



High Head Bypass Study – Green Peter Dam – Radio Telemetry, 2017

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Objectives

- ▶ Provide survival and movement information after fish pass through a high head bypass system
 - Age-1 steelhead

- ▶ Survival
 - Green Peter tailwaters to Foster Dam

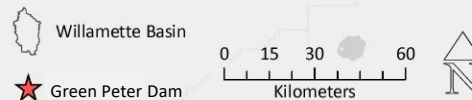
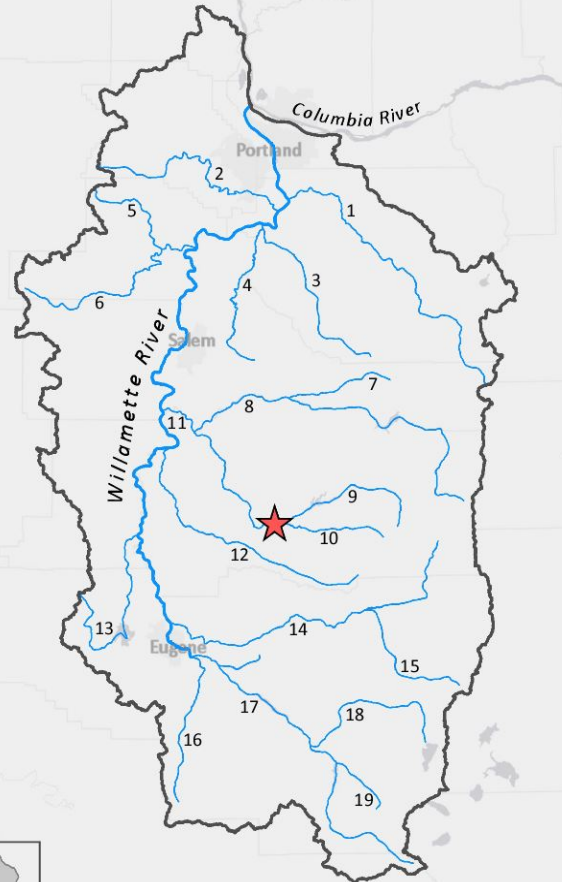
- ▶ Travel Time
 - Green Peter tailwaters to Willamette Falls Dam



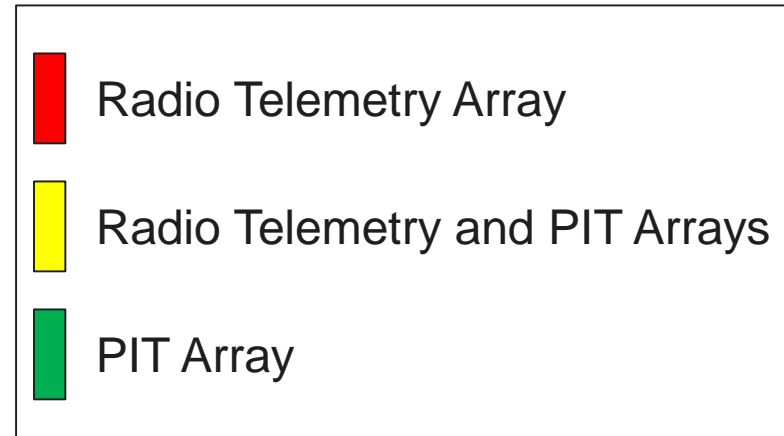
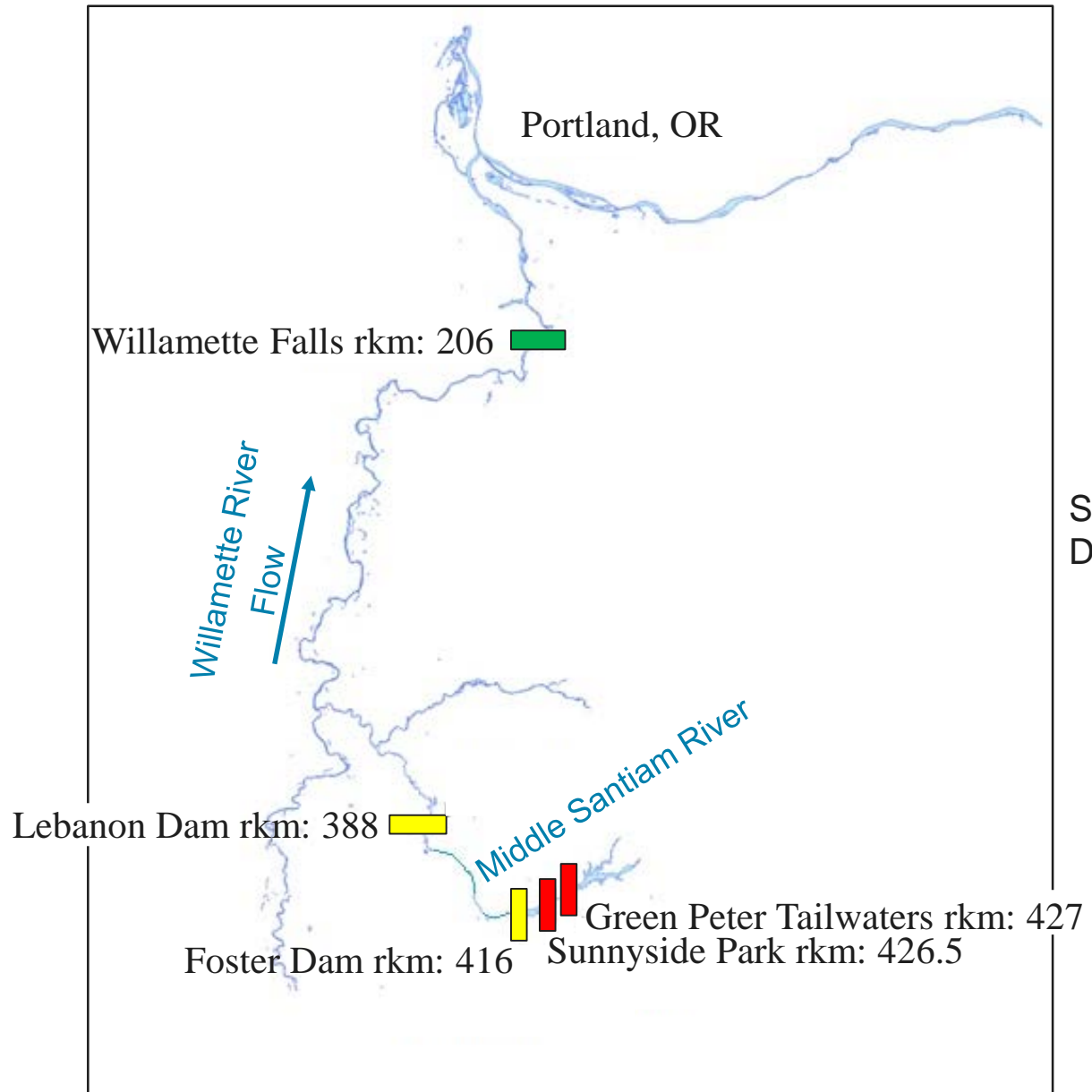
The Willamette Basin

