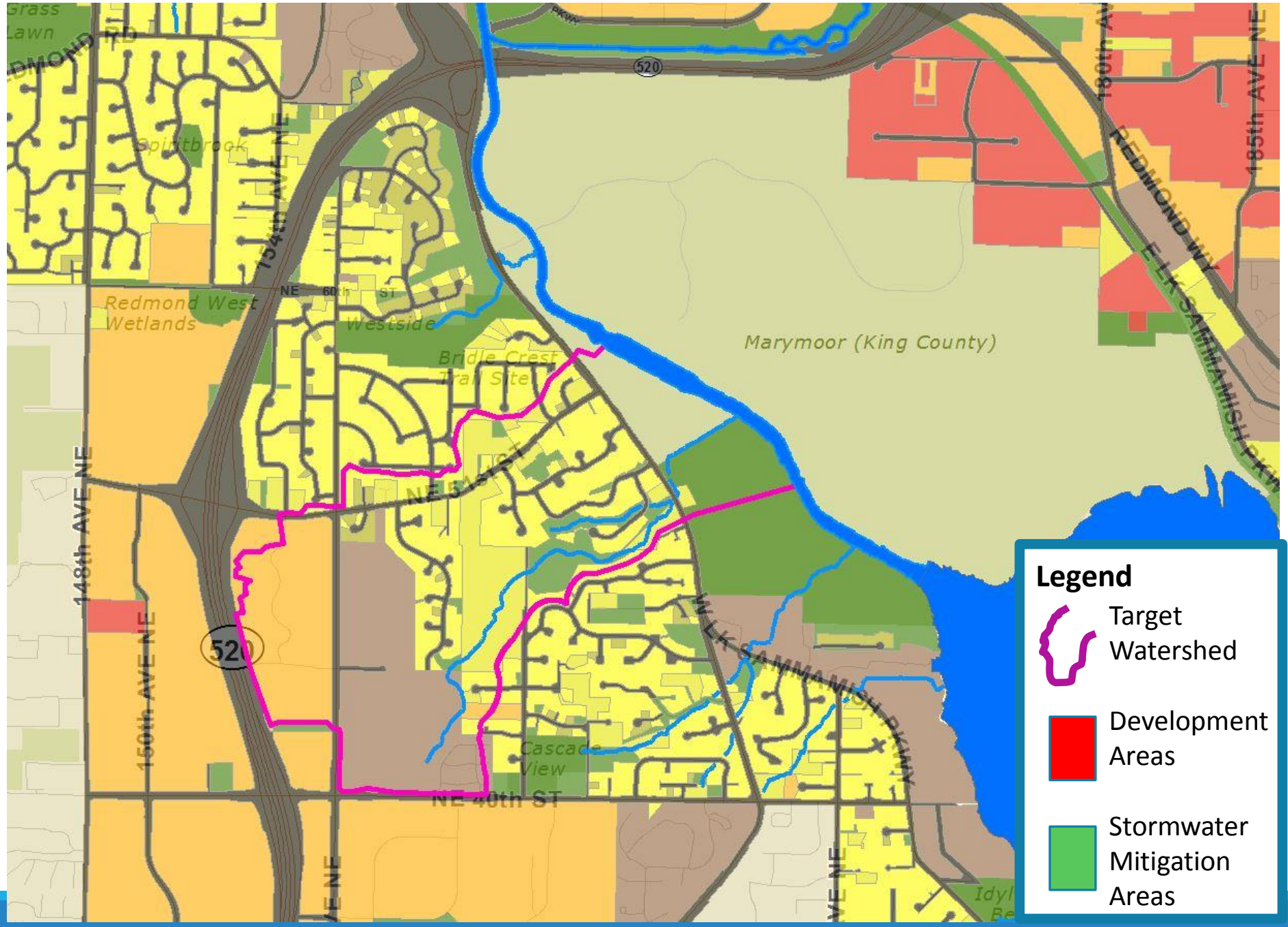


Restoration Approach

1. Identify Priority Watersheds

   (Moderate impairment = highest rehabilitation potential)
2. City builds facilities to improve stream hydrology and water quality
3. Developers in other watersheds pay fee-in-lieu to reimburse City for facility costs
4. Key:
   - Don't make anything worse
   - Allow for transfer of investments to highest priority watersheds

