Residual Chemicals and Infiltration of Reclaimed Water:

A Scientific Study to Support Local Decisionmaking

Idaho Water Reuse Conference
May 22, 2014

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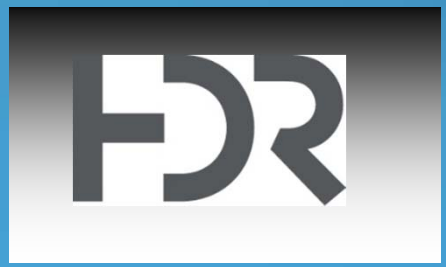
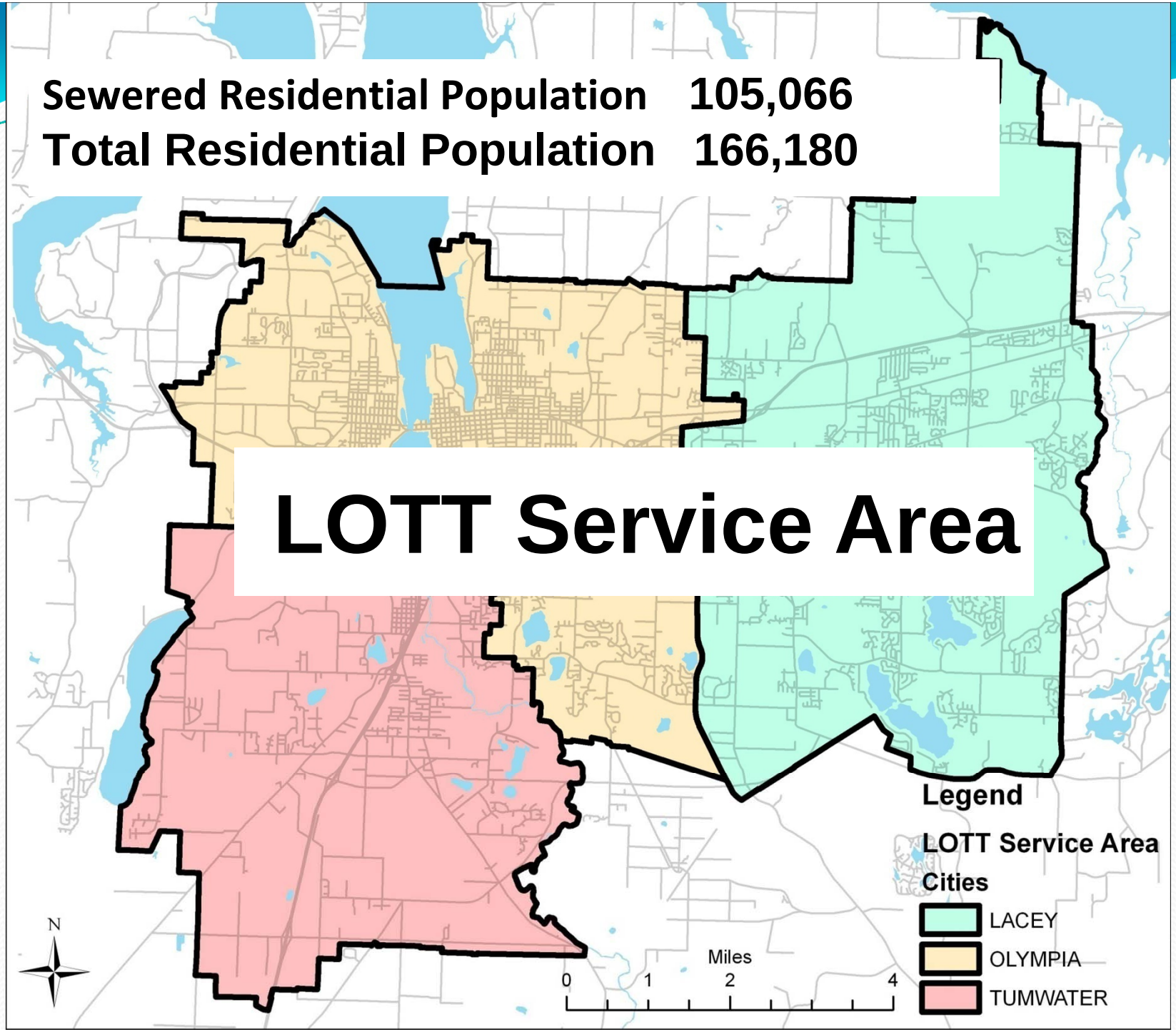


This Presentation…

Story of the start-up of a multi-year, multi-million-dollar scientific study

- Introductions to LOTT Clean Water Alliance and reclaimed water in our communities
- A look at the concerns being addressed, how the study is being structured, and who's involved
- The science to be addressed
- Field work to date

LOTT
Clean Water
Alliance
Lacey • Olympia • Tumwater • Thurston County


Sewered Residential Population 105,066
Total Residential Population 166,180
LOTT Service Area
Legend
LOTT Service Area
Cities
LACEY
OLYMPIA
TUMWATER
N
Miles
0
1
2
4

Reclaimed Water in Our Communities

Responsive to Public Values

The Values, the Plan

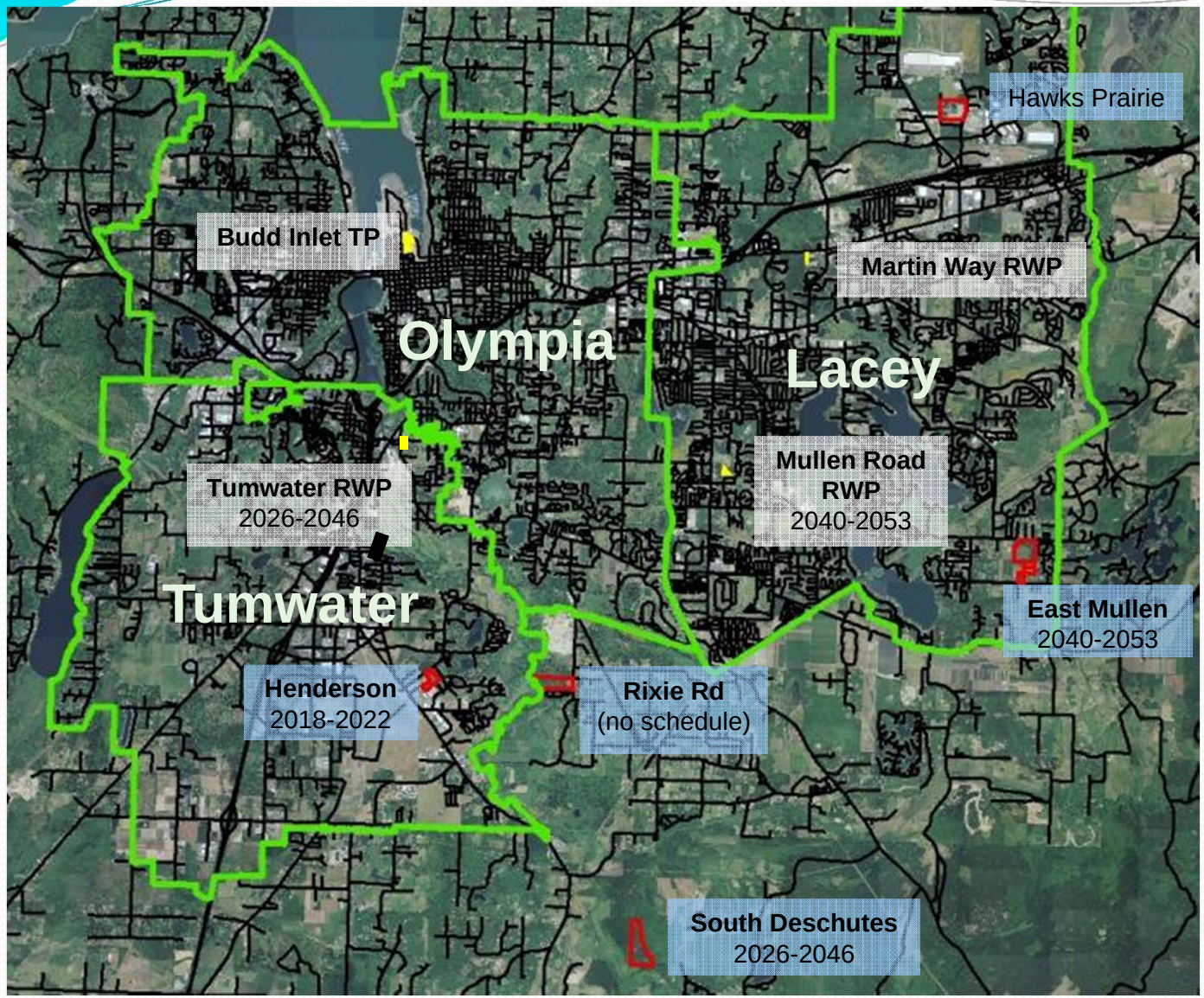
LOTT Clean Water Alliance
Lacey • Olympia • Tumwater • Thurston County

Public Values

In developing its Wastewater Resource Management Plan, LOTT recognized the following public values. These values, expressed widely by citizens throughout the LOTT service area, were drawn from citizen surveys conducted early in the planning. LOTT sought a balance among these key values in preparing its long-range plan for managing the region's wastewater resource, and continues to rely on these values to guide its planning, programs, and capital projects.

1. As a first priority, **maximize utilization of LOTT's existing treatment capacity.** Manage demand to avoid or delay the need for new treatment capacity.
2. Prepare a plan that **meets current and future wastewater needs** throughout the LOTT service area. Accommodate planned growth, consistent with LOTT's legal requirements.
3. Select wastewater facilities for the region's future that yield **maximum benefits to the environment.** Mitigate any potentially adverse impacts of new facilities.
4. Take all possible steps to **control facilities costs.** Carefully consider the lowest cost and most cost-effective alternatives, and evaluate the impact on LOTT ratepayers.
5. **Treasure LOTT's treated wastewater as a valuable, long-term resource** to be cleaned and restored, reused, then ultimately returned to the environment.
6. Clearly define, demonstrate and document the value to the community of new facilities needed for the future. Design any new LOTT facilities to **produce multiple benefits for the community.**
7. **Conduct a pro-active and open facilities planning process** that informs and involves citizens in planning and decision making.
8. **Assure an equitable distribution of costs** for any new facilities between current ratepayers and new development.
9. Establish an organizational structure to build and operate the region's future facilities effectively and efficiently, and that **assures equitable and accountable representation of the public.**
10. **Integrate LOTT's facilities plan with other related local issues, plans and infrastructure programs** to maximize regional cooperation and avoid duplication of effort and cost.

