Integrating Pacific Lamprey Specific Solutions in Redesign of a Tributary Fish Ladder

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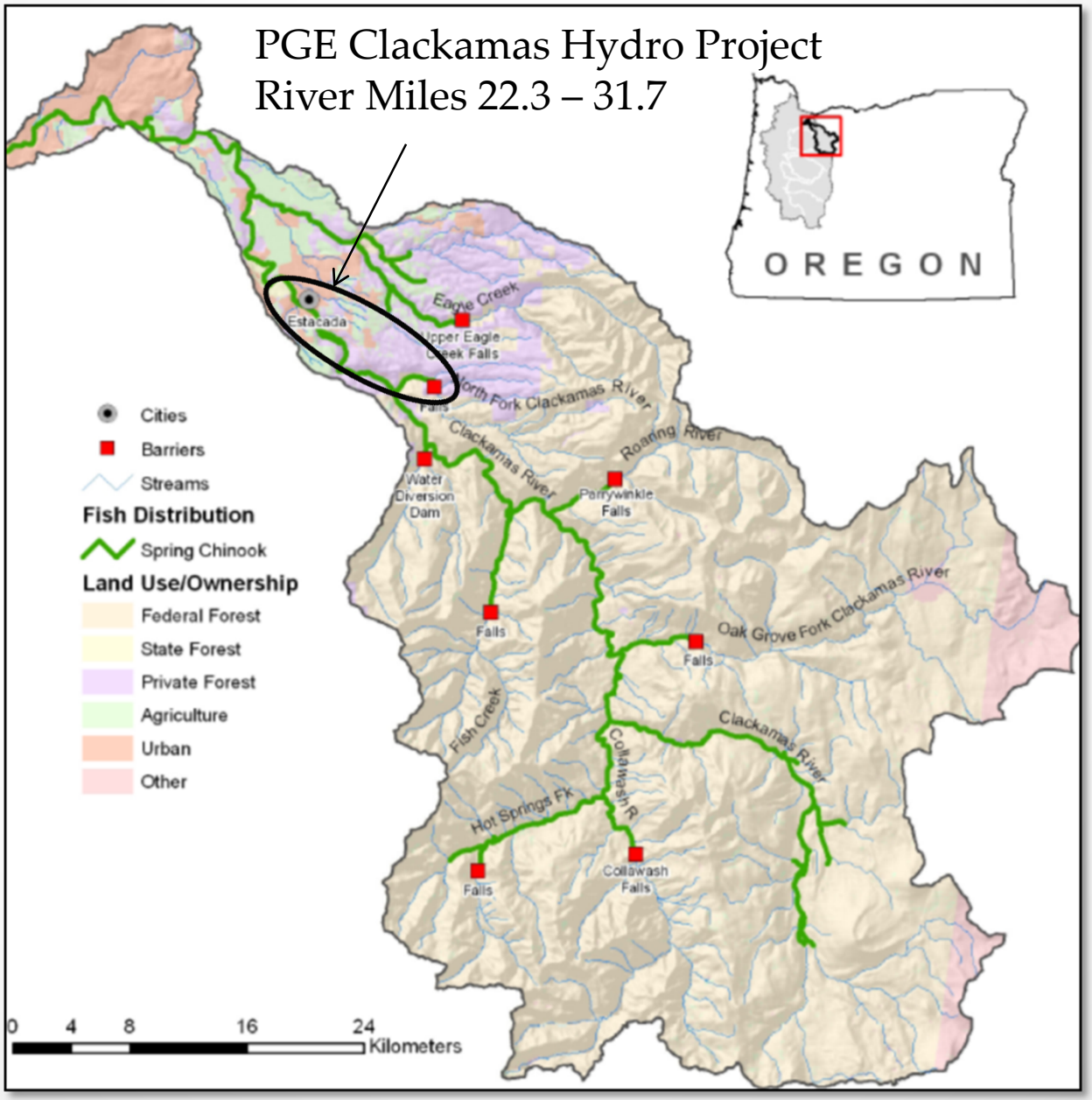
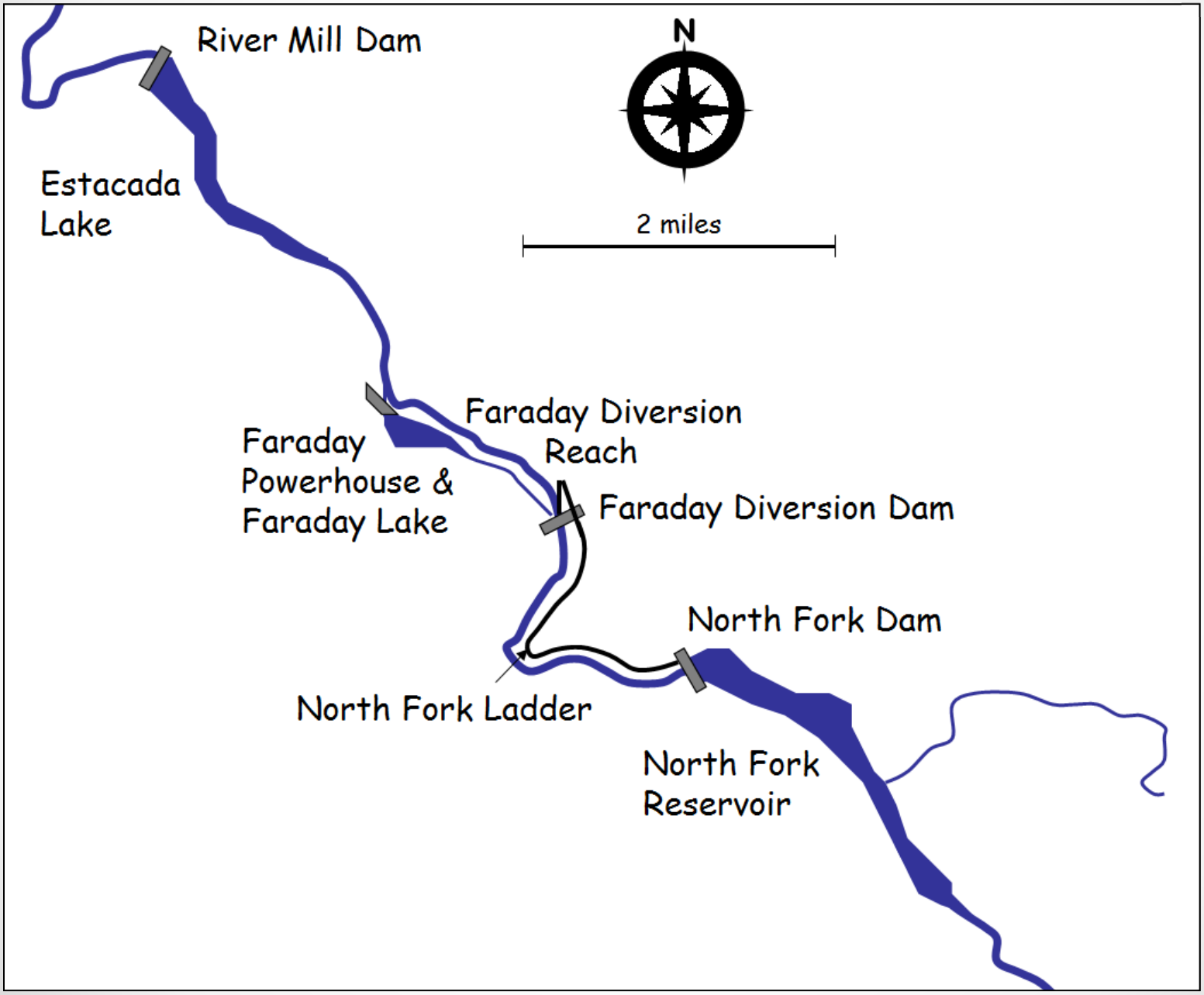
Setting:


