Lake Whatcom On-Site Sewage System Impact Assessment

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Lake Whatcom Policy Group Meeting
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2017 Study Goal

1. To determine if OSS in the North Shore Basin are impacting public health and environmental health of Lake Whatcom, using fecal bacteria and phosphorus as health measures.

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2017 Study Conclusions

1. OSS in the North Shore study area are impacting the lake with fecal bacteria and phosphorus
2. Human fecal DNA detected at moderate to high concentrations at 6 of 18 discharges to lake in study area, with one discharge containing amounts found in OSS samples
3. Fecal bacteria concentrations are not good indicators of human sources in the lake or discharges
4. Optical brightener fluorescence is a good indicator of fecal bacteria and total phosphorus

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2020 Study Goals

1. To determine if OSS are impacting fecal bacteria or phosphorus **loading** to lake.
2. To determine if there is a difference in fecal bacteria and phosphorus levels in shoreline areas serviced by **OSS versus sewer** systems.
3. If impacts are detected, determine the extent of those impacts **relative to TMDL requirements and public health**.

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Study Areas

1. **OSS Area.** The original study area along North Shore Road.
2. **Sewer Area**. A new study area with sanitary sewers between Sudden Valley and Geneva located across the lake from the OSS area with similar geology.
3. **Undeveloped Area.** The original study control area.

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Study Area OSS and Drainages

OSS Orange Drainage Outfalls Red Sewer Lines Pink

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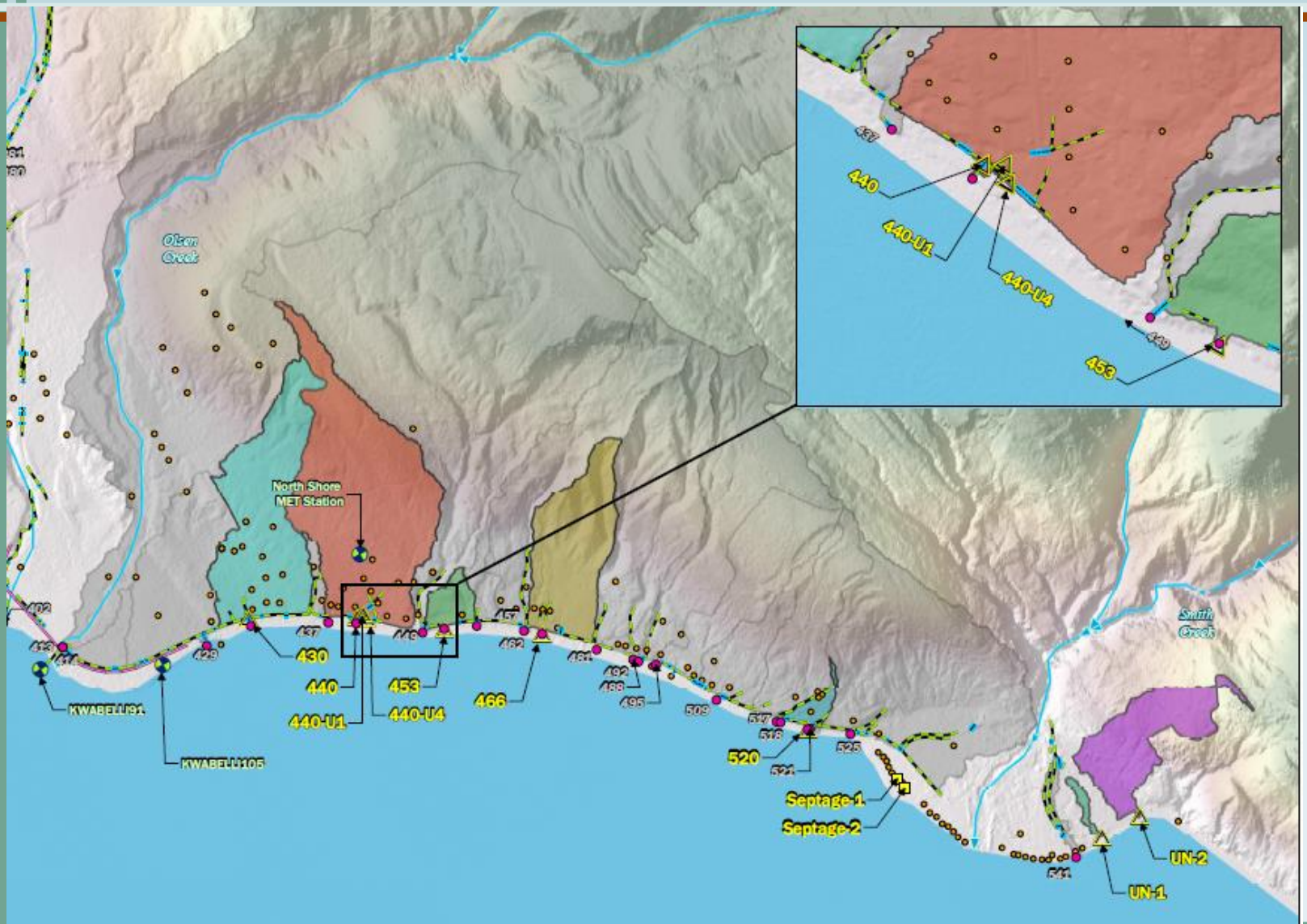
Study Design