Notable Tributaries:

1. Clackamas River
2. Tualatin River
3. Molalla River
4. Pudding River
5. N. Yamhill River
6. S. Yamhill River
7. Little N. Santiam River
8. N. Santiam River
9. Middle Santiam River
10. S. Santiam River
11. Santiam River
12. Calapooia River
13. Long Tom River
14. McKenzie River
15. S. Fork McKenzie River
16. Coast Fork Willamette River
17. Middle Fork Willamette River
18. North Fork Willamette River
19. Hills Creek

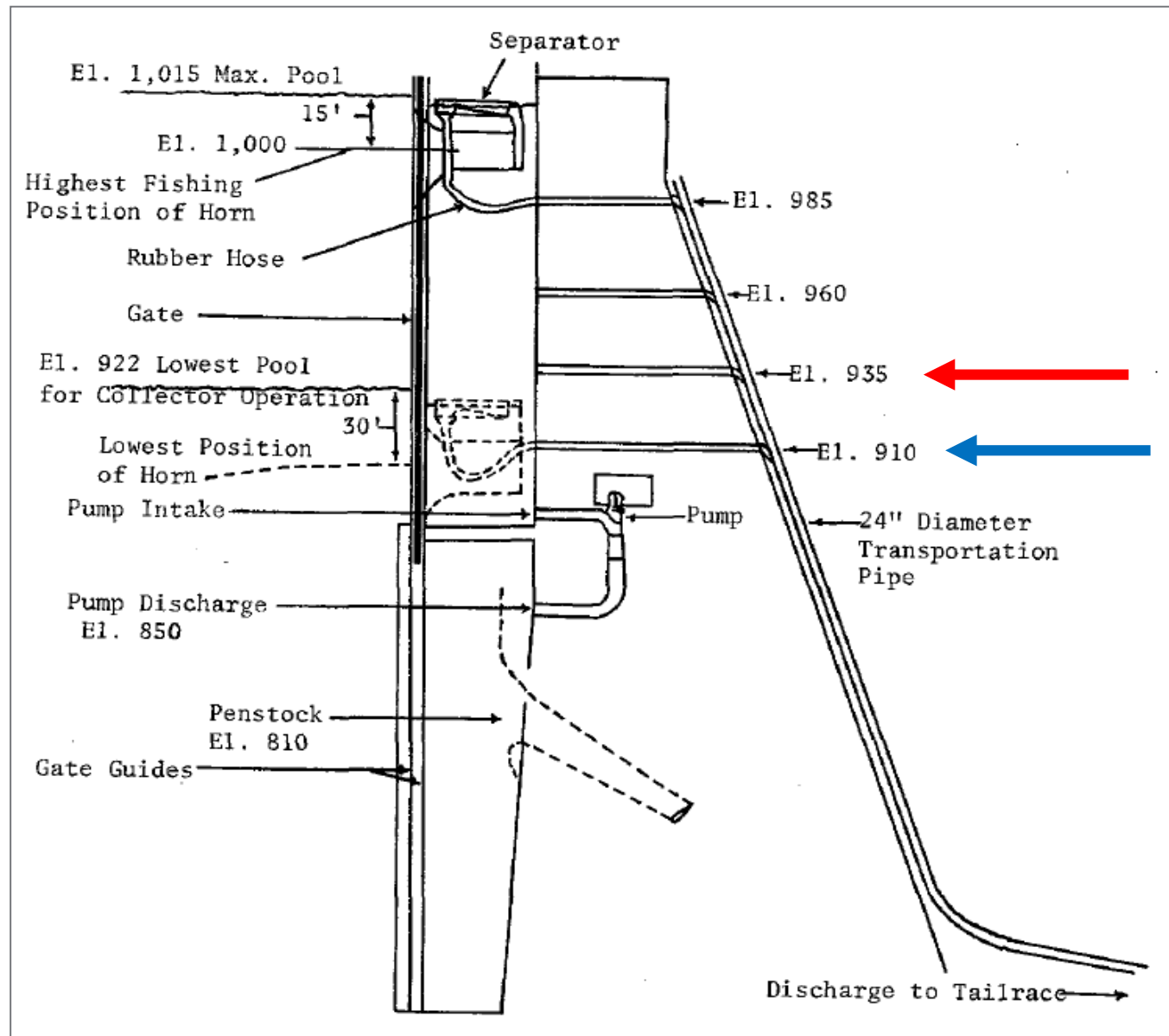


Detection Arrays



Sunnyside Park Detection Efficiency: 96.7%
Detection Ranges: ~100 m, 25-30 ft deep

