



OREGON STATE UNIVERSITY STORMWATER SYSTEM EVALUATION

Andrew Duff, Lauren Kelly, Leif Odegard



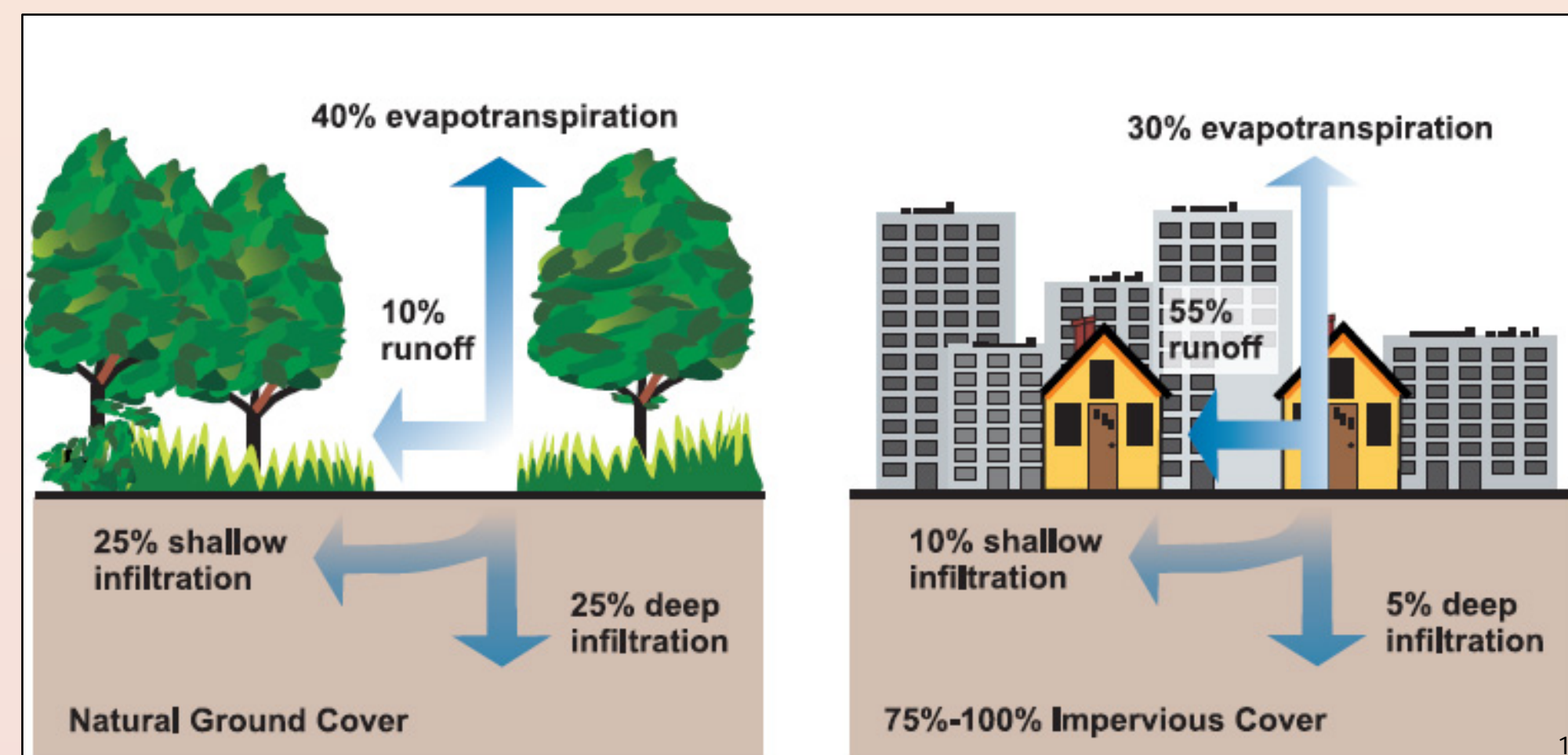
Objective

Complete stormwater independence for Oregon State University by focusing on the development and implementation of stormwater collection and characterization practices. These practices and testing methodology will be used for future work.

The Need

The urbanization of Corvallis has led to more water impermeable surfaces. Roads, sidewalks and roofs increase the flow into bodies of water by blocking vertical water penetration into the ground. Stormwater rushes unmonitored into the water systems and reaches the rivers and creeks within seconds and minutes. The increased flow through drainage and into rivers increases soil erosion and introduces contaminants.

Effects of Impermeable Surfaces



Urbanization has decreased ground water infiltration and increased stormwater runoff.