LOTT Clean Water Alliance

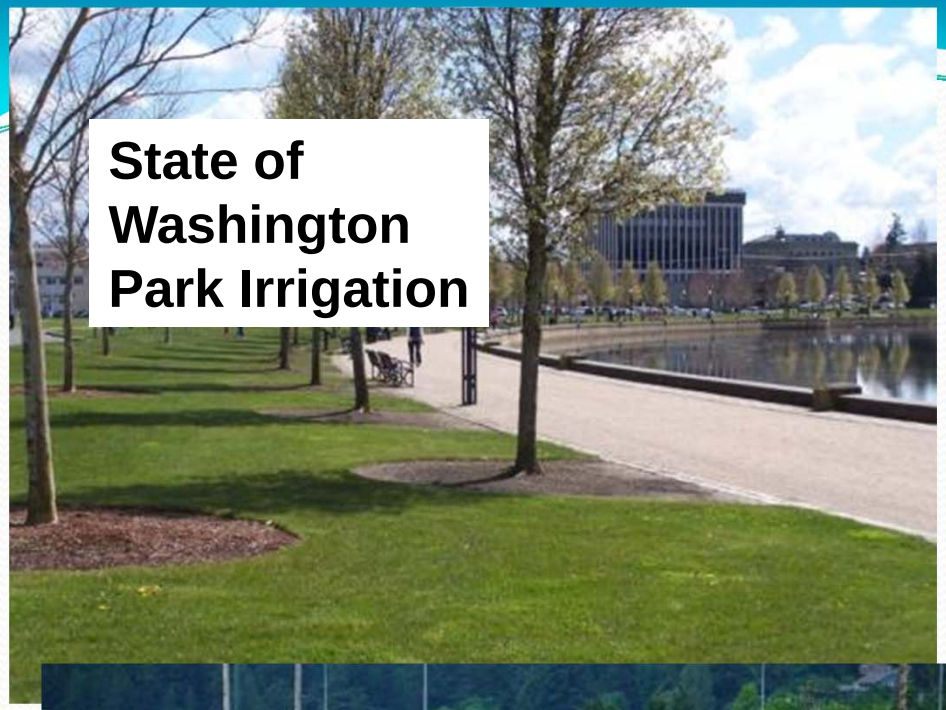


Reclaimed Water Treatment and Recharge Sites

Legend
- RW production site
- GW recharge site
- UGA boundary

Budd Inlet
Reclaimed Water
Plant

Martin Way Satellite
Reclaimed Water Plant



State of Washington Park Irrigation

City of Olympia Park Irrigation

Port of Olympia Dust Suppression

Construction Contractor Wheel Washing

Reclaimed Water Education Program

Indoors and Outdoors

WET
Science Center
Come Explore • Discover More

Exhibit Gallery

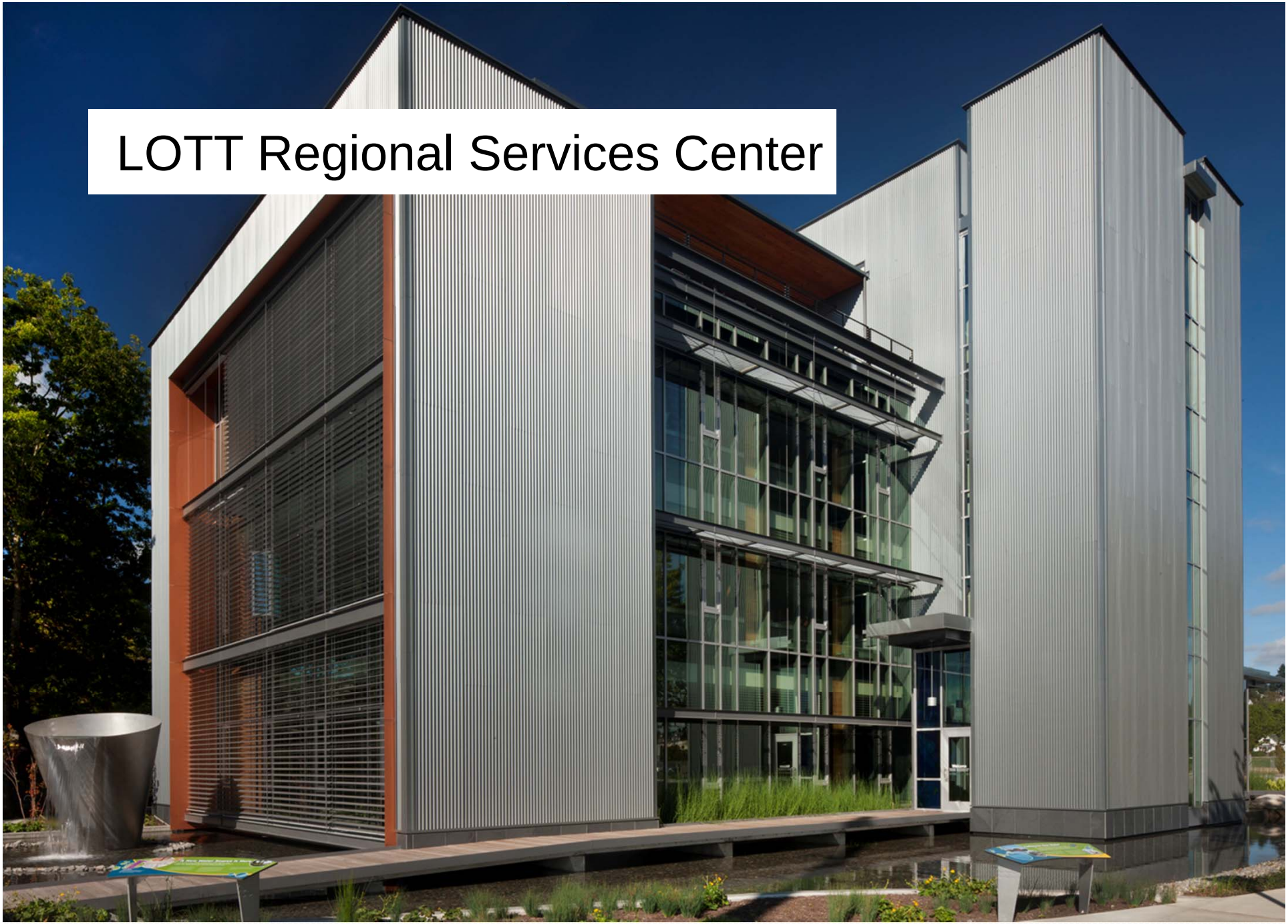
Classroom & Tours

Interpretive Panels

Reclaimed Water
We're using water wisely by irrigating with reclaimed water
Do Not Drink
from this irrigation system
LOTT Alliance

Showcasing the Product

Hawks Prairie Constructed Wetland Ponds and Recharge Basins


LOTT Regional Services Center

Welcome

East Bay
Public Plaza
Demonstration
Wetland

Recharge Basins

Groundwater Infiltration

A Focus on Pharmaceuticals
and Personal Care Products

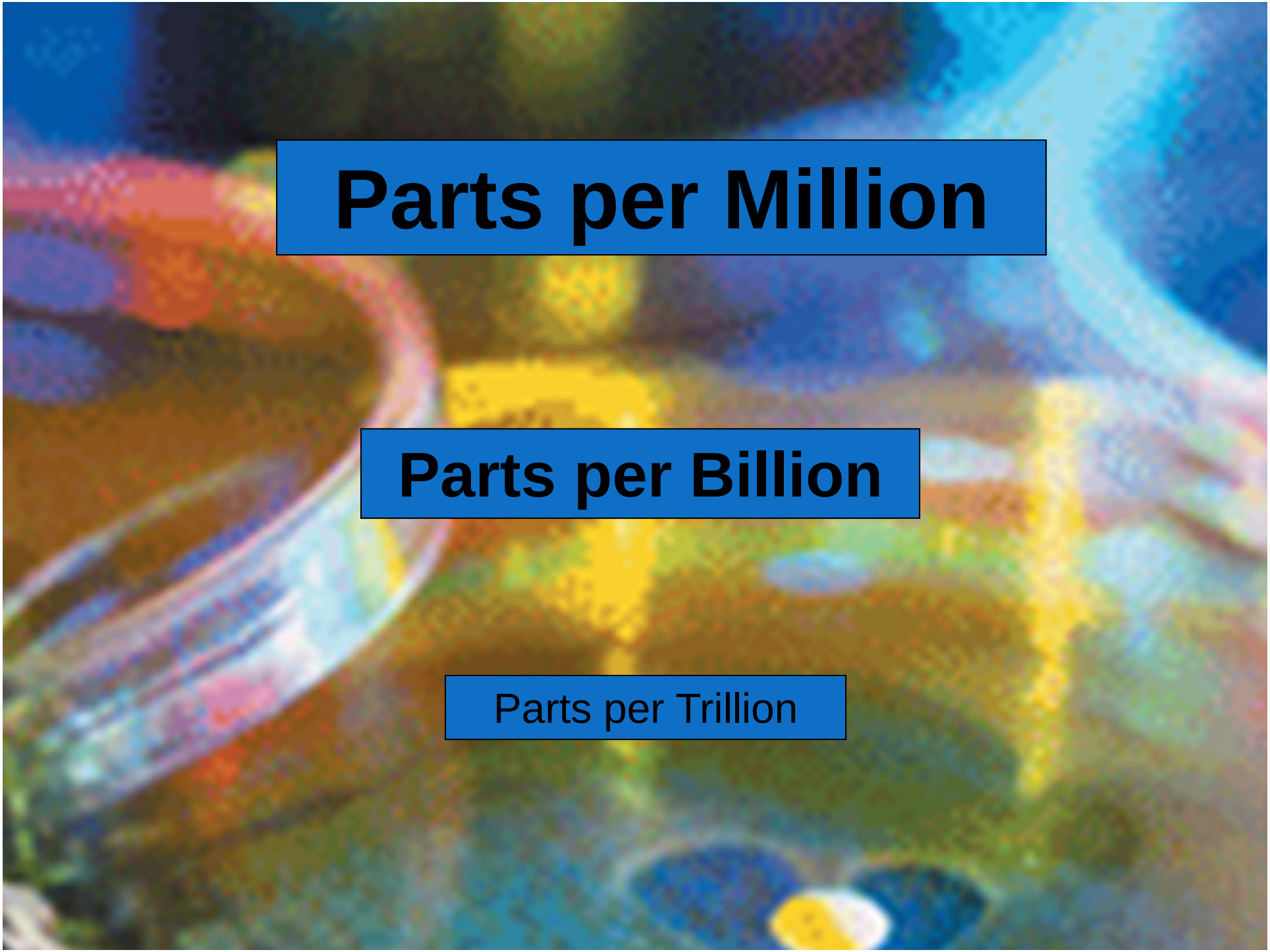
In the News…

Drugs found in fish across nation (Associated Press)

Drugs, household chemicals are a risk 'we haven't fully begun to understand' (The Olympian)

Emerging Environmental Contaminants: Much Debate, Little Consensus (W&ET)

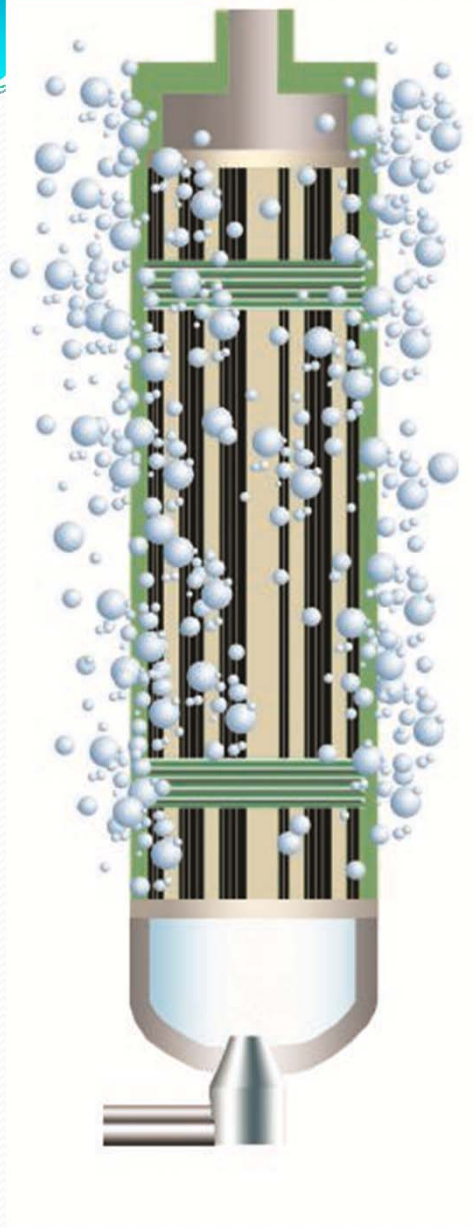
LOTT to test water for pharmaceuticals (The Olympian)


Parts per Million
Parts per Billion
Parts per Trillion

What are the Concerns?