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Marymoor (King County)
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154th AVE NE
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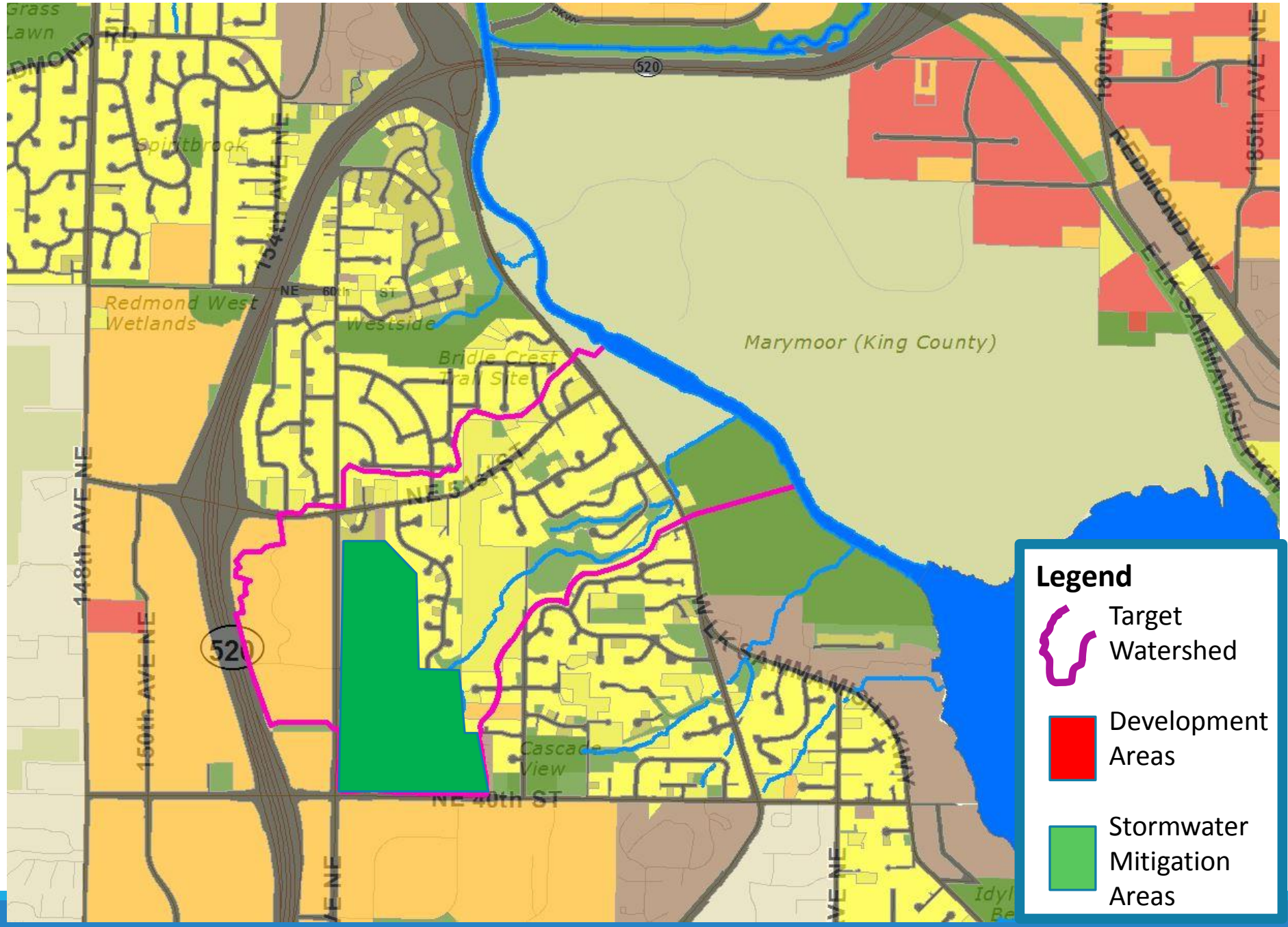
Legend