Element	Design
Drainage Stations	5 in OSS Area 5 in Sewer Area 2 in Undeveloped Area
Source Stations	1 of 2 Septic Tanks 1 Municipal Sewer
Sampling Events	3 Storm (March-April 2020) 2 Base (May-June 2020)
Field Methods	Flow measurement Grab samples for lab
Lab Parameters	Optical brighteners (modified) Conductivity Fecal coliform/E. coli Total phosphorus Human biomarker HF183 Human biomarker BacV4V5

OSS/Undeveloped Station Locations

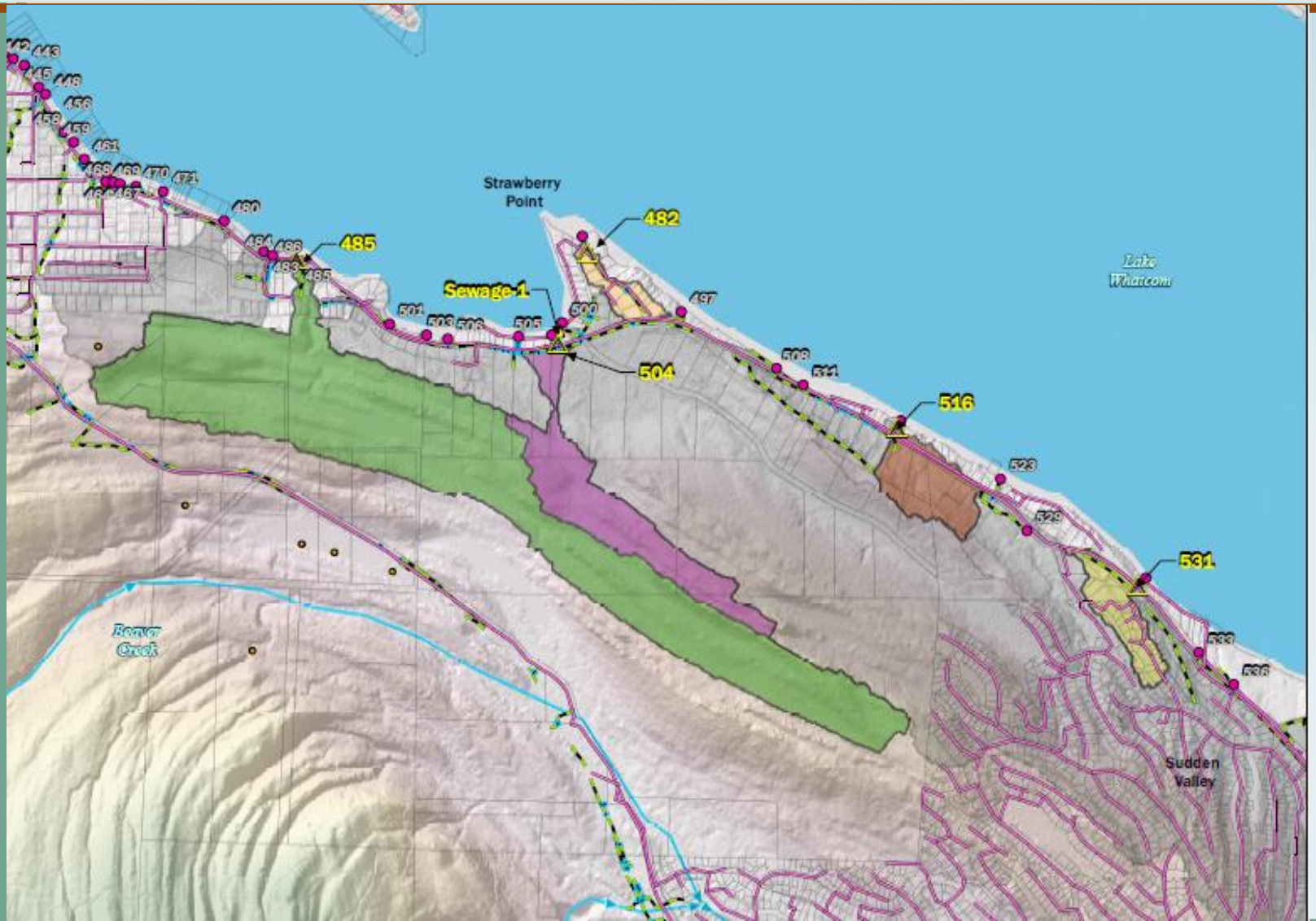


430
440
453
466
520

Septage-1
Septage-2

UN-1
UN-2

