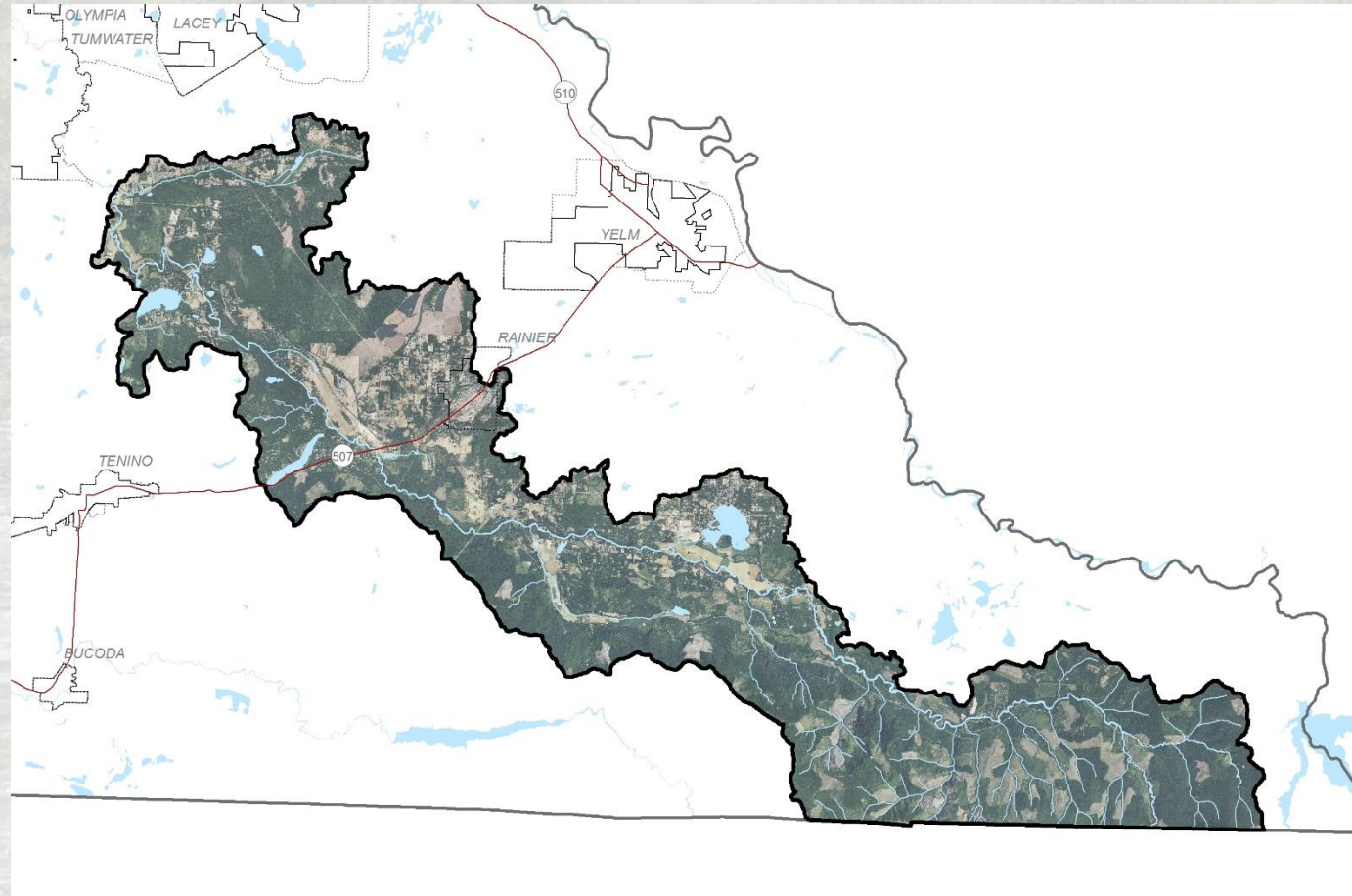


A photograph of a river flowing through a dense forest. The water is dark and reflects the surrounding greenery. The banks are covered in thick vegetation, including trees and shrubs. The title 'Deschutes Watershed Study' is overlaid in large, white, sans-serif font, centered on the image.

Deschutes Watershed Study

Concerns Identified in Priority Project Area



Bacteria and Pathogens in Surface Water

Potential sources of fecal coliform include:

- Farm animal wastes
- Stormwater runoff
- Improperly connected sewers
- Failing septic systems
- Pet wastes



