North Fork Palouse River Dissolved Oxygen & pH Water Quality Improvement Plan

Total Maximum Daily Load

August 3, 2015

DEPARTMENT OF ECOLOGY
State of Washington

Introductions

- Elaine Snouwaert
  - Water Quality Program Lead for the Project
- Tighe Stuart
  - Environmental Assessment Program Technical Lead for the Study
- Ellie Key
  - Water Quality Program Permit Manager and Engineer
- Guest presenters

Contents of Tonight's Meeting

- Overview of the water quality project on the Palouse River
- Summary of the water quality study
- What needs to be done to improve the river's water quality?
- City of Palouse
- Palouse Conservation District
- Question & Answer Session

THE NORTH FORK PALOUSE RIVER IS IMPAIRED

- Too little dissolved oxygen in the water
- Too high of pH
- Unsightly algae blooms

Water Quality Improvement Projects

- Also called “Total Maximum Daily Load” or TMDL projects.
- Required by Clean Water Act for impaired water bodies.
- Involve a study of the water quality problem(s) and a plan on how to fix it.

Clean Water Act

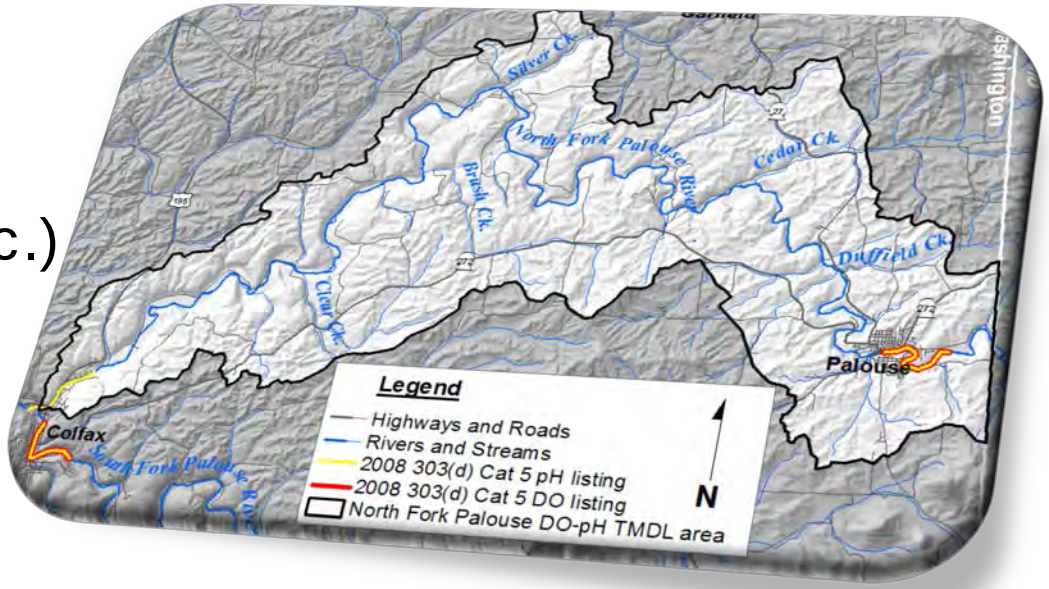
- Requires states to set water quality standards for water bodies
- Standards consist of:
  - Beneficial uses of the water
  - Criteria to support those uses
- Water bodies that don't meeting standards are listed as impaired on the 303(d)list

Clean Water Act

- Requires TMDLs to outline how to return water quality to support uses
- **TMDL** = the amount of a pollutant that a water body can receive and still meet water quality standards

TMDLs

- Watershed focused and examine all sources
  - Point sources (wastewater treatment plants, etc.)
  - Nonpoint sources (diffuse sources from surrounding land practices)
- Outline pollutant reductions needed
- Include an implementation plan



Current Plan

- Beneficial use of supporting aquatic life is impaired
  - Too little oxygen in the water for fish and insects
  - pH too high making it an unhealthy living environment
- Human consequences
  - Reduces recreational fishing opportunities
  - Unsightly aquatic vegetation growth
  - Can plug irrigation and withdrawal equipment

Previous Plans

- Toxics – PCBs and historical pesticides
- Bacteria
- Water Temperature

Water Quality Standards for North Fork Palouse River

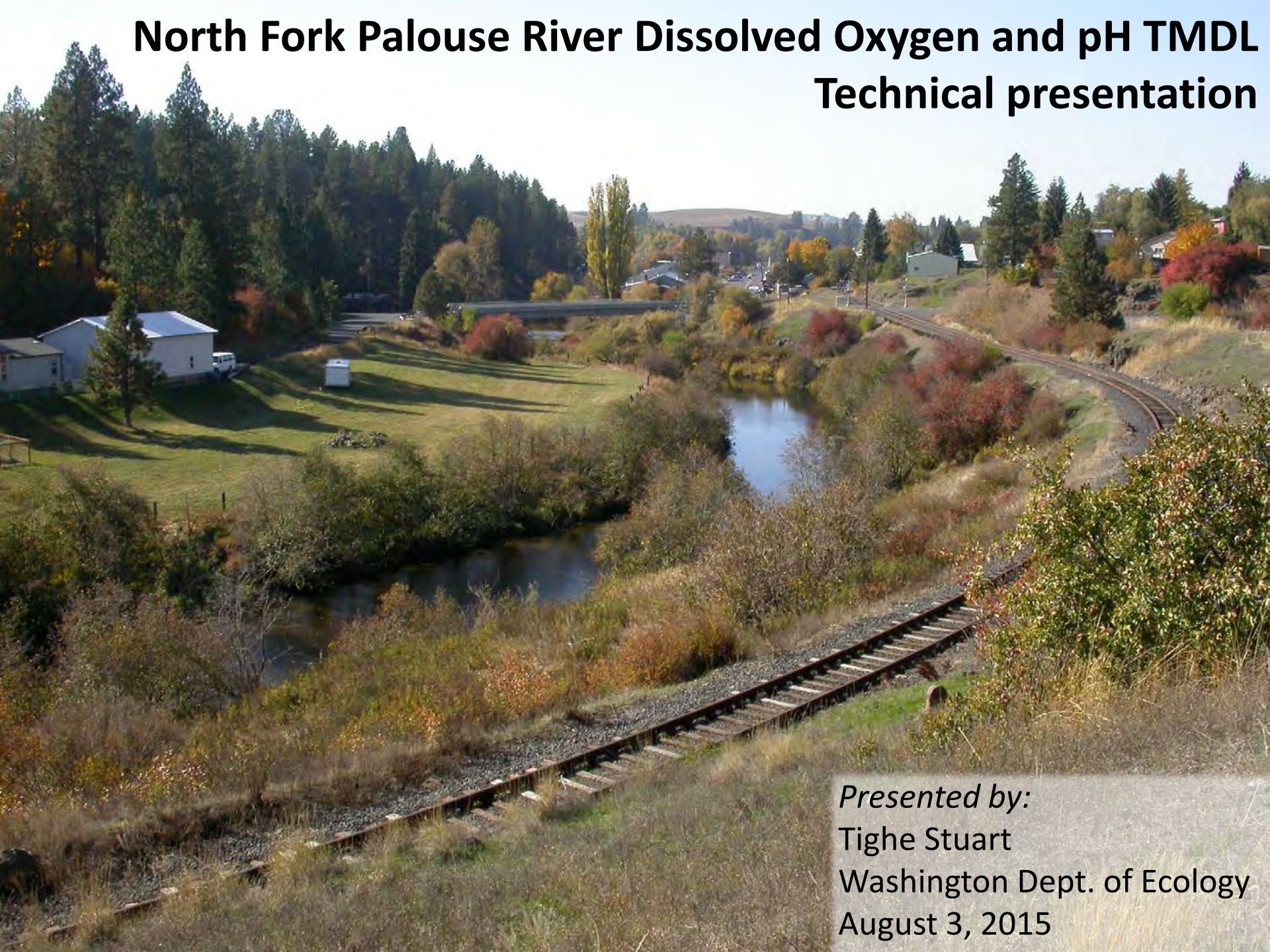
- Dissolved Oxygen
  - *The one-day minimum dissolved oxygen concentration shall not fall below 8.0 mg/L*
  - *When due to natural conditions, then cumulative human-caused activities will not decrease the dissolved oxygen more than 0.2 mg/L*