Sectional View of Pipe Elevations



Fish Acquisition and Bypass Releases



Wild Fish
Surrogate
Program



Holding Tanks



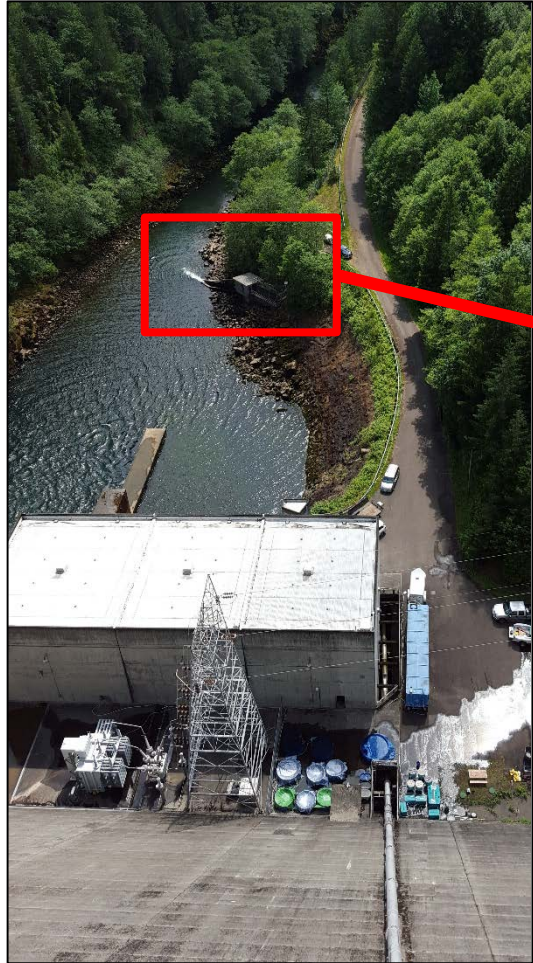
Bypass Release Tank



Bypass Releases

| <u>Valve Opening</u> | <u>Pipe Elevation</u> | <u>Species</u> |
|----------------------|-----------------------|----------------|
| 100% | 910 ft | STH-1 |
| 75% | | |
| 50% | | |