PGE Clackamas Hydro Project
River Miles 22.3 – 31.7
OREGON
Estacada
Eagle Creek
Upper Eagle Creek Falls
North Fork Clackamas River
Falls
Clackamas River
Roaring River
Water Diversion Dam
Parrywinkle Falls
Oak Grove Fork Clackamas River
Falls
Falls
Fish Creek
Collawash R.
Clackamas River
Hot Springs Fk
Falls
Collawash Falls
Cities
Barriers
Streams
Fish Distribution
Spring Chinook
Land Use/Ownership
Federal Forest
State Forest
Private Forest
Agriculture
Urban
Other
0 4 8 16 24
Kilometers

Setting:


River Mill Dam
N
Estacada
Lake
2 miles
Faraday Diversion
Reach
Faraday
Powerhouse &
Faraday Lake
Faraday Diversion Dam
North Fork Dam
North Fork Ladder
North Fork
Reservoir

River Mill Dam:

Built in 1911

First concrete fish ladder west of Mississippi River

80 ft head

River Mill Ladder: 1911 - 2006

River Mill Ladder: 1911 - 2006

River Mill Ladder: 2007 - present

River Mill Ladder: 2007 - present

- Entrance velocity:
  6.4 – 7.2 fps

6″ Radius upstream and downstream of entrance

Overview
- Built in 2005-2006
- 19 cfs
- Half Ice Harbor Style

Pools
- 10′ long
- 6′ wide x 6′ deep
- Weir Crests – 3′
- Orifice – 1.25′ x 1.5′

River Mill Ladder: 2007 - present

- Entrance velocity:
  6.4 – 7.2 fps

Flush mounted entrance gates

Overview
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- Half Ice Harbor Style