Water Quality Standards for North Fork Palouse River

- pH
  - *pH must be kept within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.5 units.*
  - *When the natural pH level is outside the criteria range, the standards only allow a de minimis change of 0.1 unit for human activities (the change that is considered the limitation of accurate measurement)*

The Study

North Fork Palouse River Dissolved Oxygen and pH TMDL
Technical presentation



Presented by:
Tighe Stuart
Washington Dept. of Ecology
August 3, 2015

Dissolved Oxygen (DO)

<u>Low concentrations of DO are harmful to aquatic life</u>

- Fish need oxygen
- Low DO affects growth rates, swimming ability, susceptibility to disease, resilience

Dissolved Oxygen (DO)

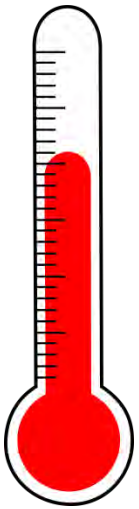
<u>Low concentrations of DO are harmful to aquatic life</u>

- If DO gets too low…

pH

Acid
Neutral
Base
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Stomach acid
Vinegar
Black coffee
Pure water
Toothpaste
Household ammonia
Oven cleaner
Car battery acid
Lemon juice
Tomato juice
Milk
Baking soda
Milk of Magnesia
Soapy water
Drain cleaner
Fresh Milk
Baking Soda
AMMONIA
Oven Cleaner
DRAIN OPEN!

Things that affect dissolved oxygen and pH



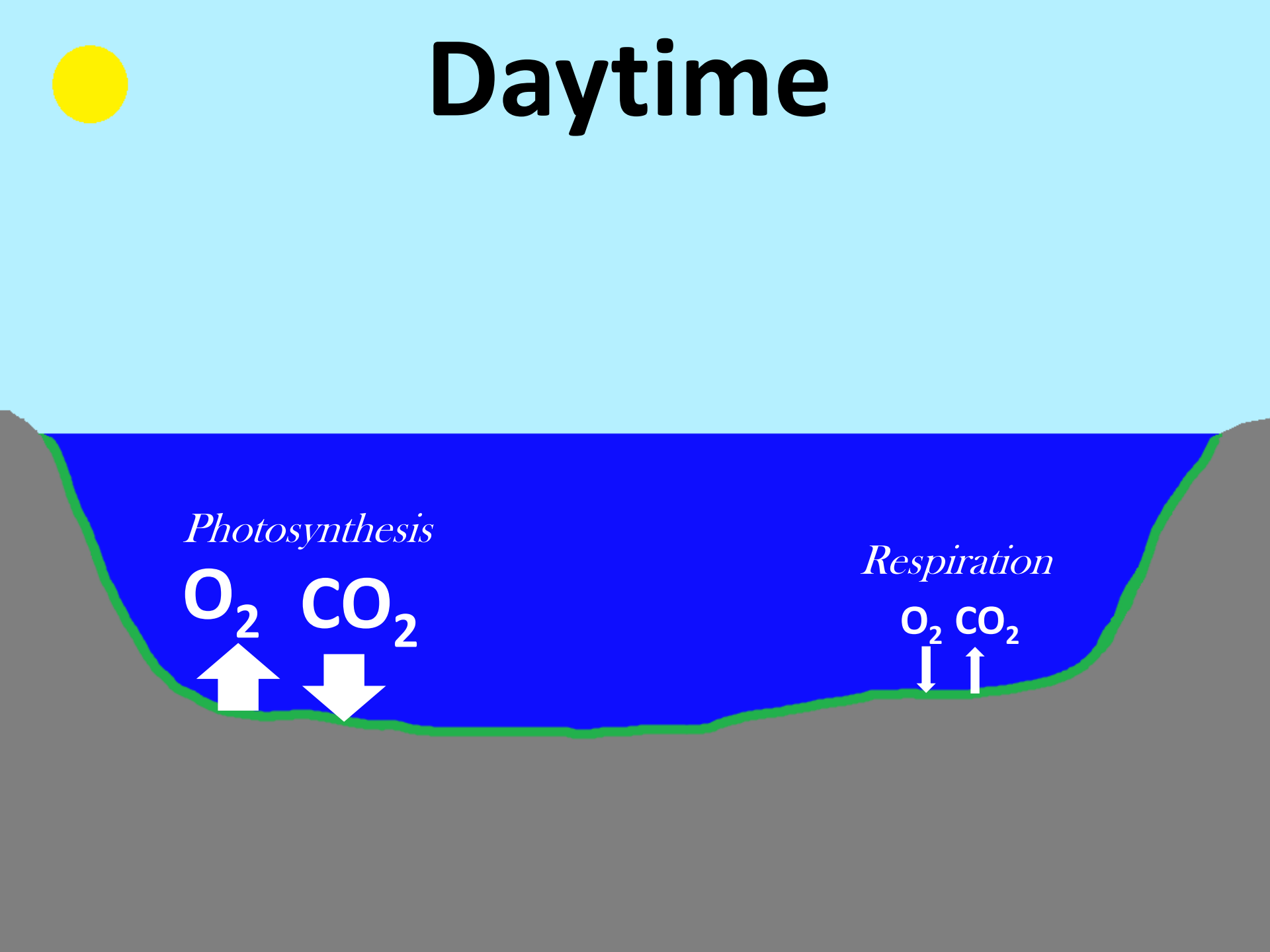
Water Temperature

Gas exchange with atmosphere (reaeration)