Opportunity

Current stormwater systems will be invalid when the next generation of codes are implemented. Oregon State University (OSU) can move ahead of the curve by proactively upgrading their drainage and treatment systems. Drainage systems on campus are not well described and will require thorough research in order to understand. Kelley Engineering Center (KEC) is a step in the right direction towards stormwater independence. Green engineering like KEC will enable OSU to move towards a sustainable campus.

Testing Suite

Physical Testing



Dissolved oxygen probe, flow rate sensor, turbidimeter, rain gauge

Chemical Testing



Zinc check test kit, phosphate test kit, pH test strips

Campus Stormwater Basins

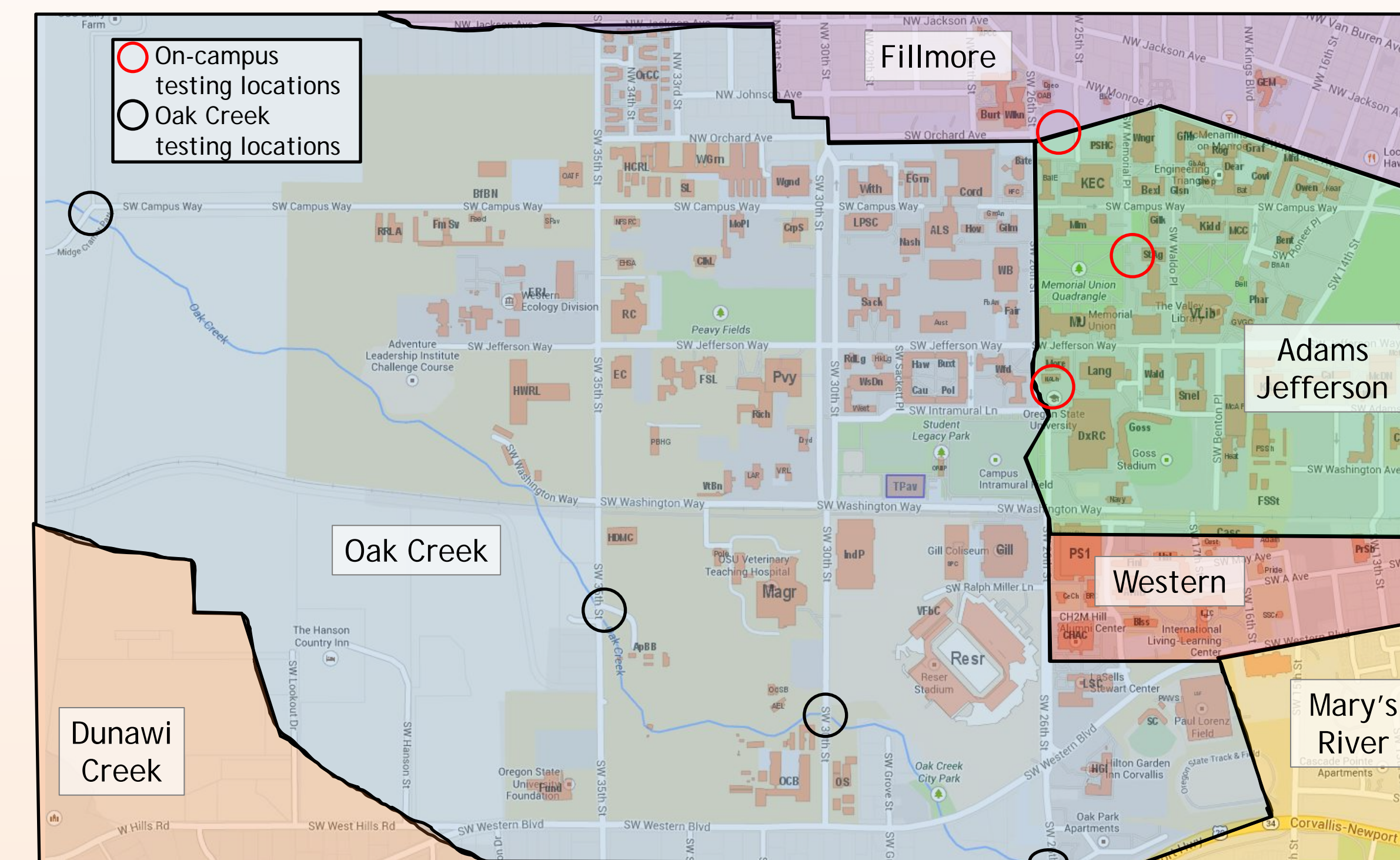


Figure 1 | A map showing the stormwater basins of Oregon State University. Fillmore and Adams Jefferson are outlets into the Willamette River. The Western water basin is taken to the Corvallis Wastewater treatment facility. The black circles show the testing locations along Oak Creek. Covered Bridge, 35th Street Bridge, 30th Street Bridge and Morris Avenue Bridge. Red circles show the on-campus locations: Kelley Engineering Center parking lot, Memorial Union Brick Mall, roof of Native American Longhouse.