Fish Collection



Fish Passage

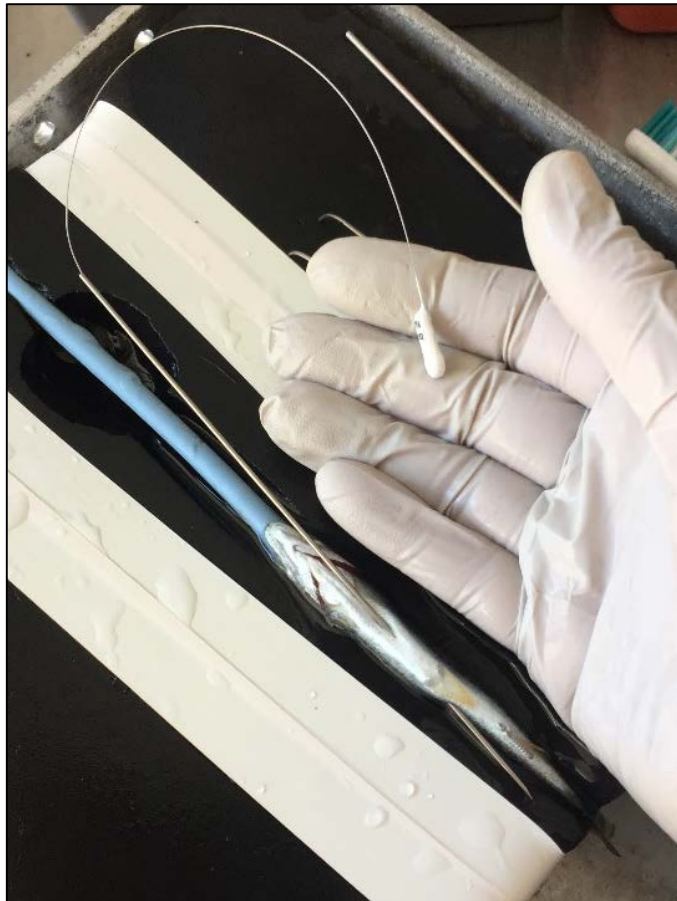


Fish Evaluator

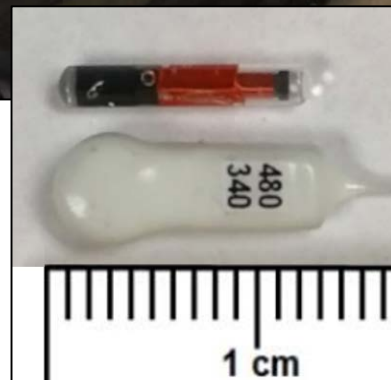
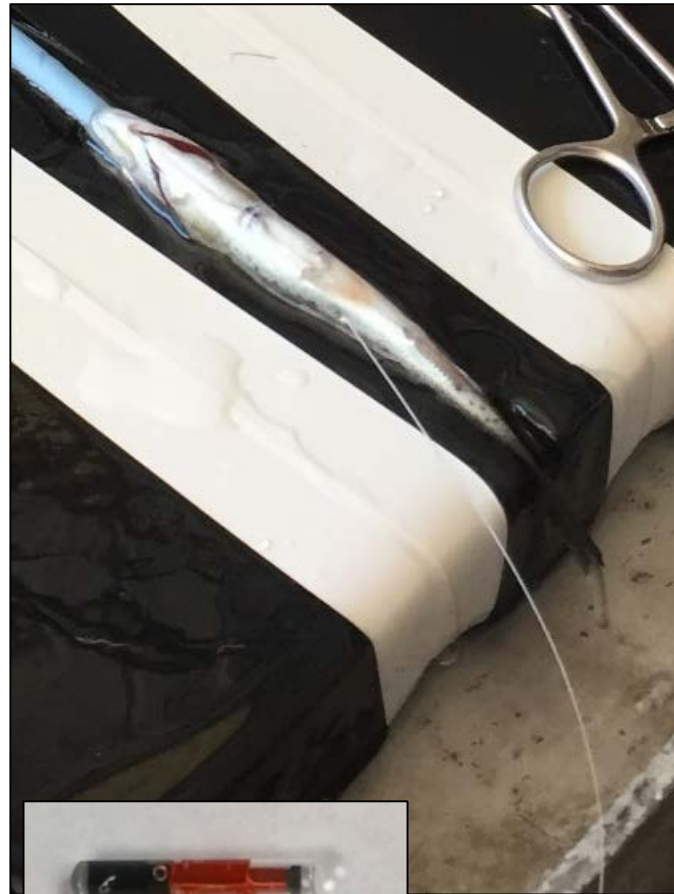


Holding Tanks

Fish Surgeries



Surgical Implantation



34.4 ± 0.8 days: tag life



Holding Tanks

Point Releases into Green Peter Tailwaters



Treatments and Release Methods

3 Release Dates: May 28—30, 2017

Age-1 Steelhead (STH-1)

STH-1 \geq 95 mm FL = radio + PIT

STH-1 < 95 mm FL = PIT-only

3 Gate Valve Openings

100%

75%

50%

2 Pipe Elevations

910 ft

935 ft

6 Test Treatments

2 Control Treatments

Control 9: Control Pipe → Tag → Release ($n = 18$)

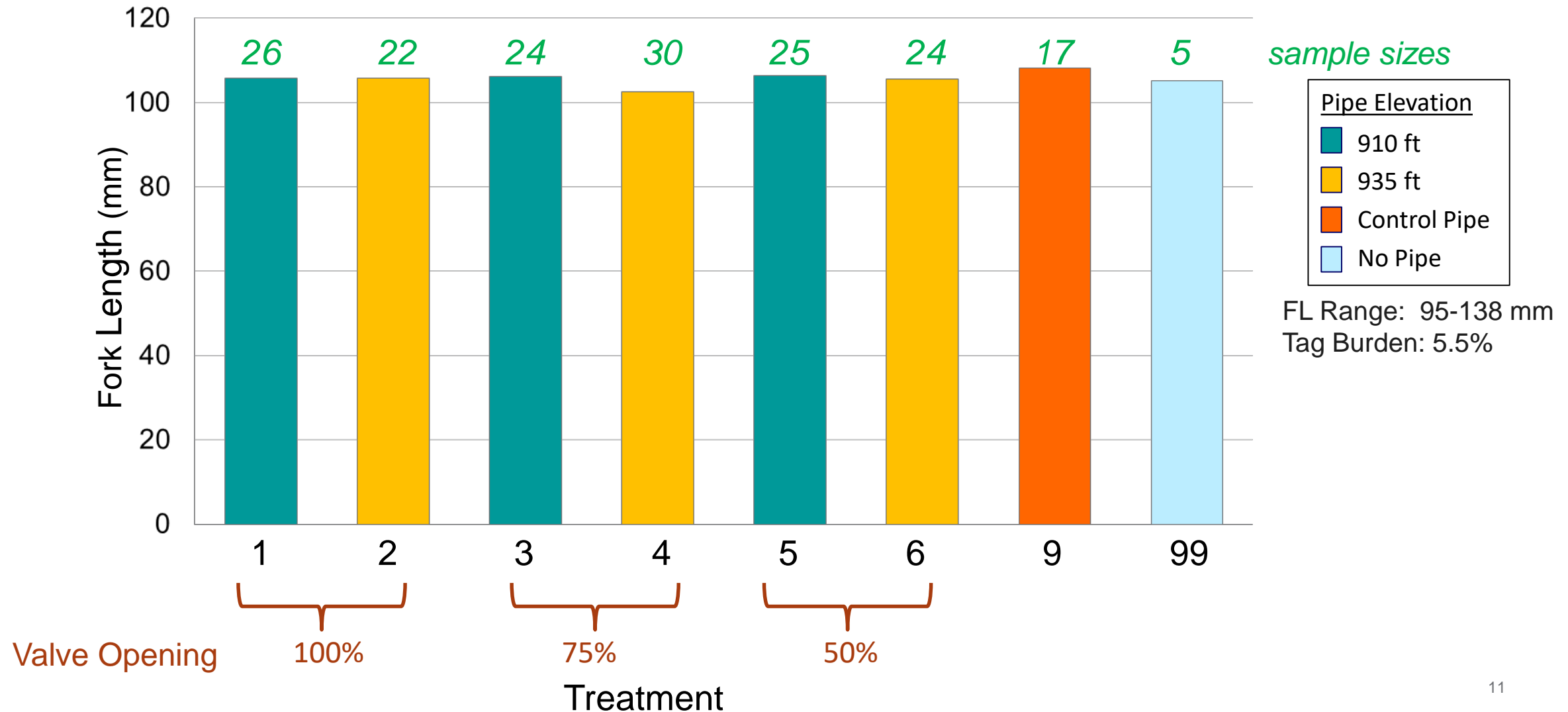
Control 99: Tag → Release ($n = 6$)

$n = 173$ STH-1 (radio + PIT)