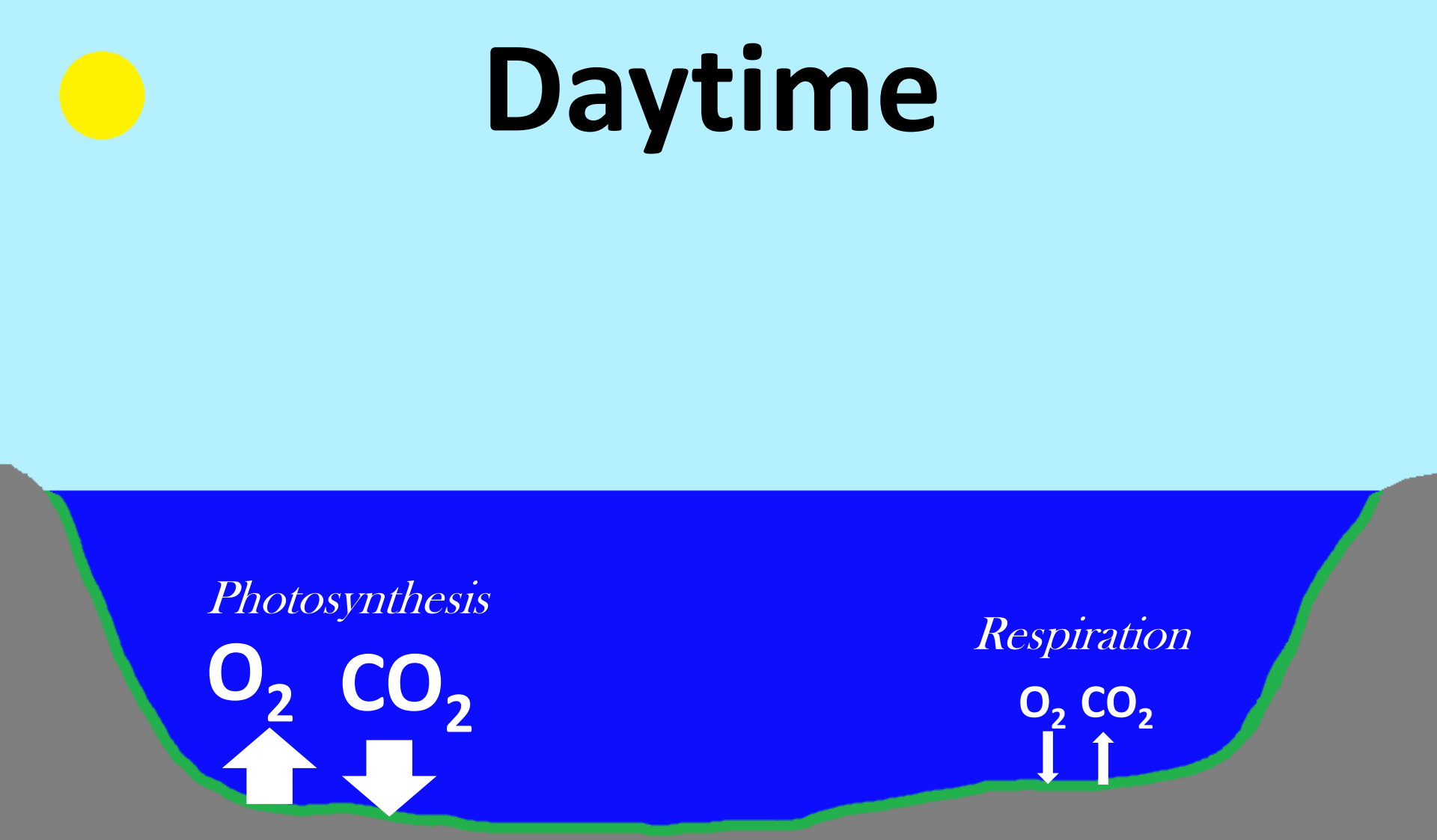
Organisms in water, especially bottom algae (periphyton)

Bottom Algae (Periphyton)

Daytime



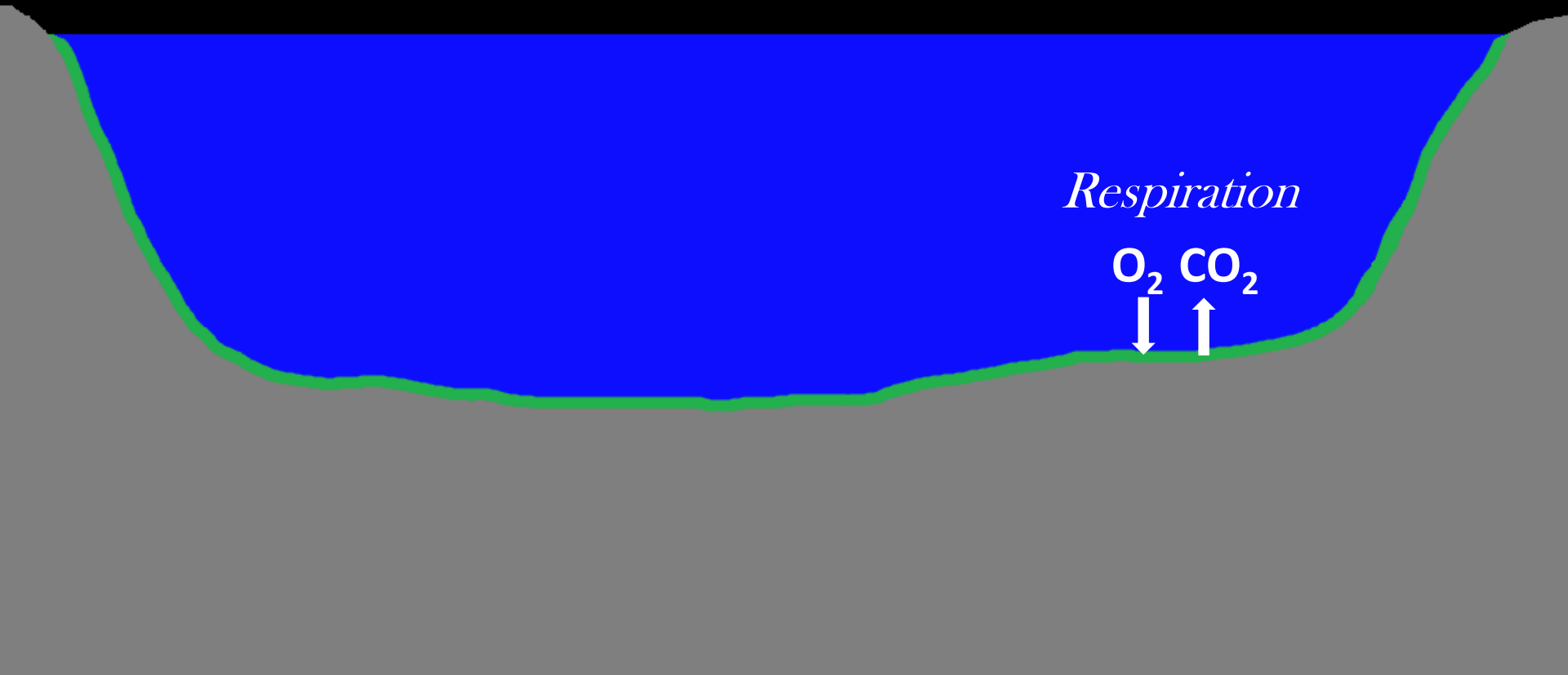
Daytime



Overall,

- Dissolved oxygen **<u>increases</u>**
- Carbon dioxide **<u>decreases</u>**, which means pH **<u>increases</u>**

Nighttime



Nighttime

Overall,

- Dissolved oxygen **decreases**
- Carbon dioxide **increases**, which means pH **decreases**

Double whammy: DO and pH

First thing in the morning

- **Low DO**
- pH ok

Mid – late afternoon

- DO abundant
- **High pH**

Nutrients

Algae need food!

