

Adventures in Studying the Fate of Residual Chemicals in Reclaimed Water Infiltrated to Groundwater

PNWS-AWWA Conference
May 9, 2014

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Reclaimed Water in Our Communities

Responsive to Public Values

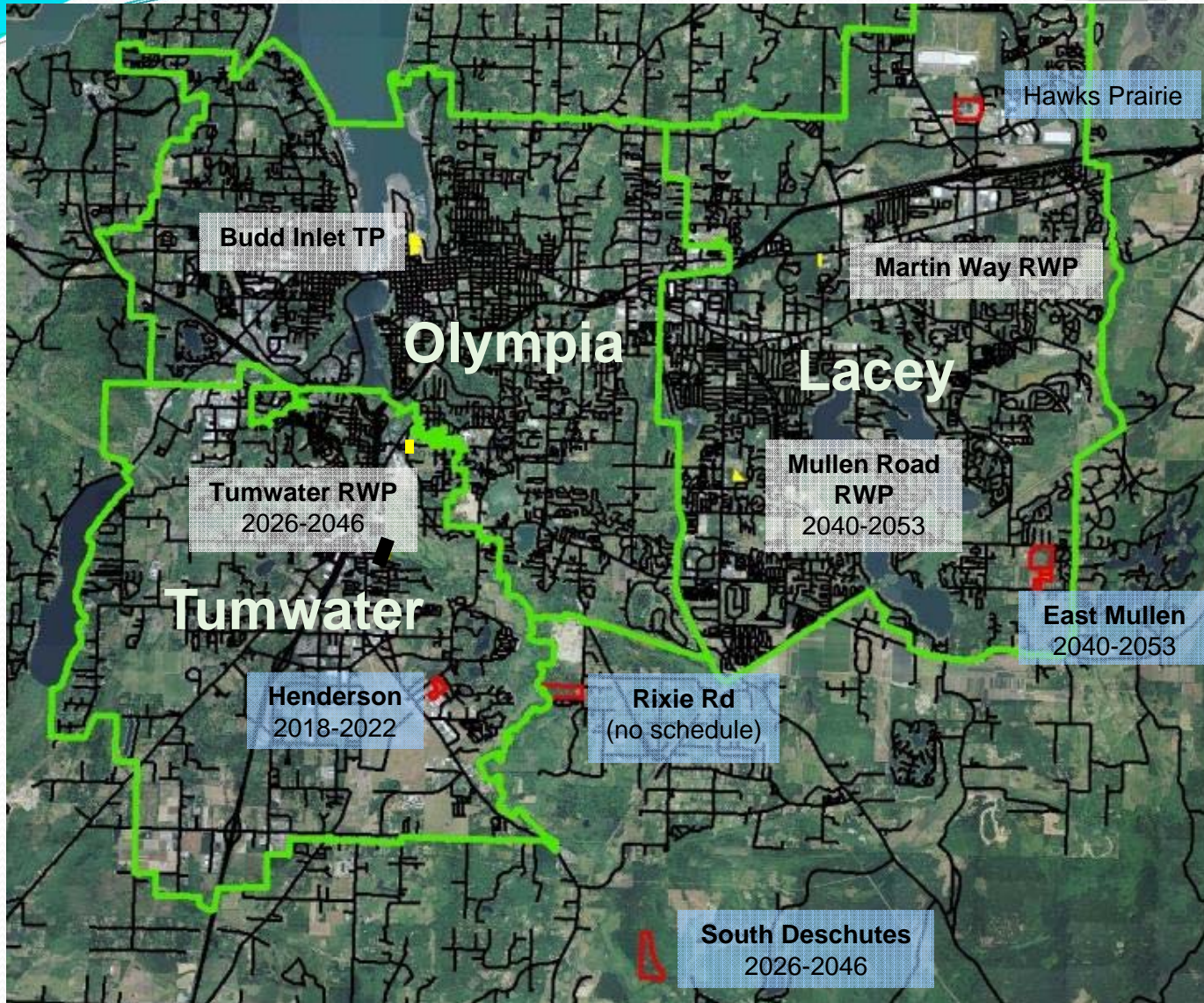
Public Values

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.

The Values, the Plan





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



Showcasing the Product



**Hawks Prairie
Constructed Wetland Ponds
and Recharge Basins**

LOTT Regional Services Center







**East Bay
Public Plaza**

**Demonstration
Wetland**





Water Conservation Department



The Right Water for the Right Use

We're using water wisely by irrigating with reclaimed water



Do Not Drink from the Irrigation System

LOTT Alliance

Groundwater Recharge

A Focus on Pharmaceuticals
and Personal Care Products

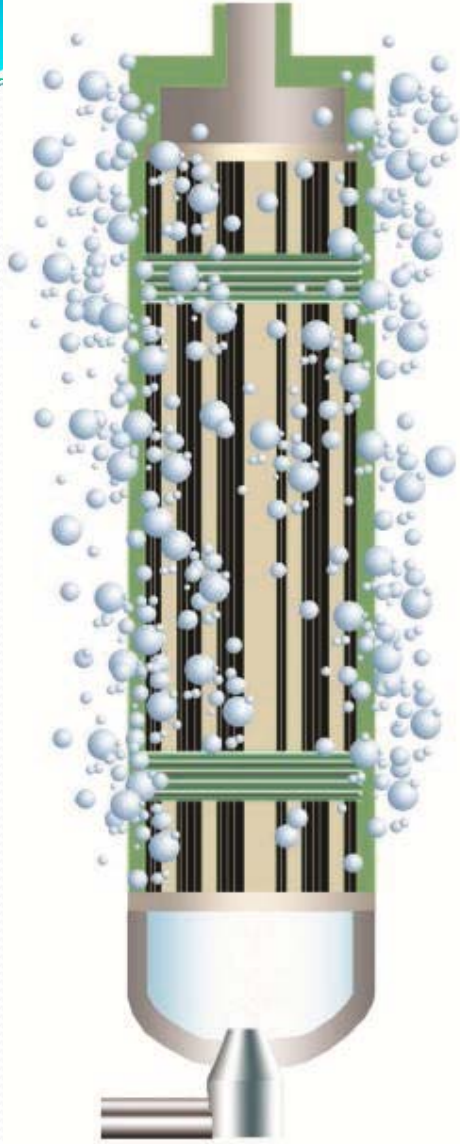
What are the Concerns?

- 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

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



**Groundwater Recharge
Scientific Study**

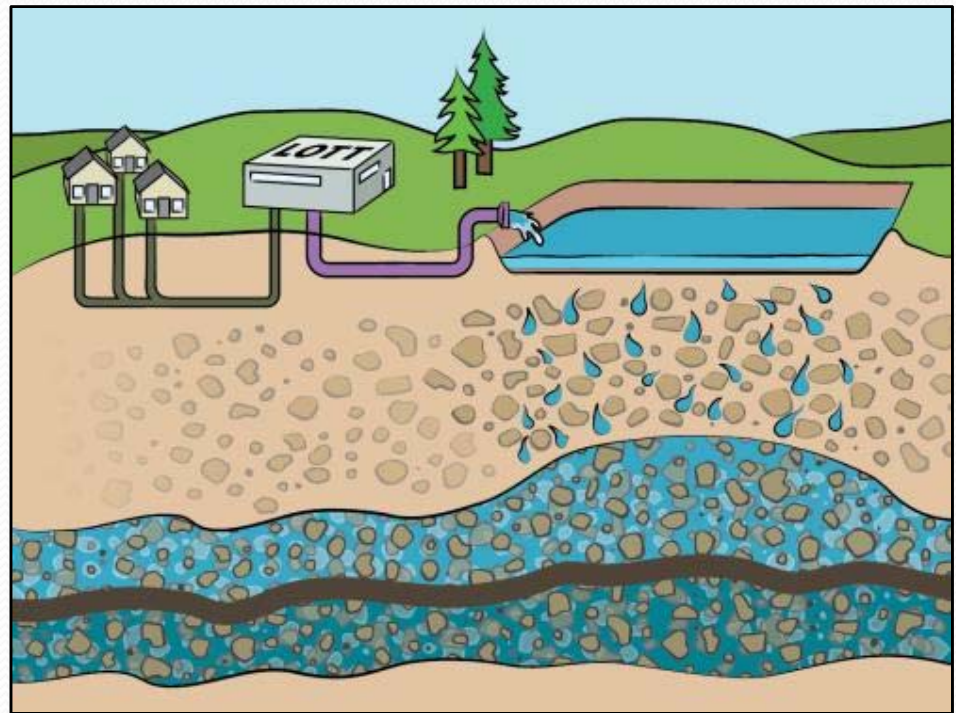


Study Goal

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?