Sewer Station Locations

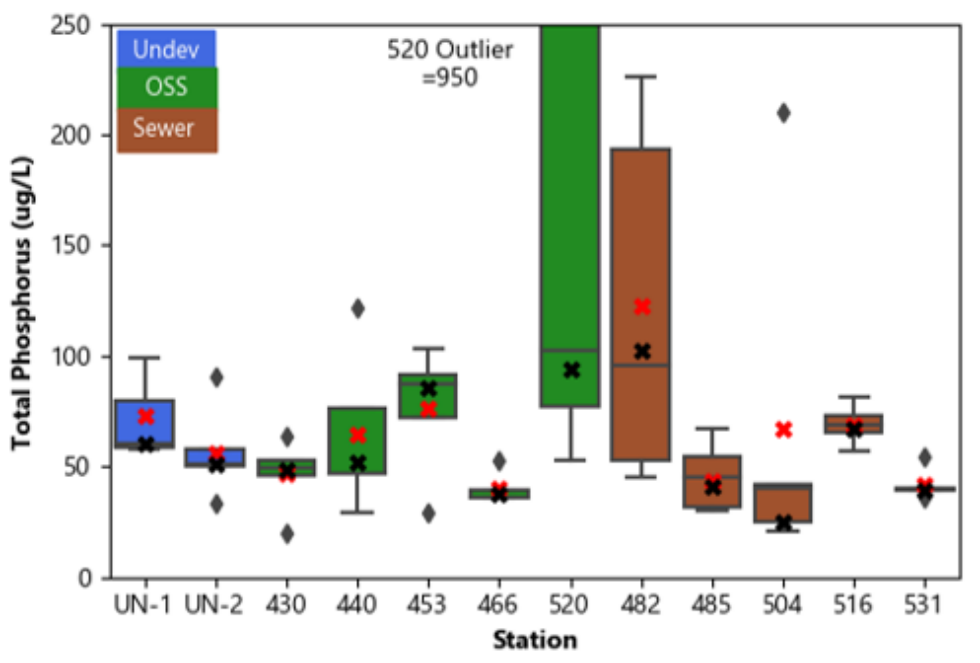


485
504
482
516
531

Sewage-1

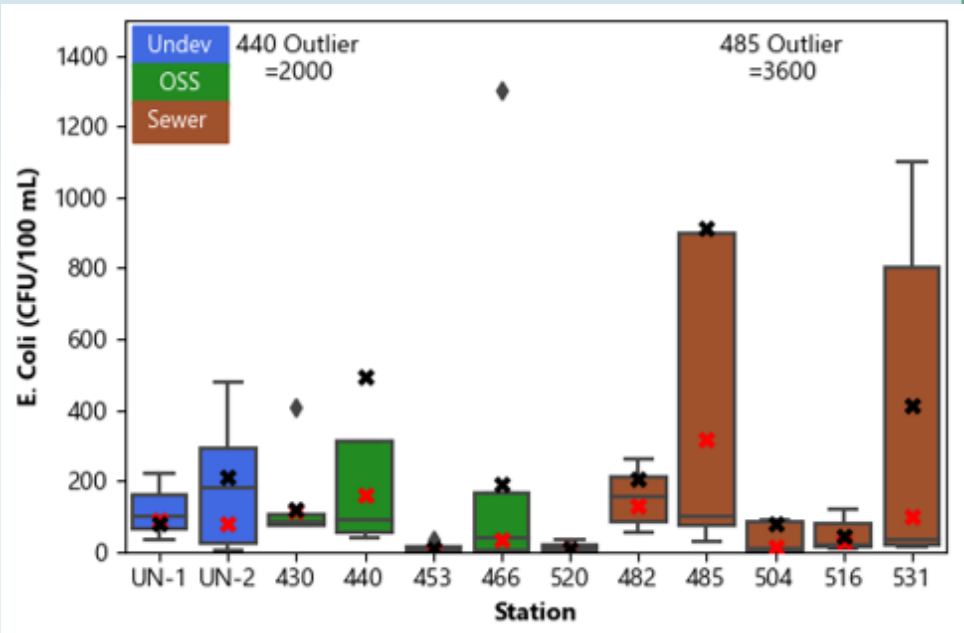
Total Phosphorus Results

- High TP (>50 µg/L) at all but 2 OSS and 2 sewer stations.
- Very high TP (>300 µg/L) at OSS station 520 and one grab upstream of OSS station 440.
- TP higher during lower flow in 2020 and compared to high flow in 2017 because TP higher in shallow groundwater than runoff from forest.
- TP higher in septic tanks (10,000 - 15,000 µg/L) than sanitary sewer (8,000 µg/L).