- Bottom Algae (periphyton) do not have roots
- They depend on nutrients dissolved in the water
- Most important aquatic nutrients:
  - Nitrogen
  - Phosphorus
- In the Palouse River, algae growth is limited by ***nitrogen***

Dept. of Ecology study of the North Fork Palouse River

Where?

- Sampling locations along the NF Palouse River from state line to Colfax

When?

- Surveys during July 2007, August 2007, and September 2012
- Ongoing monthly monitoring at Bridge St. in Palouse

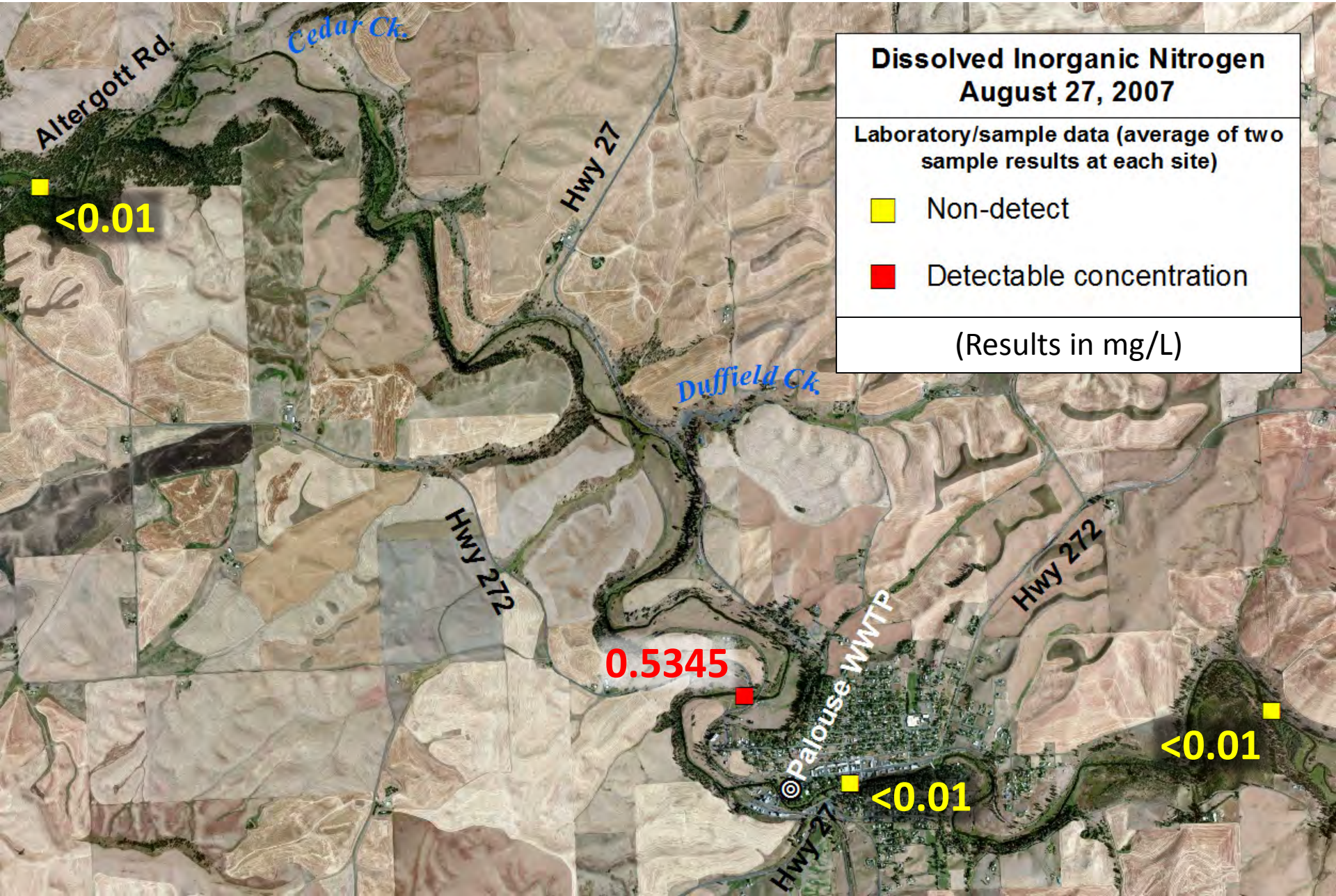
What?

- Diel (round-the-clock) dissolved oxygen and pH
- Continuous stream temperature
- Nutrient samples (nitrogen and phosphorus)
- Stream flow
- Time of travel (stream velocity)
- Periphyton (bottom algae) biomass
- Groundwater