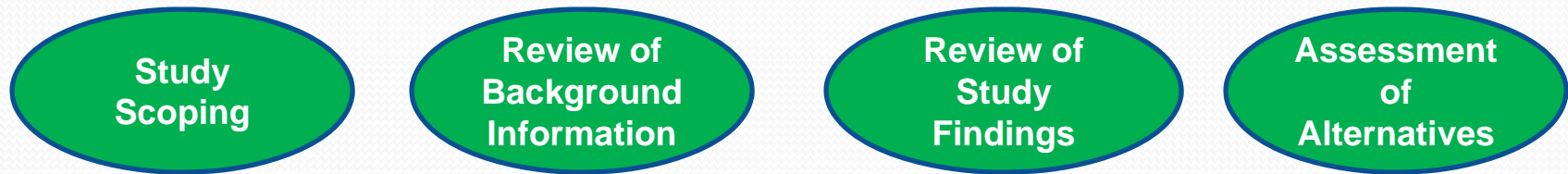
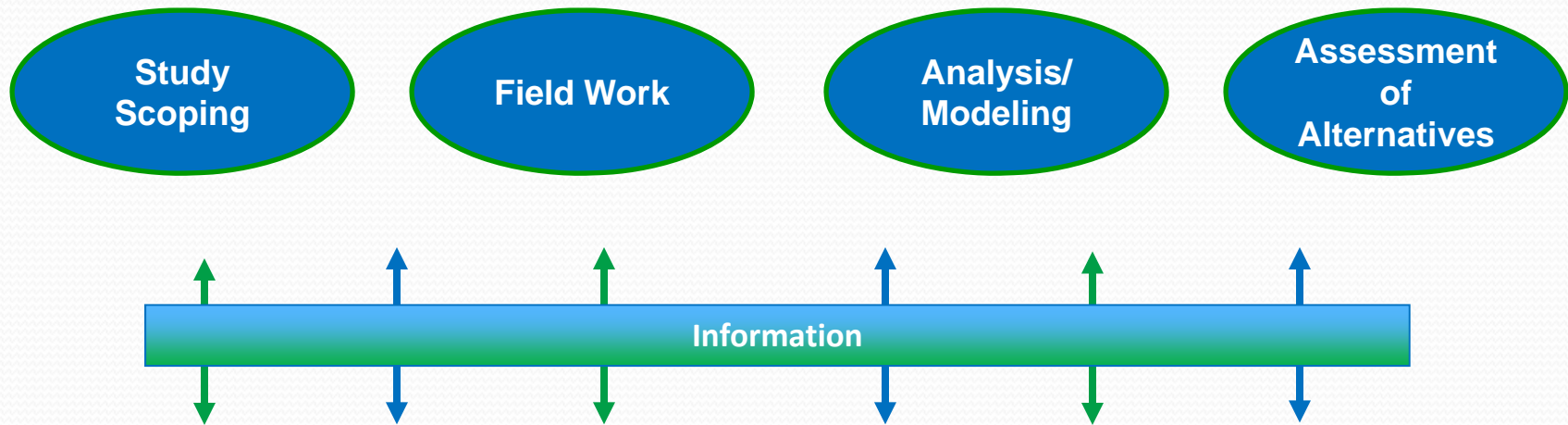


Study Process and Results Must be...

- 1) Credible
- 2) Objective
- 3) Transparent

Study Structure

Science Track



Public Involvement Track



Community Advisory Group

- 16 members
 - Selected by the Board of Directors
 - Cross-section of backgrounds, interests, knowledge
- 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

LOTT Clean Water Alliance
Groundwater Recharge Scientific Study
Public Opinion Research

**Structured Interviews:
Summary Report**

May 8, 2013

Prepared by:

KATZ
& Associates

Katz & Associates, Inc.
4250 Executive Square, Suite 670
San Diego, CA 92037

LOTT
Clean Water
Alliance

Groundwater Recharge
Scientific Study
Telephone Survey of Residents
Report on Findings

May 2013

Prepared by:

EMC MARKET & OPINION RESEARCH SERVICES



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



Focus Groups

- Study name
- Terminology
- Study narrative – how to explain what this study is

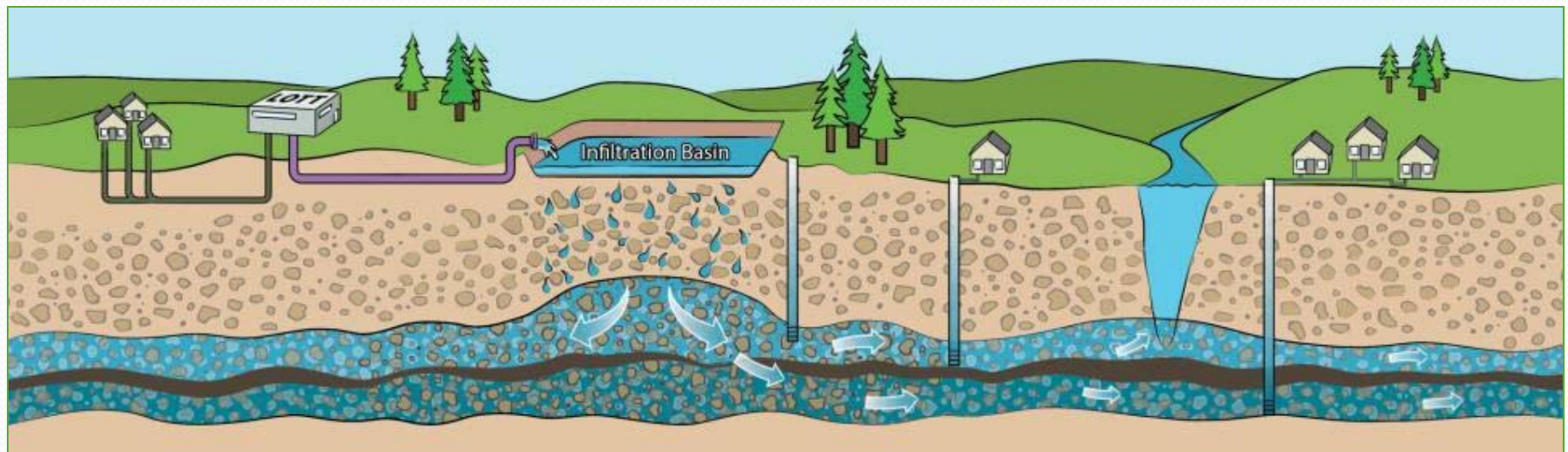
What We Learned

- “Reclaimed Water” or “Recycled Water”?



What We Learned

- “Recharge”, “infiltration” or other?
- “Replenish groundwater with reclaimed water”
- “Infiltration of reclaimed water to groundwater”
- Important to have a graphic





What We Learned

- What to call the material we flush or pour down the drain?

Medicines and
household and personal care
products

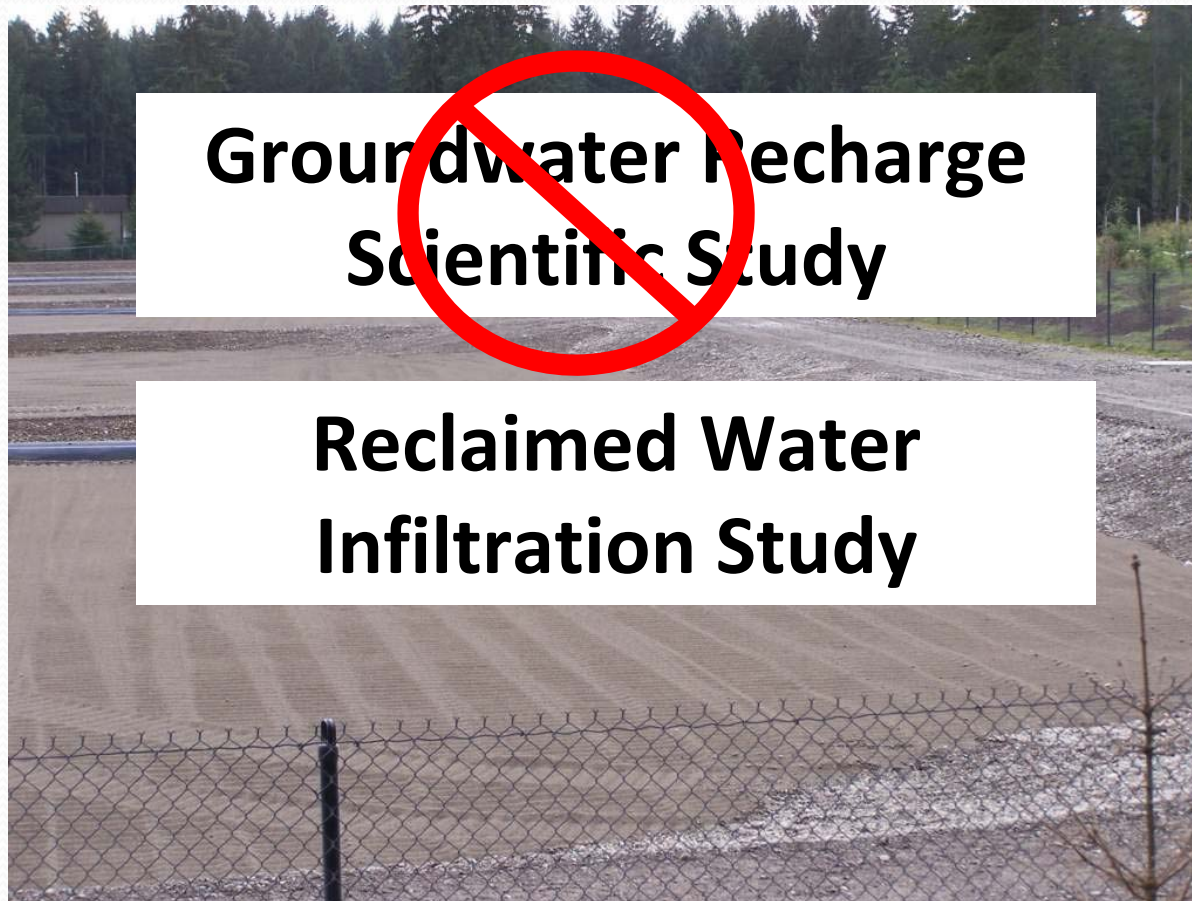
What We Learned

- What to call the material that remains in the water after treatment?