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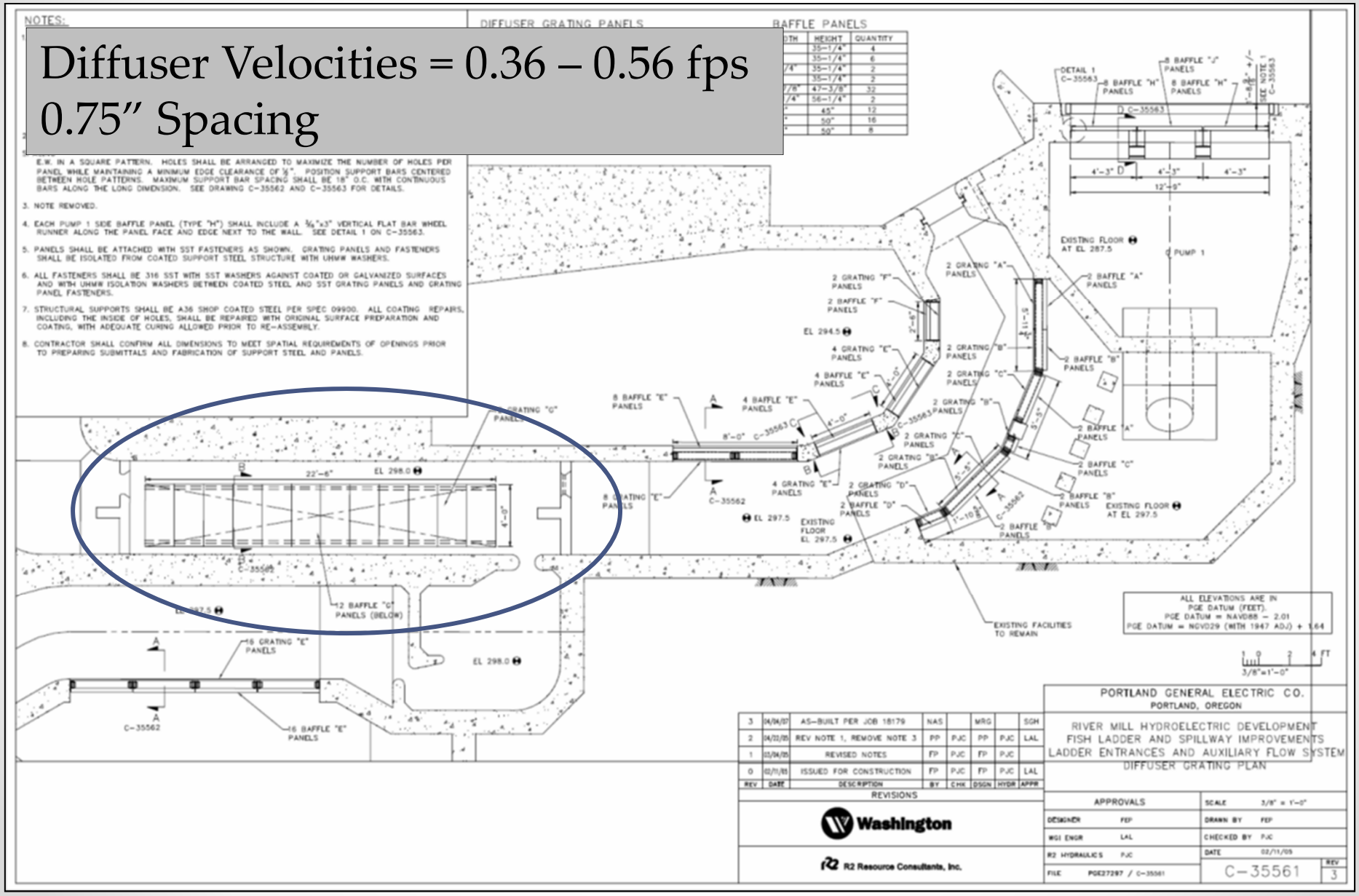
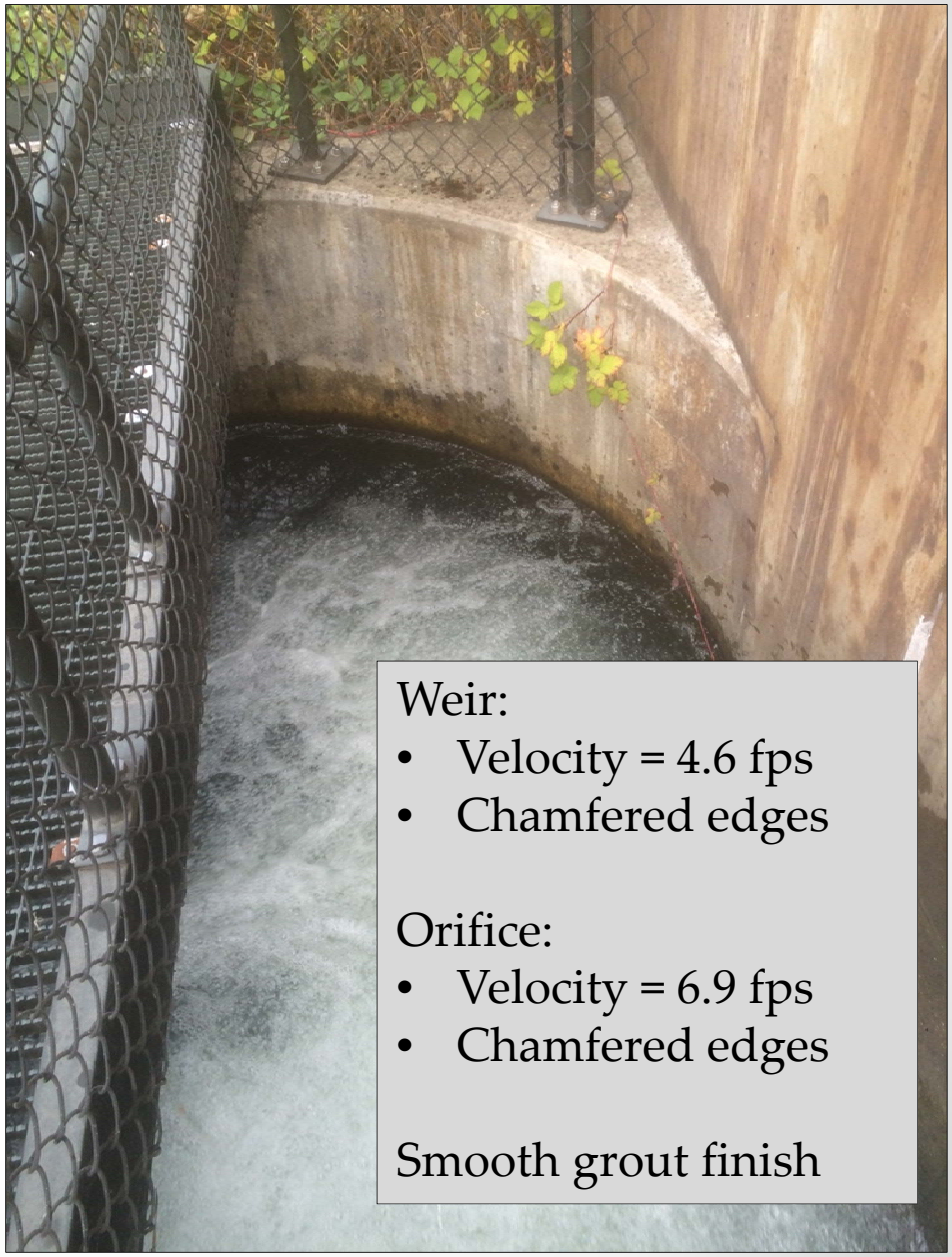
River Mill Ladder: 2007 - present