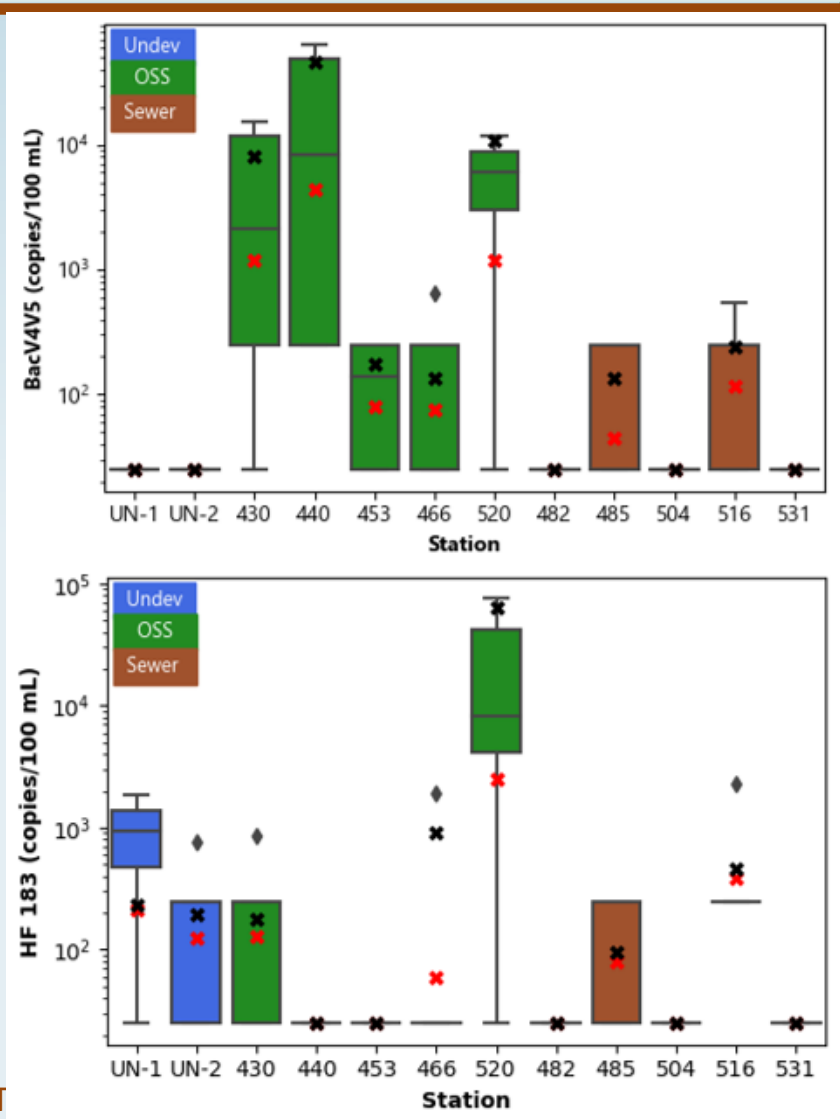
Fecal Bacteria Results

- High E. coli at OSS station 440 and sewer station 485 (geomeans of 163 and 316 CFU/100 mL, respectively).
- Fecal bacteria typically lower with the lower flows in 2020, likely due to less runoff of animal deposits.
- E. coli higher in sanitary sewage than septic tanks, (greater than 600,000 CFU/100 mL in a sewage sample).



Human Biomarker Results

- High human biomarker BacV4V5 at OSS stations 520, 430, and 440, but high biomarker HF183 only at station 520.
- Experimental biomarker BACV4V5 found more frequently than the EPA-approved biomarker HF183, and is a more selective and reliable human waste indicator.
- Low to moderate levels of both biomarkers at sewer station 516, but much lower than those observed at OSS stations 430, 440, and 520.



Human Biomarker Results (Cont.)

- Sampling of two stations upstream of OSS station 440 during one wet event identified which area of the basin impacted by OSS.
- Human biomarker patterns among the 5 OSS stations did not appreciably change from 2017 to 2020.
- OSS drainages are not being impacted by overland flow of surfacing OSS failures based on moderate fecal bacteria and TP.
- Human biomarkers are transported slowly through soils to drainages while fecal bacteria die-off and phosphorus is adsorbed to soil particles.

Loading Analysis