Residual chemicals

What We Learned

- The study name wasn't working



What We Learned

- Explaining the Story
 - Make it personal...
 - Your water...
 - Did you know?...
 - Use visuals



**Down the Drain
...and Then What?**

Your Water: Down the Drain... and Then What?



Did you know...

Some of the water you use and wash down the drain is treated and cleaned so it can be used again as reclaimed water?

Some of the medicines and chemicals from products you use every day may remain in reclaimed water?

Some reclaimed water is infiltrated into groundwater, our region's source of drinking water?

The **LOTT Clean Water Alliance** is designing a study to answer questions about those chemicals, what happens them in the environment, and risks they may pose to drinking water and other water resources.

You're Invited to a Public Workshop

Wednesday, October 23, 2013
LOTT Board Room • 500 Adams Street NE, Olympia
6:30-9:00 p.m.

6:30 p.m. Open House with Information Stations

7:00 p.m. Presentations About the Study Design

7:45 p.m. Discussion Sessions

8:30 p.m. Open House

For more information, visit www.lottcleanwater.org or call (360) 528-5719

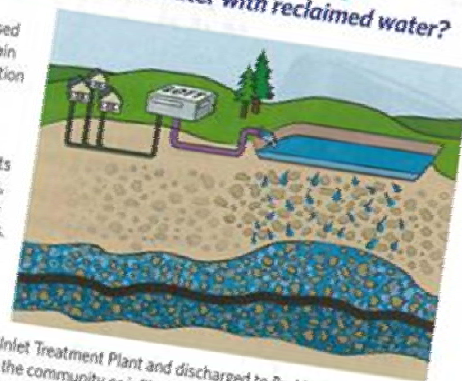
LOTT Reclaimed Water Infiltration Study:

What are the risks from replenishing groundwater with reclaimed water?

Community questions and concerns about infiltration of reclaimed water have been raised because of residual chemicals that may remain in the water. LOTT's Reclaimed Water Infiltration Study is being designed to answer those questions.

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. Portions of those products 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.



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 will help policymakers make informed decisions about future reclaimed water treatment and uses, including whether or not additional treatment processes are needed to remove residual chemicals.



Get Involved...

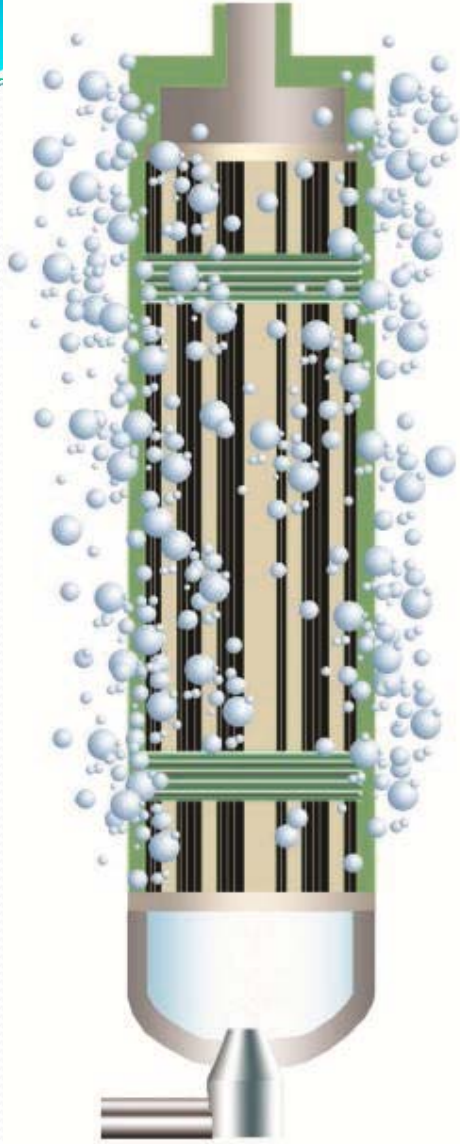
For more information or to provide your input, call (360) 528-5719, send an email to groundwaterstudy@lottcleanwater.org, or visit www.lottcleanwater.org/groundwater.htm

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



Groundwater Recharge

The Science

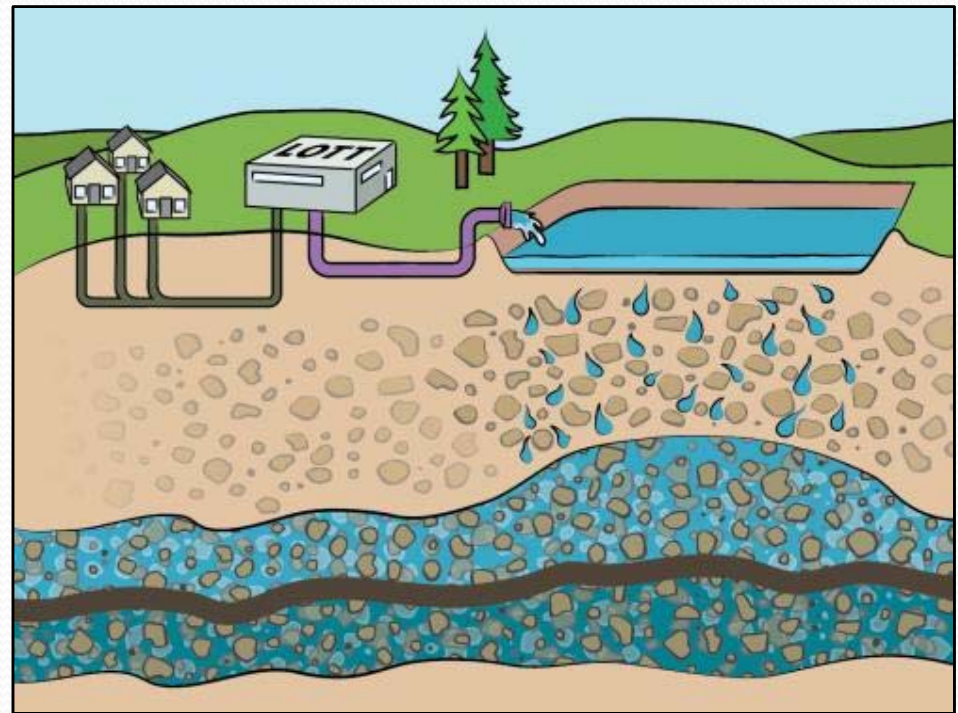


Study Goal

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?