- Our drinking water comes from groundwater
- Community questions and concerns raised about what's still in the water
- Lack of regulations/guidelines to address the concerns
- Lack of local science data to provide answers
- County regulations proposed to prohibit recharge
- Increasing national publicity about the issue

Reclaimed Water
Infiltration Study



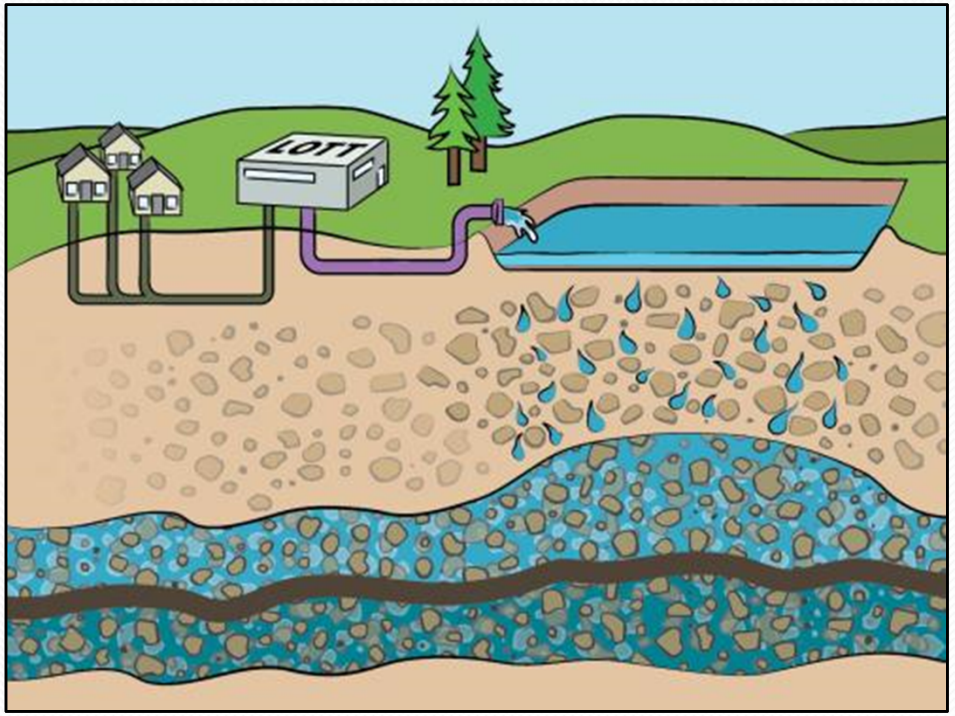
Study Goal

Provide local scientific data and community perspectives to help policymakers make informed decisions about future reclaimed water treatment and uses.

Primary Study Question

What are the risks from infiltrating reclaimed water into groundwater because of chemicals that may remain in the water from products people use every day, and

what can be done to reduce those risks?

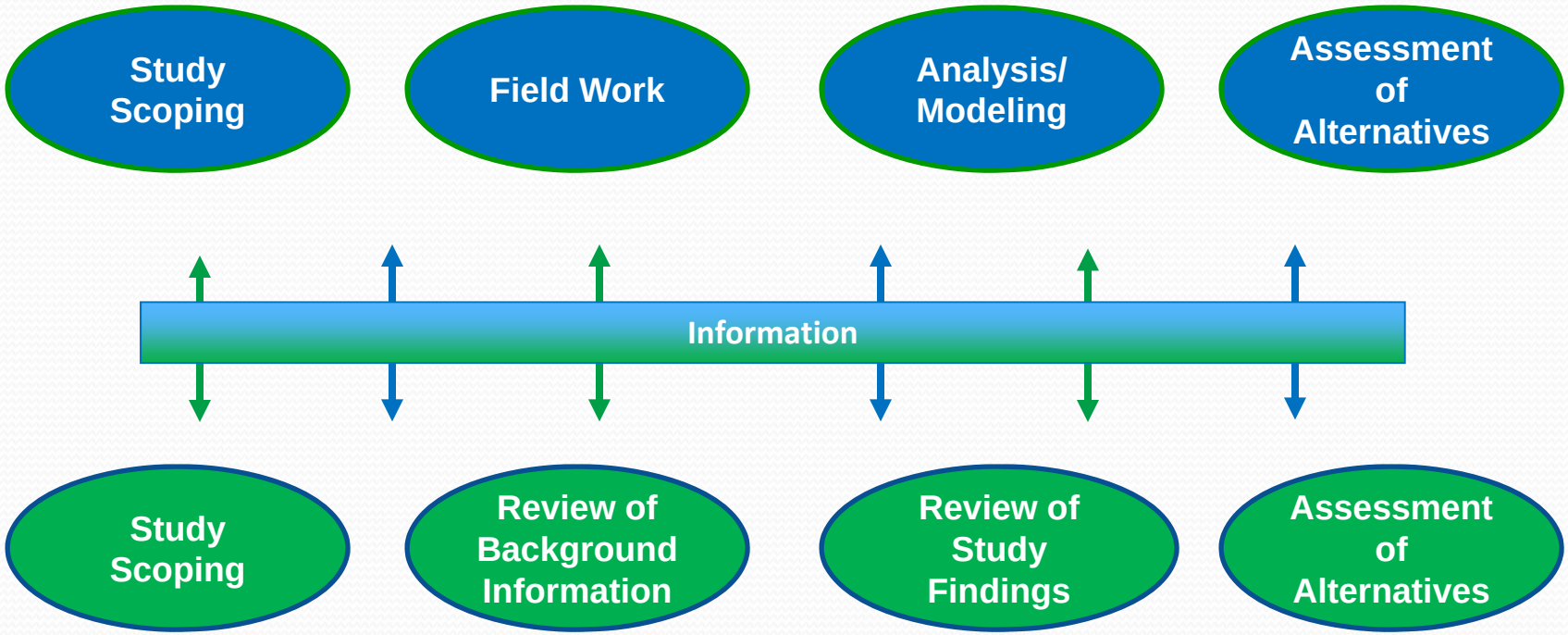


Study Process and Results Must be…

1) Credible
2) Objective
3) Transparent

Study Structure

Science Track



Public Involvement Track

The Players

- **Study Team** – Consultants and LOTT Staff
- **Community Advisory Group** – 16 citizens
- **Science Task Force** – Water resource, hydrogeology, and environmental health staff from 3 cities, the county, and state departments of Ecology and Health
- **Technical Sub-Committee** – Public works directors from the cities and county
- **Board of Directors**

Community Advisory Group

- 16 members
  - Selected by the Board of Directors
  - Cross-section of backgrounds, interests, knowledge, opinions
- Mission
  - Develop understanding of community concerns
  - Ensure those concerns are addressed through the study
  - Guide effective public involvement efforts
- Board Direction to the Committee
  - Be skeptical
  - Ask Questions

Public Opinion Research

Communication Challenges

- Public perception
  - Tendency to view groundwater as pristine
  - Presence of any compounds in the water is bad
- Nature of the topic
  - The more you talk about it, the scarier it gets
- Those concerned get very emotional
- Need to be technically/scientifically accurate, but do it in a way that's understandable to the general public

Communication Materials

LOTT Clean Water Alliance

Reclaimed Water Infiltration Study
Phase 1 (Technical Data Review)

Technical Memorandum – "State of the Science"

May 31, 2013

HDR
606 Columbia Street NW
Suite 200
Olympia, WA 98501
(360) 570-4400

LOTT Clean Water Alliance

Reclaimed Water Infiltration Study
Phase 1 (Technical Data Review)

Memorandum – Case Study Summary

July 26, 2013

Reclaimed Water Infiltration Study

LOTT Clean Water Alliance
Lacey • Olympia • Tumwater • Thurston County

Introduction

LOTT is conducting a study to answer community questions and concerns about residual chemicals that may remain in reclaimed water, and what happens to them when reclaimed water is infiltrated into the ground.

The many household and personal care products we all use, such as medicines, soaps, shampoos, cleaning products, lawn care products, and even some foods, contain a broad variety of chemicals. Some of these chemicals end up in wastewater that gets sent to a treatment plant for cleaning before it is released back to the environment. Most of our wastewater from the Lacey-Olympia-Tumwater area is currently treated at LOTT's Budd Inlet Treatment Plant and discharged to Budd Inlet. Some is treated to reclaimed water standards and reused in the community or infiltrated into the ground where it mixes with groundwater, our region's source of drinking water. Infiltrating reclaimed water to groundwater is a key part of our communities' long-range plan for managing wastewater into the future.

Study Goal

The goal of the Reclaimed Water Infiltration Study is to provide local scientific data and community perspectives to help policymakers make informed decisions about future reclaimed water treatment and uses.

The key question that the Reclaimed Water Infiltration Study is intended to answer is:

What are the risks from infiltrating reclaimed water into groundwater because of chemicals that may remain in the water from products people use every day, and what can be done to reduce those risks?

Study Structure

The Reclaimed Water Infiltration Study is a dual track study focusing on science and public engagement.