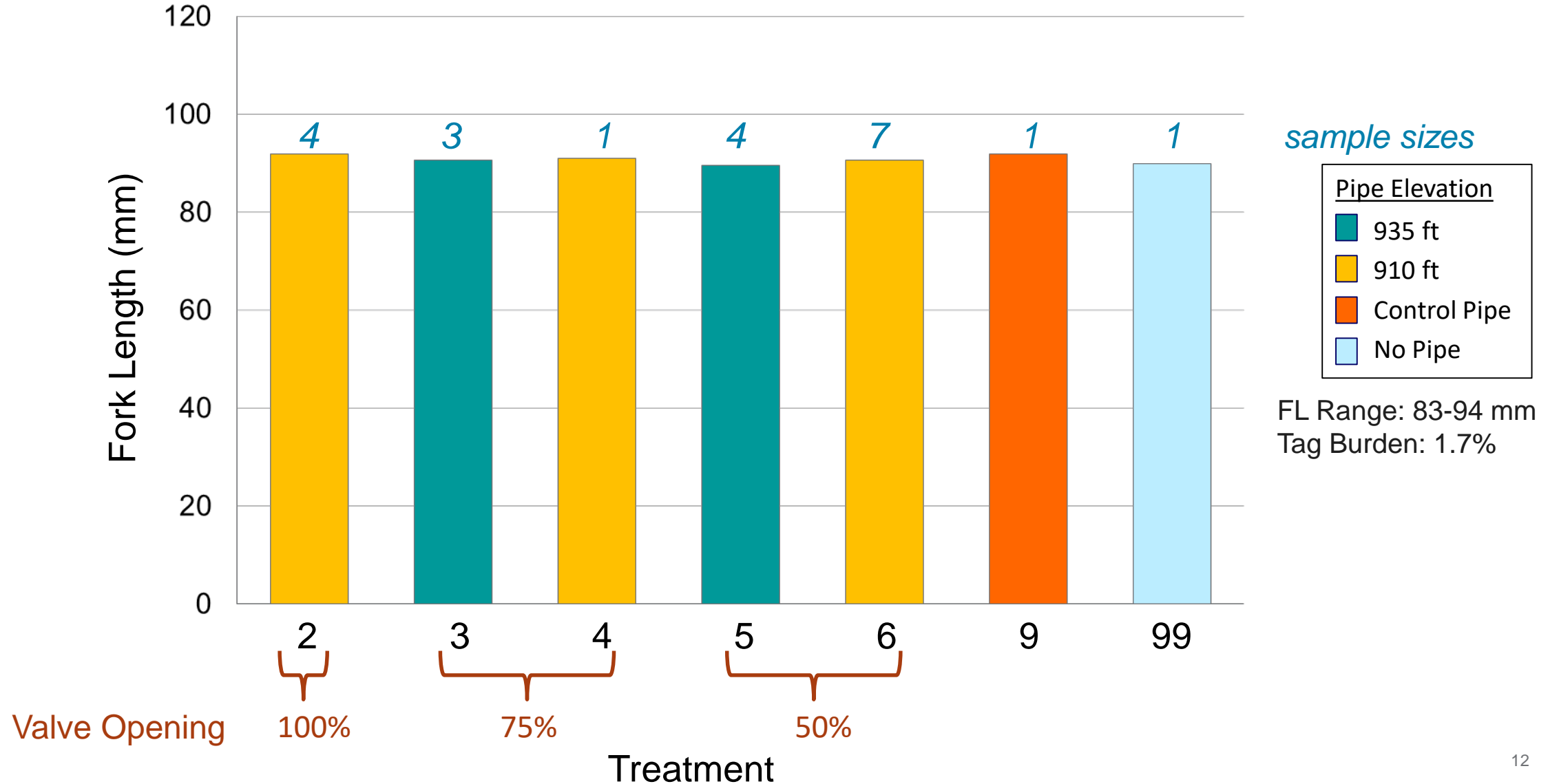
$n = 21$ STH-1 (PIT-only)

1-6: Bypass Pipe → Tag → Release ($n = 26-31$)