Target Watershed
Development Areas
Stormwater Mitigation Areas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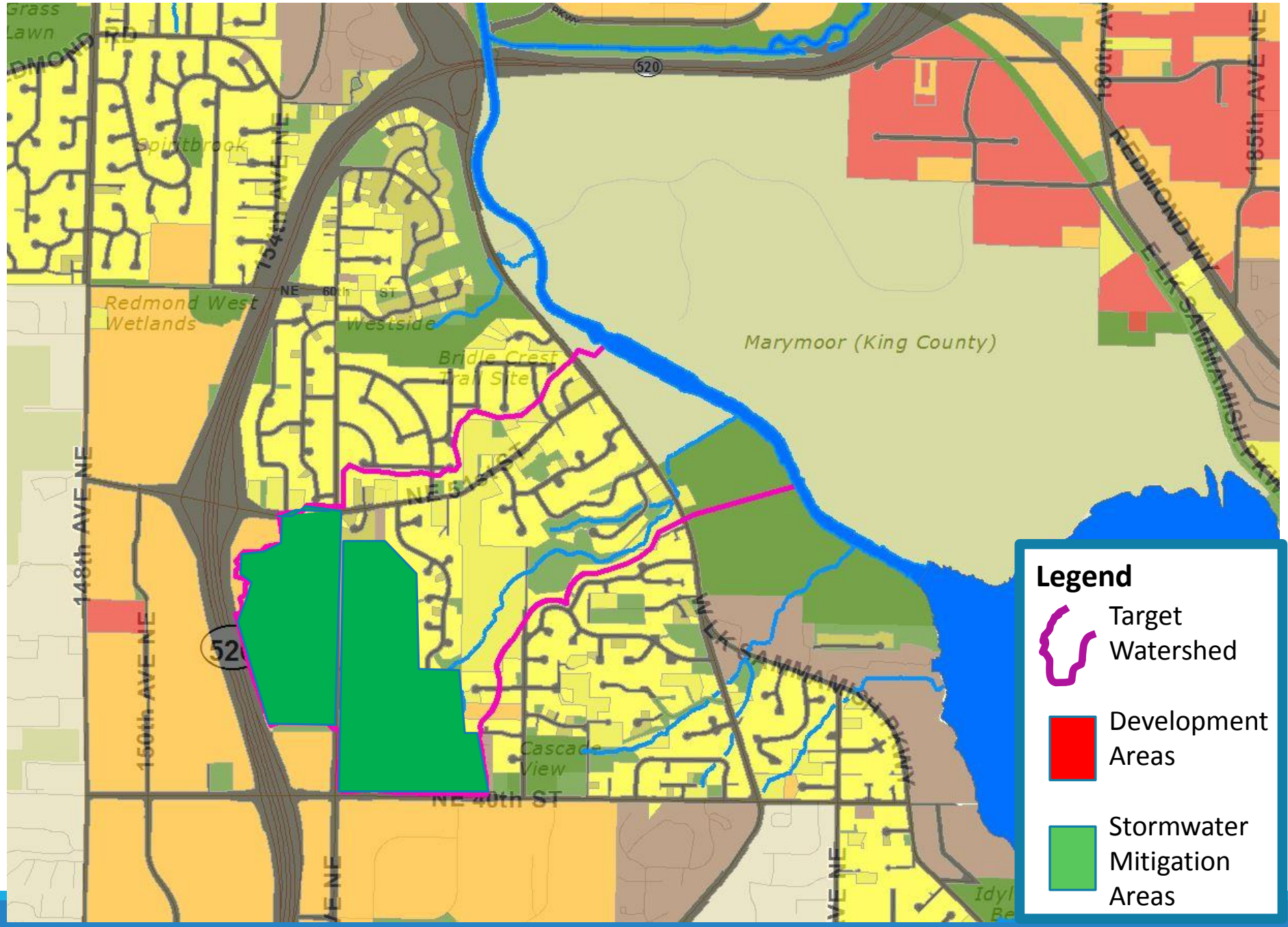
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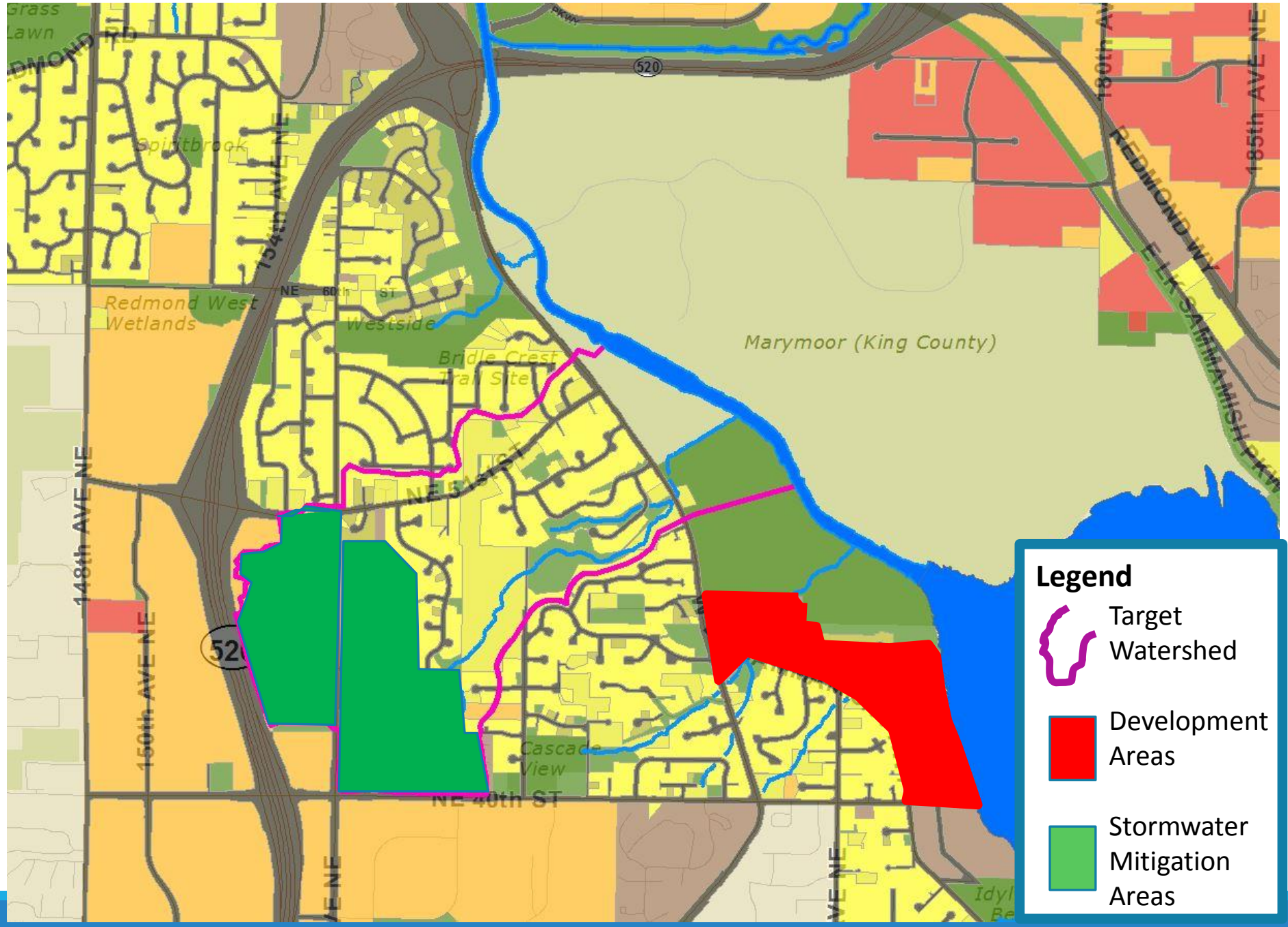