Bacteria and Pathogens in Surface Water

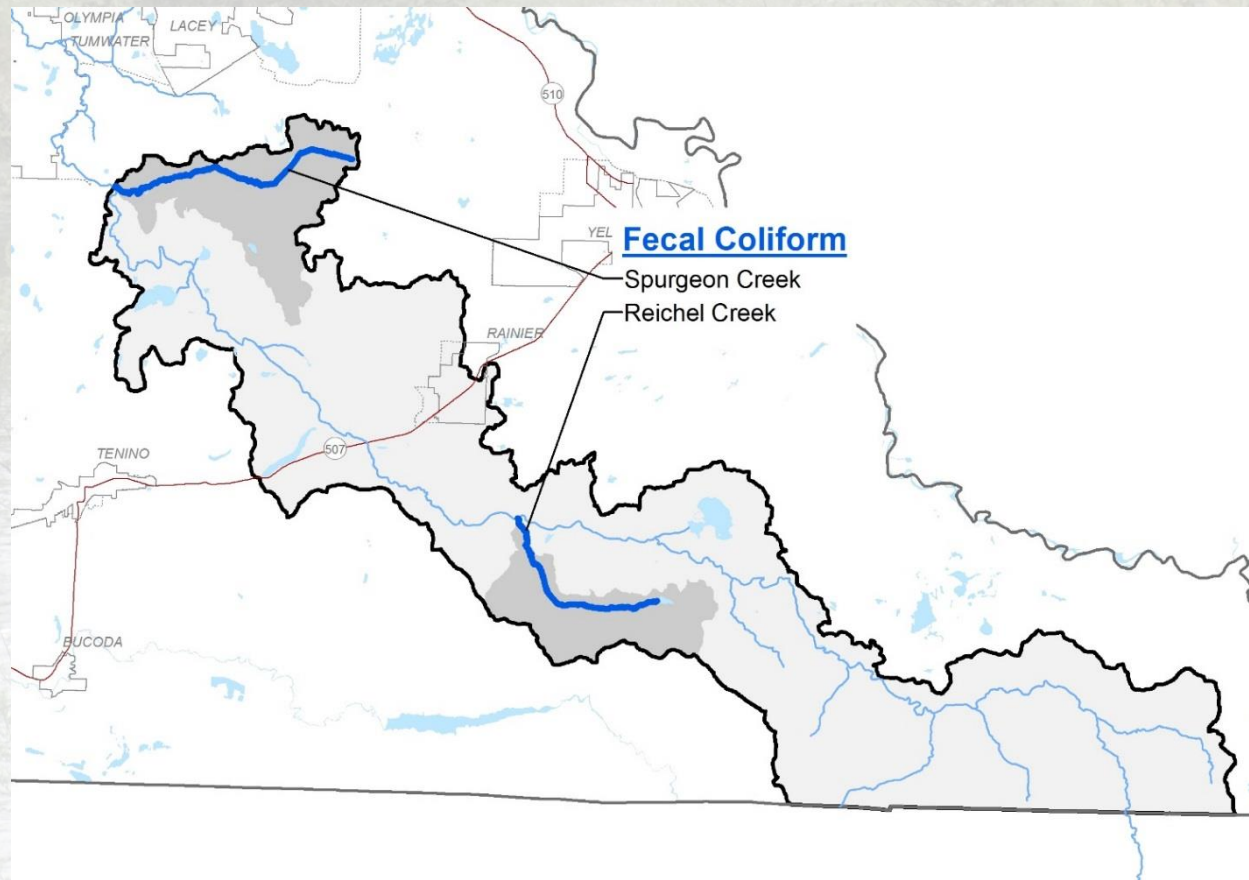
Current Concerns

- Spurgeon Creek
- Reichel Creek

Future Concerns



171% increase in
septic systems
on non-porous
soils near
waterbodies



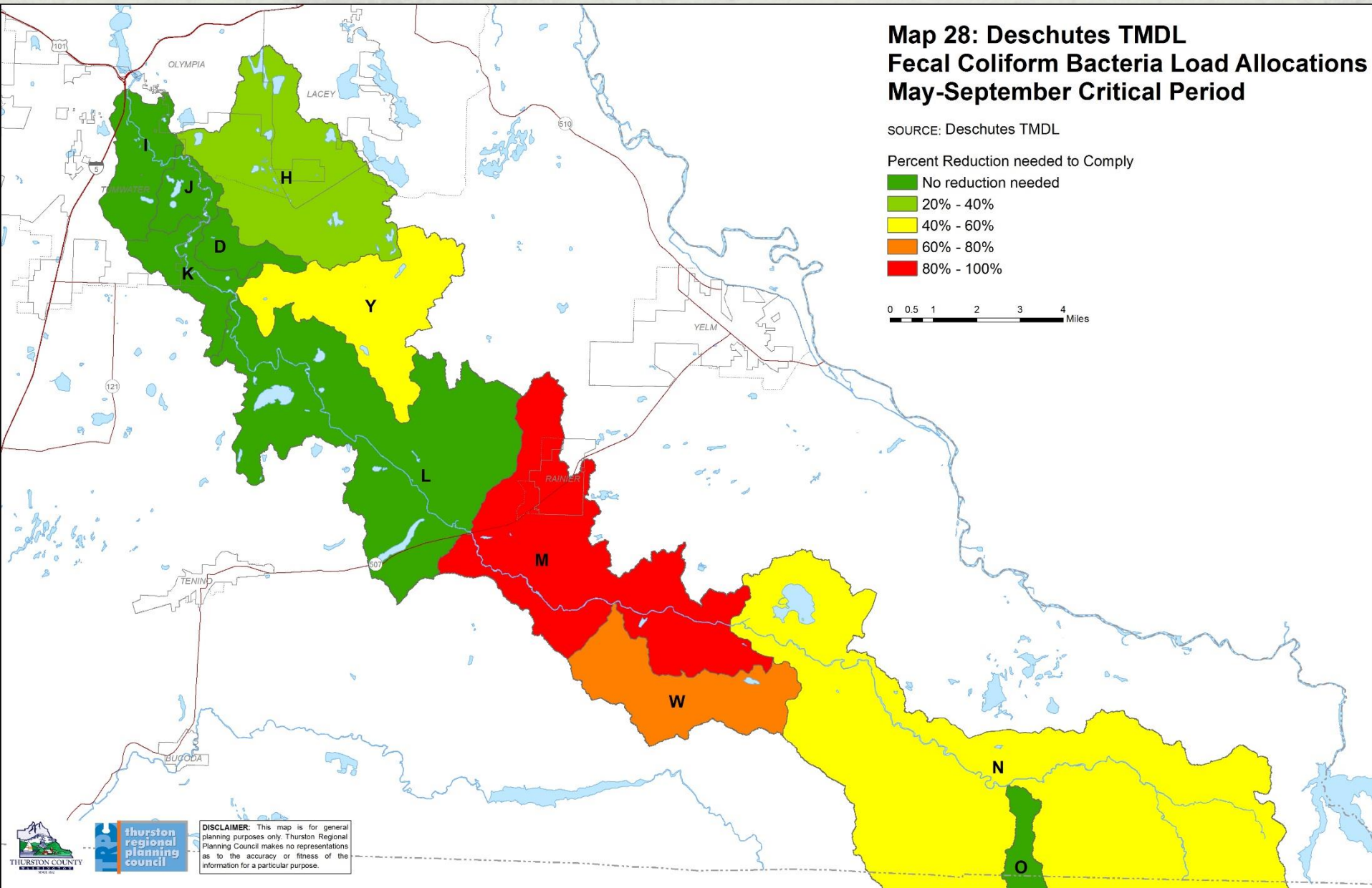
Map 28: Deschutes TMDL Fecal Coliform Bacteria Load Allocations May-September Critical Period

SOURCE: Deschutes TMDL

Percent Reduction needed to Comply

- No reduction needed
- 20% - 40%
- 40% - 60%
- 60% - 80%
- 80% - 100%

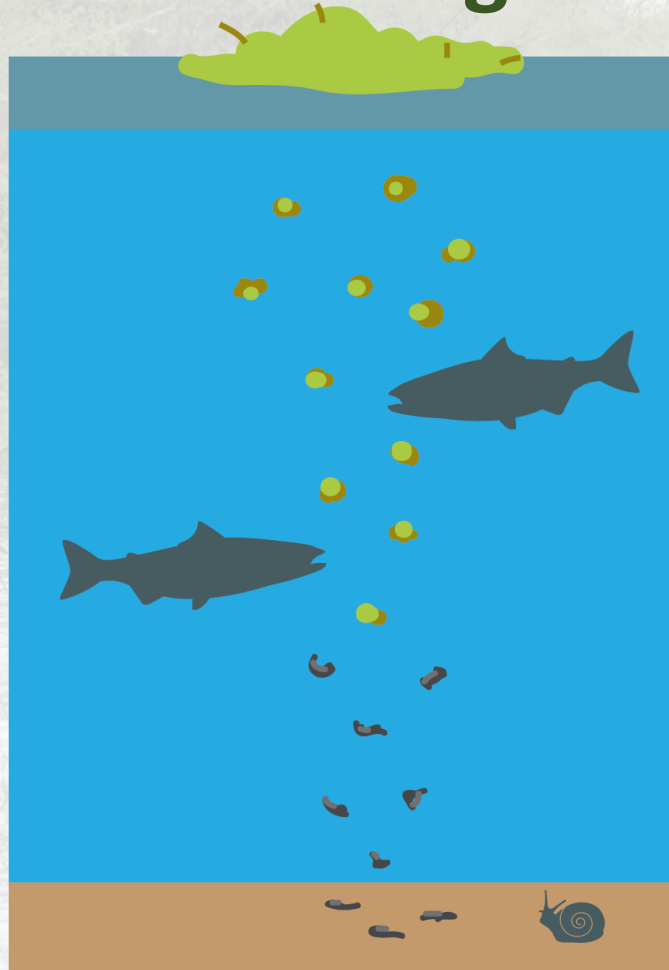
0 0.5 1 2 3 4 Miles



Increased Nutrients and Algae Blooms

Primary cause of algae blooms:

- **Phosphorous from septic systems**
- **Stormwater runoff and fertilizers**
- **Erosion**



Nutrients from runoff and shallow groundwater fuel algae blooms in lakes.



Algae cells die and decompose.



Decomposition lowers dissolved oxygen concentrations in bottom waters.