Chemical Testing Results

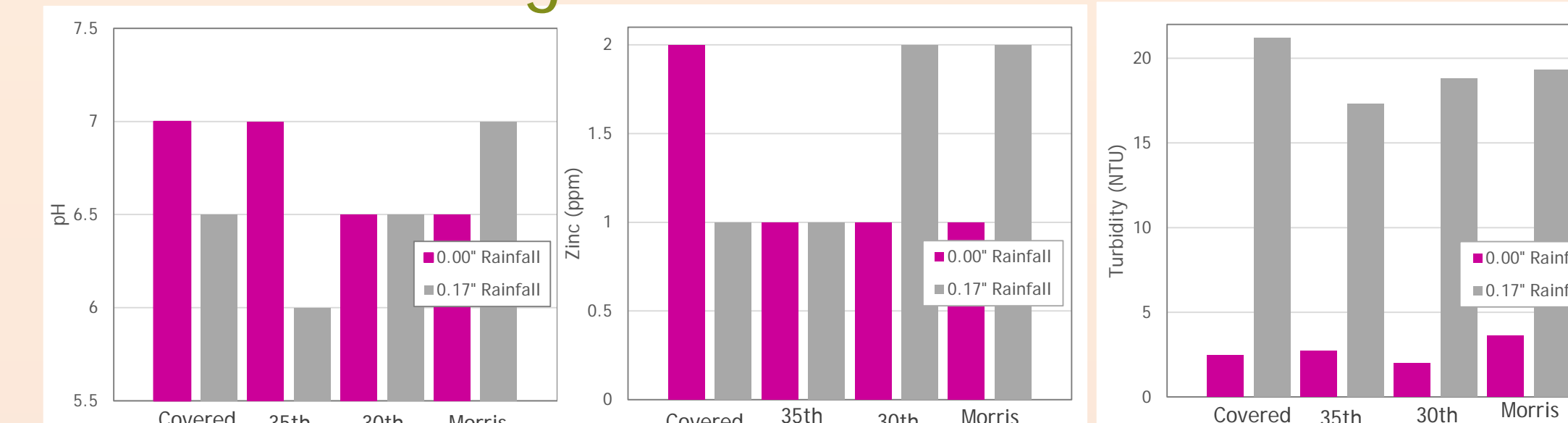


Figure 2 | Plots showing pH, zinc concentration and turbidity for Oak Creek testing locations. Samples from Oak Creek were collected during no (0.00") and light (0.17") rainfall.

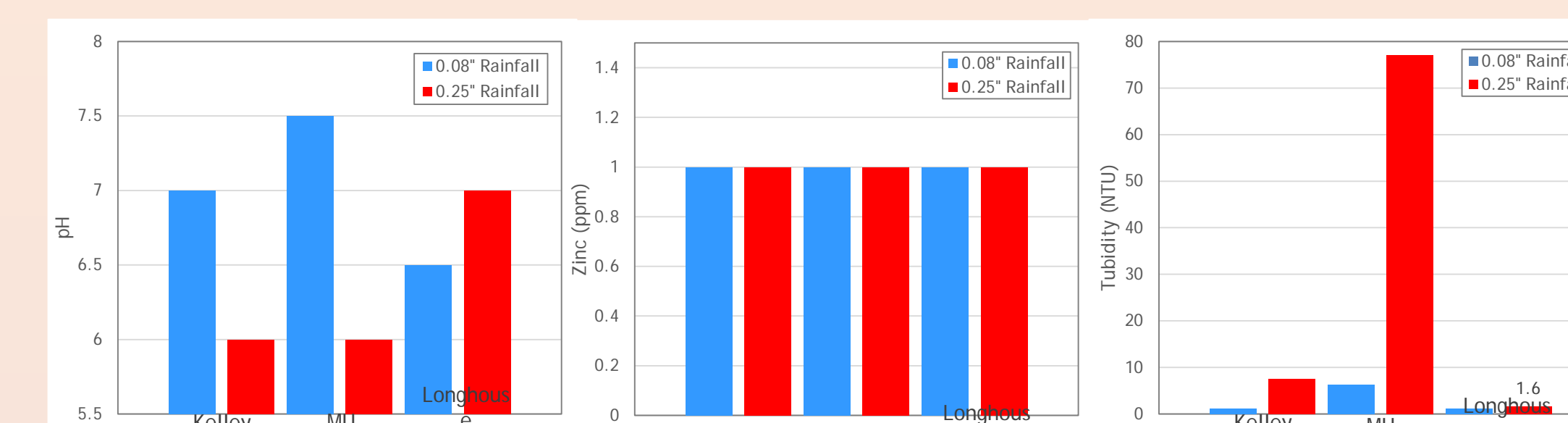


Figure 3 | Plots showing pH, zinc concentration and turbidity for on-campus locations. Stormwater was collected during light (0.08") and heavy (0.25") rainfall.