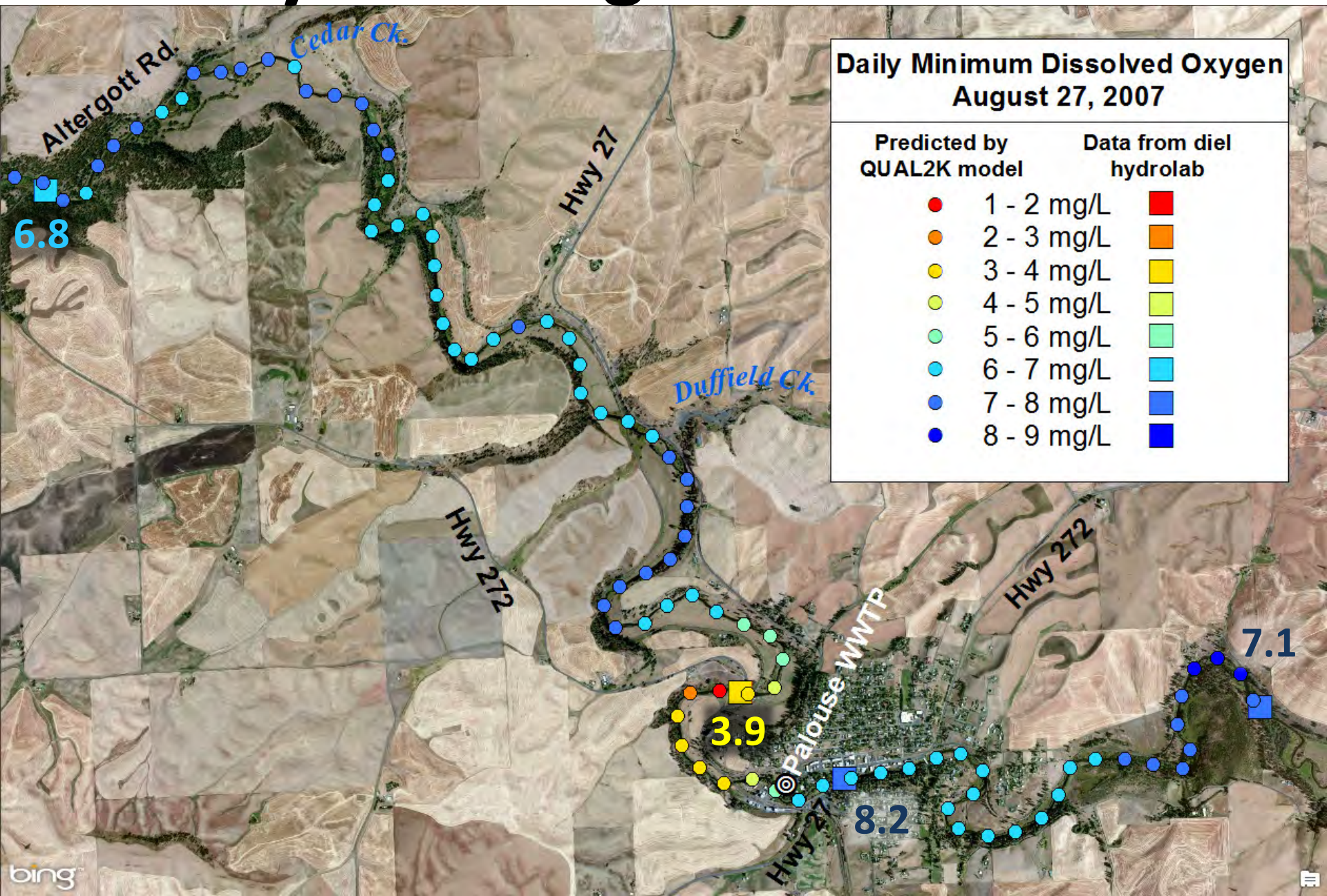
How did we use the data?

- QUAL2Kw computer model
  - Predicts what happens between sampling sites
  - Provides understanding of what happens in the stream (cause and effect; the hows and whys)
  - Predicts what would happen under different conditions