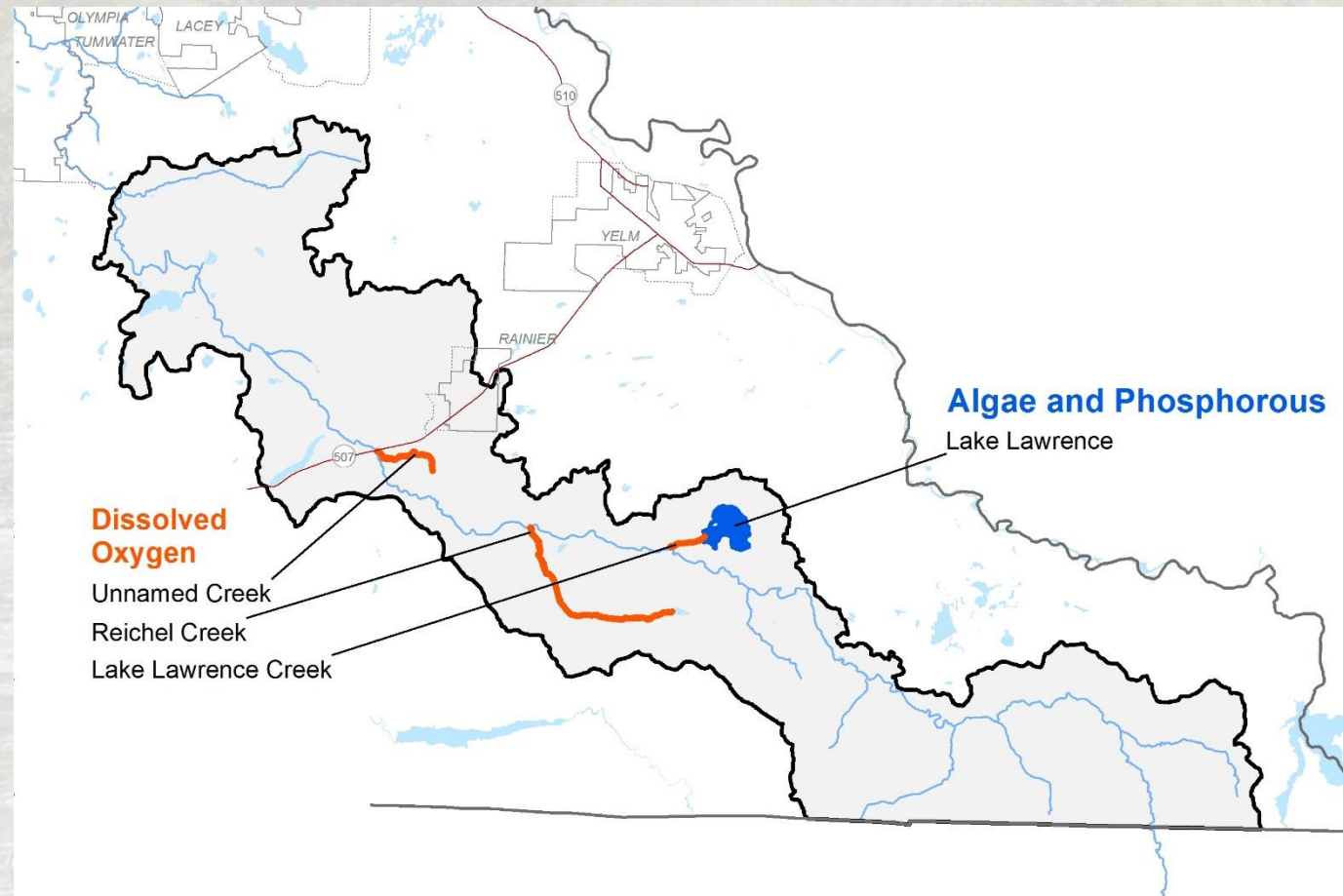


Low dissolved oxygen stresses fish and other aquatic organisms.

Increased Nutrients and Algae Blooms

Current Concerns

- Lake Lawrence
- Reichel Creek, Lake Lawrence Creek, and an unnamed tributary



Map 30: Deschutes TMDL Dissolved Oxygen Improvements

SOURCE: Deschutes TMDL

DO Improvement (DO8 Scenario)

-0.66 to -0.38 mg/L

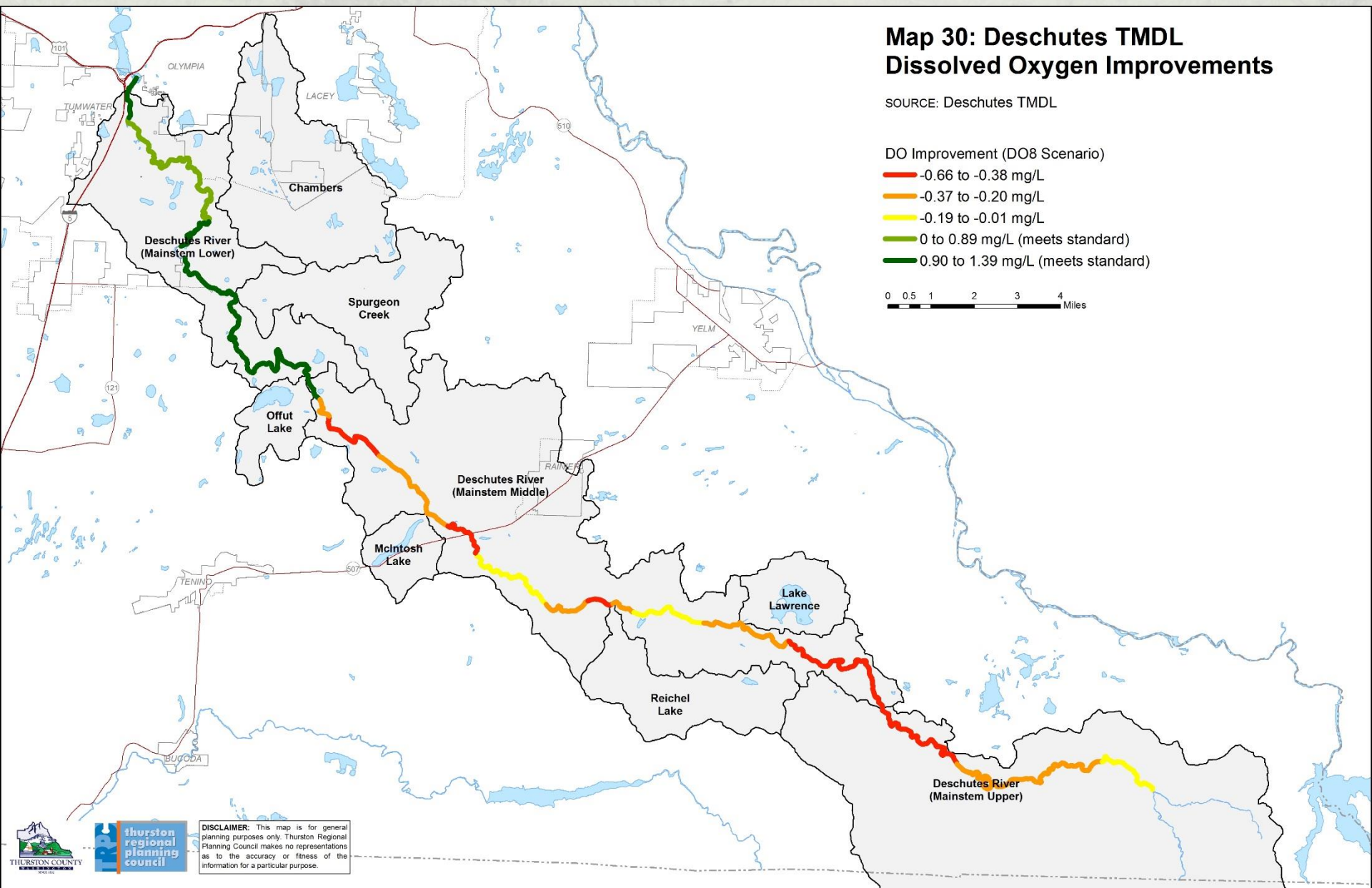
-0.37 to -0.20 mg/L

-0.19 to -0.01 mg/L

0 to 0.89 mg/L (meets standard)

0.90 to 1.39 mg/L (meets standard)

0 0.5 1 2 3 4 Miles



DISCLAIMER: This map is for general planning purposes only. Thurston Regional Planning Council makes no representations as to the accuracy or fitness of the information for a particular purpose.