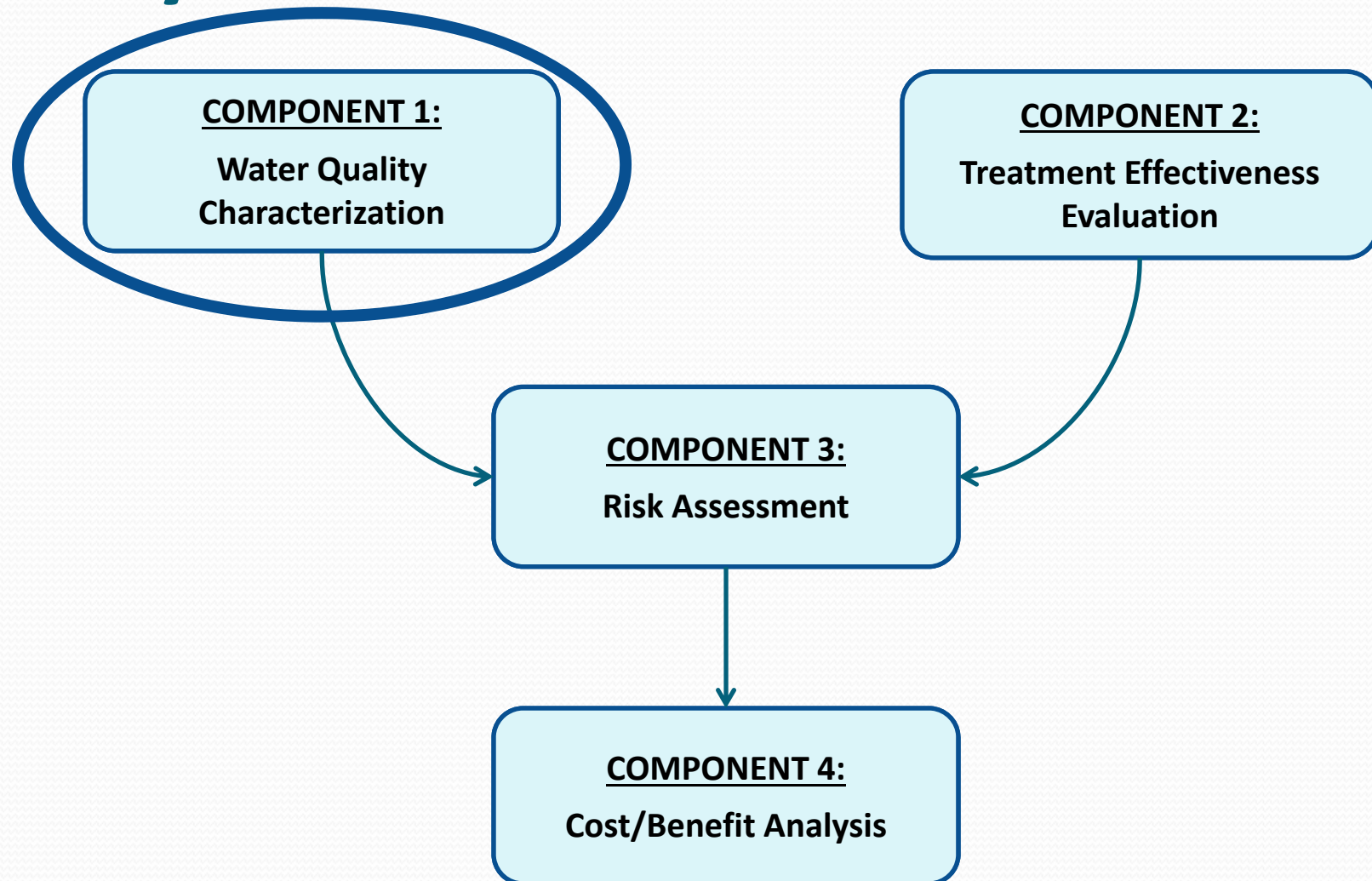


Key Questions

(Foundation for the Study Framework)

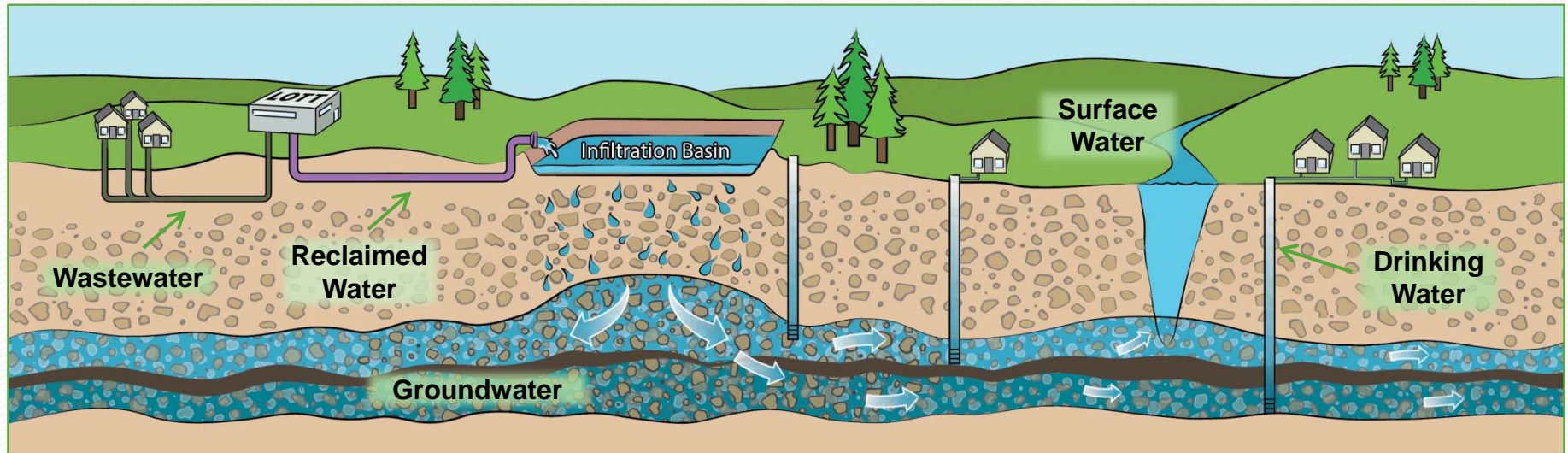
- 1) What is the current quality of our local waters: groundwater, surface waters, drinking water, wastewater, and reclaimed water?**
- 2) What happens to reclaimed water that is infiltrated to groundwater: where does it travel and how quickly, and how does the quality change over time?**
- 3) What are 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)



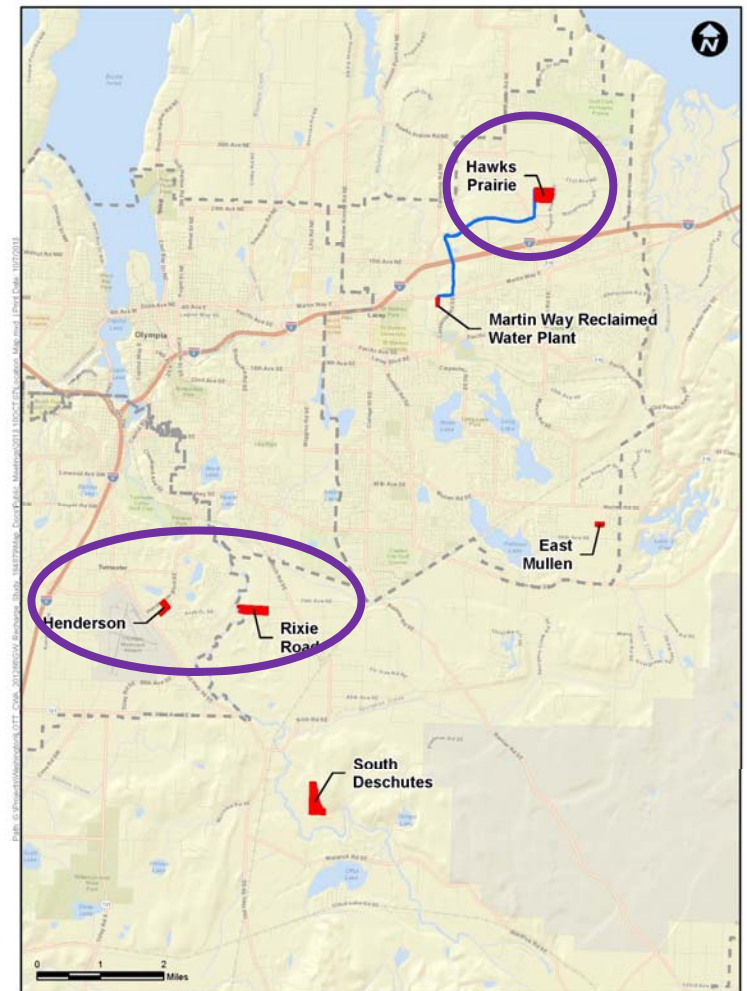
Water Quality Characterization:

Where should we look?