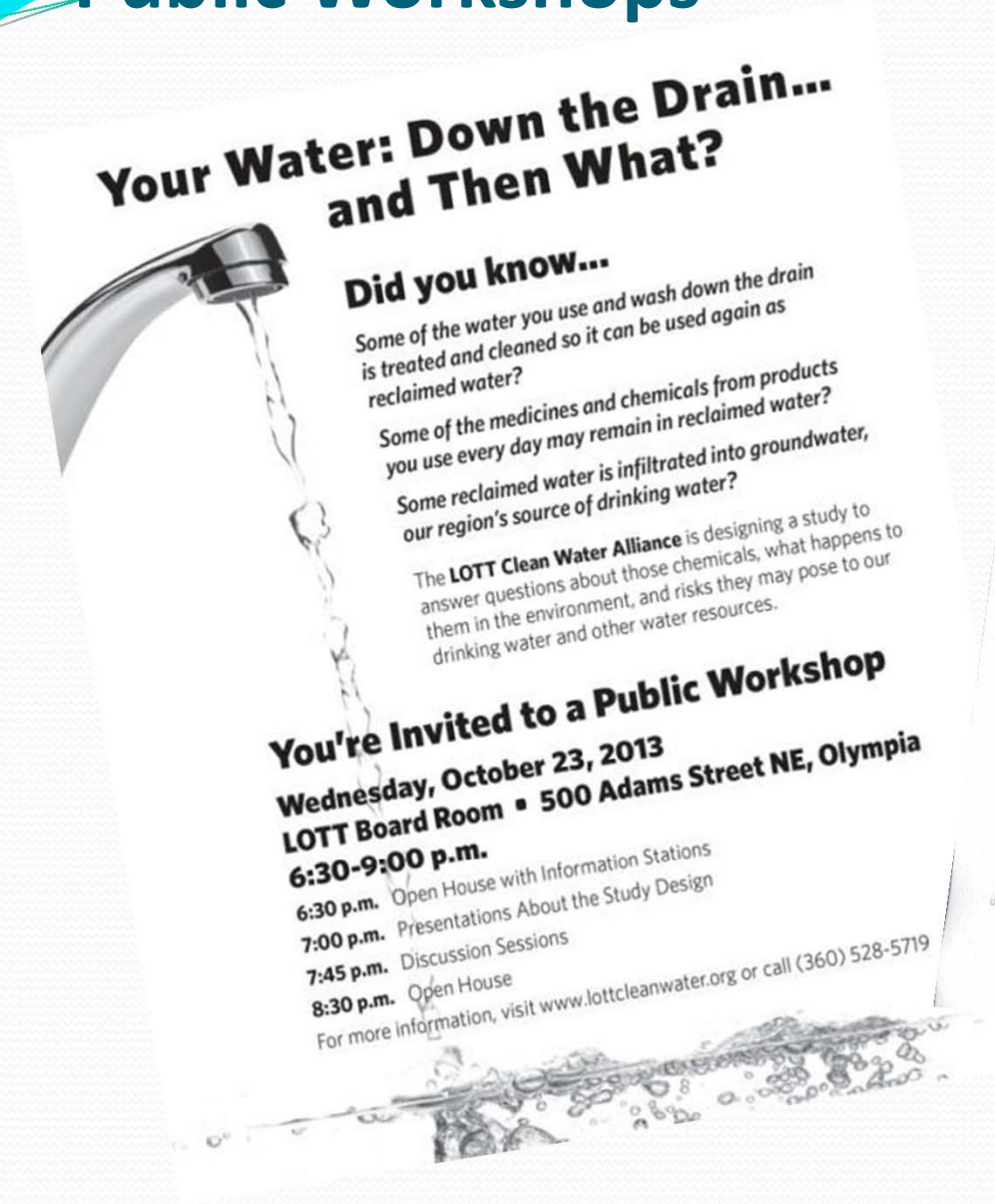
- The scientific portion of the study will provide local data about potential risks from infiltrating reclaimed water into groundwater.
- Public engagement will encourage community conversations about what can be done to reduce those risks.

Both the scientific data and the community perspectives are essential for meeting the study's goal.

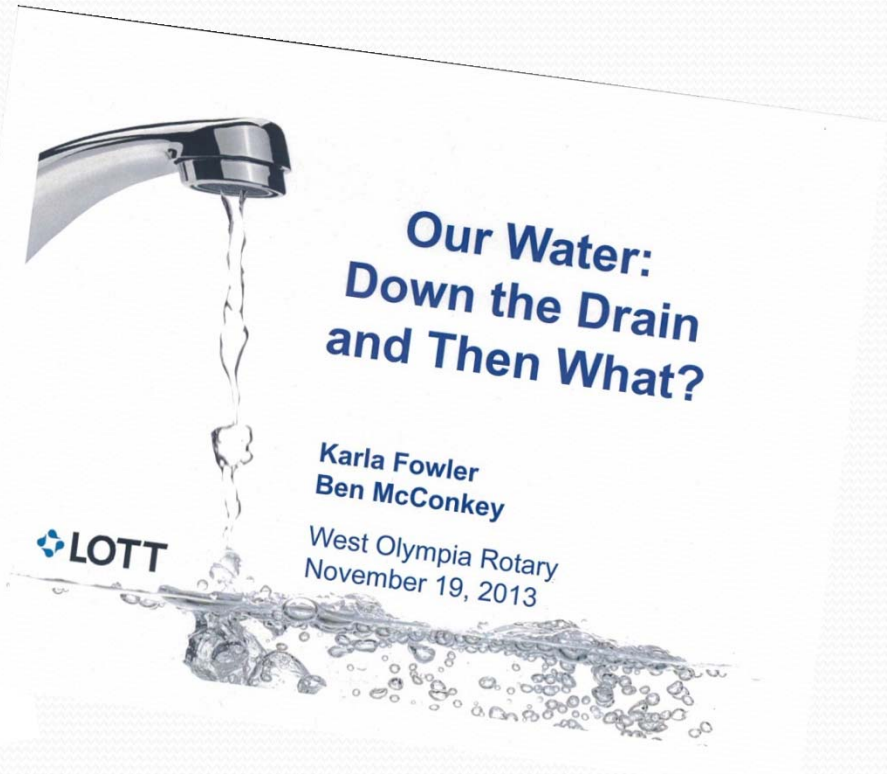
groundwater recharg

home

Public Workshops



Group Presentations



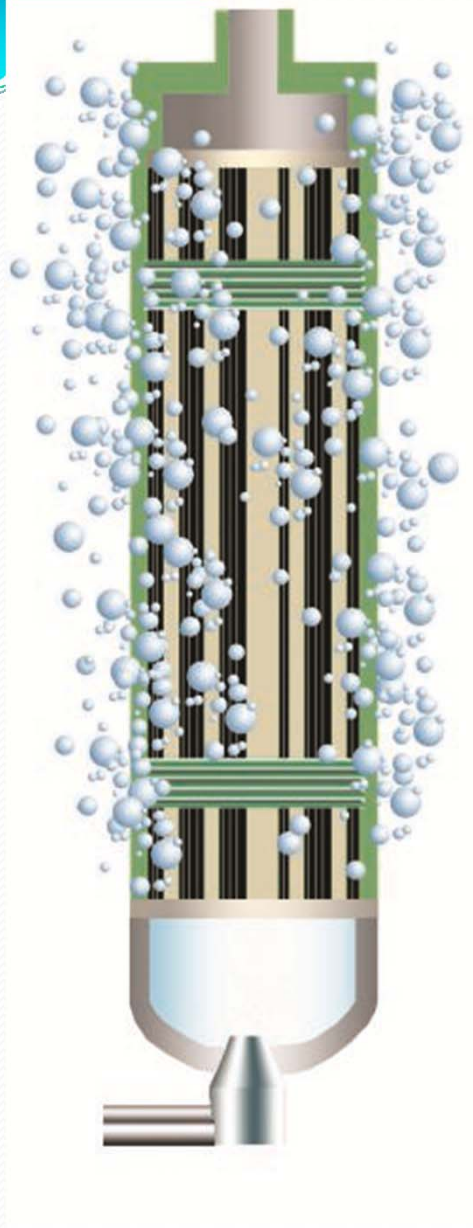
Independent Peer Review Panel

National Water Research Institute

Creating New Sources of Water...

Groundwater Recharge

The Science



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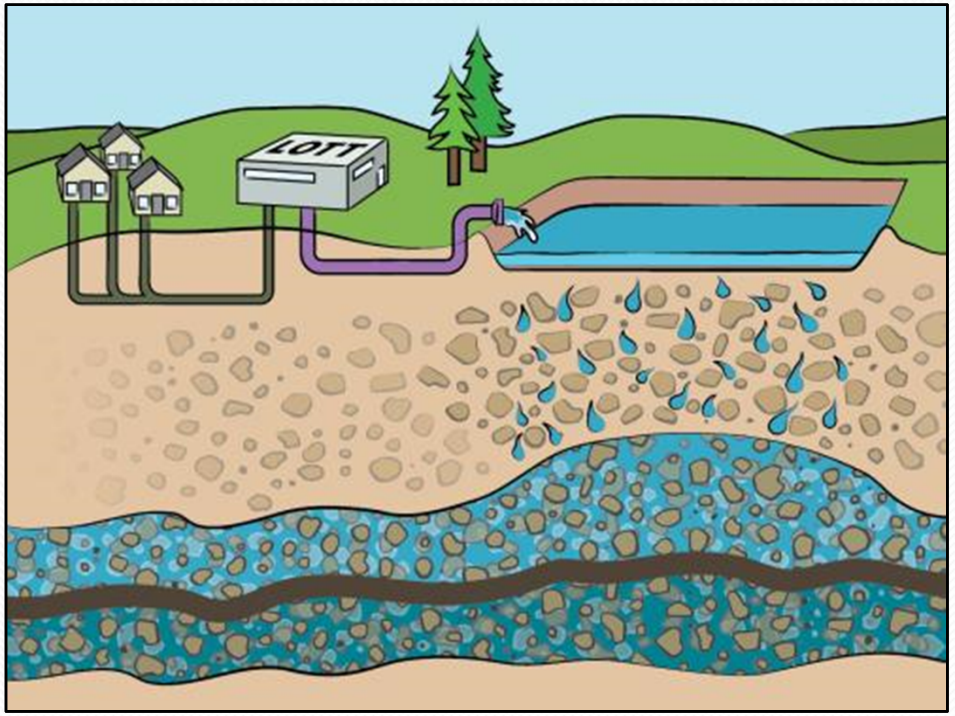


Key Questions

(Foundation for the Study Framework)