Increased Nutrients and Algae Blooms

Future Concerns



171% increase in septic systems on non-porous soils near water bodies



Impervious area in Offut Lake basin: 3.4% to 6.8% at buildout



Loss of forest cover in Offut Lake basin – 55% today to 47% - similar to Lake Lawrence today

Impervious Surface and Forest Cover



Intact

Impervious Surface: <2%
Forest Cover: >80%

- Water is cool and clean
- Stream banks and bottom typically stable
- Many fish species (less tolerant coho salmon more prevalent than cutthroat)
- Many insect taxa

Sensitive

Impervious Surface: 2-10%
Forest Cover: 65-80%

- Water may be warmer and slightly polluted
- Erosion may be evident
- Many pollution tolerant fish
- Many insect taxa

Impacted

Impervious Surface: 10-25%
Forest Cover: 45-65%

- Water warmer
- Erosion usually obvious
- Fewer fish species (shift to more tolerant cutthroat salmon)
- Mostly tolerant insects

Degraded

Impervious Surface: >25%
Forest Cover: 45-65%

- Warm water and pollution usually evident
- Unstable habitat
- Only tolerant fish species

Sediment and Erosion

Risk of landslides increases with removal of vegetation and road building

Erosion adds fine sediments to stream, degrading salmon spawning habitat



Sediment and Erosion

Current Concerns

- Erosion along stream banks
- Risk of landslides

Future Concerns

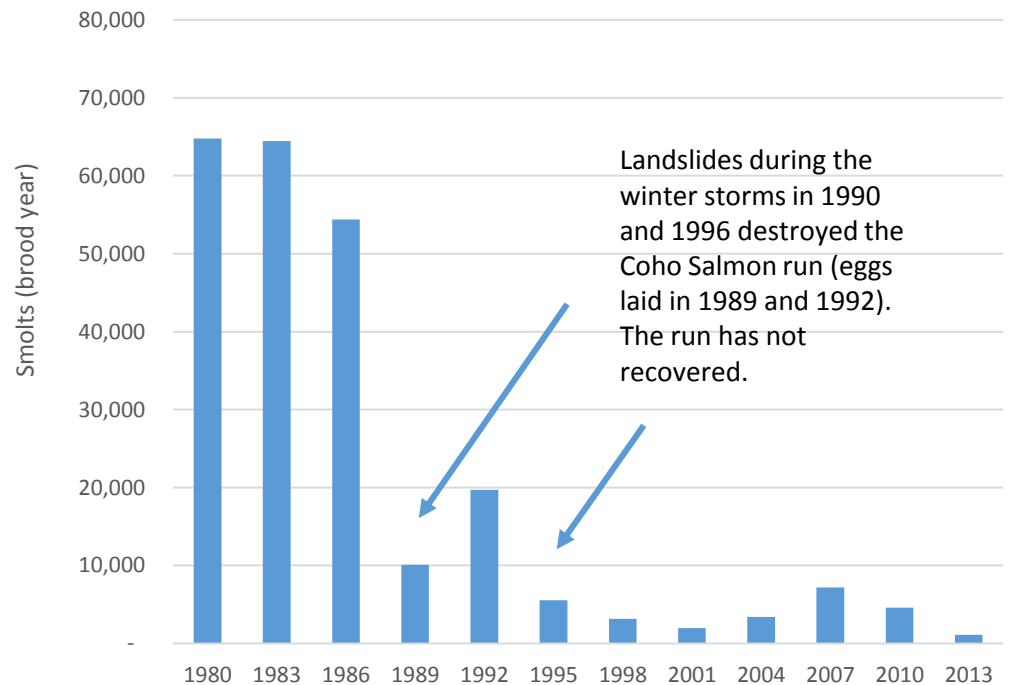


Need for stream bank restoration



Up to 6% loss of forest lands on steep slopes

Deschutes River Coho Salmon Smolts - Cohort B



Map 32: Deschutes TMDL Fine Sediment Reduction Allocations

SOURCE: Deschutes TMDL

Fine Sediment Reduction Allocations

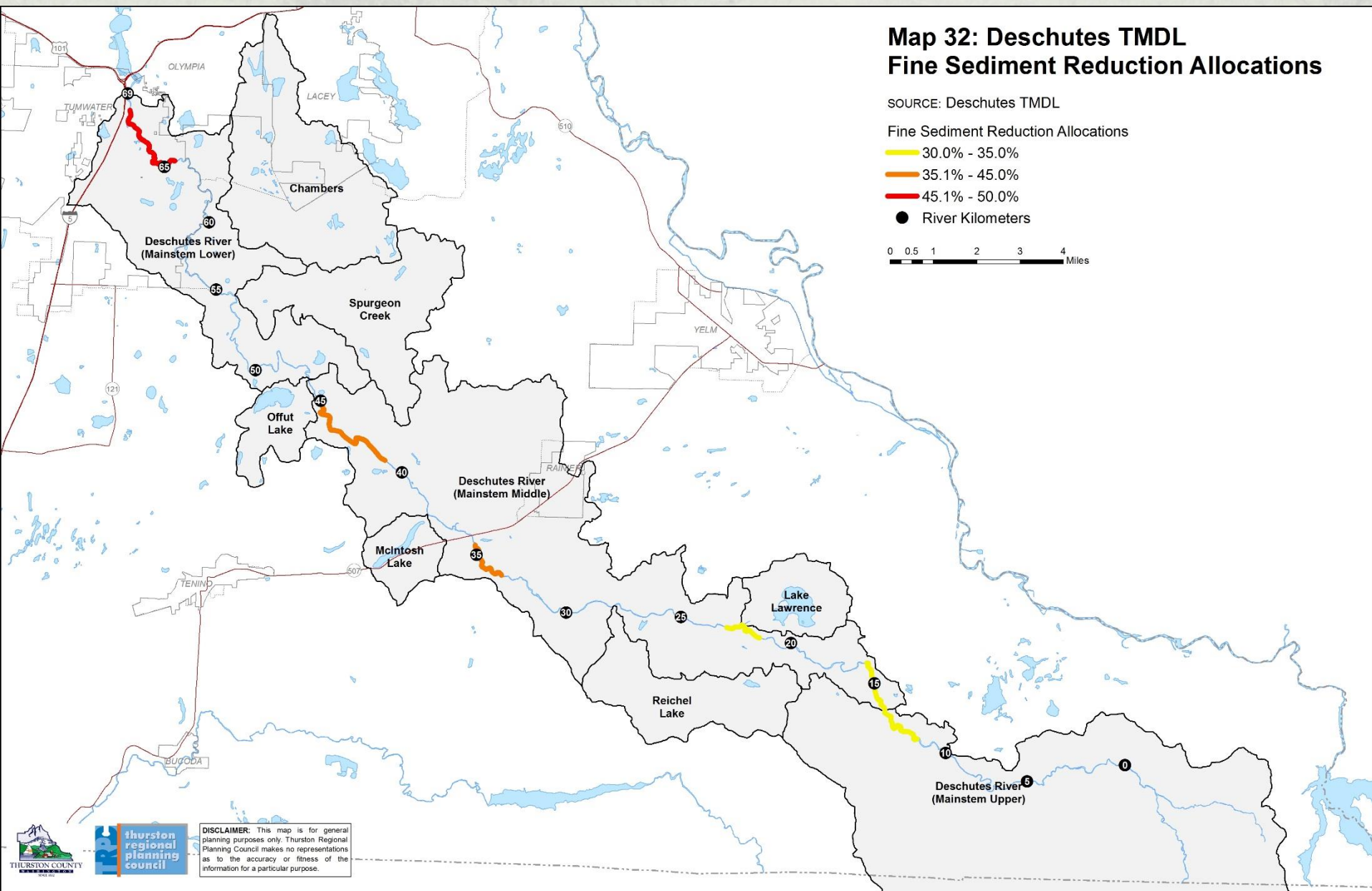
30.0% - 35.0%

35.1% - 45.0%

45.1% - 50.0%

● River Kilometers

0 0.5 1 2 3 4 Miles



Stream Temperature

Current Concerns

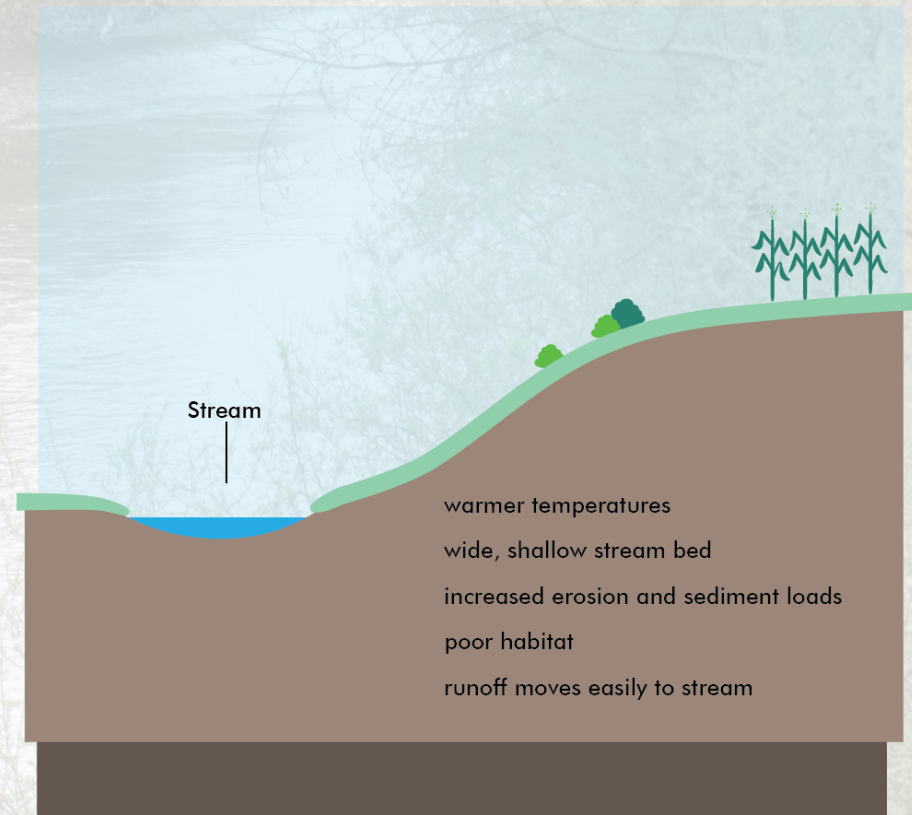
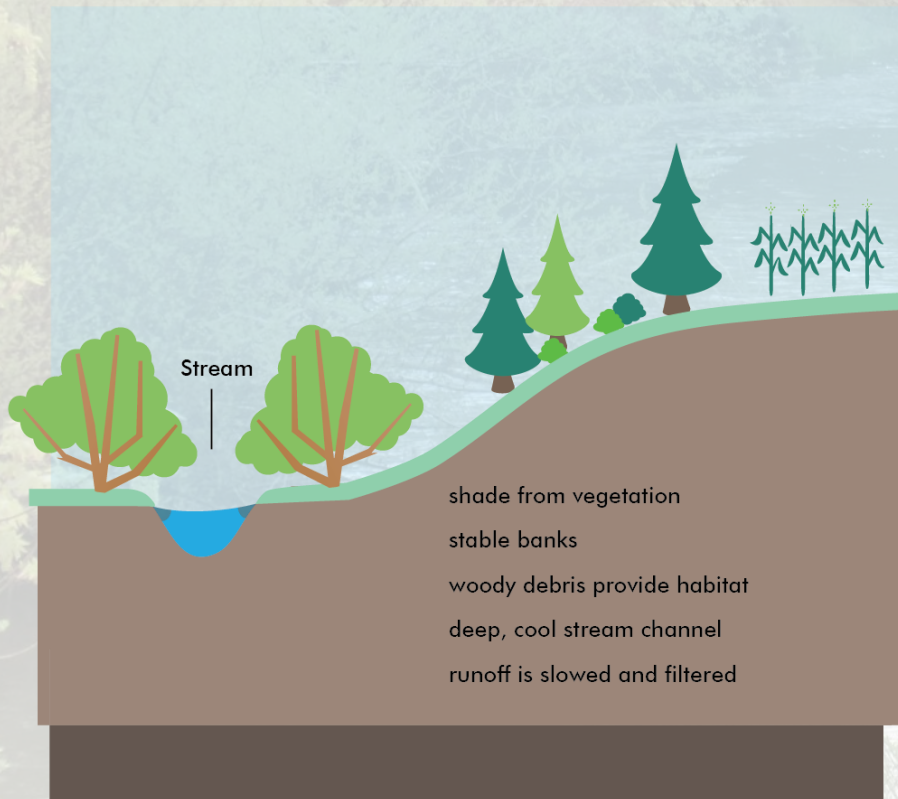
- Temperature identified as a concern in Deschutes River