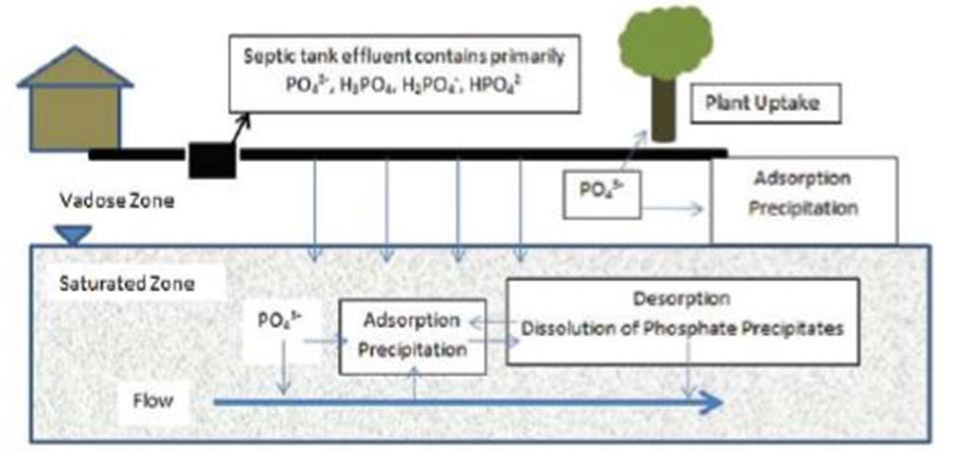
- High human biomarker loadings for OSS stations 430, 440, and 520 compared to undeveloped and sewer stations.
- Higher TP loading for the sewer area (0.19 kg/acre-year) than the undeveloped and OSS areas (0.08 kg/acre-year), and similar to stormwater loading for the OSS area by TMDL (0.16 kg/acre/year).
- Low TP loading for OSS area indicates that OSS are not a significant source of phosphorus loading to the lake, which agrees with 2017 study and 2011 estimate (< 15 percent of annual loading from the North Shore basin).

OSS Maintenance Assessment

- OSS repairs since 2017 study in basins 466 and 430 did not reduce human biomarkers input.
- Further investigation would be needed to determine if OSS are contributing effluent contaminants other than TP and fecal bacteria.

Conclusions

- OSS are not a significant source of fecal bacteria or phosphorus loading to the lake.
- Septage is transported slowly through soils to some drainages, but not by overland flow.
- Fecal bacteria die-off in soil and phosphorus is adsorbed to soil particles, but other chemicals may get to lake.
- OSS repairs since 2017 study did not reduce septage inputs to the lake.



Next Steps

- Research septage contaminant transport and prepare final report
- Conduct septage and phosphorus source tracking upstream of Site 520

Questions