River Mill Ladder: 2007 - present

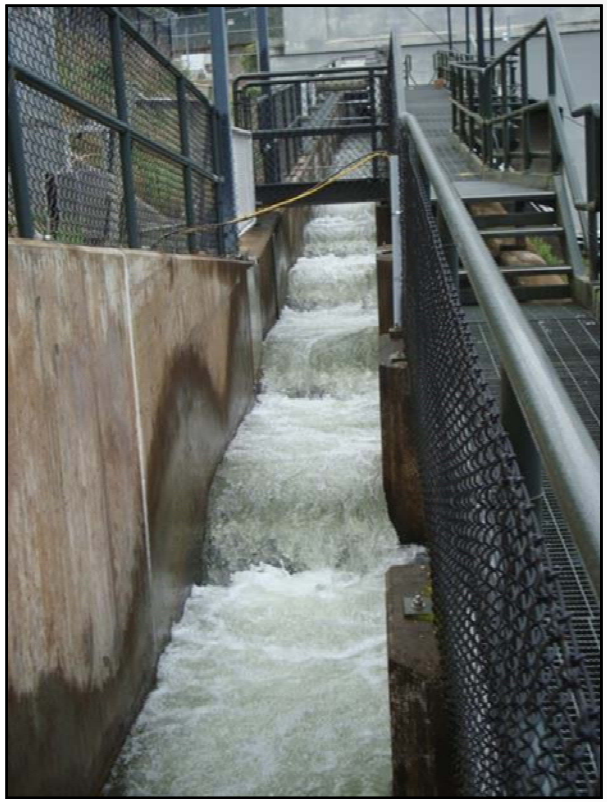


Weir:
- Velocity = 4.6 fps
- Chamfered edges

Orifice:
- Velocity = 6.9 fps
- Chamfered edges

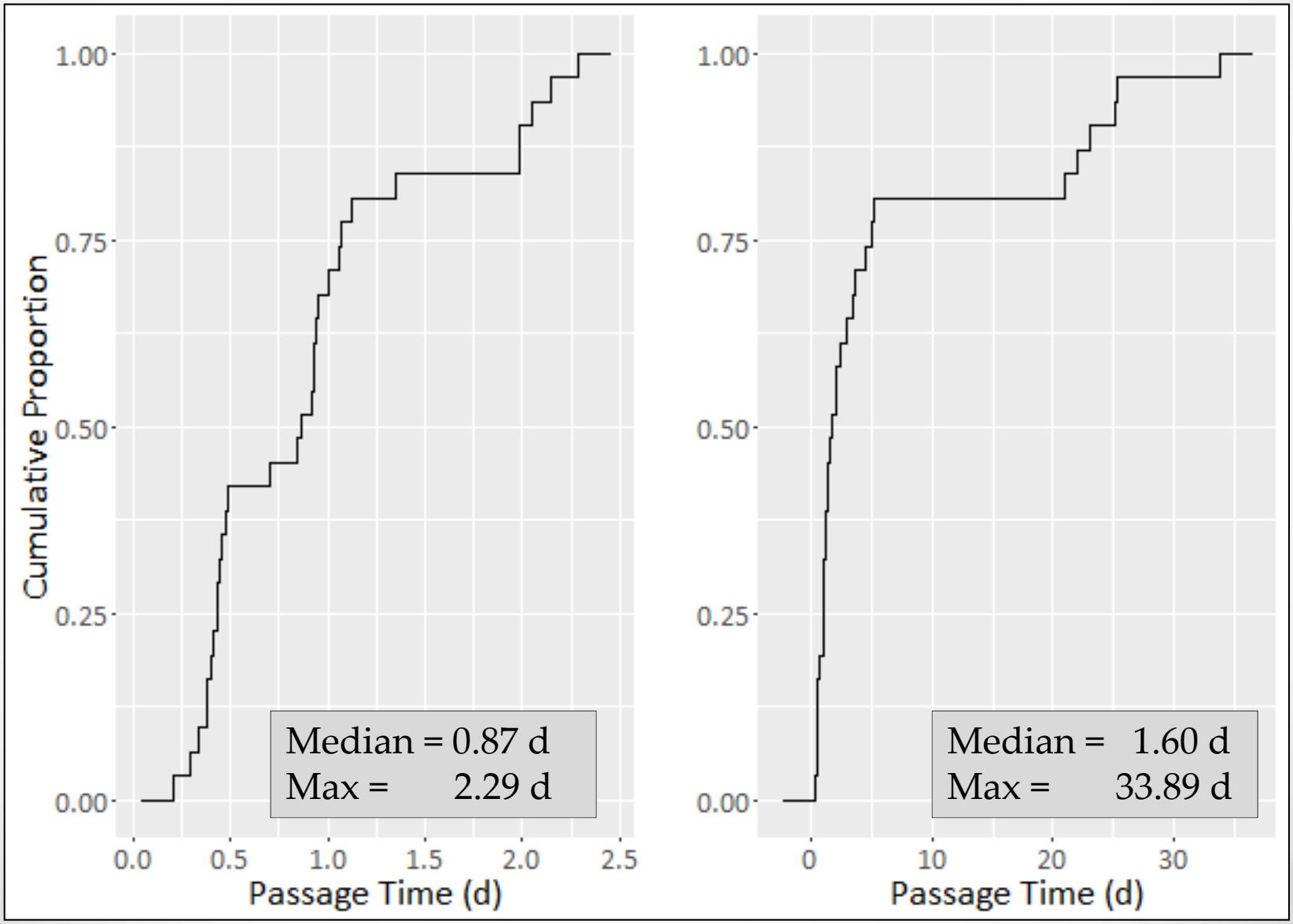
Smooth grout finish

Ladder Performance Evaluation



			Passage Rate	
Year	Tag Type	# Released/In TR	Estimate	95% CI
2013	PIT	42	**96%**	68-100%
	Radio	37	**84%**	69-92%
2015	PIT	51	**94%**	86-100%
	Radio	20	**90%**	70-97%

Ladder Performance Evaluation



Regional Lamprey Passage Efficiency:

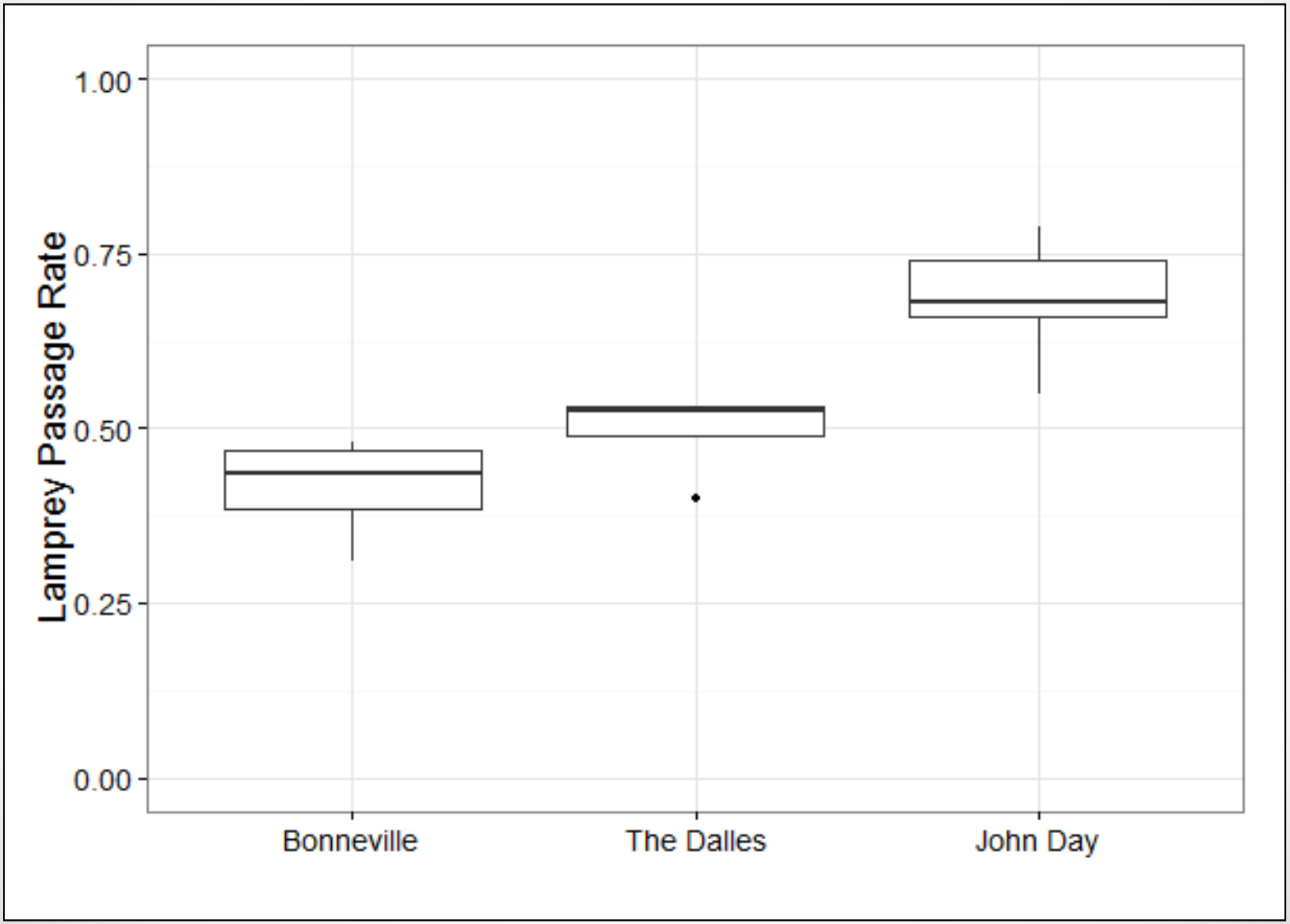
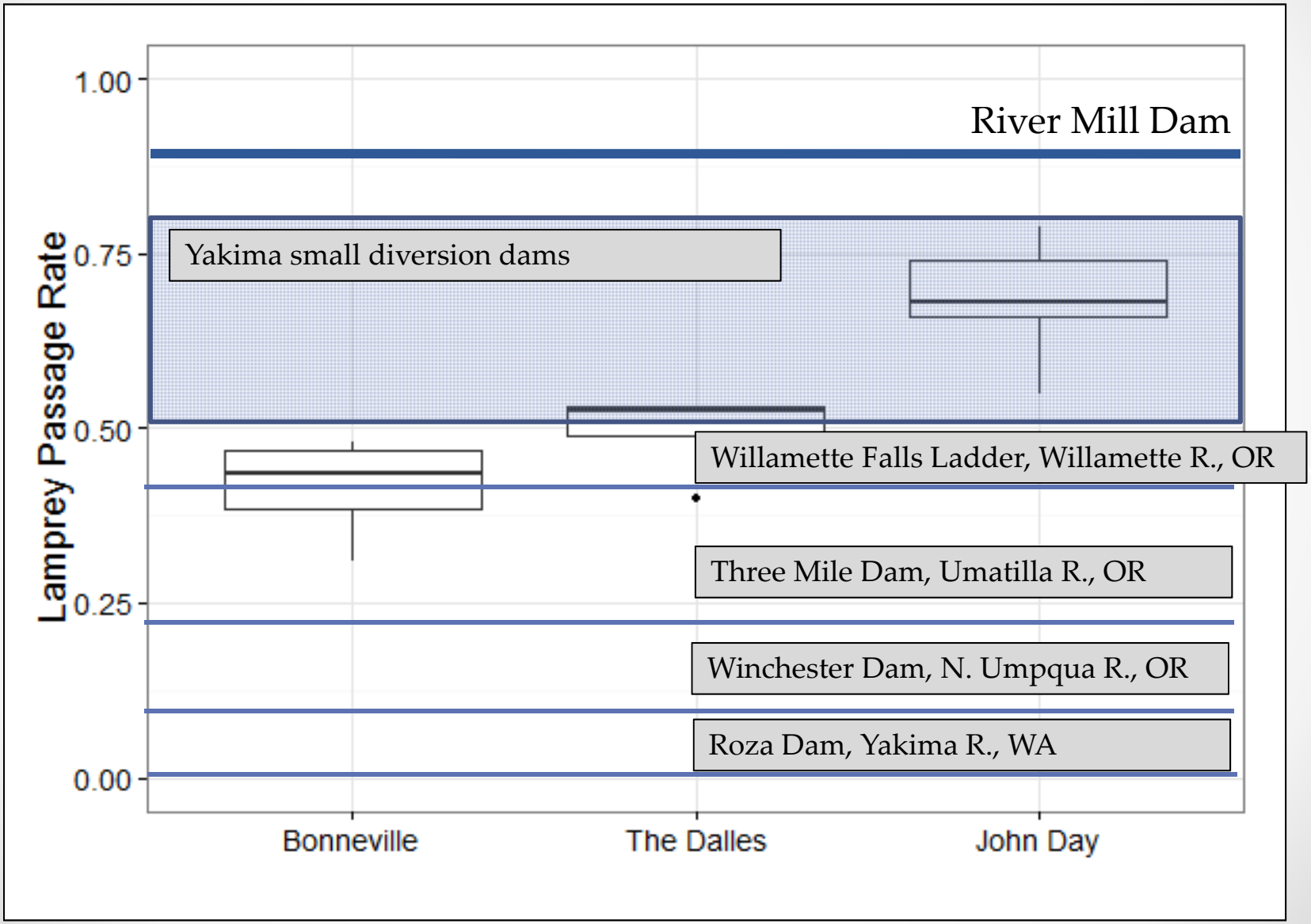