Future Concerns



**Need for stream
restoration**

Stream Temperature



Map 27: Deschutes TMDL Effective Shade Improvement Allocations

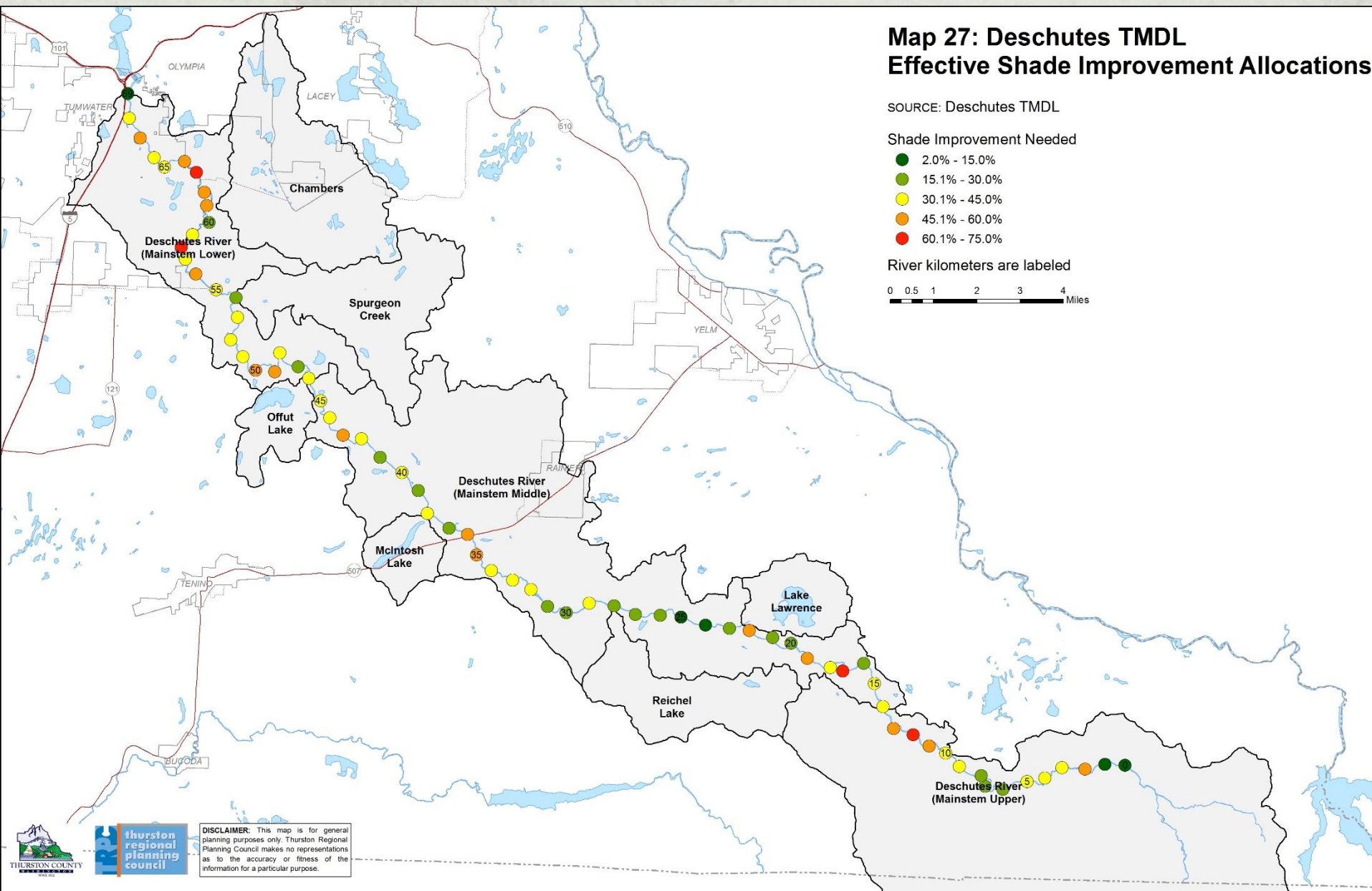
SOURCE: Deschutes TMDL

Shade Improvement Needed

- 2.0% - 15.0%
- 15.1% - 30.0%
- 30.1% - 45.0%
- 45.1% - 60.0%
- 60.1% - 75.0%

River kilometers are labeled

0 0.5 1 2 3 4 Miles



Water Levels During Drought Periods

Current Concerns

- Low summer stream flows in Deschutes River and effect on Coho salmon

Futures Concerns

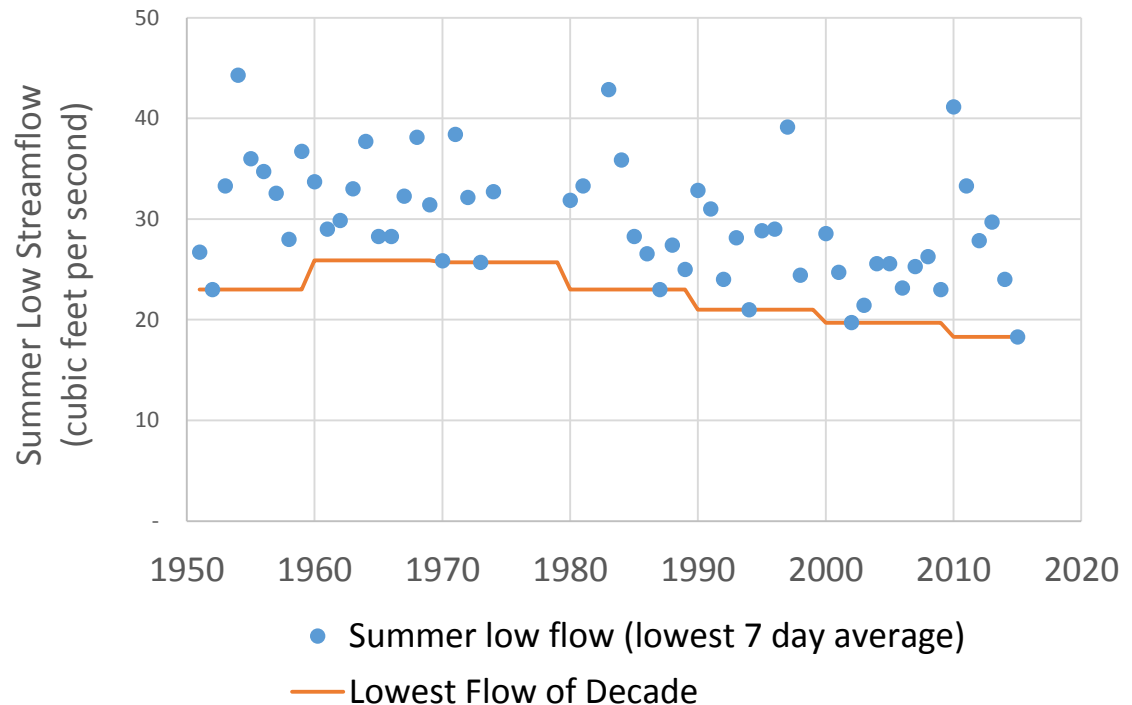


Potential for over 3,000 new homes in study area



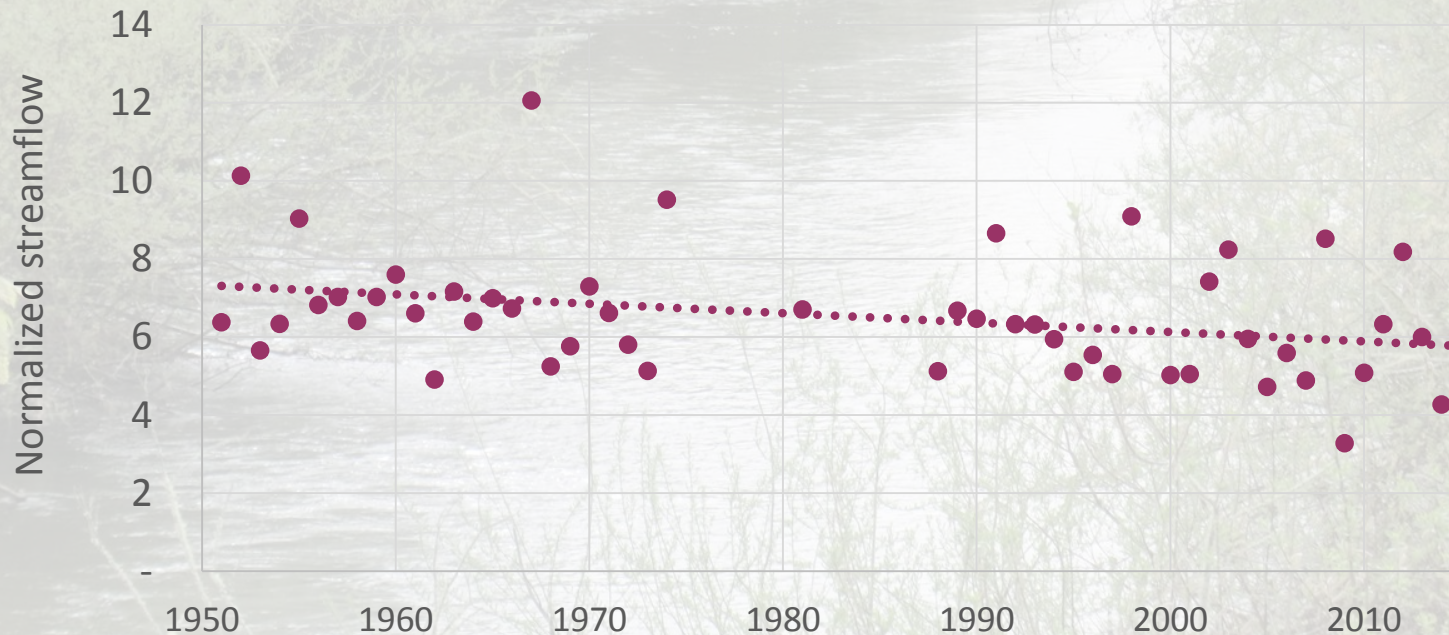
Up to a 96% increase in water consumption

Rainier Gage Summer Low Flow
(lowest 7 day average)