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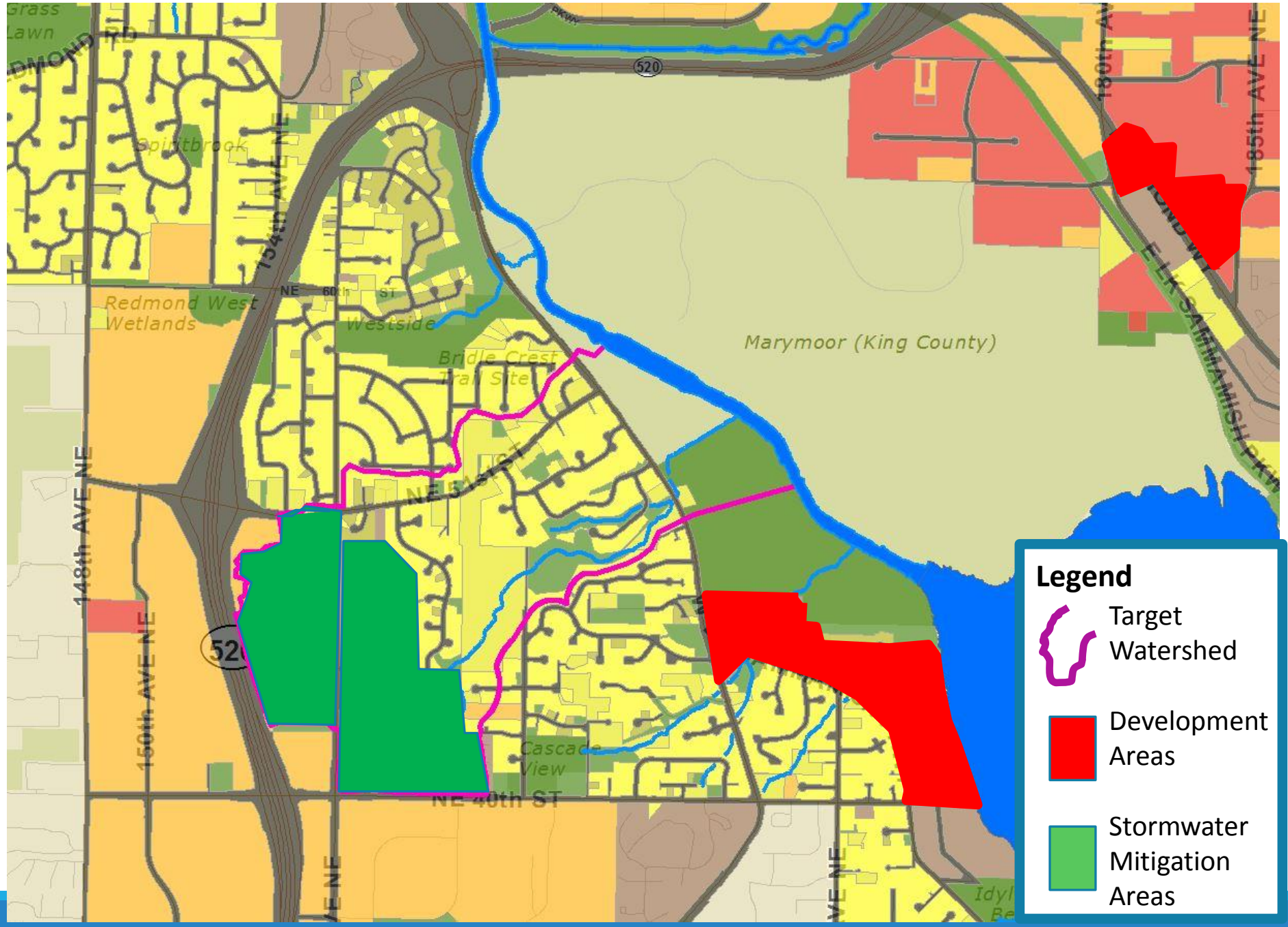
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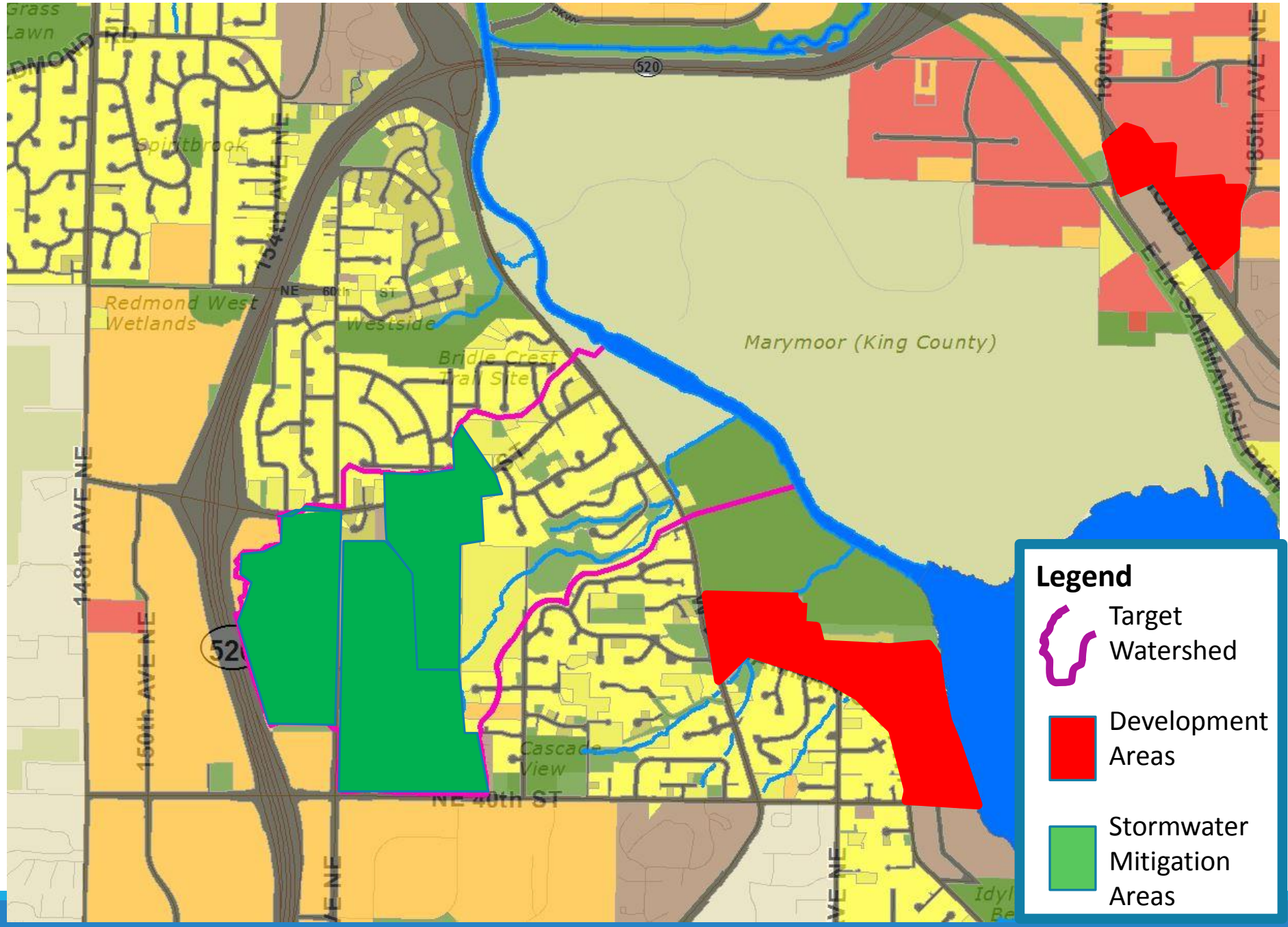
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