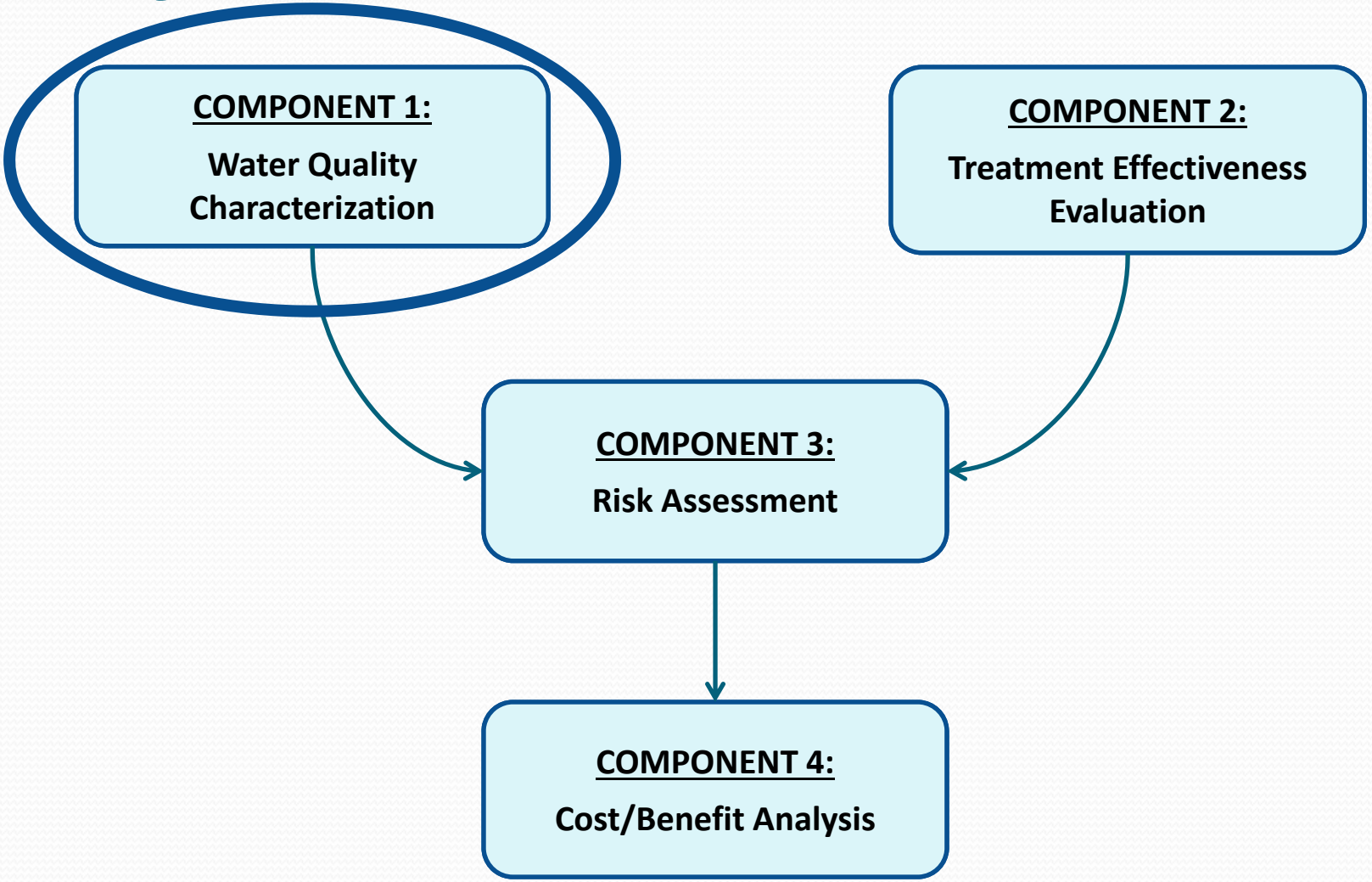
1) **What is the current quality of our local waters: groundwater, surface waters, drinking water, wastewater, and reclaimed water?**

2) **What happens to reclaimed water that is infiltrated to groundwater: where does it travel and how quickly, and how does the quality change over time?**

3) **What are the relative risks of replenishing groundwater with reclaimed water?**

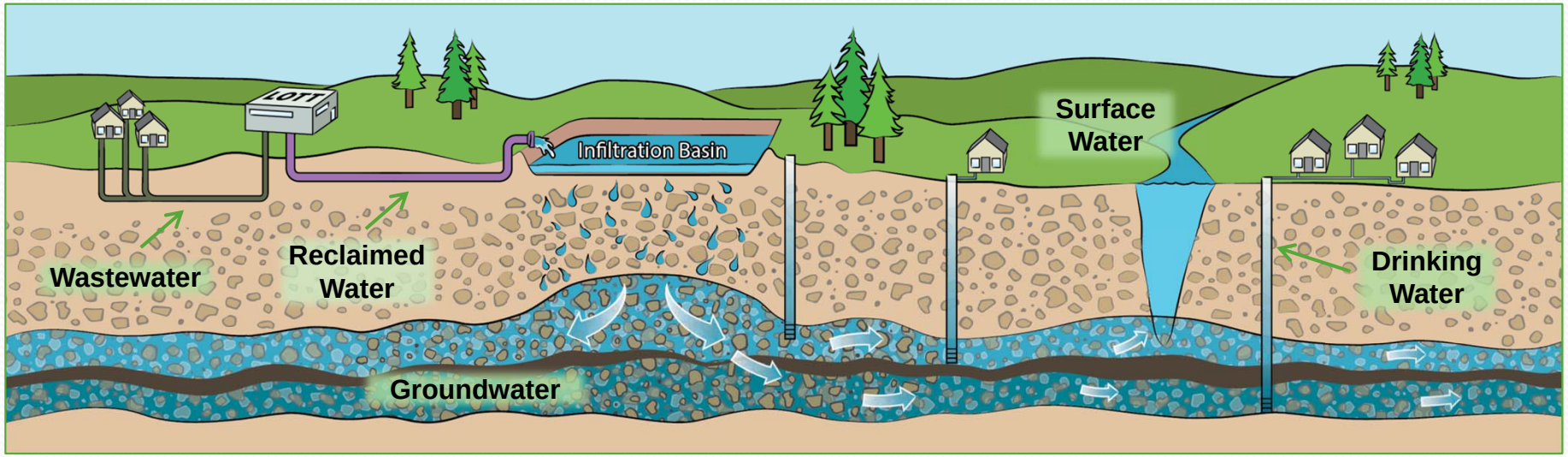
4) **What are the costs and benefits of various approaches for treating and using reclaimed water?**

Study Framework



Component 1:

Water Quality Characterization



- Measure water quality
- Define existing (background) conditions
- Data will be used in Risk Assessment (Component 3) to evaluate relative risks associated with exposure to current groundwater and surface water compared with exposure to water influenced by reclaimed water infiltration

Water Quality Characterization:

What should we look for?

Water Quality Characterization
Proposed Parameter List

Regulated Parameters

- Pathogens (coliform bacteria, viruses)
- Nutrients (nitrogen, phosphorus)
- Drinking Water Parameters (inorganics, metals, etc.)
- Other (temperature, dissolved oxygen, etc.)

Unregulated Parameters (Residual Chemicals)

- Medicines (anti-seizure, analgesics, antibiotics)
- Personal Care Products / Foods (sucralose, caffeine, anti-microbials)
- Hormones (estrogenic, steroid)
- Household Chemicals (flame retardants, pesticides)
- ~100 unregulated chemicals in total

Examples

- Medicines
  - Analgesics (ibuprofen, acetaminophen)
  - Anti-seizure (dilantin, carbamazepine)
- Personal Care Products / Foods
  - Anti-bacterials (triclosan)
  - Sweeteners (sucralose)
- Other
  - Estrogenic hormones
  - Herbicides (2,4-D)
  - Flame retardants (TCEP)

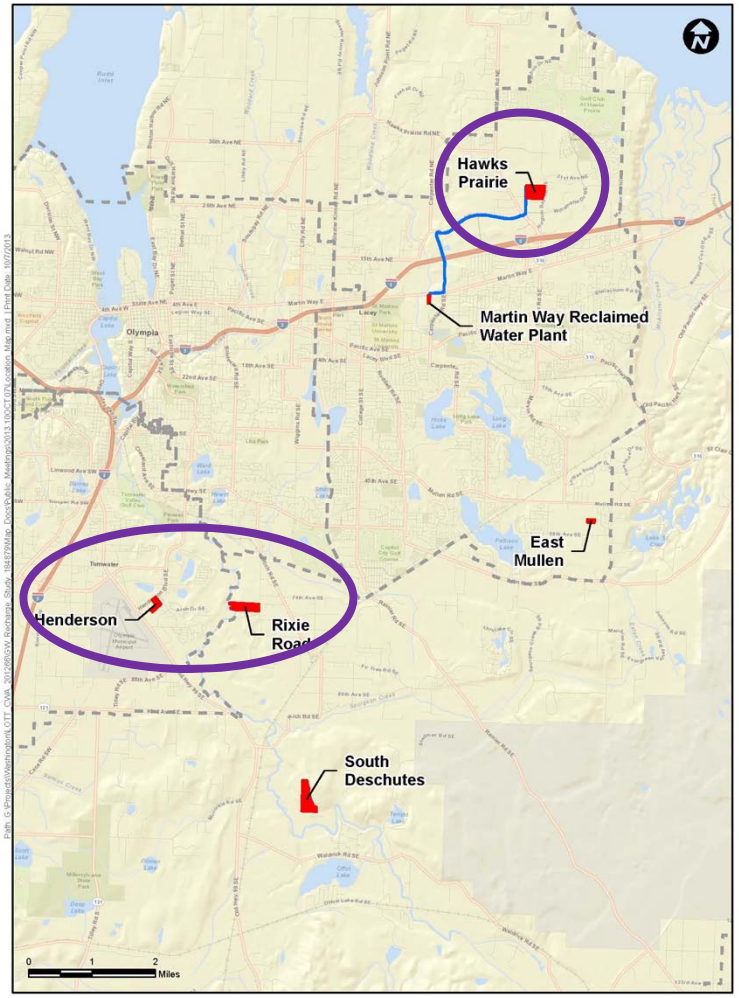
Water Quality Characterization:

Where should we look?