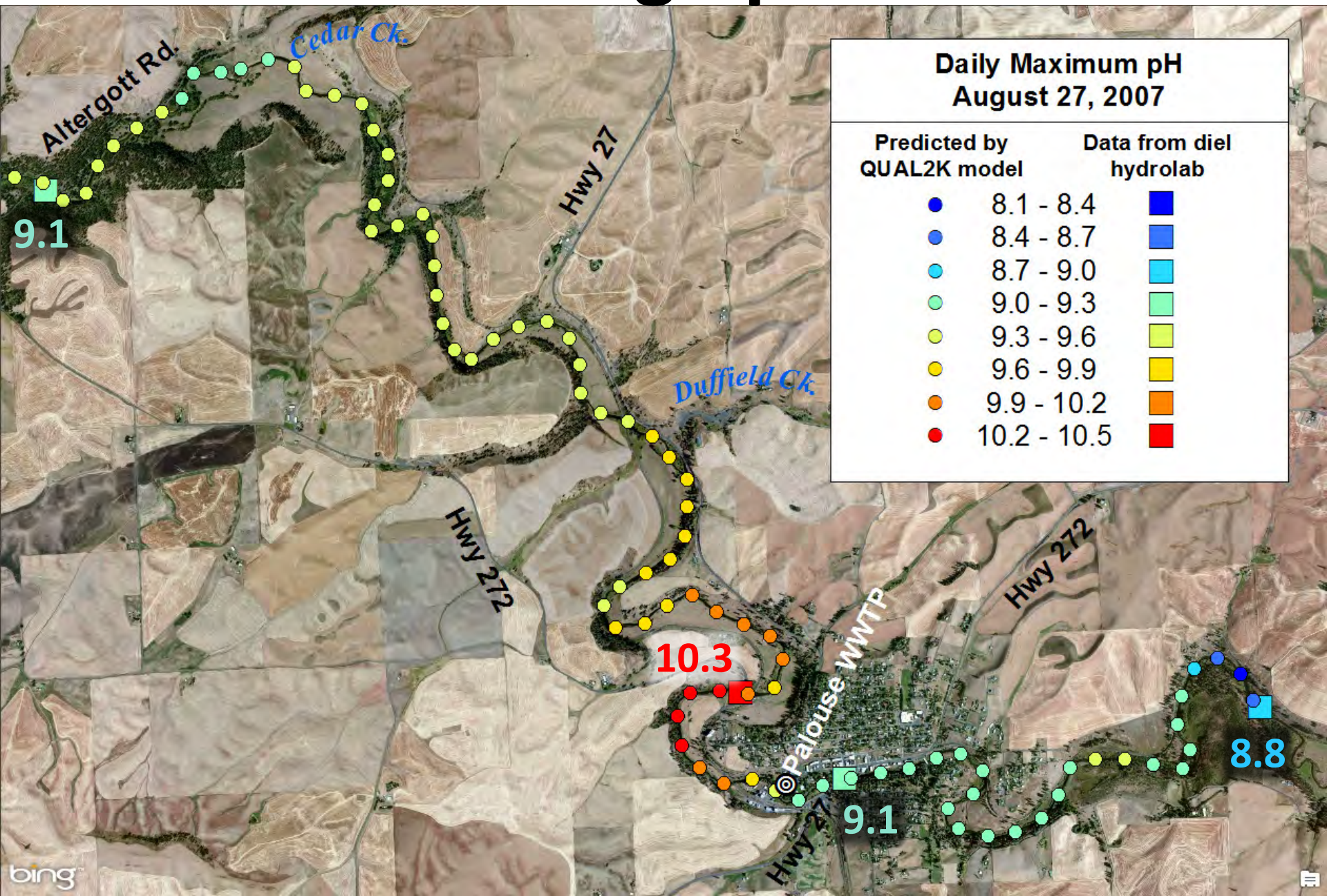
Dissolved Inorganic Nitrogen results



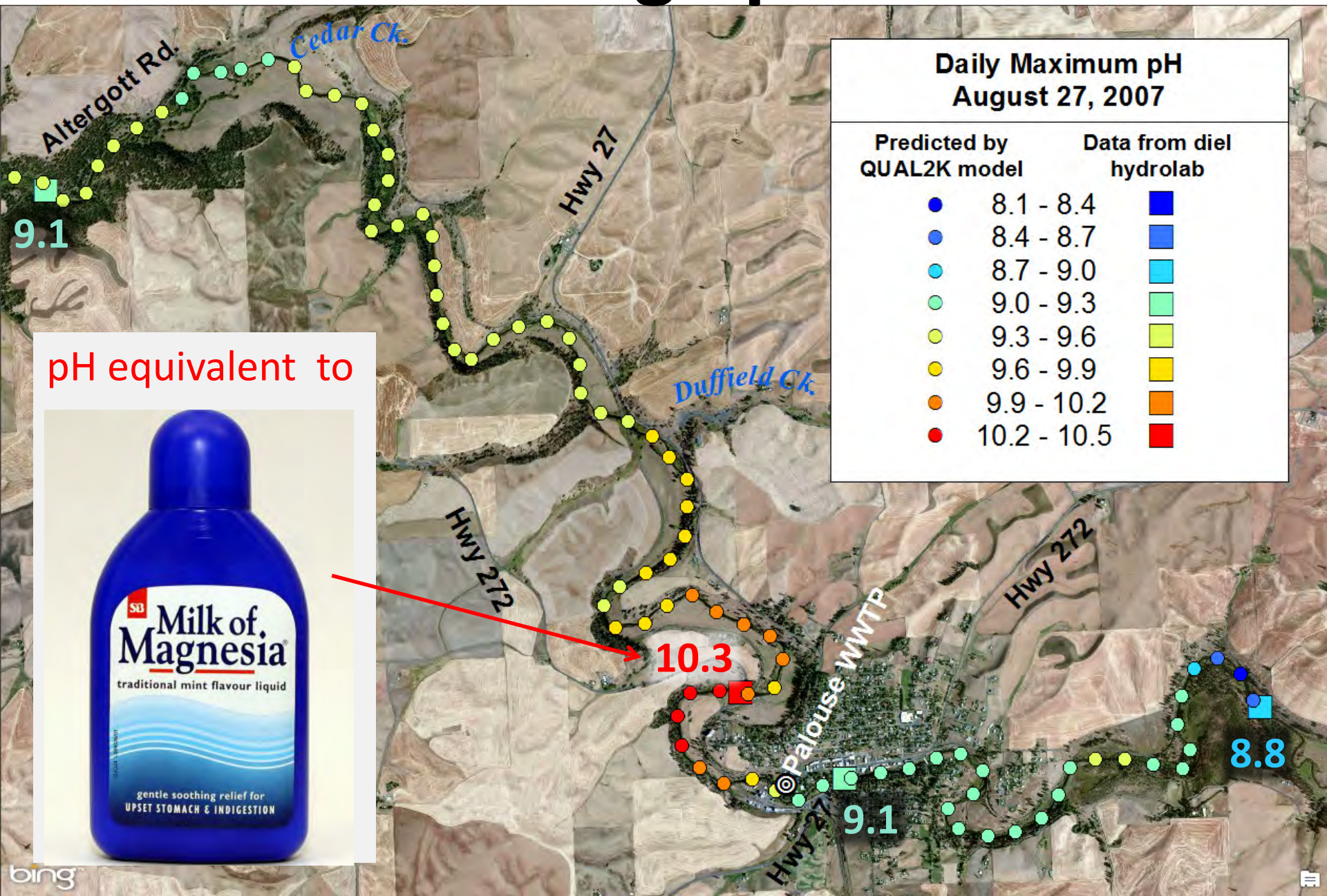
Early morning low DO results



Afternoon high pH results



Afternoon high pH results

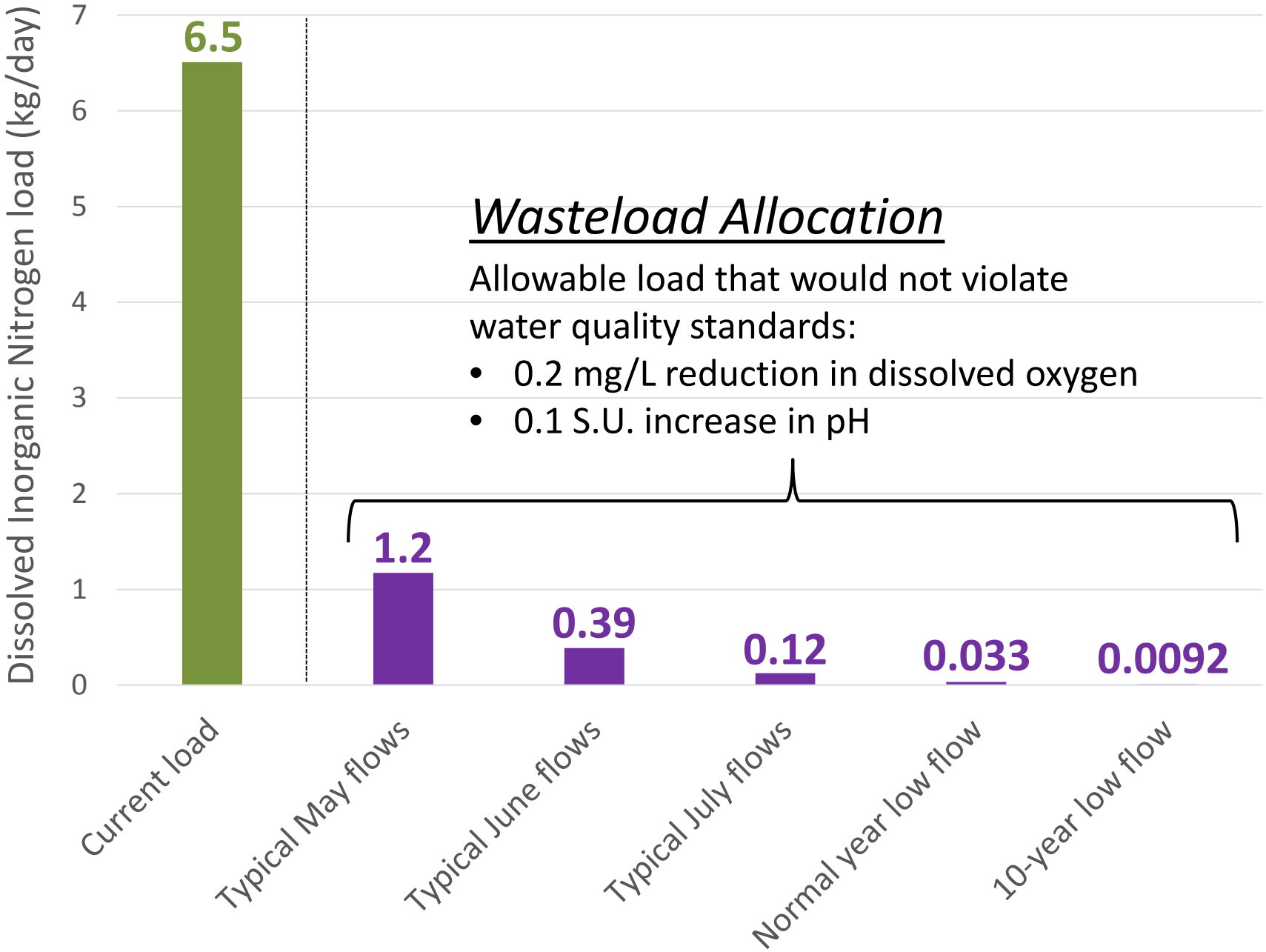


OK during
spring runoff

OK during
winter

Critical season: May-October

Need to reduce Dissolved Inorganic Nitrogen coming from Palouse WWTP

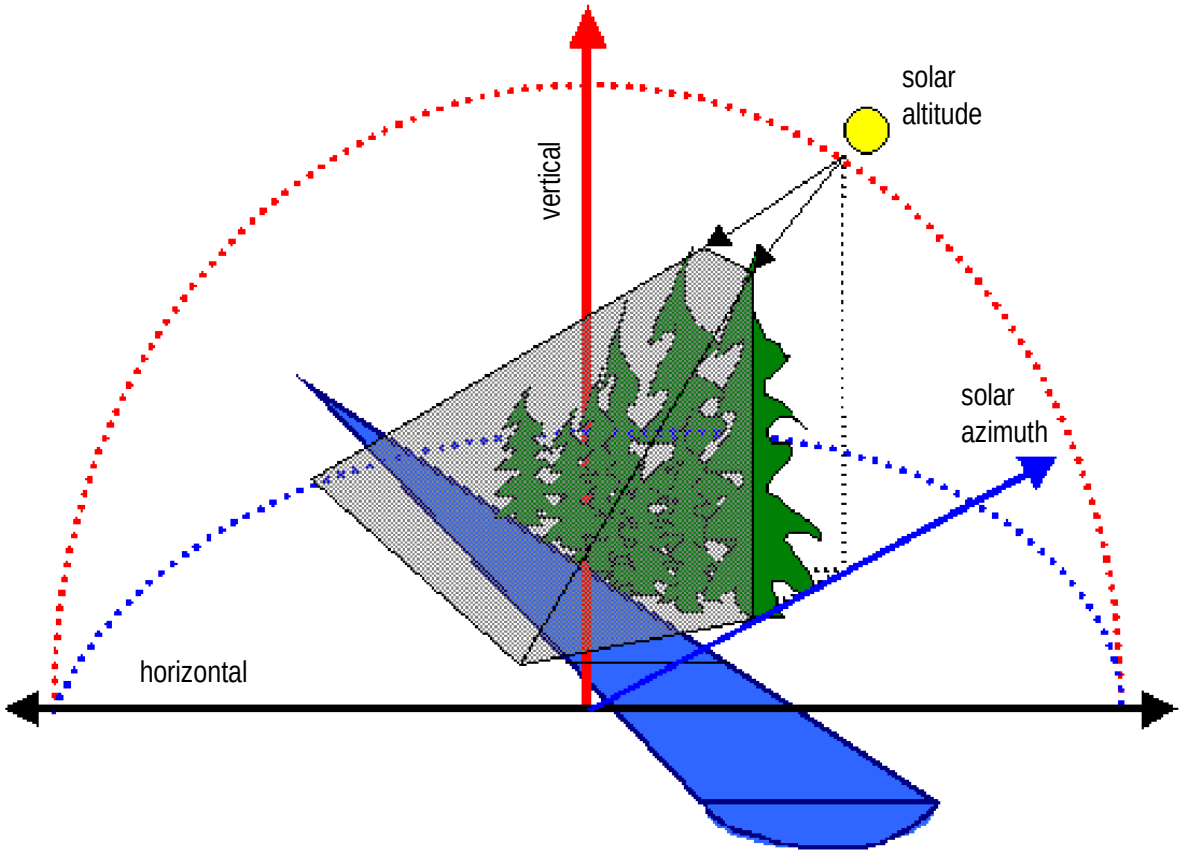


Need to reduce DIN runoff to river during summer storms

Load allocations

Algae bloom in NF Palouse River near Colfax
Photo taken 7/28/2014
Rainstorm occurred 7/22-23/2014; 0.32 in of rain at Pullman Airport

Need to increase shade



- Implement *Palouse River Temperature TMDL* (includes N. Fork Palouse)
- Expected to improve dissolved oxygen by up to 0.8 mg/L
- Expected to improve pH by up to 0.16 S.U.

Discussion/Questions

The Implementation Plan

How do we improve DO & pH?

- Reduce stream temperature
  - Warm water holds less DO than cold water
  - Temperature affects biological and chemical processes
- Reduce in-stream nitrogen
  - Feeds algae causing it to grown at a higher rate than normal