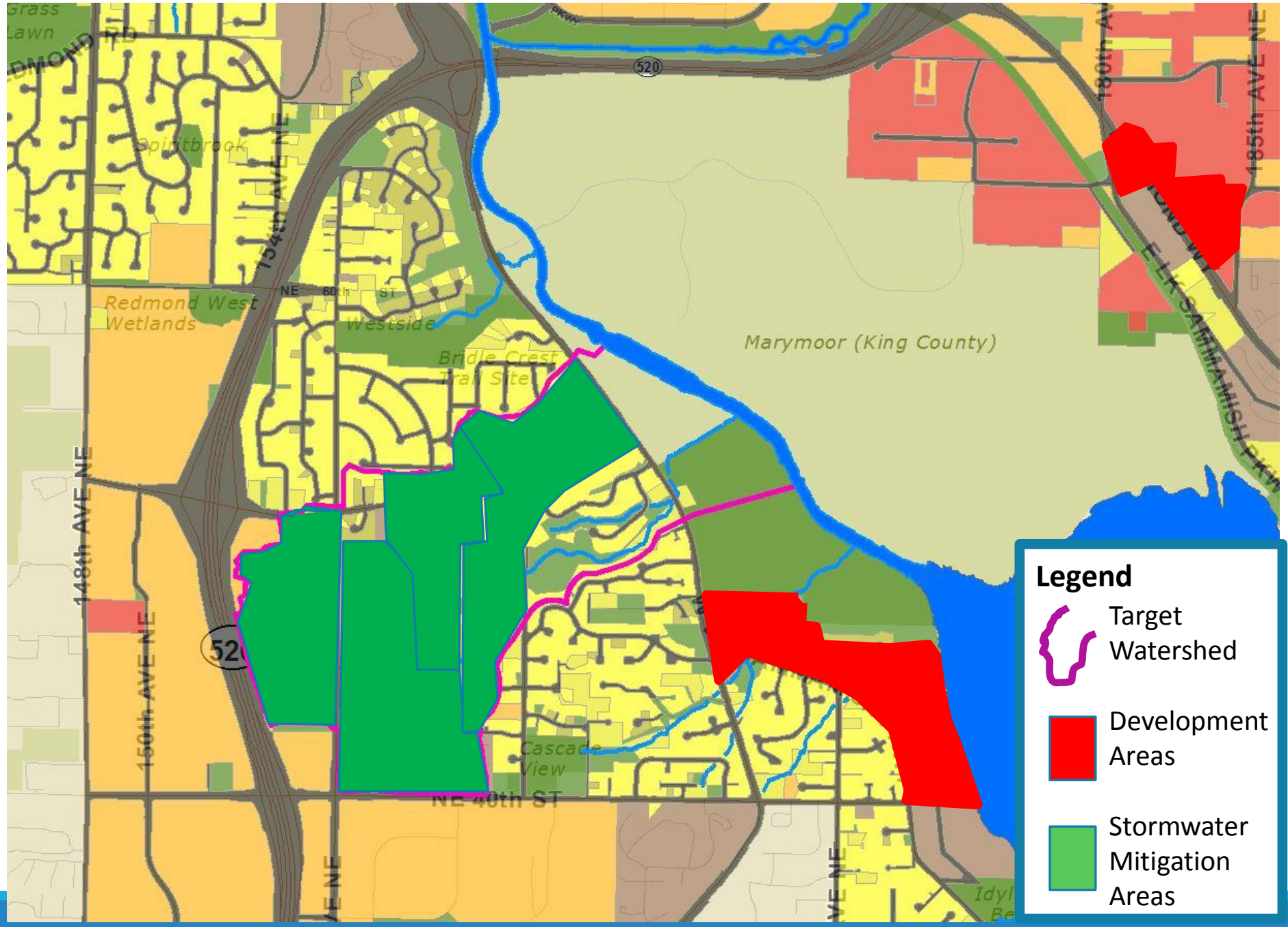
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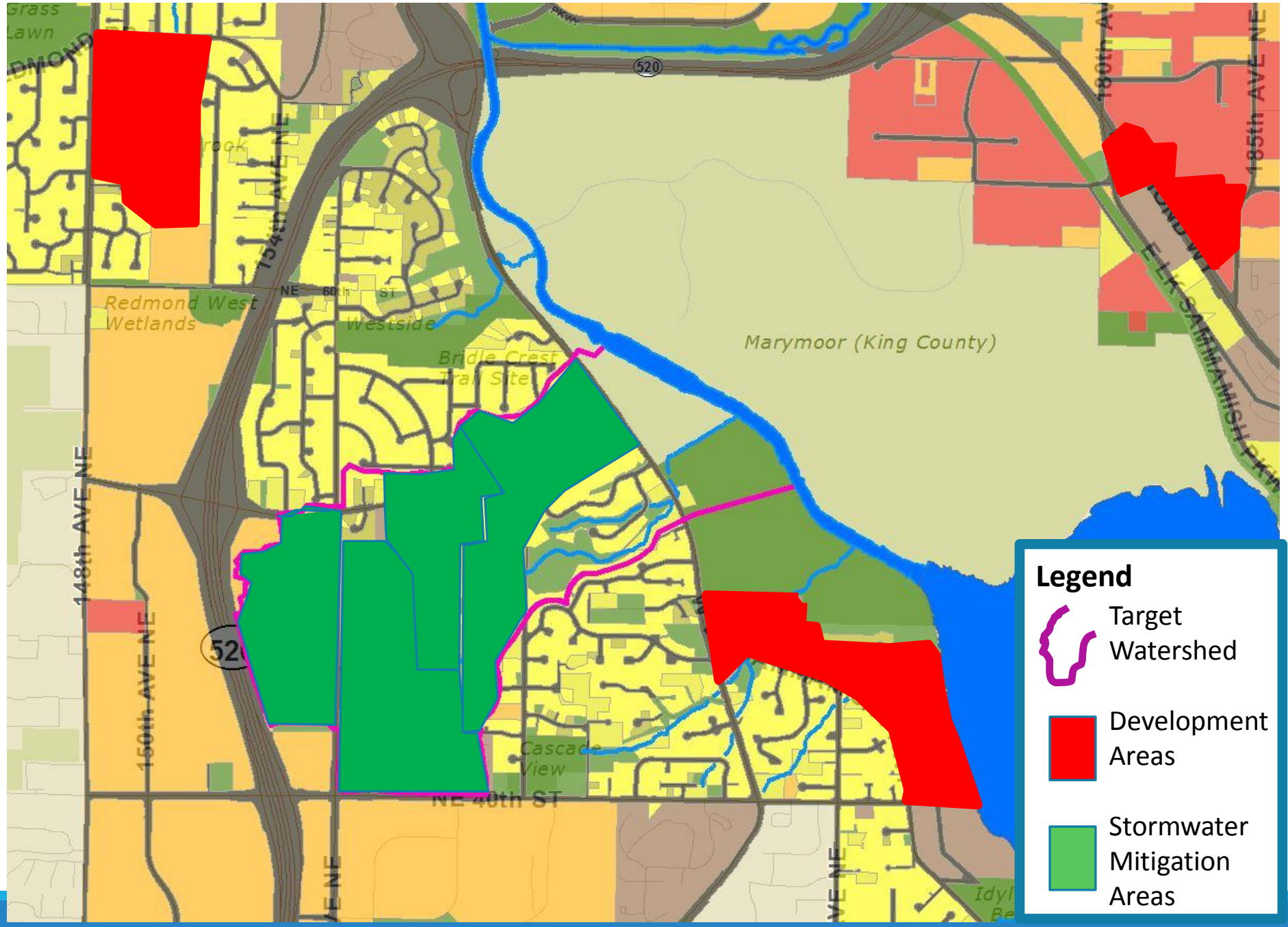
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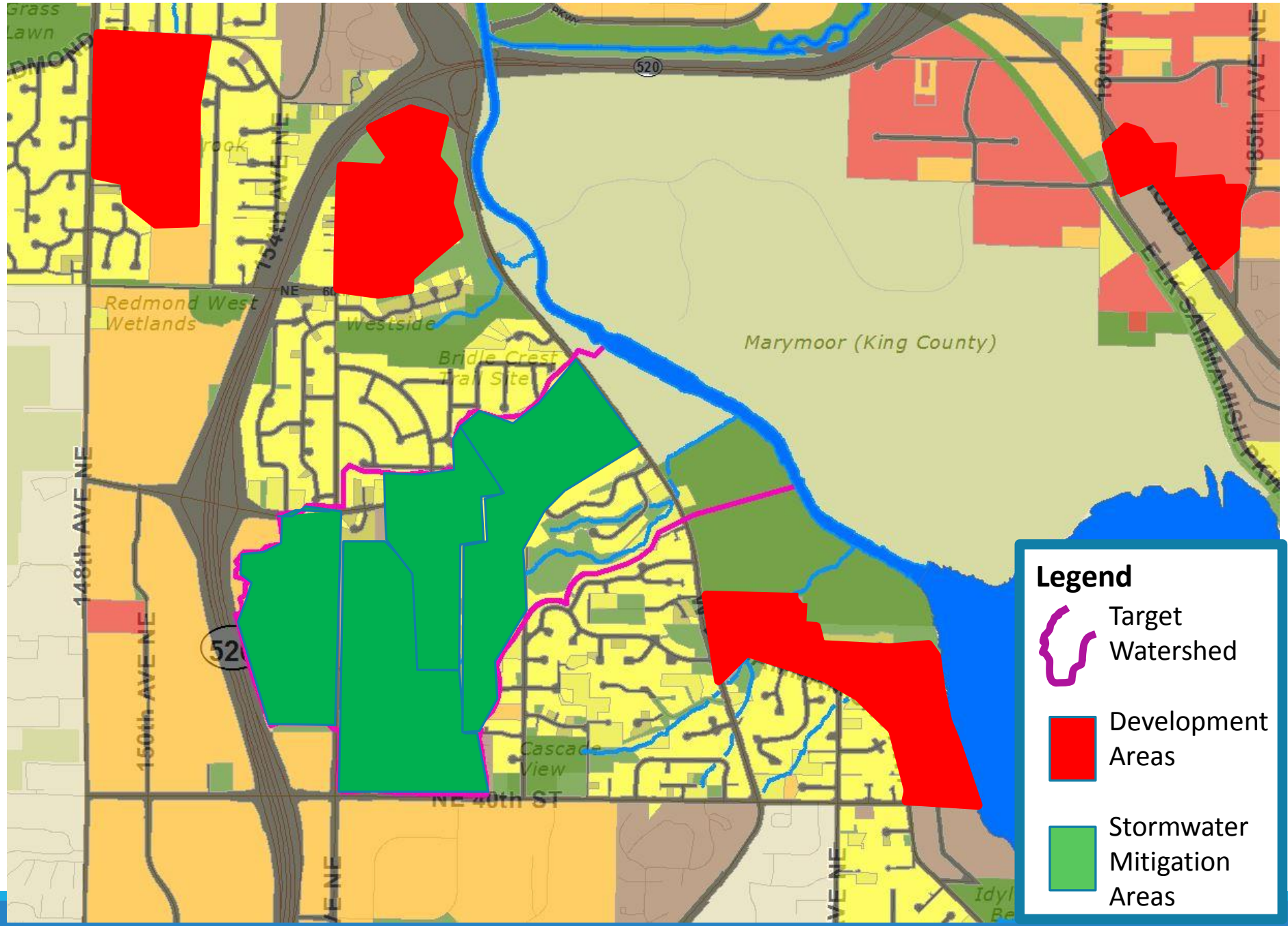