Mean Length for Radio and PIT Tagged STH-1

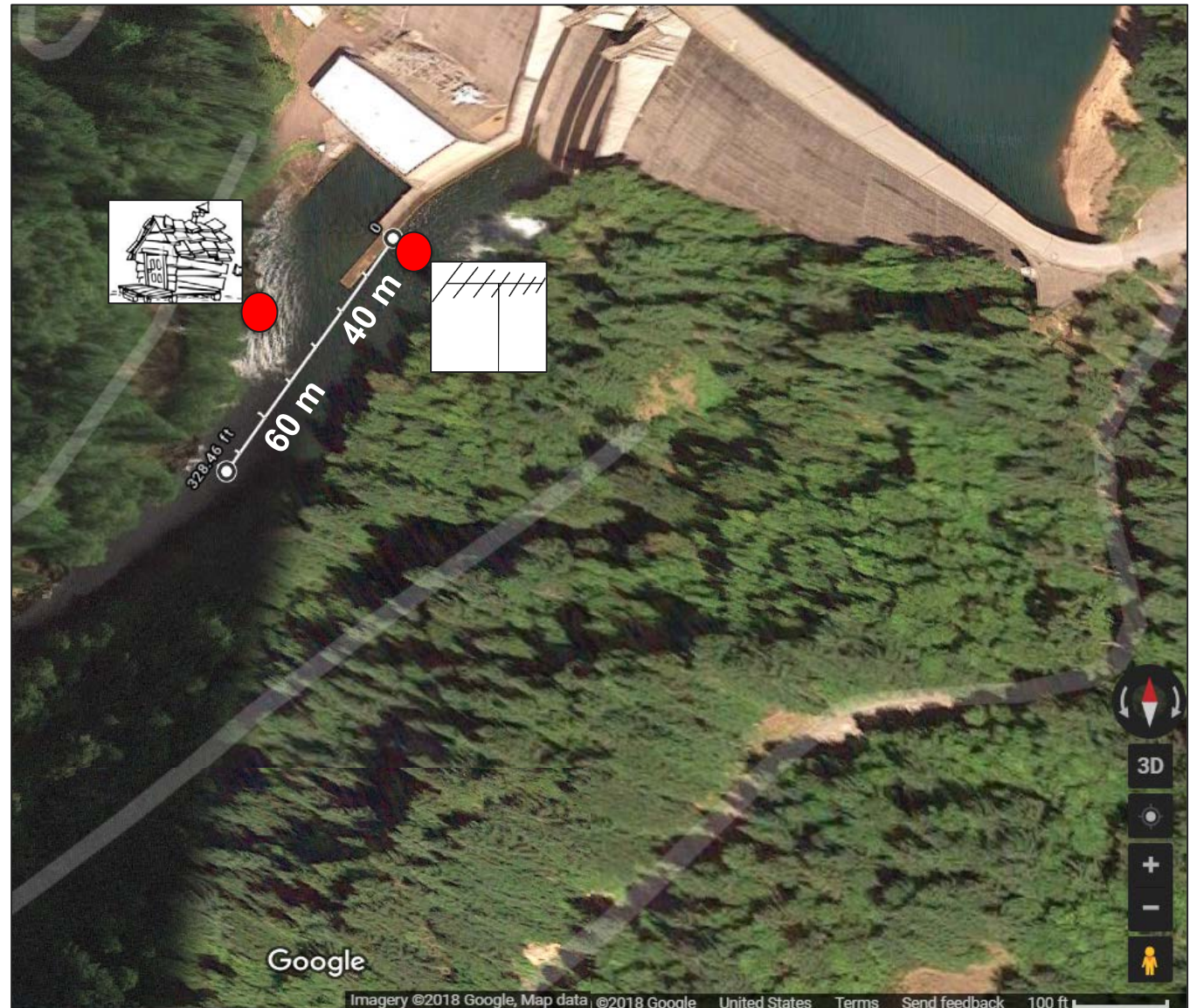


Mean Length for PIT-only Tagged STH-1

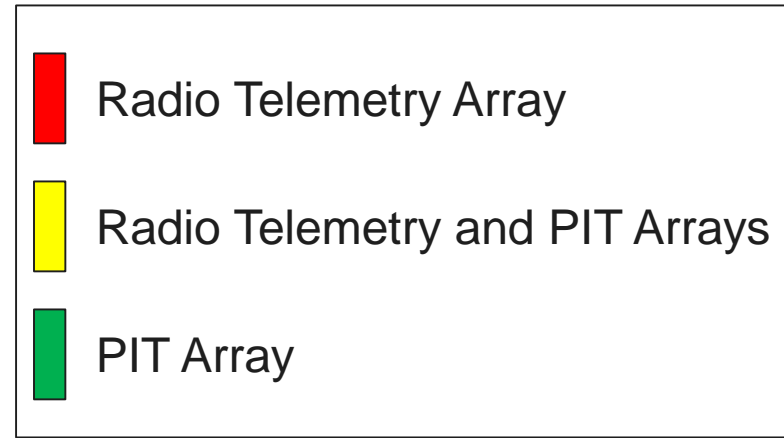
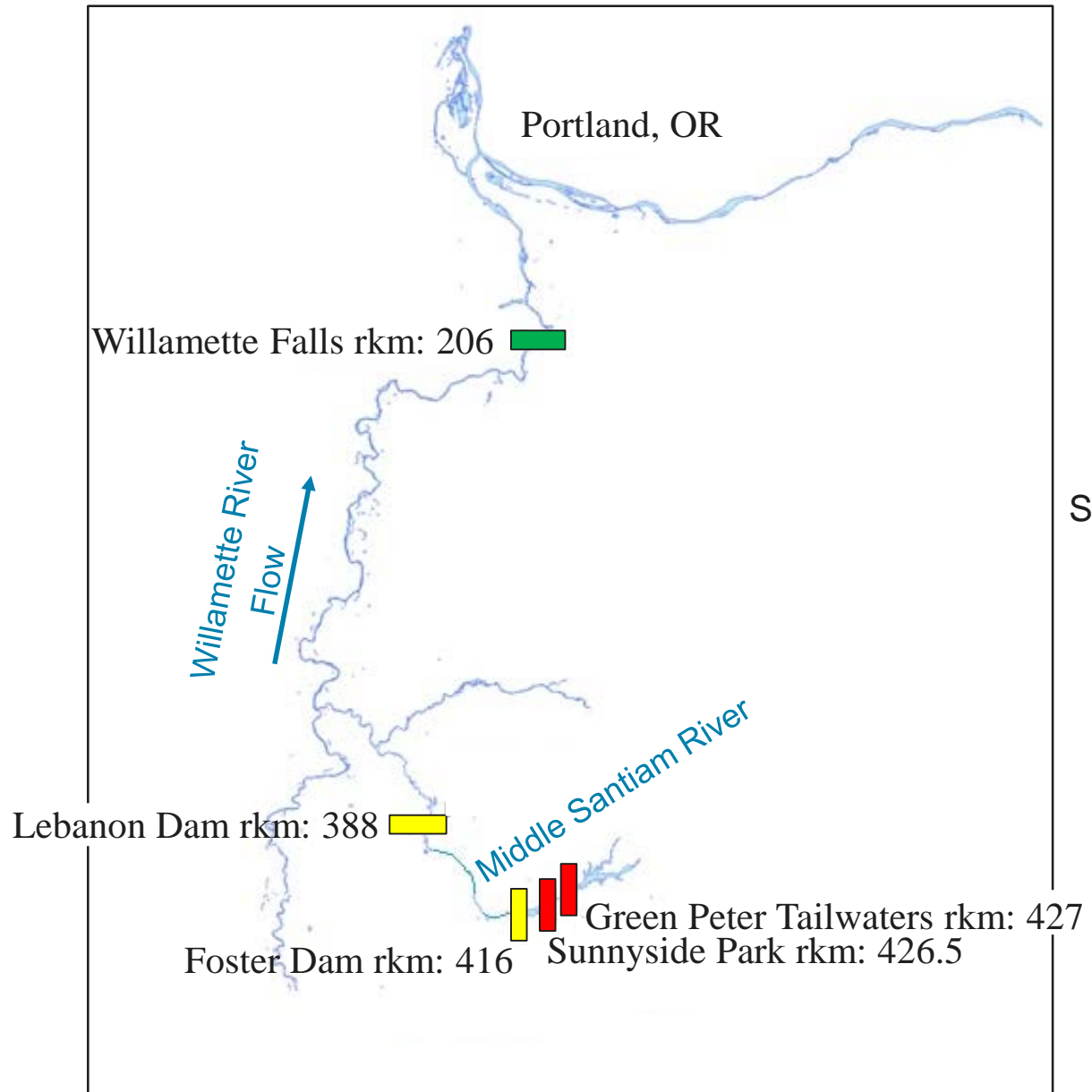