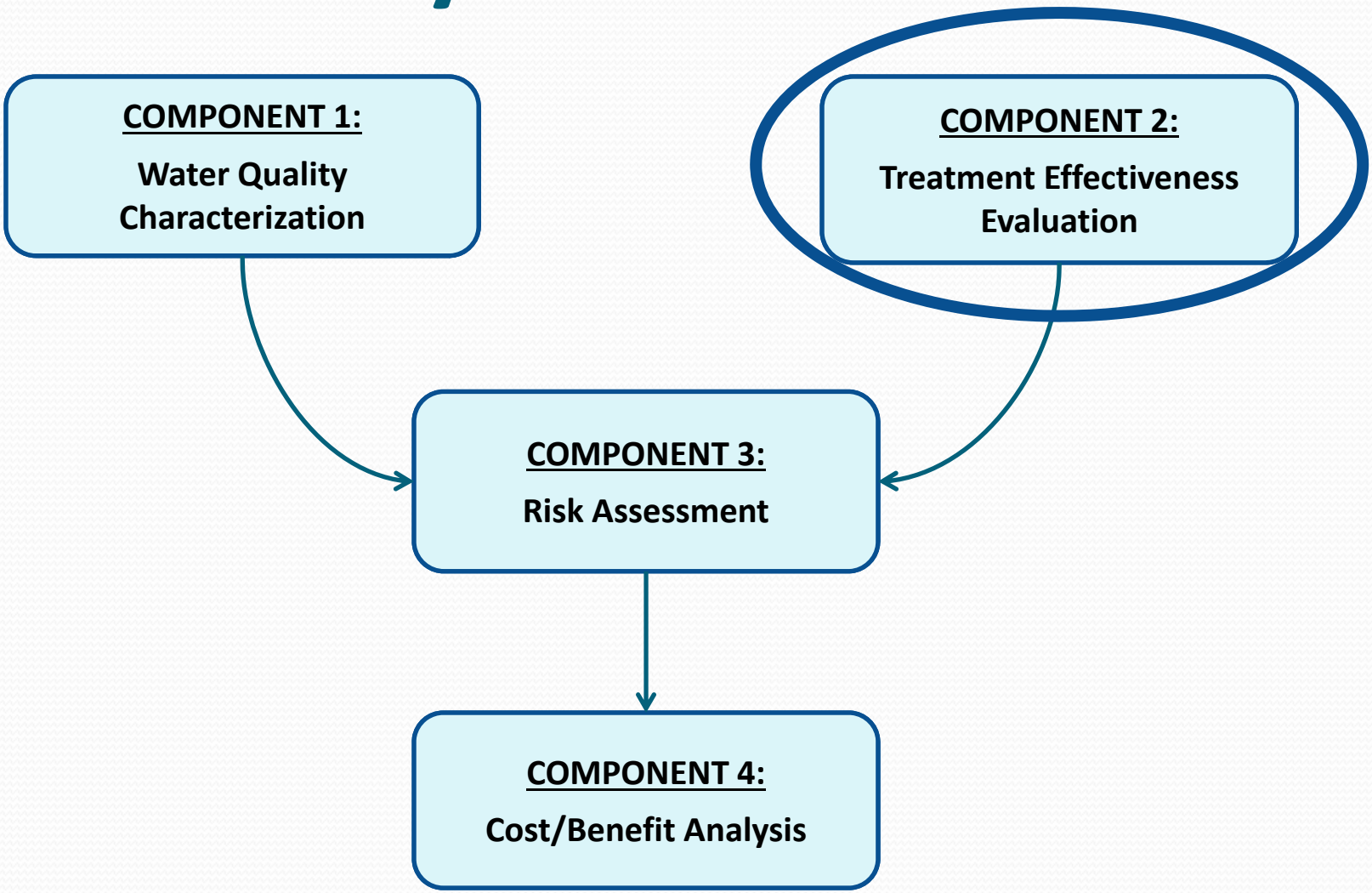
Groundwater Quality Characterization

- Evaluate groundwater quality at:
  - Hawks Prairie (existing recharge facility)
  - Another potential recharge site
- Sampling plan (in each area)
  - 10-30 domestic wells
  - 5-10 municipal/community wells
- Determine if there are residual chemicals or other contaminants in groundwater.
- Provide context and background information to support Risk Assessment.

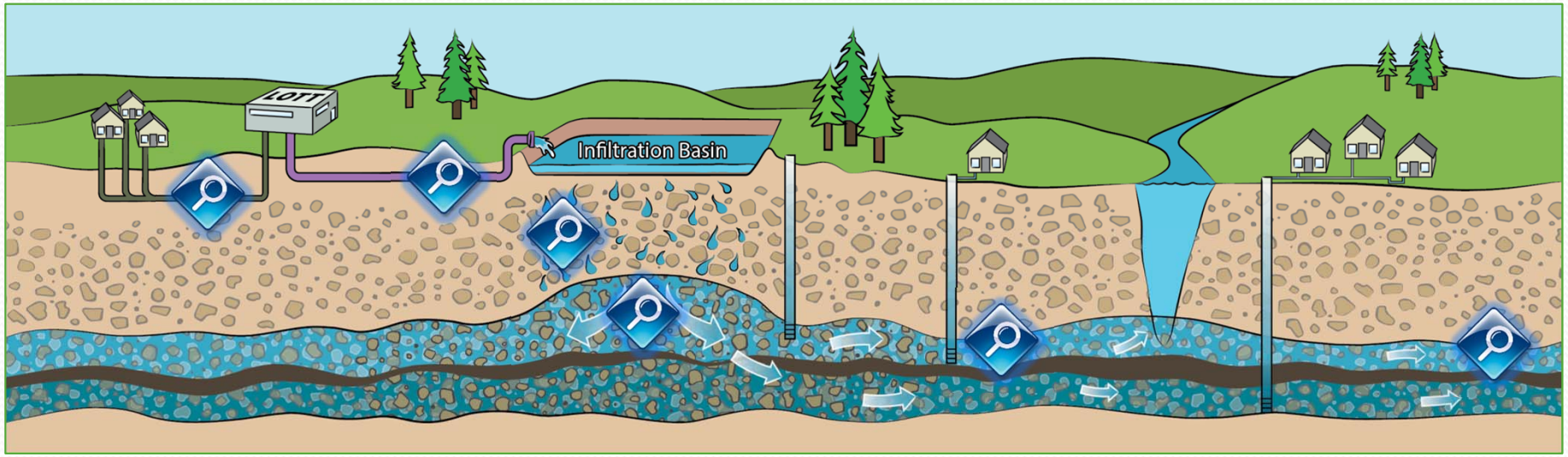
LOTT Groundwater Recharge Sites



Study Framework



Component 2:
Treatment Effectiveness Evaluation

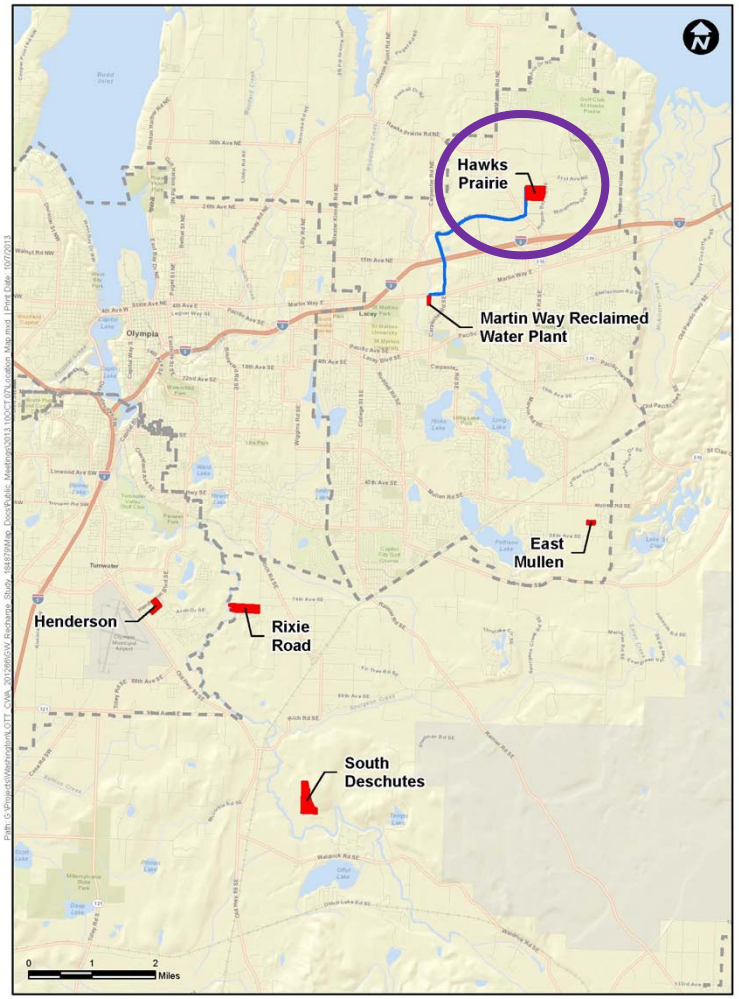


- Measure water quality at various steps within the treatment process (prior to and after infiltration)
- Identify which residual chemicals remain in reclaimed water that is infiltrated to groundwater
- Requires extensive field work to understand groundwater movement and chemistry

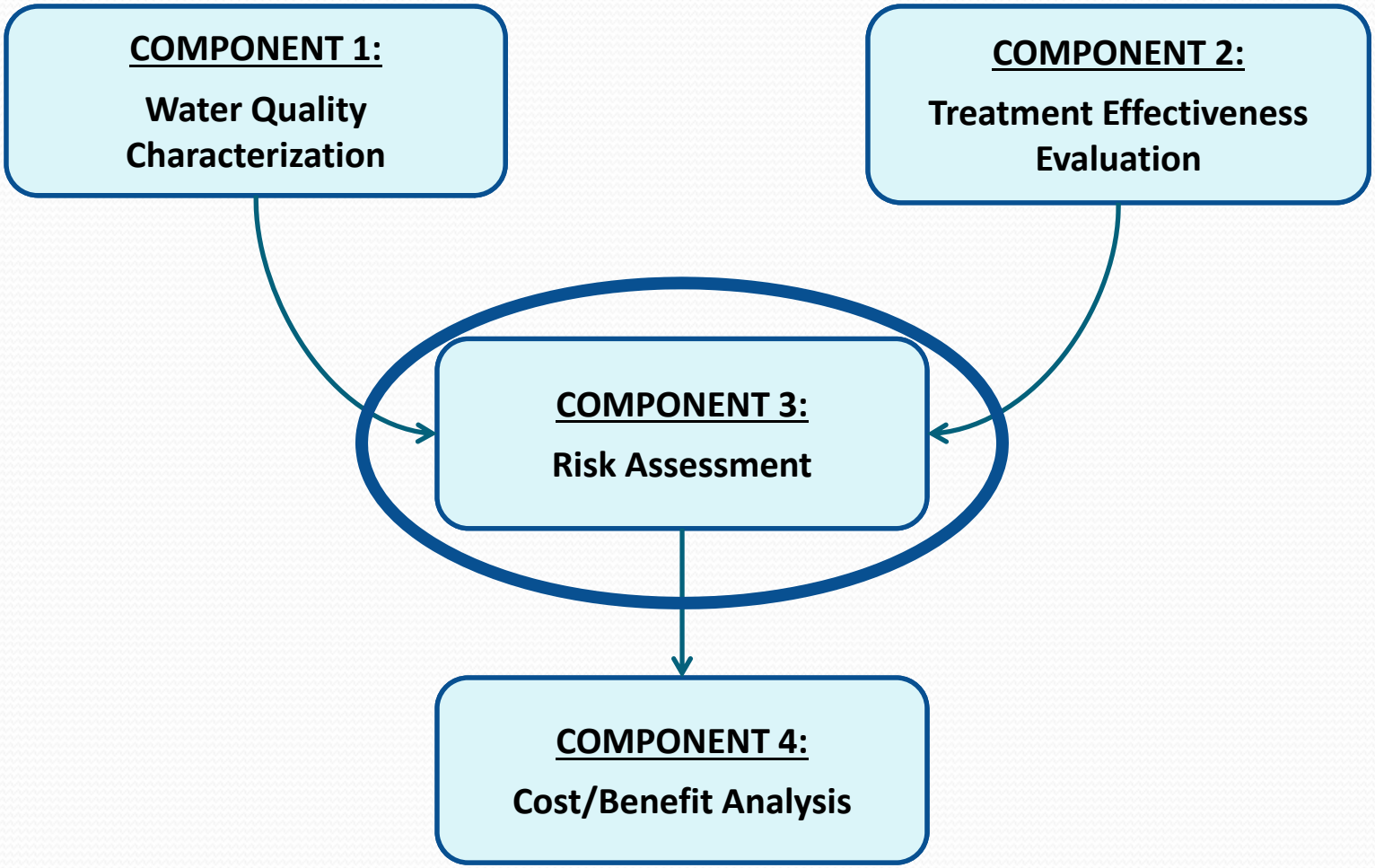
Outline of Tasks

- **Hawks Prairie Site** (LOTT's active infiltration facility)
  - Conduct tracer test (physically track reclaimed water movement underground)
  - Update computer model
  - Characterize reclaimed water flow paths and travel times
  - Characterize residual chemical concentrations in groundwater beneath and downgradient from the infiltration basins

LOTT Groundwater Recharge Sites



Study Framework



Component 3:

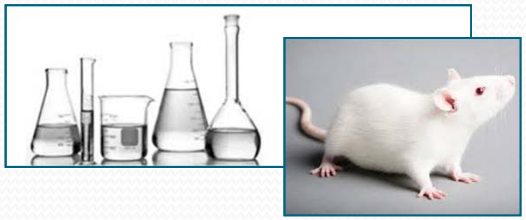
Risk Assessment

1) Determine which residual chemicals pose a risk.