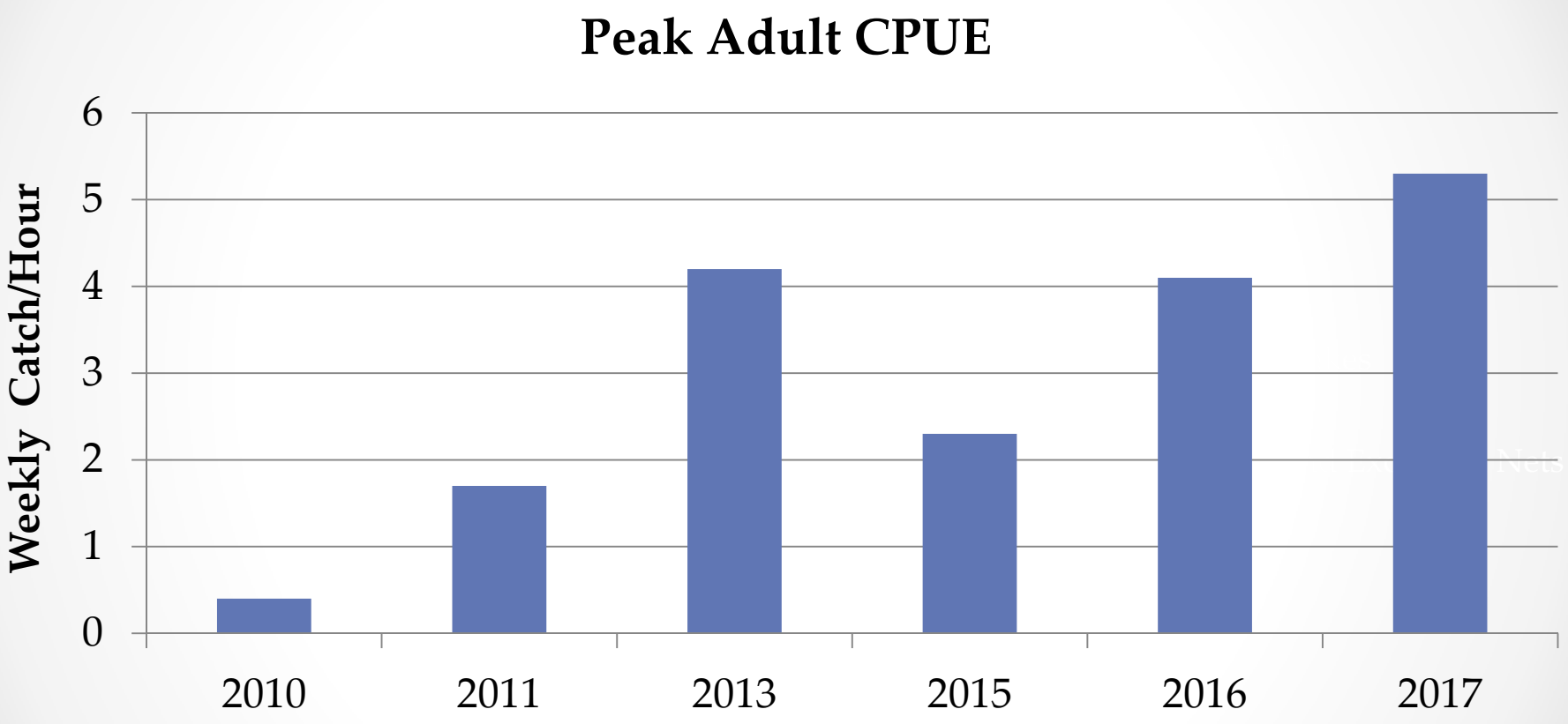
Figure developed from data presented in Keefer et al. 2012