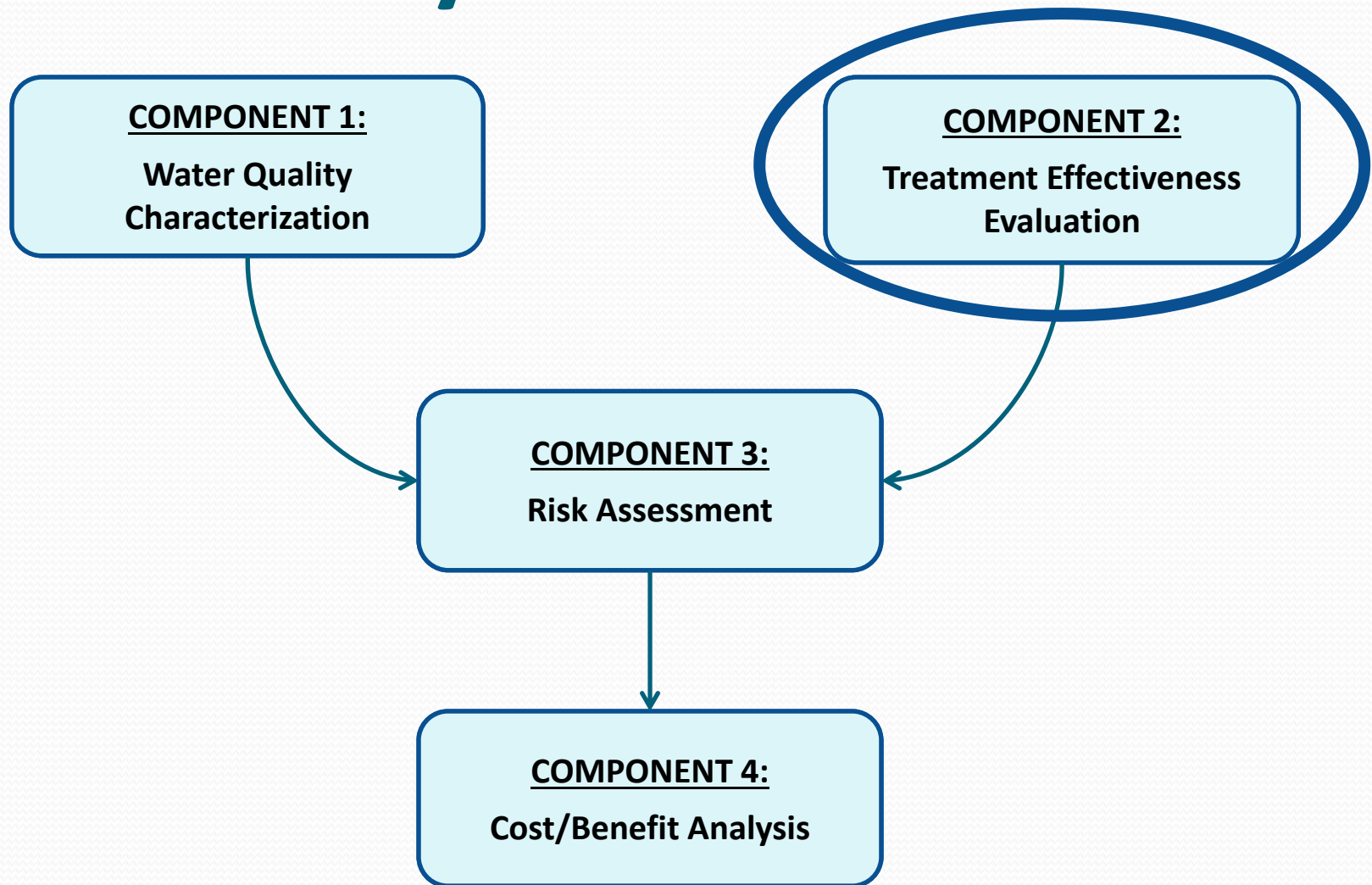
Groundwater Quality Characterization

- 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.

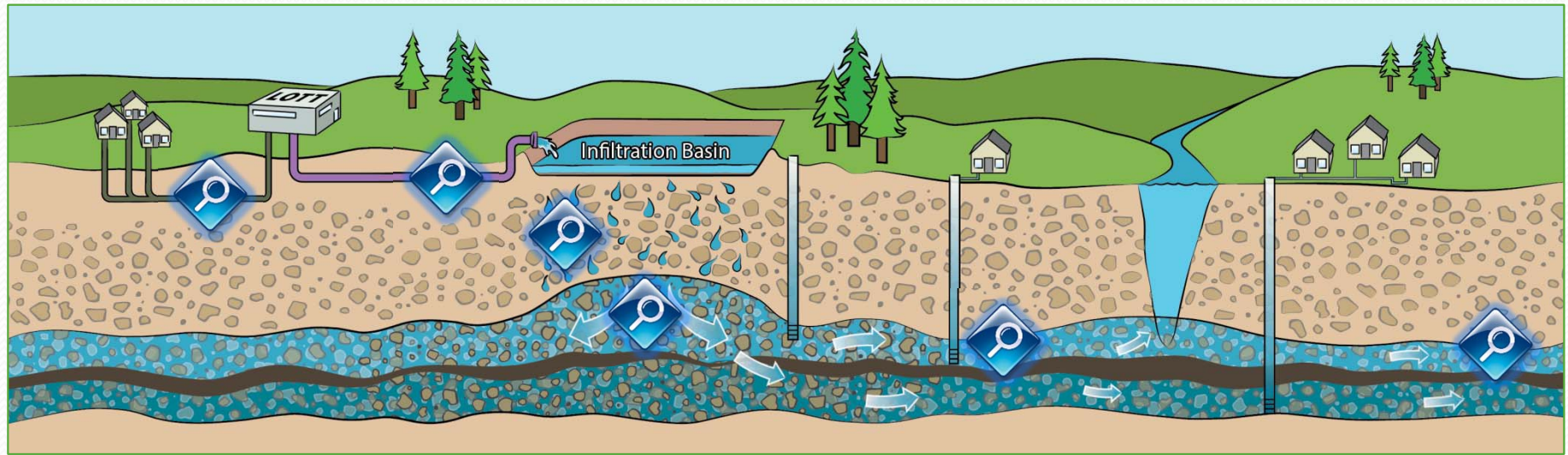
LOTT Groundwater Recharge Sites



Study Framework



Component 2: Treatment Effectiveness Evaluation

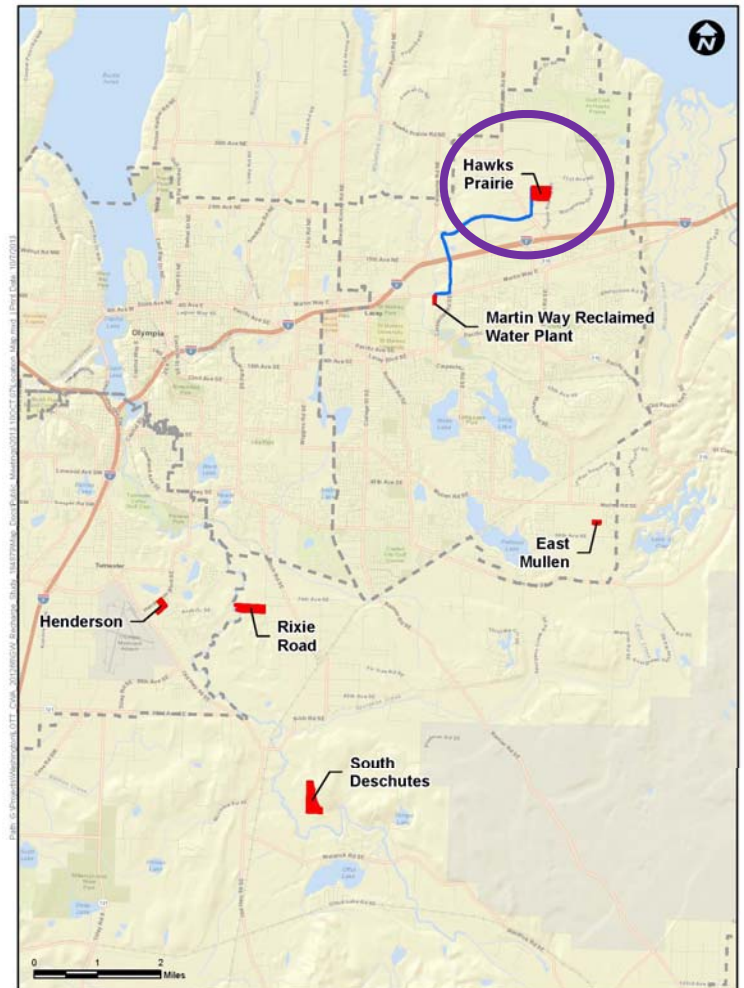


- Measure water quality at various steps within the treatment process (prior to and after infiltration)
- Identify which residual chemicals remain in reclaimed water that is infiltrated to groundwater
- Requires extensive field work to understand groundwater movement and chemistry