Results: No Detections Downstream of Green Peter Tailwaters

- ▶ No detections downstream of Green Peter tailwaters for radio and PIT tagged fish
- ▶ No PIT detections for radio and PIT tagged or PIT-only fish
- ▶ Detection Range
 - ~100 m
 - 25-30 ft deep

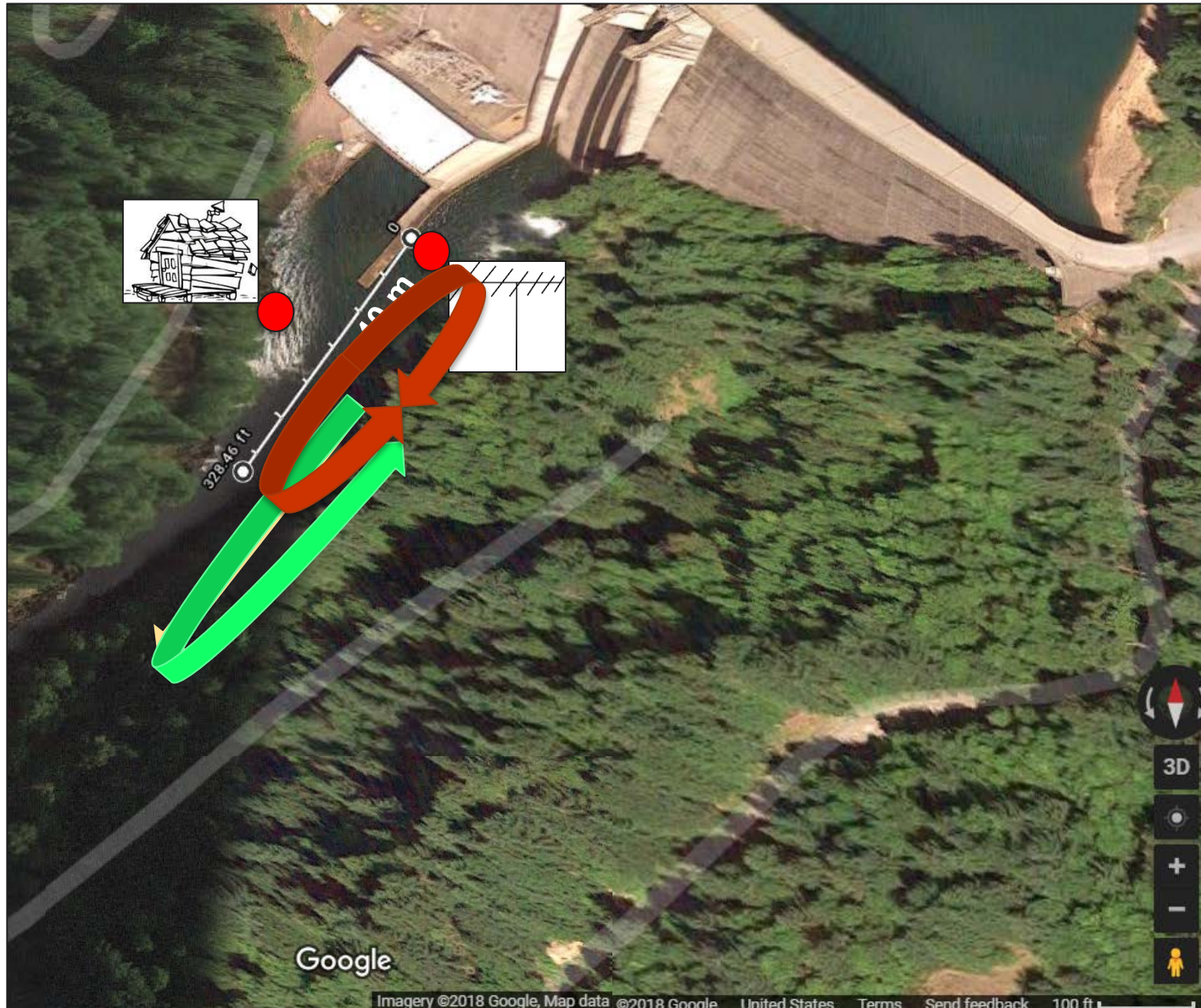


Detection Arrays



Sunnyside Park Detection Efficiency: 96.7%

Results: Movers, Movers and Returners, Stayers



| Classification* | <i>n</i> | Description |
|---------------------------|----------|--|
| Mover | 97 | < 30 days between first and last detections |
| Mover and Returner | 60 | Exited detection zone for at least 1 day, but returned and were again detected |
| Stayer | 15 | Detected at least once per day for ≥ 30 days. |

*Only describes radio and PIT tagged fish.
 34.4 ± 0.8 days: tag life

Discussion: Movers and Stayers

▶ Movers

- Suitable habitat between Green Peter and Sunnyside RT arrays?