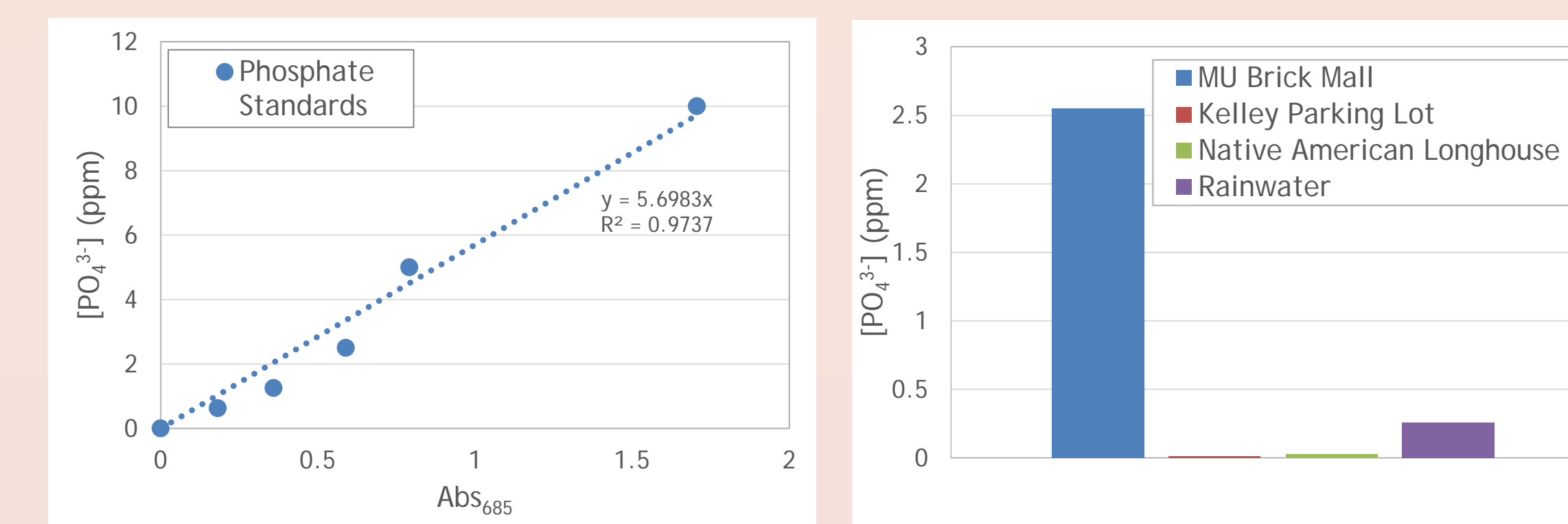


Figure 4 | A plot showing a phosphate standard absorbance curve created from PO_4^{3-} dilutions. Samples of 10, 5, 2.5, 1.25, 0.625 and 0.313 ppm PO_4^{3-} were mixed with API Phosphate test reagents and then scanned using a spectrophotometer at 685nm. And a plot showing the phosphate concentration of the stormwater collected at the on-campus locations compared to rainwater.

Revelations & Recommendations

What was Learned

- Turbidity measurements from ground campus locations are affected by natural debris.
- Zinc testing in Oak Creek showed minimal changes and future teams should explore more quantitative testing.
- Phosphate measurements were more accurate when a spectrophotometer was used.
- Cross-sectional area and flow rate measurement techniques did not provide consistent and reliable results.

What Should be Done

- Developing an in situ continuous flow recording device
- Creating a Standard Operating Procedure for stormwater collection and assessment
- Refining the existing testing suite
- Expanding on-campus stormwater inlet sites
- Biological testing of inlet and outlet storm drains.

Acknowledgements

David Eckert (Corvallis Sustainability Coalition), Andy Brickman (OSU), Dr. Philip Harding (OSU)

References

- ¹http://upload.wikimedia.org/wikipedia/commons/4/46/Natural_%26_impervious_cover_diagrams_EPA.jpg
- ²<http://www.jjstech.com/480026.html>
- ³http://www.drfsostersmith.com/product/prod_display.cfm?pcatid=15471
- ⁴<http://www.homebrewers.com/product/5418/pH-Strips--Winemaking-28-44.html>
- ⁵<http://oregonstate.edu/campusmap/>