2) Identify who is potentially at risk.
   - Human Health
   - Ecological Health

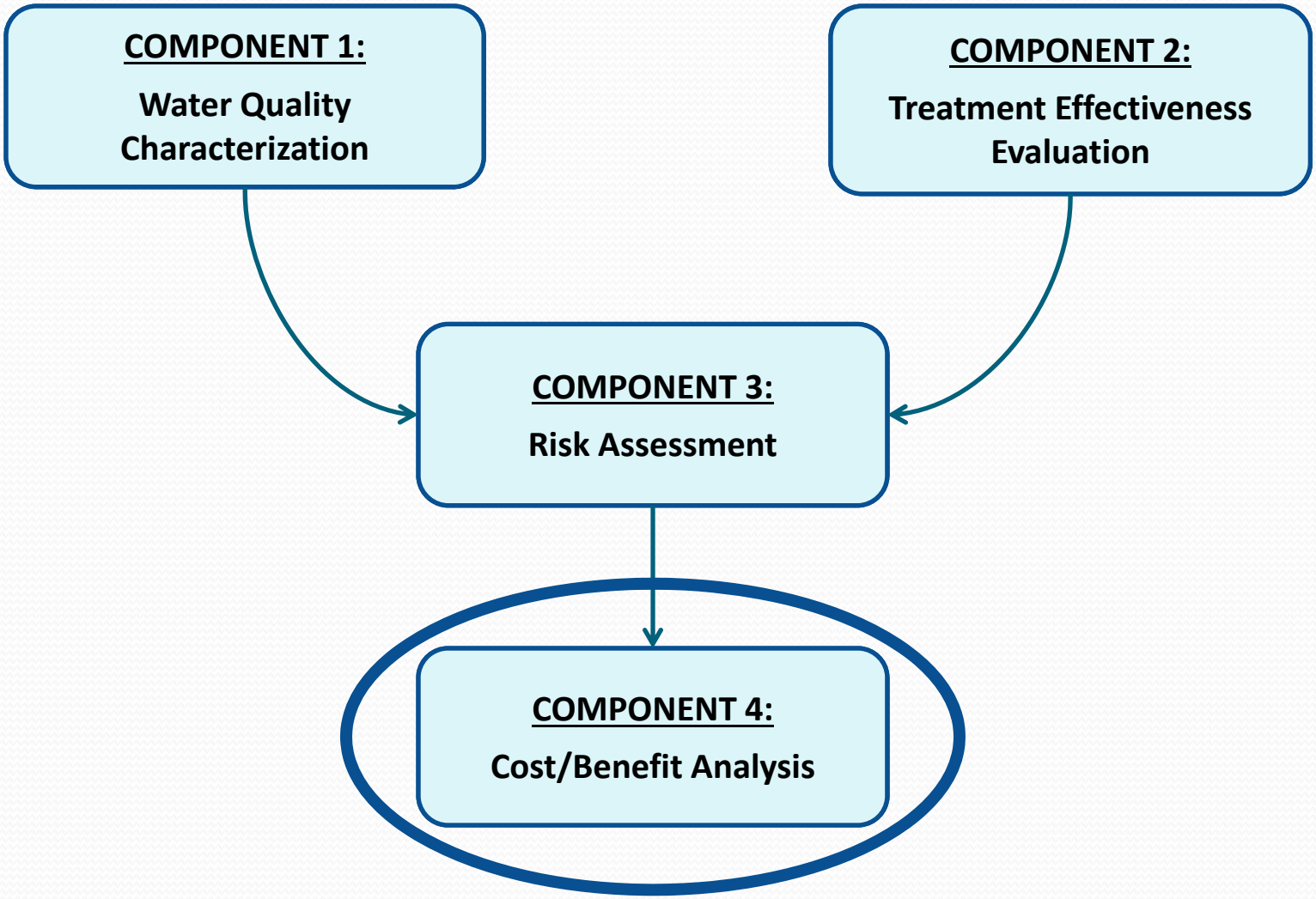
3) Identify available toxicological data.

4) Compare measured chemical concentrations with threshold levels that define risk.



5) Approach is based on USEPA developed risk assessment frameworks.

Study Framework

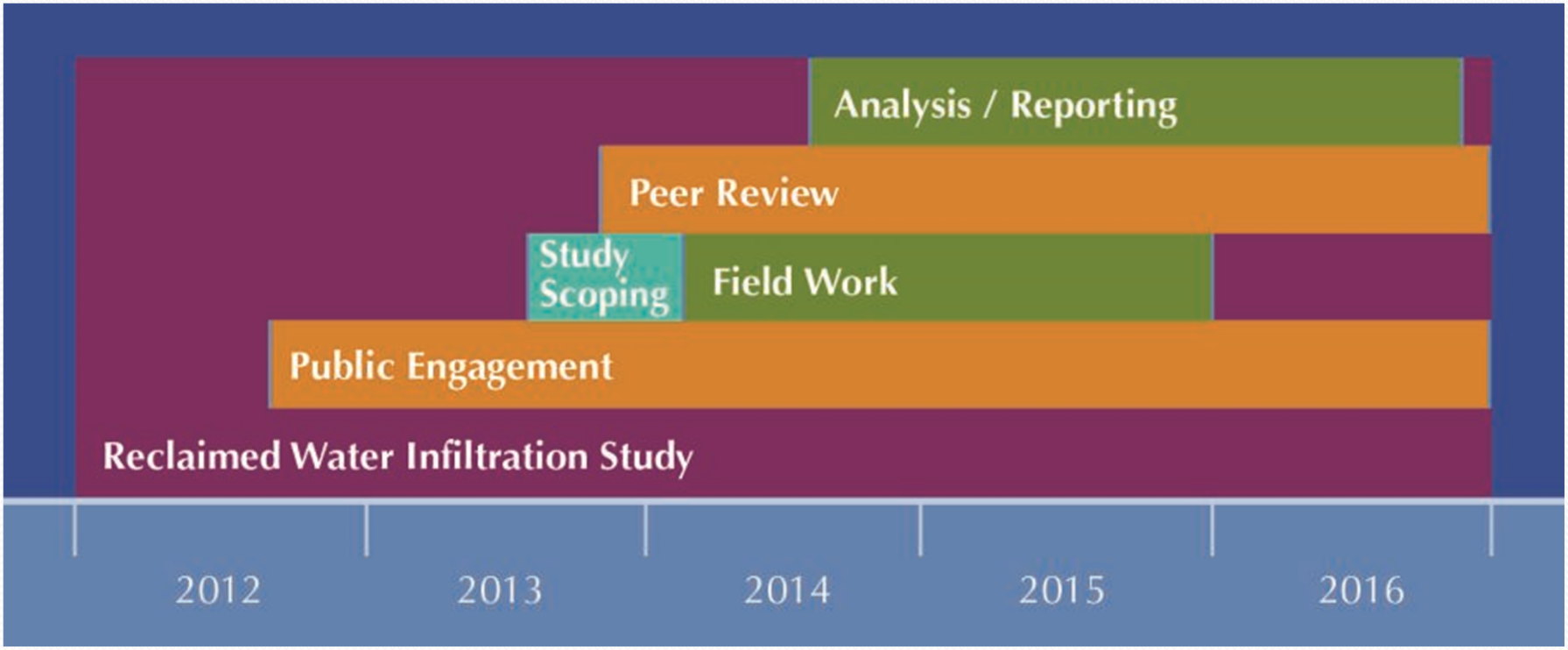


Component 4:

Cost/Benefit Analysis

- Reclaimed water treatment alternatives
  - Class A (current level of treatment)
  - Class A + Advanced Treatment
- Other types of reclaimed water uses
  - Irrigation - Parks / Golf Courses
  - Streamflow Augmentation
  - Recreational Water Features
- Compare life-cycle costs with the risk reduction benefits associated with each treatment alternative

Study Timeline



The Study

Field Work To Date

Initial Activities: Hawks Prairie

Purpose

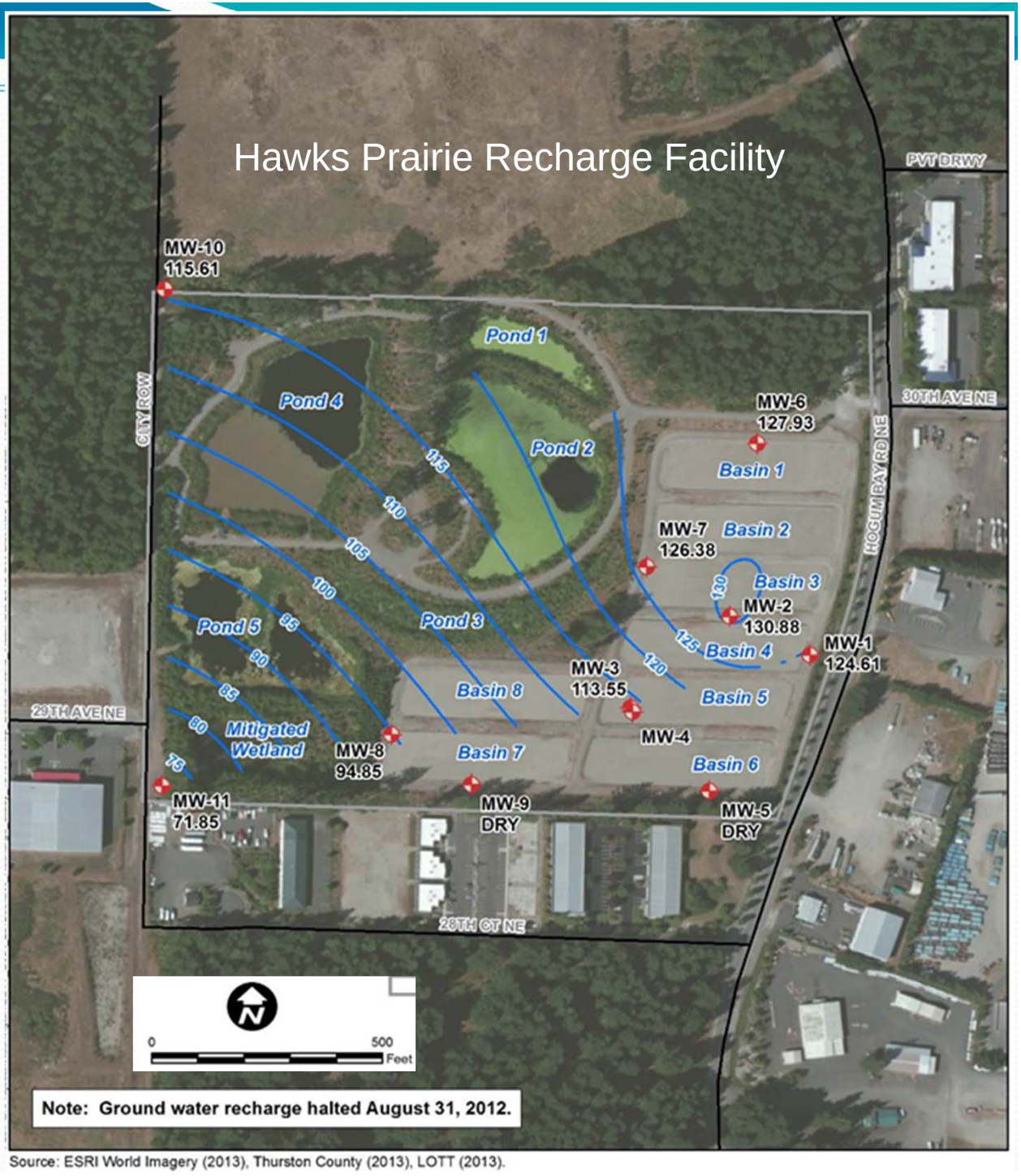
- Characterize “background” groundwater quality
- Preliminarily assess on-site travel time of infiltrated reclaimed water
  - Support design of larger-scale tracer test (e.g., additional well locations)