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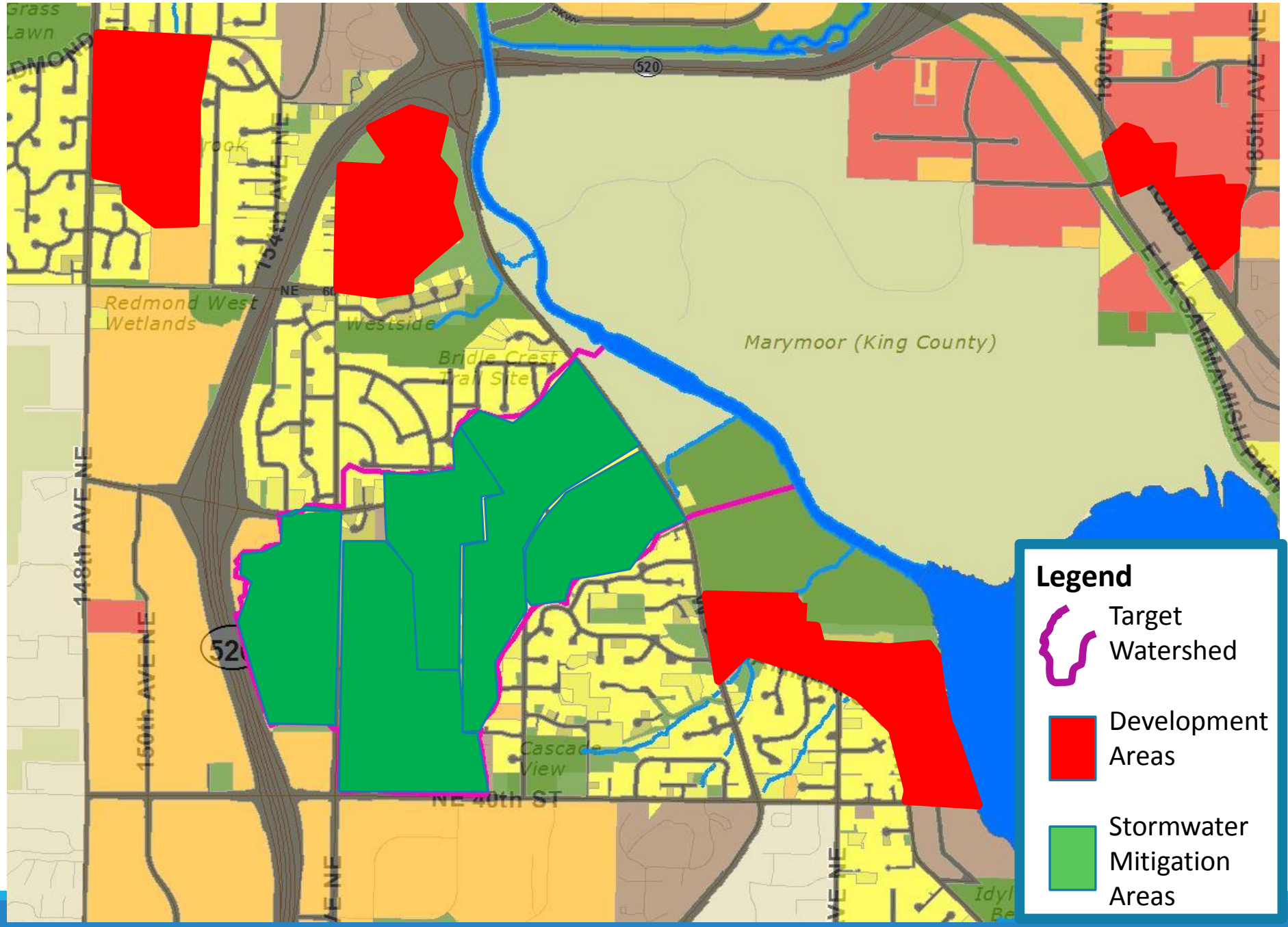
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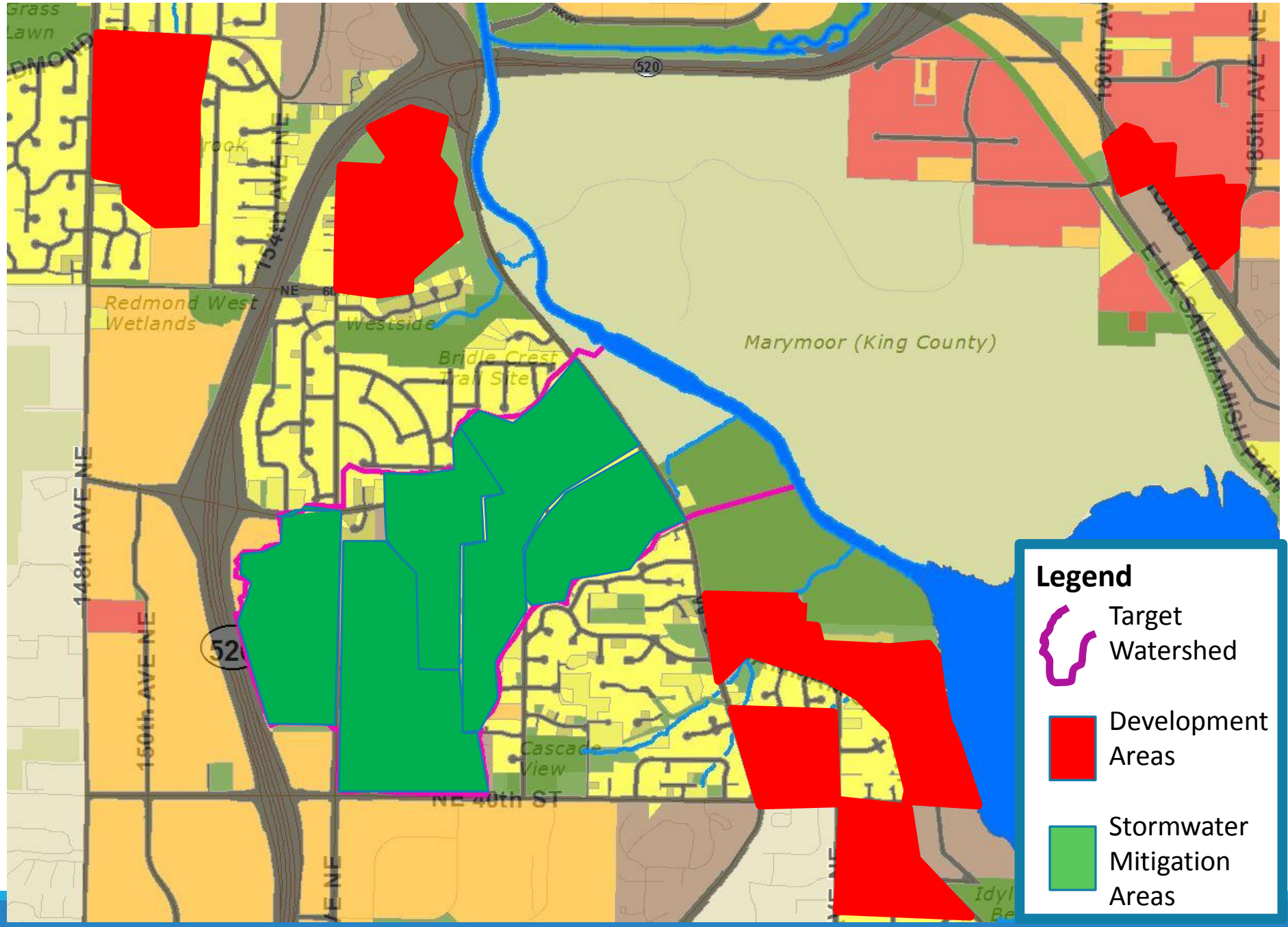
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Watershed Planning