▶ Movers and Returners

- Milling behaviors?

▶ Stayers

- Suitable habitat in Green Peter tailwaters?



► Consistent with previous juvenile steelhead studies in the Santiam River Basin

■ Hughes et al. 2016

- 1.5% ($n = 12$ of 796) age-2 steelhead detected at Willamette Falls
- 4.1% ($n = 4$ of 98) age-1 steelhead detected downstream of Foster Dam

■ Liss et al. 2017

- 2.0% ($n = 6$ of 294) age-2 steelhead detected at Foster Reservoir
- 0.3% ($n = 1$ of 294) age-2 steelhead detected downstream of Foster Dam

■ Monzyk et al. 2017

- Age-0 and age-1 steelhead typically rear for a minimum of an additional year



Summary

- ▶ STH-1 did not migrate through the Middle Santiam River
 - Radio and PIT tagged STH-1 not detected downstream of Green Peter tailwaters
 - No STH-1 detected on PIT arrays
- ▶ 56% Movers
- ▶ 35% Movers and Returners
- ▶ 9% Stayers



Acknowledgments and Questions?

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 - Engineering staff
 - Reservoir Control staff

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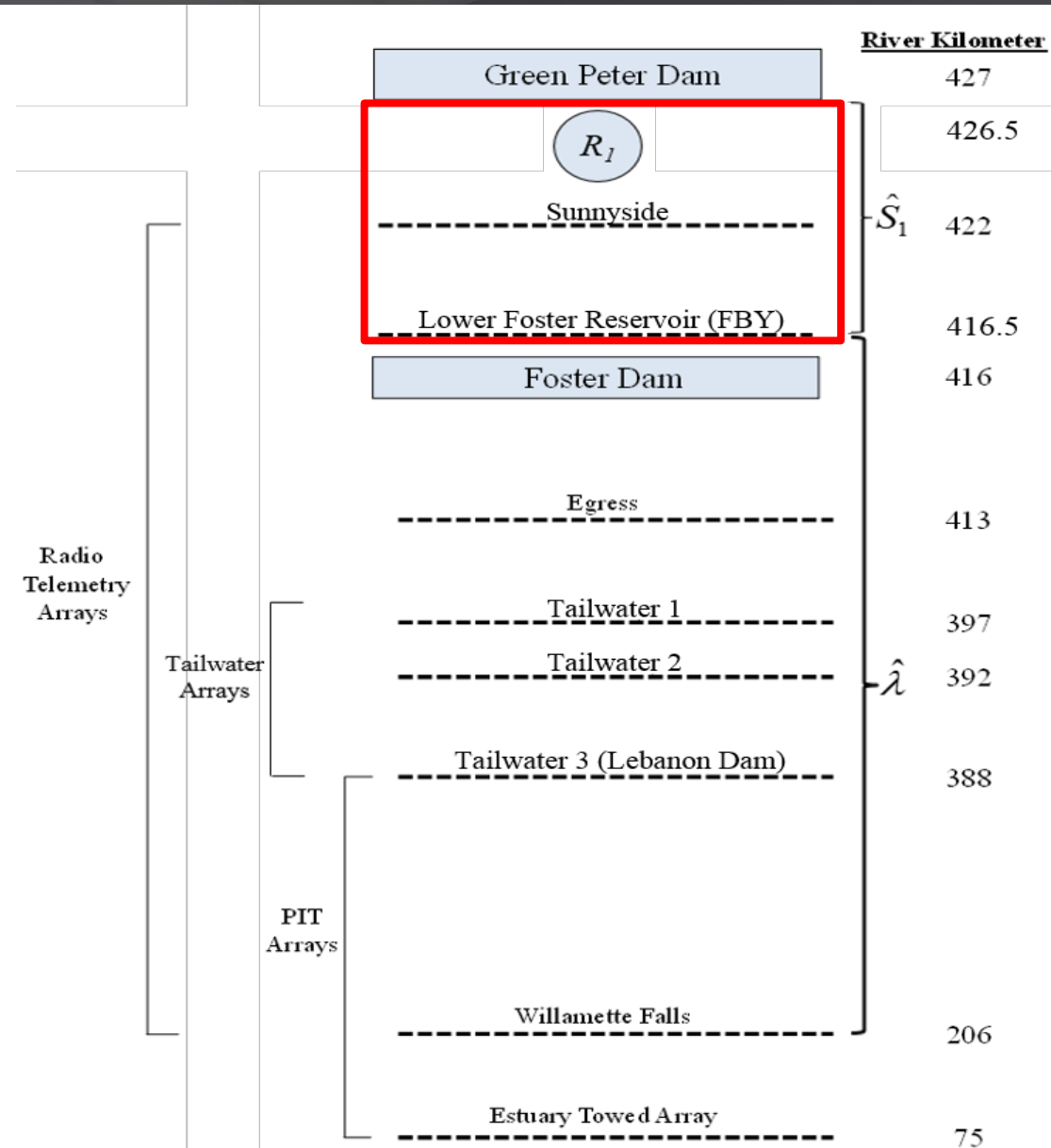
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Survival and Joint Probability of Detection and Survival



Daily Temperature during High Pool (635 ft) at Foster Reservoir



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