Approach

- One “background” groundwater quality sampling event (Nov 2013)
  - No recharge for 15 months prior to sampling (since Aug 2012)
- Groundwater monitoring during startup of infiltration
  - Three months of study beginning with facility operation restarting (Feb 2014)

Background Water Quality

- 1 sampling event (Nov 2013); 8 wells
- Analyzed for ~100 residual chemicals
- Detected 13



Source: ESRI World Imagery (2013), Thurston County (2013), LOTT (2013).

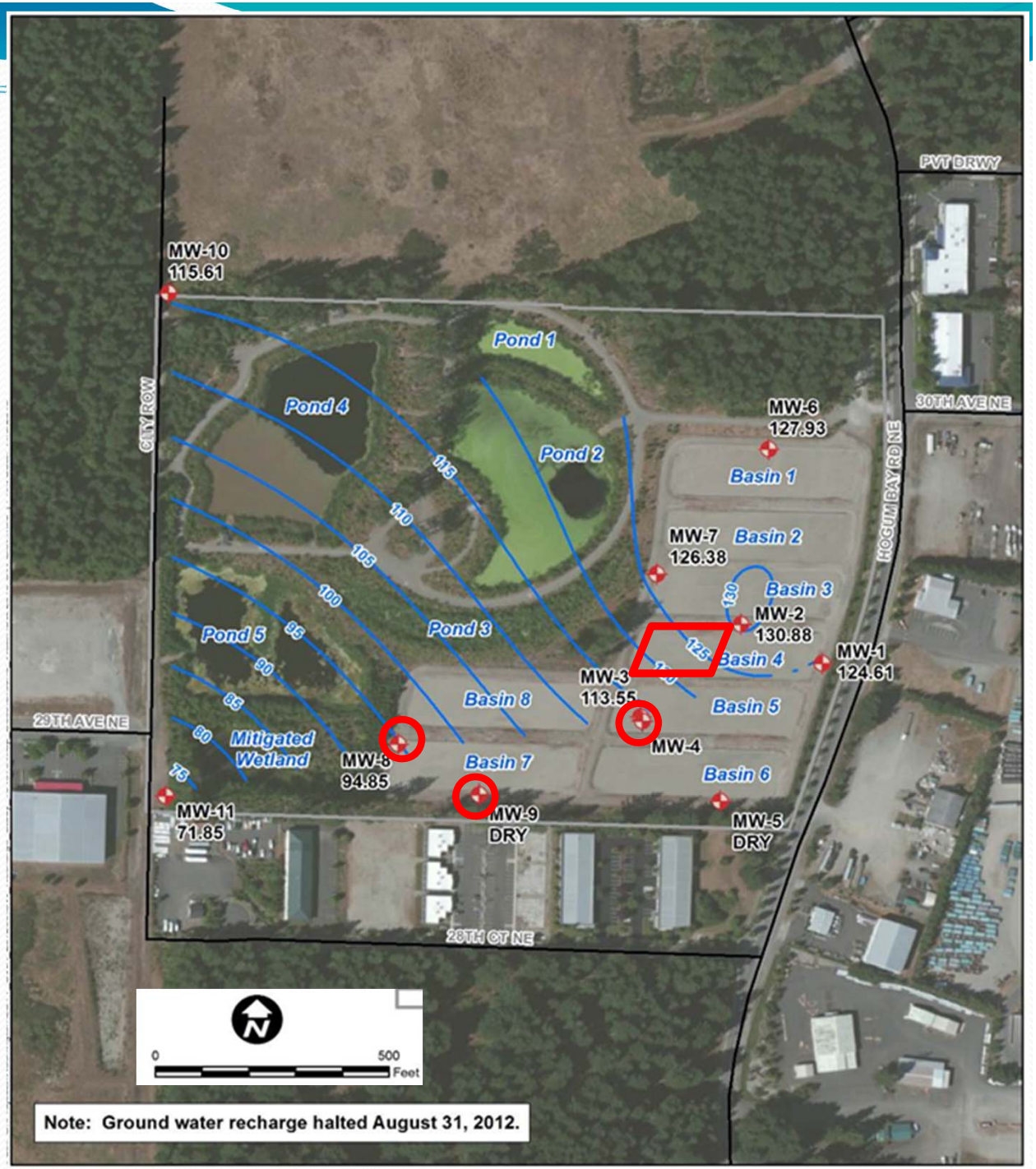
Detected Residual Chemicals (Nov 2013)

Chemical Name	Detects [a]	Concentration (ng/L) [b]
Pharmaceuticals		
Albuterol (anti asthmatic)	2	16 – 31
Carbamazepine (anti seizure)	5	9 – 78
Dehydronifedipine (blood pressure drug)	2	6 – 22
Primidone (anti convulsant)	4	10 – 52
Sulfamethoxazole (antibiotic)	4	35 – 110
Personal Care Products		
1,4-Dioxane (solvent, e.g. in cosmetics)	3	116 – 396
Bisphenol A (plasticizer)	1	22 – 53 (results from 2 methods)
DACT (triazine used in resins, pesticides)	1	8
Nonylphenol Monoethoxylate (emulsifier)	1	130
Flame Retardants		
TCEP	2	13 – 36
TDCPP	1	960
Sugar Substitutes		
Acesulfame-K	8	820 – 23,000
Sucralose	8	270 – 10,000

Notes: (a) 8 wells sampled in total; (b) ng/L = nanograms per liter (parts per trillion)

Startup Monitoring

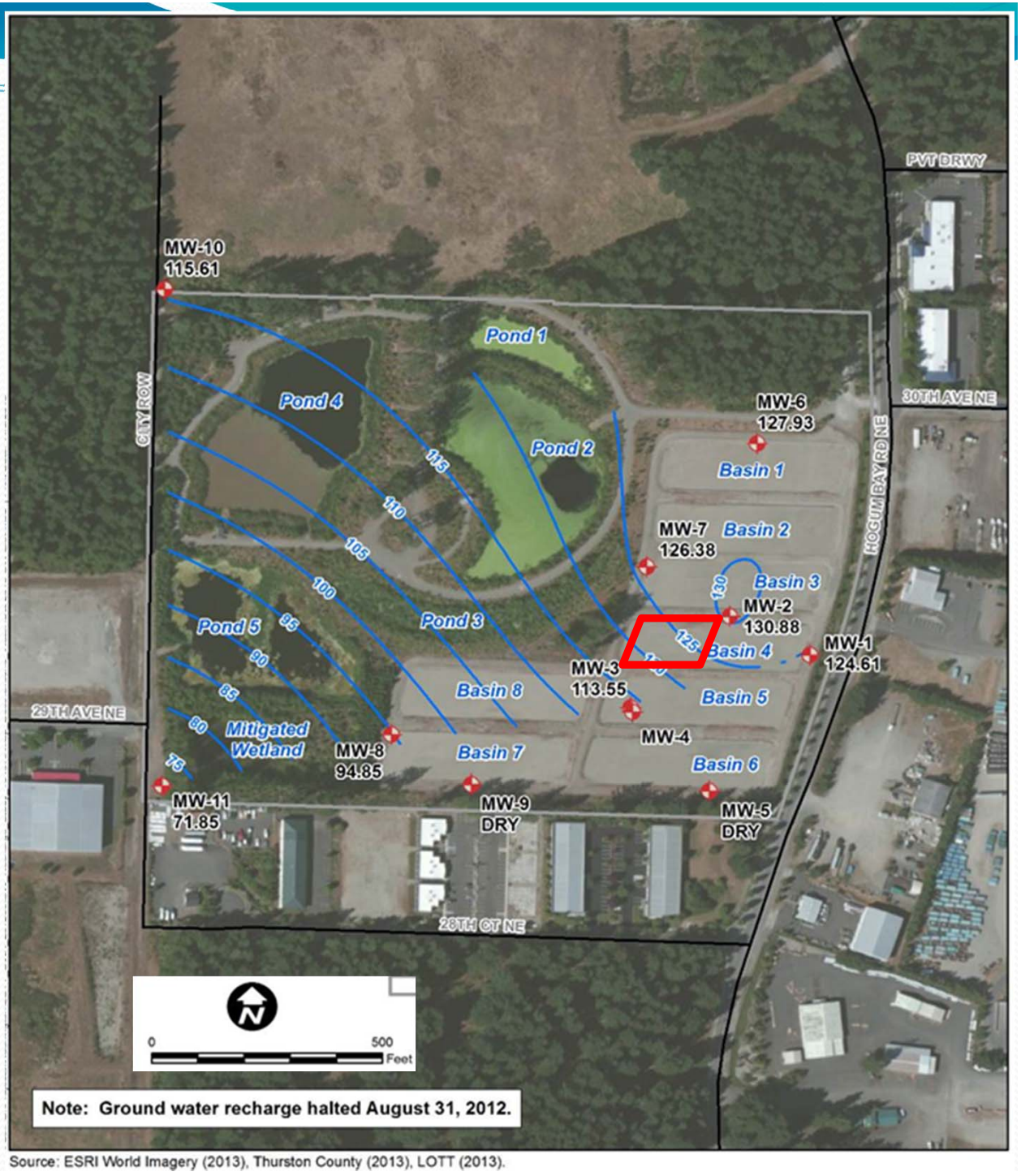
- Flow concentrated in ½ of Basin 4
- Continuous in-well monitoring
  - Groundwater levels
    - 10 wells
  - Conductivity & Temperature
    - 3 wells



Source: ESRI World Imagery (2013), Thurston County (2013), LOTT (2013).

Water Quality Monitoring

- 10 wells
- Parameters
  - Total Organic Carbon
  - Nitrogen
  - Chloride
  - Total Dissolved Solids
- Schedule
  - Infiltration restarted February 17 (~0.6 mgd)
  - 4 sampling events (at 2, 4, 8, 12 weeks)



Basin 4 (looking SE, divider berm on left)

Basin 4 (looking SE, stilling well in foreground)

Basin 4 (looking E)

(3/6/14)

(3/18/14)

Questions?

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