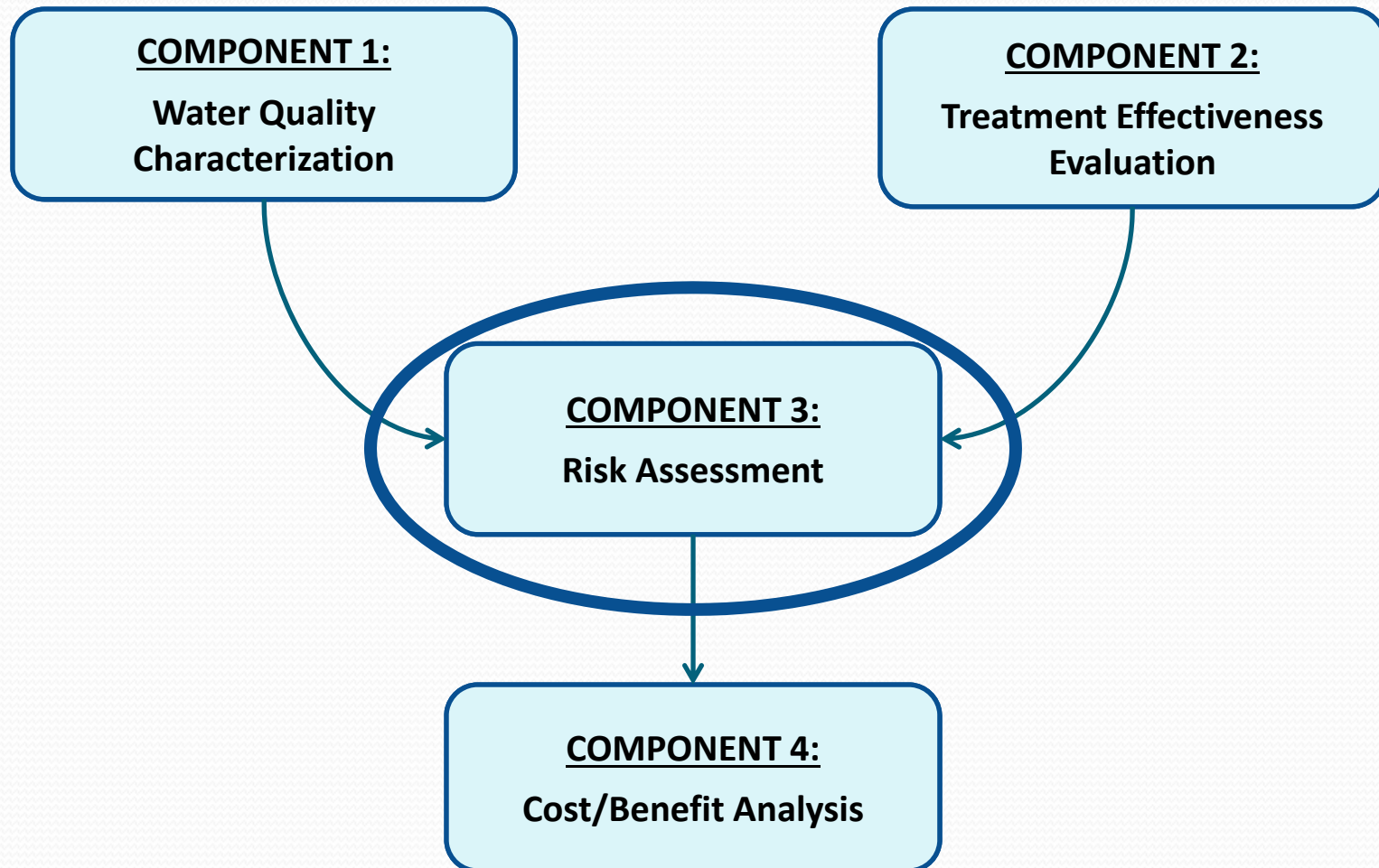
Outline of Tasks

- **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



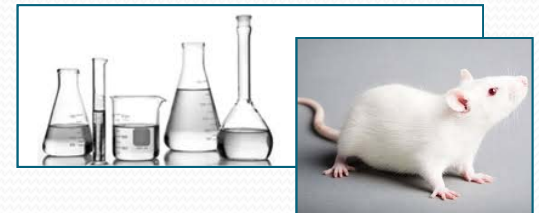
Study Framework



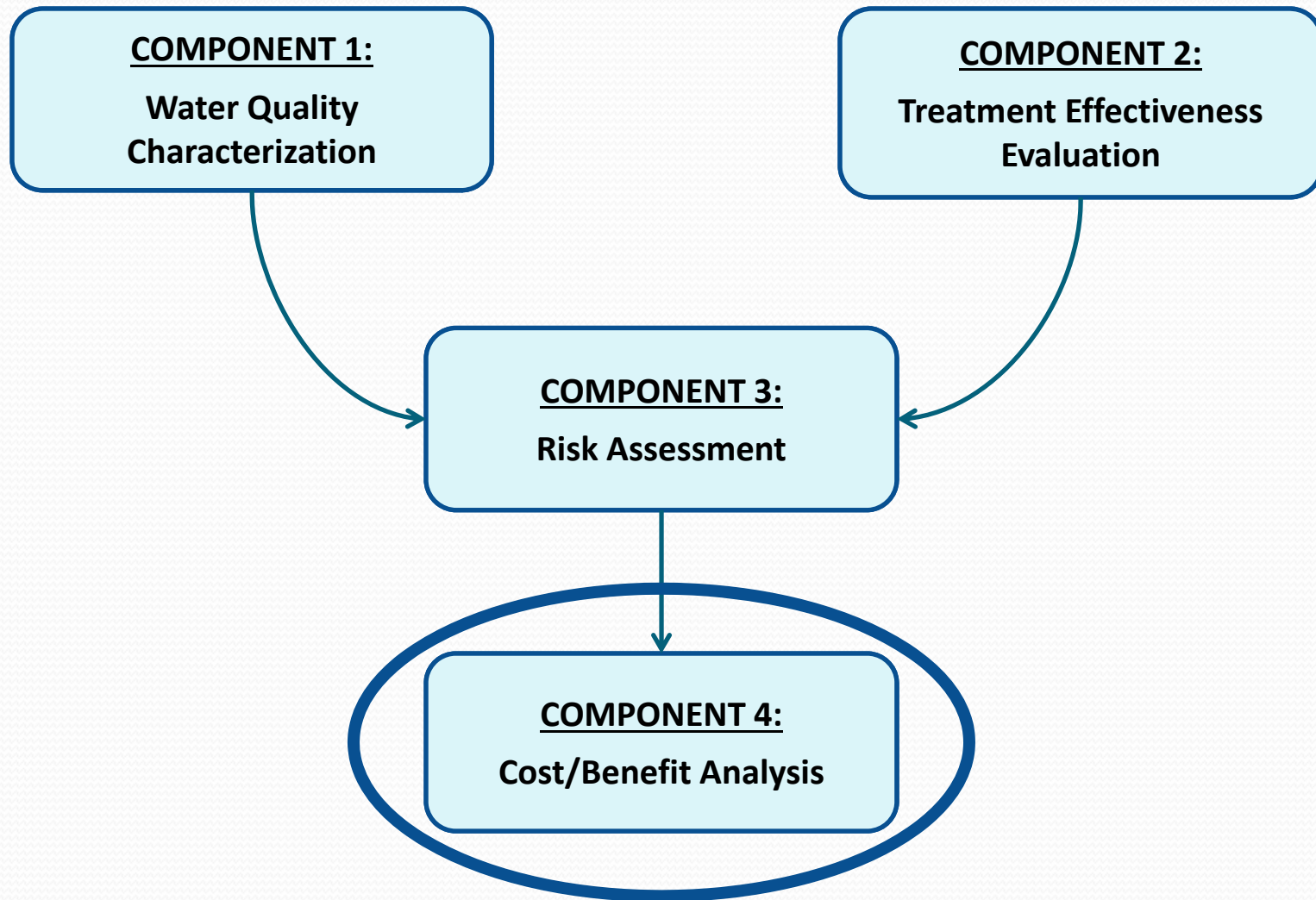
Component 3:

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



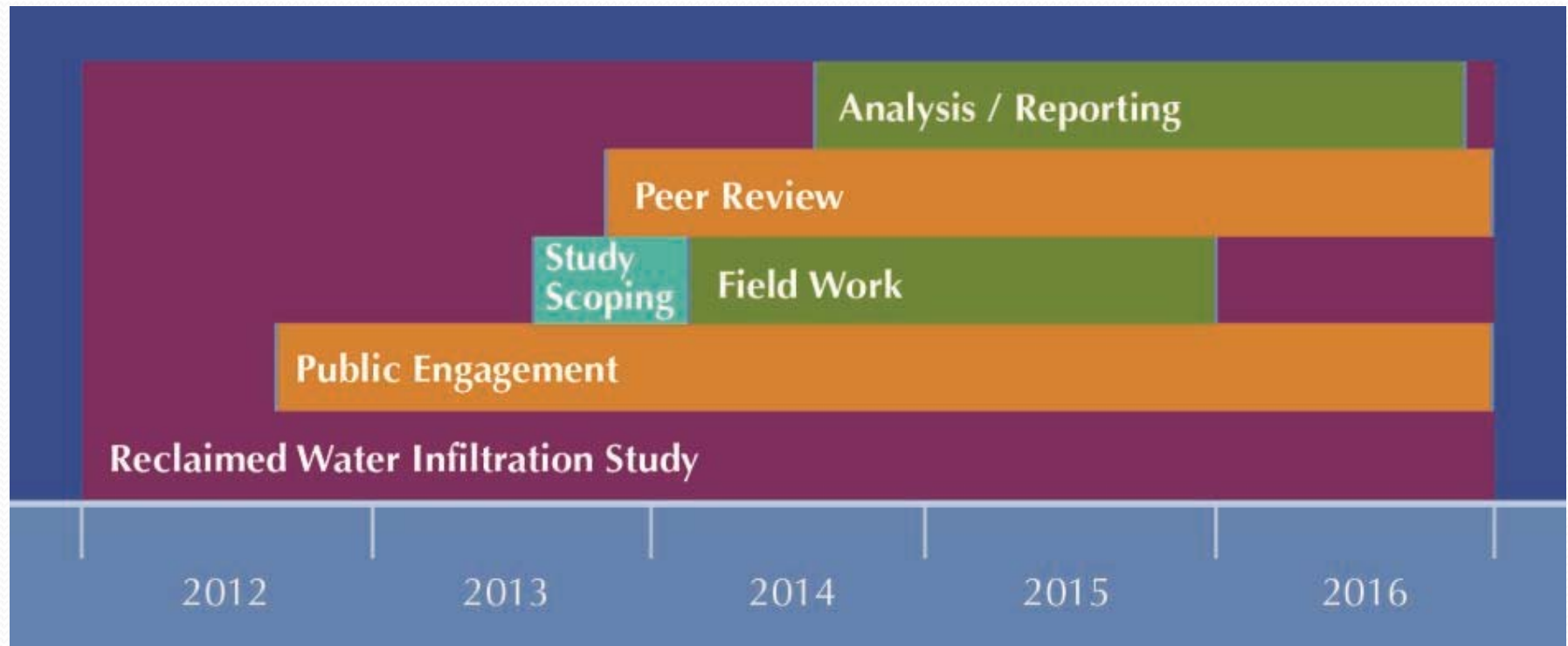
Component 4:

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

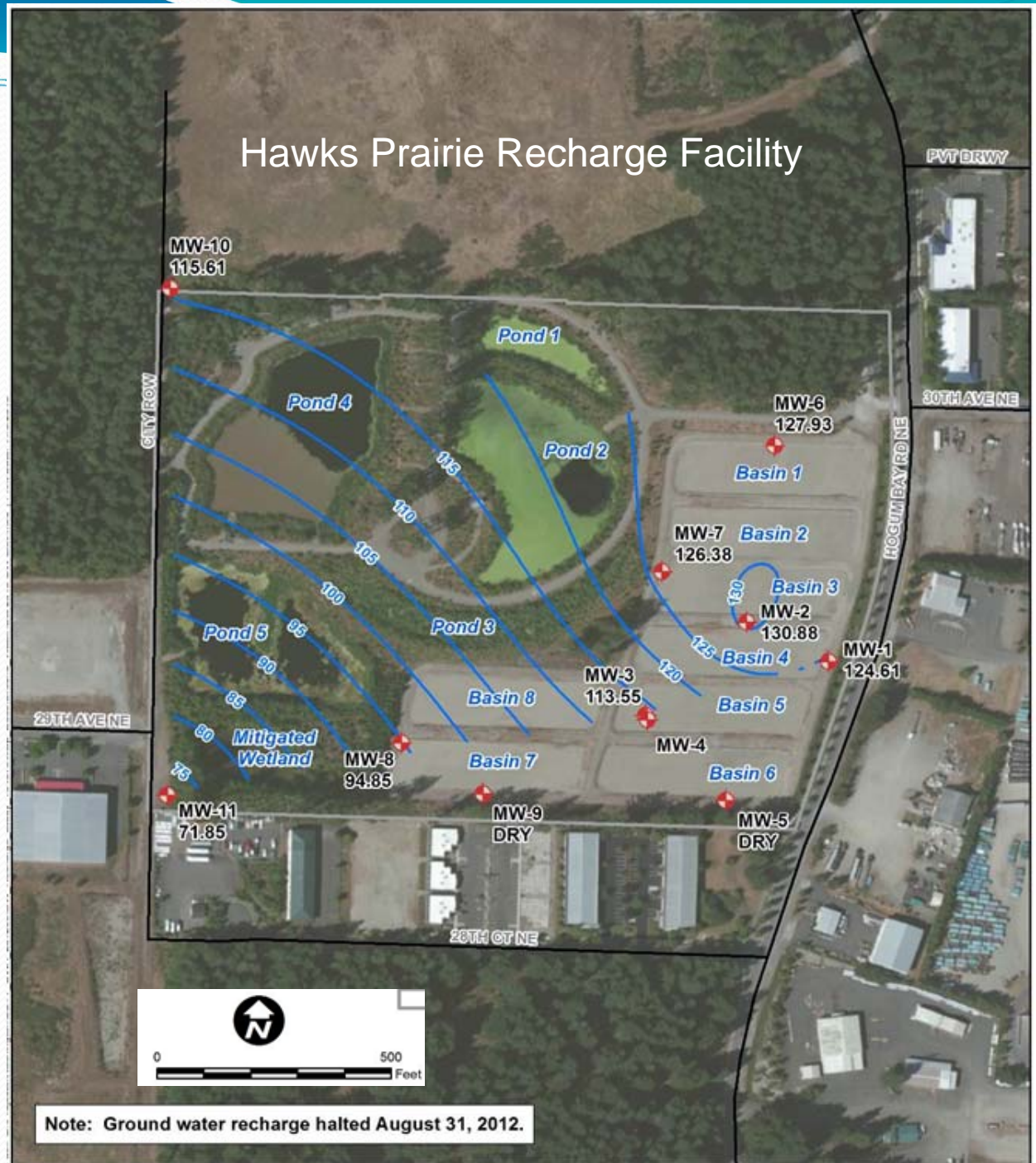
- Characterize “background” groundwater quality
- Preliminarily assess on-site travel time of infiltrated reclaimed water
 - Support design of larger-scale tracer test (e.g., additional well locations)

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); 11 wells
- Analyzed for ~100 residual chemicals
- Detected 13



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

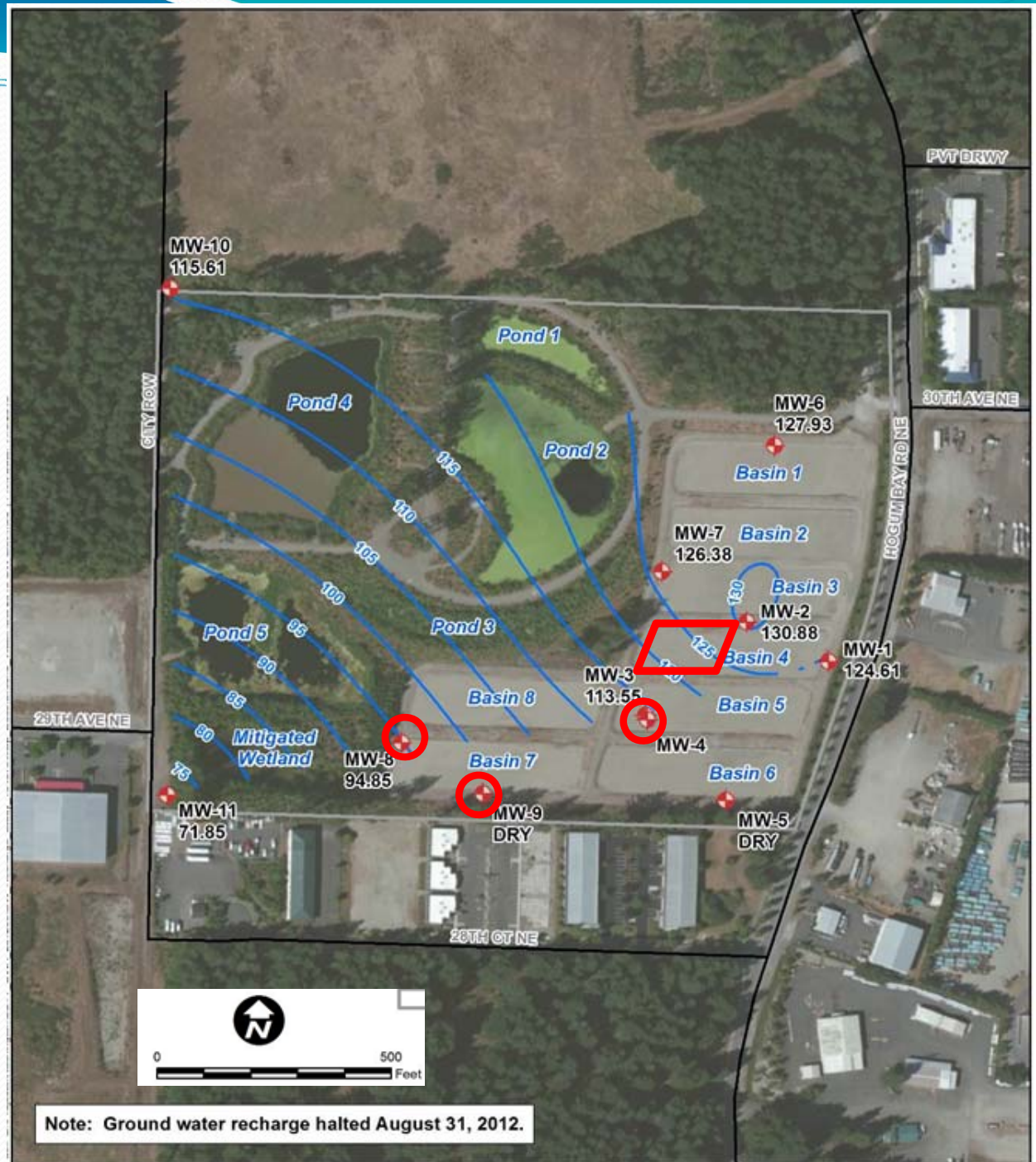


Detected Residual Chemicals (Nov 2013)