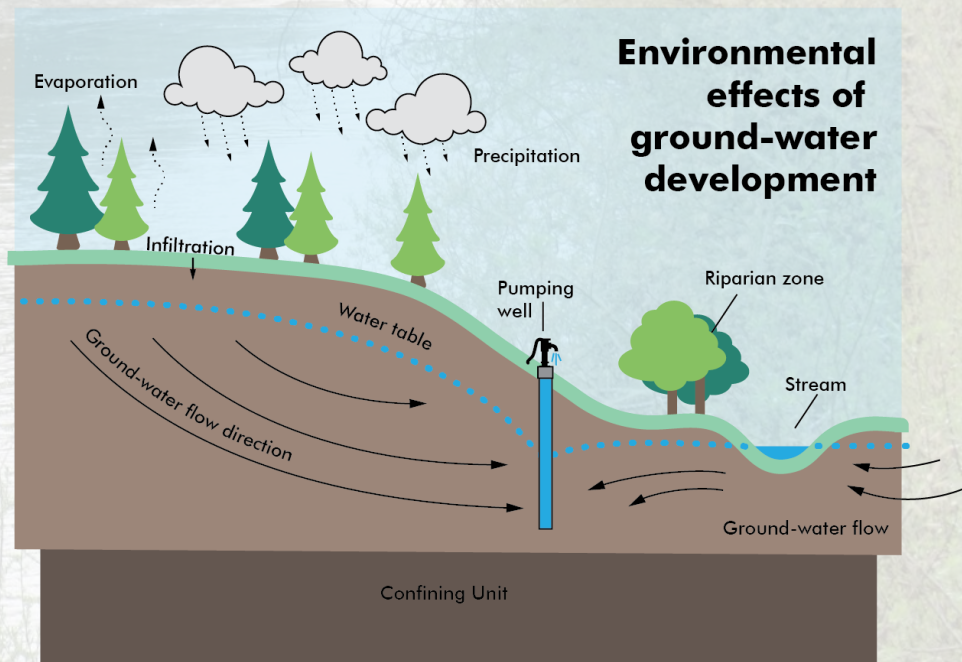
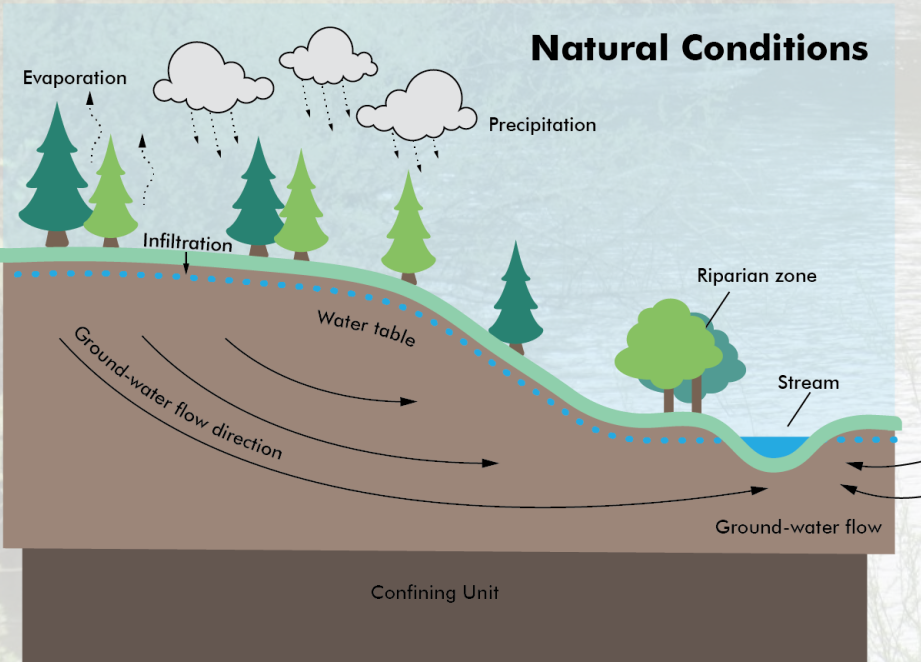


Water Levels During Drought Periods

Normalized Summer Streamflow
Summer streamflow (July to September) divided by
Summer Precipitation (May to September)
Deschutes River – Rainier Gage



Water Levels During Drought Periods



Loss of Farmland

Current Concerns

- Over 700 acres lost between 2000 and 2011

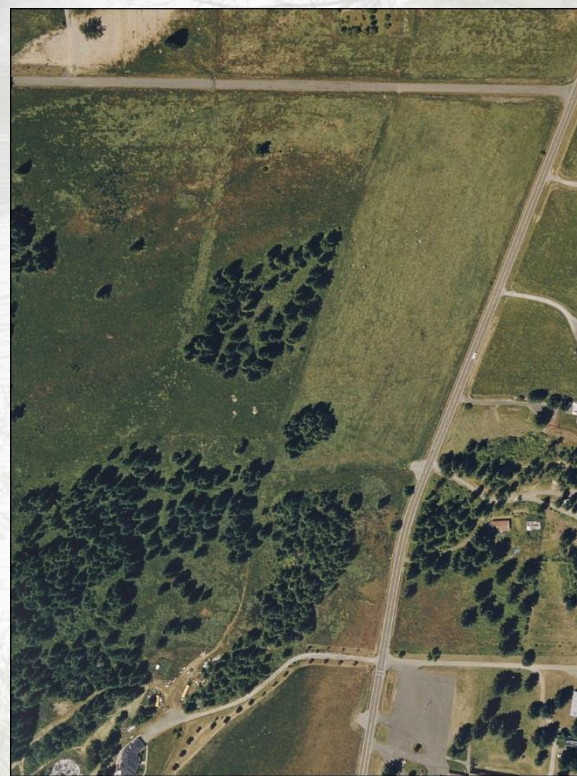
Futures Concerns



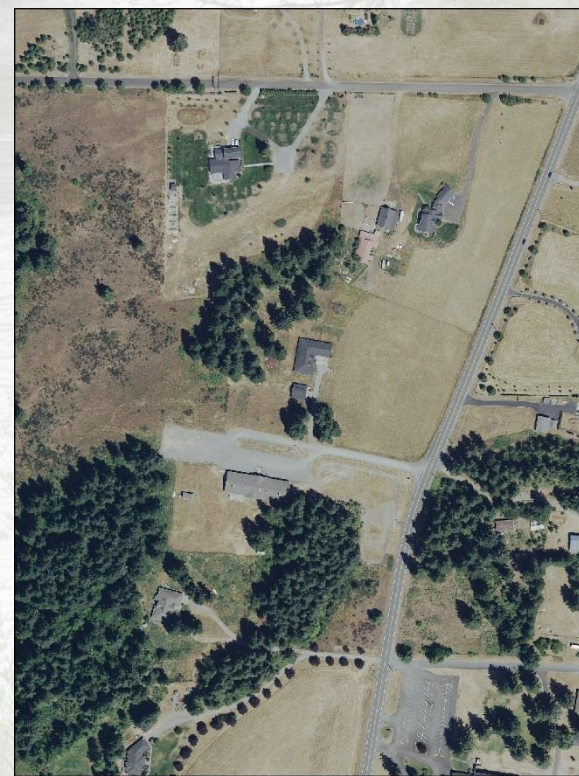
Over 3,000 acres
vulnerable to
urbanization