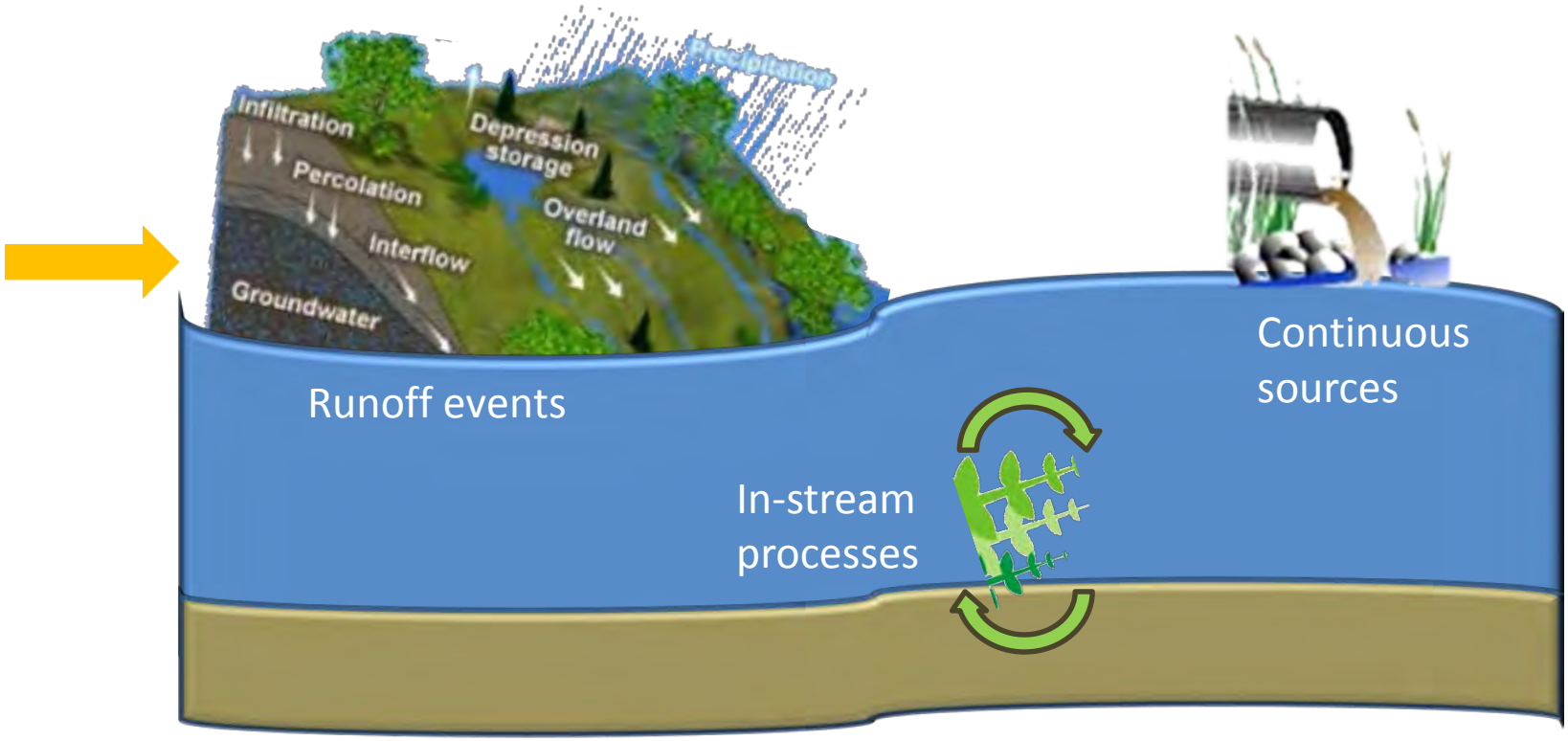
Temperature

- Restore system potential shade along the streams (the level of shade that would be there if natural/historical native vegetation was intact)
- Reduce temperature of Palouse wastewater treatment plant discharge during critical summer months
- Natural targets outlined in Temperature TMDL finalized in 2013

Nutrients

- Most obvious source with largest impact
  - Palouse Wastewater Treatment Plant
  - Permit will be updated to reflect new restrictions to protect river
- Smaller diffuse human-caused sources (nonpoint)
  - Important localized effects
  - Control sources of nitrogen entering river through stormwater and land use practices

Sources of nutrients



- Erosion
- Stormwater (urban)
- Agricultural runoff
- Drainage tiles

- Sediment
- Groundwater
- Plant die-off and decomposition

- Wastewater discharges
- Failing septic systems

Nutrients

- Correct unknown source near Colfax
  - Swimming pool leakage
  - Other unknown source(s); potentially groundwater
- Prevent soil erosion and fertilizer mobilization to water
- Prevent human sources of nitrogen in stormwater
- Eliminate failing septic systems that could be discharging nitrogen to surface or groundwater
- Prevent livestock impacts
- Reduce stream bank erosion

Partners in Implementation

- Permittees
  - City of Palouse
  - WA Dept. of Transportation (stormwater)
  - Empire Disposal (stormwater)
- City and County Planning Departments
- Whitman County Roads Department
- Whitman County Health Department
- Landowner assistance agencies
  - Palouse Conservation District
  - Palouse Land Trust
  - Whitman Conservation District
  - Natural Resources Conservation Service
- Landowners and residents

City of Palouse's Discharge Permit

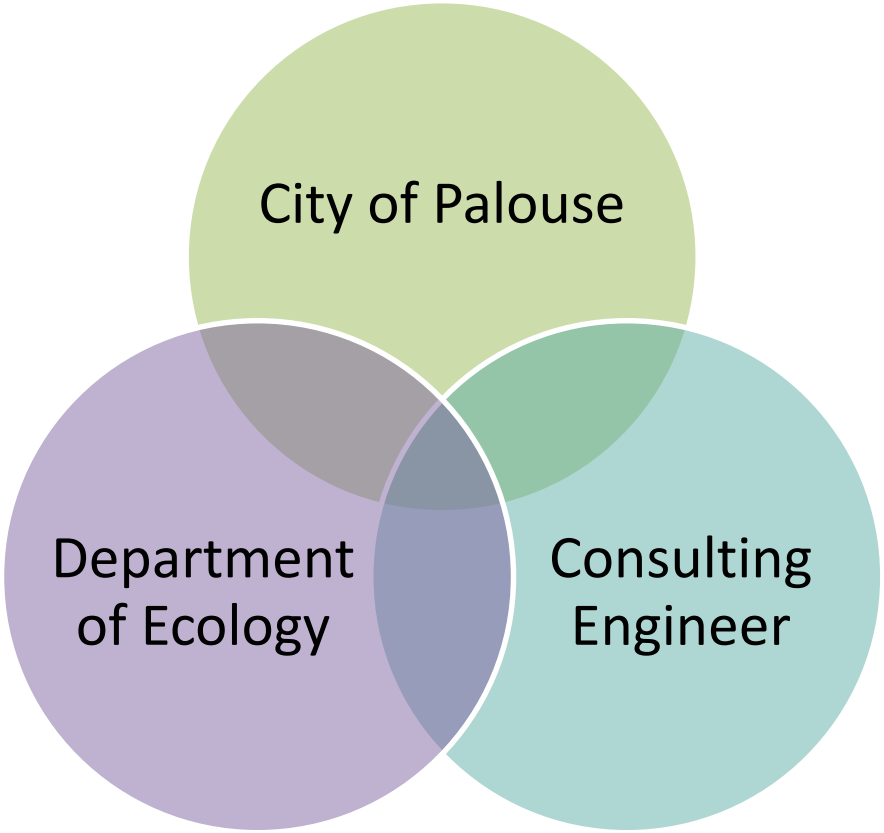
Permit Details

- NPDES Permit No. WA-0044806
  - Reissued: 2/19/2015
  - Effective Date: 4/01/2015
  - Expires: 3/31/2020

- Provides effluent limits for the City's discharge to the NFPR
  - Based on current water quality standards, design parameters, and assimilative capacity of the receiving water

- Current permit contains a provision to start timeline for compliance once EPA approves the TMDL

Path to Success



Compliance Schedule

- 10 years for planning/construction of upgrade
  - Effective by 2025 Permit Cycle
- Steps to Compliance:
  - Current Permit: Facility Plan by December 1, 2017
    - Will contain both interim and final design limits (WLAs from TMDL) as targets
    - Planning dollars available from DOE's Grant/Loan Program
    - Collaboration between consulting engineer and permit manager to develop several viable alternatives for meeting TMDL requirements
    - Planning document to select most ***affordable and cost effective*** alternative.
  - Future Permit (2020-2025)
    - Deadlines for design and construction documents
    - Requirements for substantial completion of the selected upgrade alternative
    - Time for optimization

Impacts to City

- Modifications to existing treatment process needed to ensure compliance
  - Rate increases to finance treatment plant upgrades
  - City should consider life cycle costs including annual operation and maintenance requirements during the alternative selection
  - Upgrades now will ensure the City of Palouse has viable wastewater treatment for several decades into the future
- Investments in infrastructure can promote growth and vitality

Public Comment Period

- July 22 – August 21, 2015
- Submit written comments to:

Elaine.Snouwaert@ecy.wa.gov

4601 N Monroe Street
Spokane, WA 99205

www.ecy.wa.gov/programs/wq/tmdl/palouse/DOpH.html

Questions?