Ecology created watershed characterization model

Covers all of western Washington

Aligns with Redmond's local analysis

Redmond Watershed Plan Implementation

Watershed Planning - How it Works

City approval of watershed approach

Develop a detailed plan for specific improvements by watershed

New stormwater impacts will typically be addressed at or close to the site

Improving existing impact can be moved to priority areas

City projects can benefit

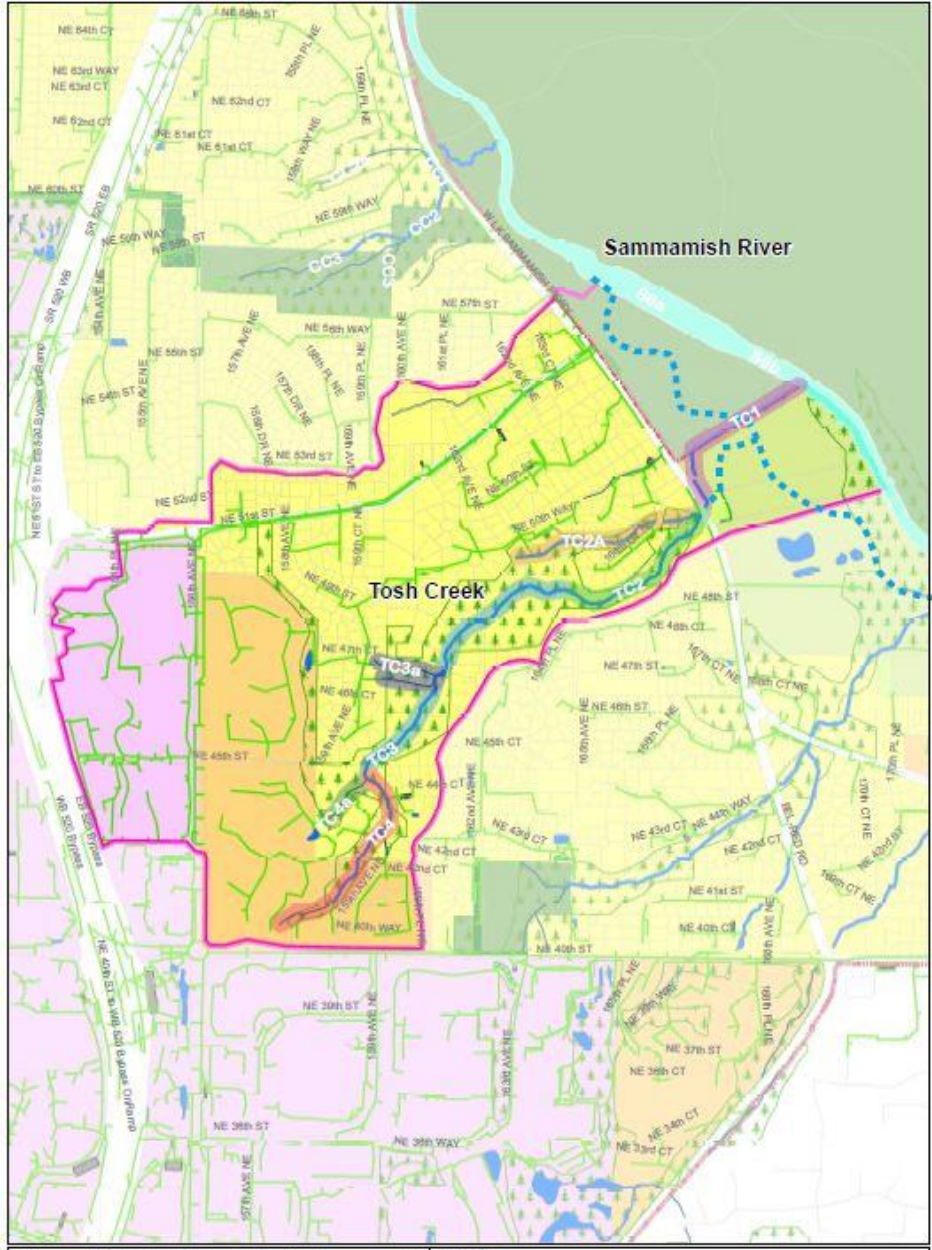

Figure 5.10 - Tosh Creek Needs Assesment Reaches and Future Land Use

City of Redmond, Washington

02/14/2013

0 0.05 0.1 0.2 Miles

Legend

Watershed Planning
How it Works (Continued)

Tracking (accounting)

Performance (outcome) monitoring is essential

Funding strategy

Have public support to invest in the environment

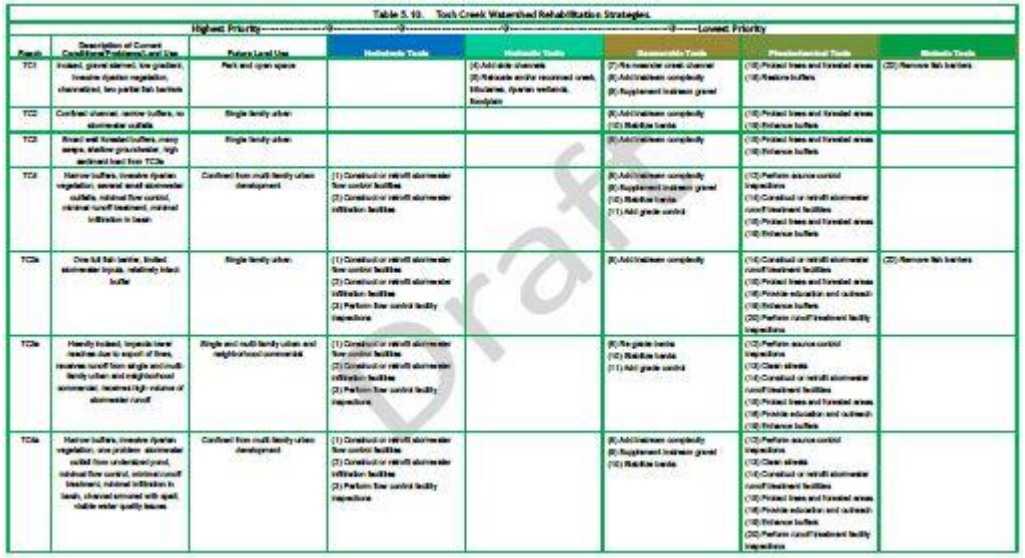

Table 5.10. Tosh Creek Watershed Rehabilitation Strategies.