- Pharmaceuticals
 - Albuterol (anti asthmatic)
 - Carbamazepine (anti seizure)
 - Dehydronifedipine (blood pressure drug)
 - Primidone (anti convulsant)
 - Sulfamethoxazole (antibiotic)
- Personal Care Products
 - 1,4-Dioxane (solvent, e.g. in cosmetics)
 - Bisphenol A (plasticizer)
 - DACT (triazine used in resins, dyes, pesticides)
 - Nonylphenol Monoethoxylate (emulsifier, e.g. in detergents)
- Flame Retardants
 - TCEP
 - TDCPP
- Sugar Substitutes
 - Acesulfame-K
 - Sucralose

Startup Monitoring

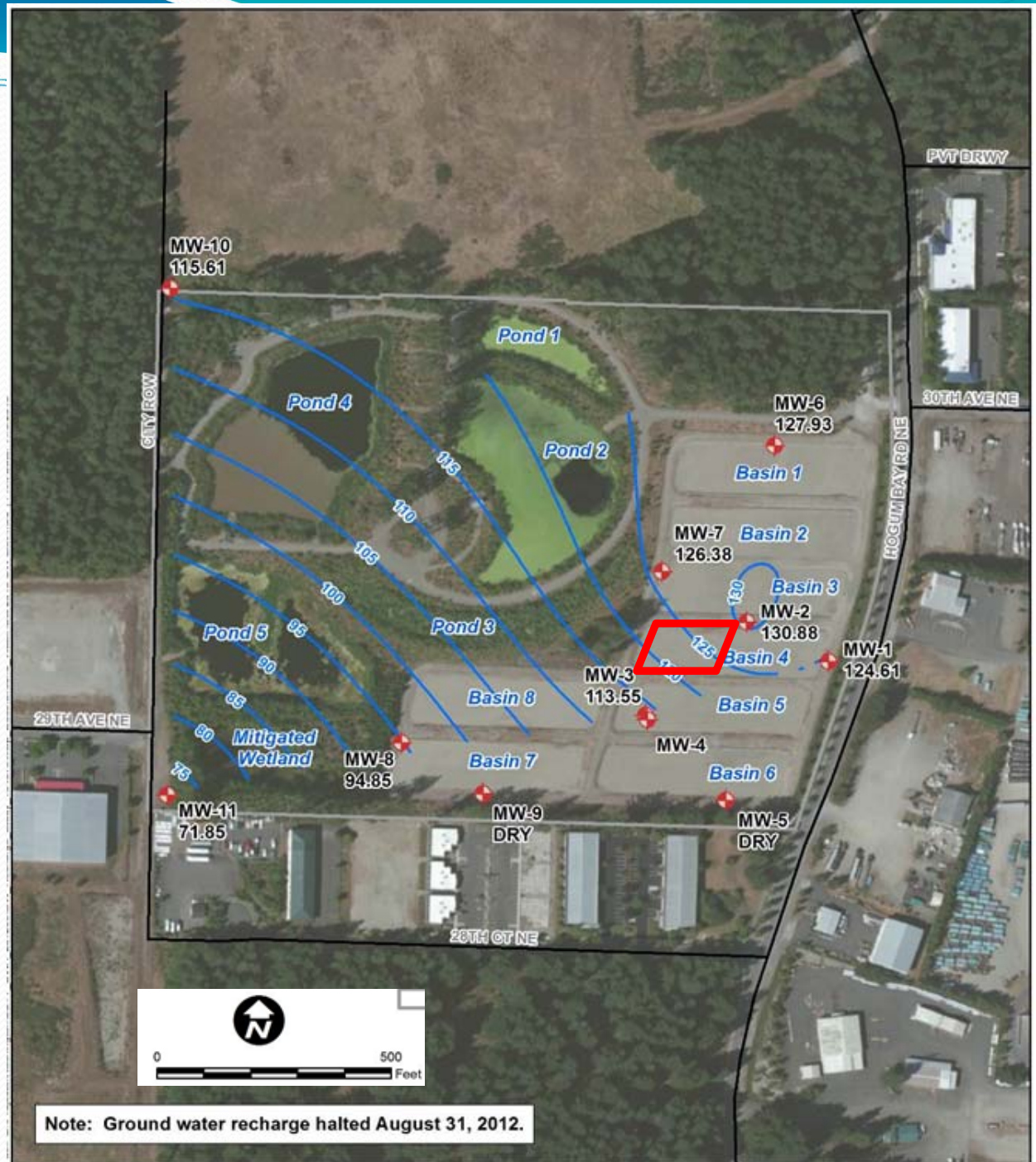
- Flow concentrated in ½ of Basin 4
- Continuous in-well monitoring
 - Groundwater levels
 - 10 wells
 - Conductivity & Temperature
 - 3 wells



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)



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



Basin 4 (looking SE, divider berm on left)



Basin 4 (looking SE, stilling well in foreground)

Basin 4 (looking E)

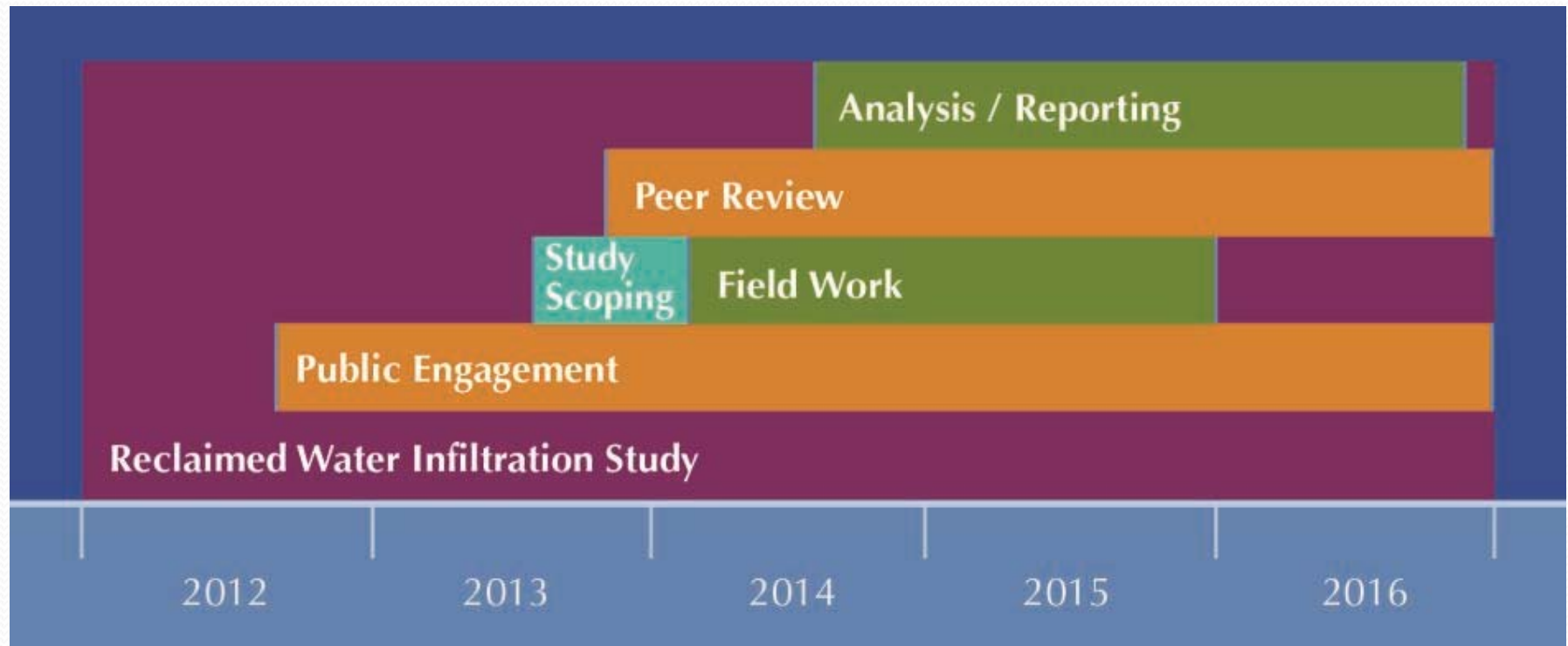


(3/6/14)



(3/18/14)

Study Timeline



Questions?

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