Loss of Farmland - 2000



Loss of Farmland - 2015



Groundwater Quality

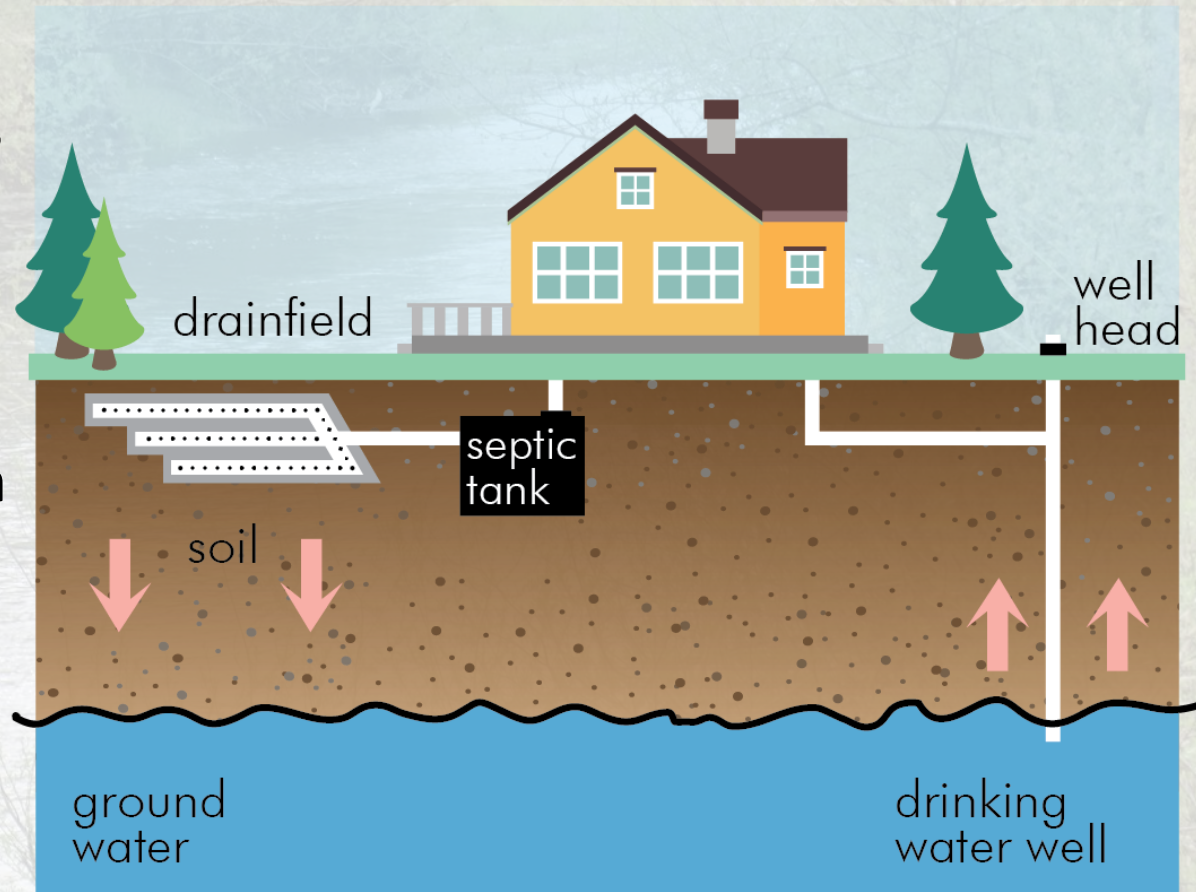
Current Concerns

- Failing septic systems contribute nitrates to ground water

Future Concerns



Up to 59% increase in homes on septic systems on porous soils; 20% increase if Rainier is converted to sewer.



Solutions

Management Tools

- Conservation
- Restoration
- Education & Outreach
- Septic Inspection Program

- Zoning/Density Changes
- Impervious Surface Limits
- Expanded Enforcement

Not Included in Scenarios

- Regulations for exempt wells
- Water metering
- Tree retention standards
- Wastewater treatment for City of Rainier

Education and Outreach Scenario

- **Watershed Stewardship**

- Action: Increased education on watershed issues
- Result: Reduction in nutrients in the river, tributaries and lakes

- **Farm Plans**

- Action: Increase number of farm plans
- Result: Reduced agricultural impacts on water quality

- **Septic Inspections**

- Action: Voluntary septic education and outreach program
- Result: More failing septic systems identified and fixed

- **Water Conservation**

- Action: Increase outreach and incentives during drought years
- Result: Increased water efficiency and reduced water consumption



Restoration and Conservation Scenario

- **Restoration**

- **Action:** Increase funding and incentives for habitat restoration
- **Result:** Increased habitat restored and shade cover to reduce water temperatures
- **Action:** Assess for opportunities and implement stormwater retrofits
- **Result:** Decreased stormwater runoff, nutrients and sediments

- **Conservation**

- **Action:** Include more lands in the Purchase of Development Rights and Transfer of Development Rights programs and more funding
- **Result:** Increase in protection of sensitive areas and landowners benefit (\$)
- **Action:** Identify and fund wildlife corridor linking conservation areas
- **Result:** Increase in protected habitat and financial benefits to landowners



Zoning Regulations Scenario

- **Reduce the number of new homes in sensitive areas**
 - **Action:** Rezone parcels in areas with nonporous soils near water bodies
 - **Result:** Less pollution entering waterbodies from new septic systems
- **Action:** Rezone parcels on forest lands with steep slopes
- **Result:** Less erosion and less sediment from new development
- **Action:** Rezone parcels in Lake Lawrence, McIntosh and Offut Lake basins
- **Result:** Decreased impacts of new growth on nutrient and algae issues in lakes



Development Regulations Scenario

- **Impervious Surface Limits**

- **Action:** Reduce limits for parcels in lake basins
- **Result:** less impervious surfaces and more compact development in sensitive basins
- **Action:** For remaining parcels reduce limits to the typical amount (10%)
- **Result:** limit excessive impervious surfaces, would have limited impact



- **Septic Inspection**

- **Action:** County implements a mandatory septic inspection program
- **Result:** Identify, repair and decrease the number of failed systems



Measuring Outcomes

*Not everything that matters can be measured
and not everything that can be measured
matters*

Indicators

BASELINE Estimates

- **Future conditions – based on trends and current regulations and programs**
 - Existing studies for septic failure rate
 - Estimates of actual habitat restored
 - Land cover estimates from NOAA-C-CAP
 - Land use model linked to zoning to forecast
 - Dwelling units
 - Impervious area
 - Forest cover

Indicators

New Homes



↑ 84%

increase in new
homes 4,300
today... capacity
for 8,000.

Indicators

Impervious Area



≈ 4%

impervious area
could increase to 4%
from below 2%.

Indicators

Forest Cover

Vulnerable to Urbanization



↓ 44%

decrease in forest
cover amid Lake
Lawrence basin,
even with regrowth on
resource lands.

Indicators

Septic Systems

on nonporous soils near
surface water bodies

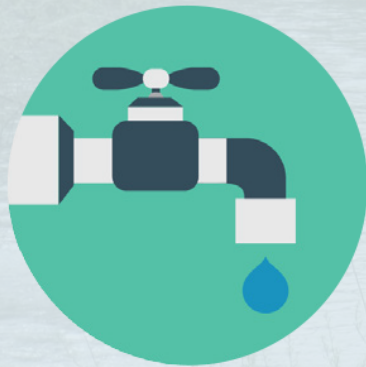


↑ 171%

increase in homes
on septic systems
on non-porous soils
on properties within 100 feet of
a water body.

Indicators

Residential Water Consumption



↑ 2x

almost double the
amount of water
consumed for
residential uses alone.

Indicators

Septic Systems

on porous soils



↑ 59%

increase in septic homes on porous soils if Rainier doesn't install a wastewater treatment plant. With the plant, some septic homes will convert to sewer, and the increase will be 20%.

Indicators

Landslide Hazards



1,800

acres of forest
lands on steep
slopes vulnerable
to development

Indicators

Farm Lands



45%

of farmlands
vulnerable to
development

Indicators

**Riparian Habitat
Restored**



**56
Years**

to restore stream shade.

Comparing Scenarios

Indicators used to look at relative difference between scenarios

- Not a complete picture – only measures where there is data or an estimate as to the effectiveness of a measure

Comparing Scenarios

Estimate of failing septic systems on nonporous soils near waterbodies



| | Buildout Estimates | | | | | |
|--------------------------|--------------------|----------|----------------------|----------------------------|--------|--------------------------|
| | 2015 | Baseline | Education & Outreach | Restoration & Conservation | Zoning | Regulations & Monitoring |
| Failing septic systems | 73 | 197 | 162 | 197 | 161 | 62 |
| Change from 2015 | - | 125 | 89 | 125 | 89 | -10 |
| Percent change from 2015 | - | 171% | 122% | 171% | 122% | -14% |
| Estimated failure rate | 14% | 14% | 11% | 14% | 14% | 4% |