Reach	Description of Current Conditions/Problems/Land Use	Future Land Use	Highest Priority		Lowest Priority		
TC1	Incised, gravel stained, low gradient, invasive riparian vegetation, channelized, two partial fish barriers	Park and open space		(4) Add side channels (5) Relocate and/or reconnect creek, tributaries, riparian wetlands, floodplain	(7) Re-meander creek channel (8) Add instream complexity (9) Supplement instream gravel	(18) Protect trees and forested areas (19) Restore buffers	(23) Remove fish barriers
TC2	Confined channel, narrow buffers, no stormwater outfalls	Single family urban			(8) Add instream complexity (10) Stabilize banks	(18) Protect trees and forested areas (19) Enhance buffers	
TC3	Broad well forested buffers, many seeps, shallow groundwater, high sediment load from TC2a	Single family urban			(8) Add instream complexity	(18) Protect trees and forested areas (19) Enhance buffers	
TC4	Narrow buffers, invasive riparian vegetation, several small stormwater outfalls, minimal flow control, minimal runoff treatment, minimal infiltration in basin	Confined from multi family urban development	(1) Construct or retrofit stormwater flow control facilities (2) Construct or retrofit stormwater infiltration facilities		(8) Add instream complexity (9) Supplement instream gravel (10) Stabilize banks (11) Add grade control	(12) Perform source control inspections (14) Construct or retrofit stormwater runoff treatment facilities (18) Protect trees and forested areas (19) Enhance buffers	
TC5a	One full fish barrier, limited stormwater inputs, relatively intact buffer	Single family urban	(1) Construct or retrofit stormwater flow control facilities (2) Construct or retrofit stormwater infiltration facilities (3) Perform flow control facility inspections		(8) Add instream complexity	(14) Construct or retrofit stormwater runoff treatment facilities (18) Protect trees and forested areas (19) Provide education and outreach (19) Enhance buffers (20) Perform runoff treatment facility inspections	(23) Remove fish barriers
TC5b	Heavily incised, impacts lower reaches due to export of fines, receives runoff from single and multi-family urban and neighborhood commercial, receives high volume of stormwater runoff	Single and multi family urban and neighborhood commercial	(1) Construct or retrofit stormwater flow control facilities (2) Construct or retrofit stormwater infiltration facilities (3) Perform flow control facility inspections		(9) Re-grade banks (10) Stabilize banks (11) Add grade control	(12) Perform source control inspections (13) Clean streets (14) Construct or retrofit stormwater runoff treatment facilities (18) Protect trees and forested areas (19) Provide education and outreach (19) Enhance buffers	
TC5c	Narrow buffers, invasive riparian vegetation, one problem stormwater outfall from undeveloped pond, minimal flow control, minimal runoff treatment, minimal infiltration in basin, channel armored with spall, visible water quality issues	Confined from multi family urban development	(1) Construct or retrofit stormwater flow control facilities (2) Construct or retrofit stormwater infiltration facilities (3) Perform flow control facility inspections		(8) Add instream complexity (9) Supplement instream gravel (10) Stabilize banks	(12) Perform source control inspections (13) Clean streets (14) Construct or retrofit stormwater runoff treatment facilities (18) Protect trees and forested areas (19) Provide education and outreach (19) Enhance buffers (20) Perform runoff treatment facility inspections	

Redmond Paired Watershed Study

Experimental Design

Watershed Type	Watershed Name	WQ Sites (#)	Physical Habitat Sites (#)	Dominant Land Use/Cover	Watershed Areas (acres)	Watershed Area in Redmond (acres)
Reference	Colin	1	1	Forest	1,990	90
Reference	Seidel	2	3	Forest	1,188	615
Application	Monticello	3	5	Residential/Commercial	345	264
Application	Tosh	2	4	Residential/Commercial	299	276
Application	Evans	2	2	Residential	397	NA
Control	Tyler's	3	2	Residential/Commercial	168	167
Control	Country	2	2	Residential/Commercial	212	212

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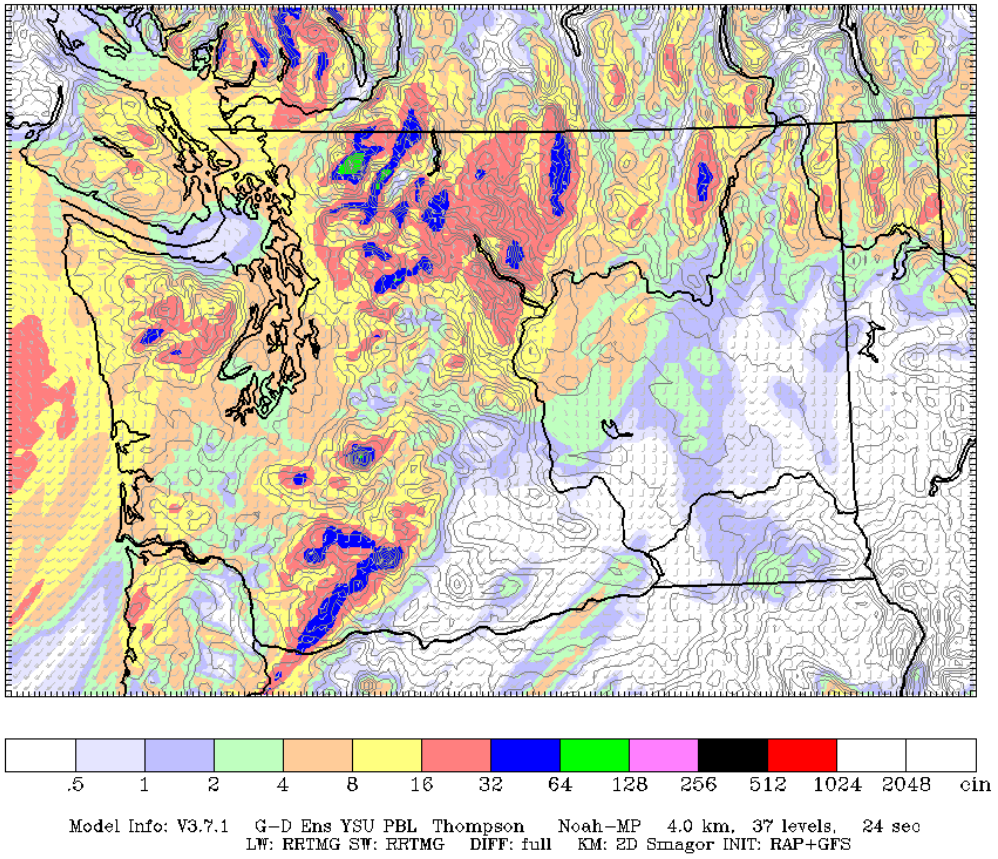
Water quality monitoring
- 12 storm flow events annually
- 4 base flow events annually

Habitat monitoring
- Annually

Hydrologic monitoring
- Continuous

Sediment monitoring
- Annually

Biological monitoring
- Annually



Questions?

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