Regional Lamprey Passage Efficiency:



Grote et al. 2014; Karchesky et al. 2010; Jackson and Moser 2012; Lampman 2011

Trends in Abundance:



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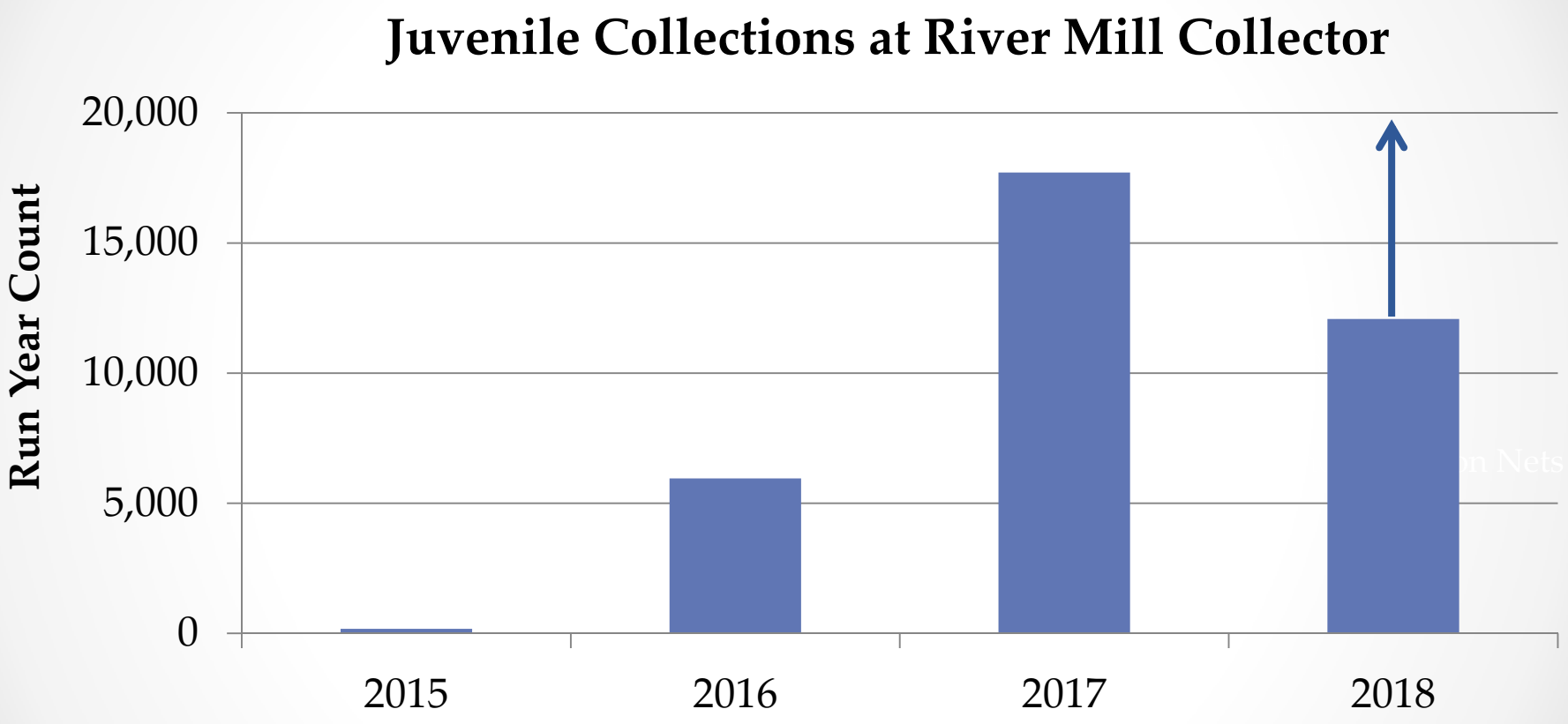

Conclusions:

Original ladder was the first concrete fish ladder built west of the Mississippi

New ladder was the first built with lamprey specific design elements

Lamprey passage rate of 90% exceeds regional estimates by 10-90%

Exclusion Nets

Passage times relatively rapid

Adult and juvenile counts trending upwards

Questions?

Bibliography

Grote, A.B., M.C. Nelson, C. Yonce, A. Johnsen, D.J. Sulak, and R.D. Nelle. 2014. Passage of radio tagged adult Pacific lamprey at Yakima River diversion dams. 2013. Annual Report. USFWS, Leavenworth, WA.

Karchesky, C.M., D.P. Cramer and M.E. Hanks. 2010. Evaluation of adult Pacific lamprey passage at the Willamette Falls Project, 2009. Prepared for Portland General Electric (PGE), Portland, OR.

Keefer, M.L., T.C. Clabough, M.A. Jepson, E.L. Johnson, C.T. Boggs and C.C. Caudill. 2012. Adult pacific lamprey passage: data synthesis and fishway improvement prioritization tools. Department of Fish and Wildlife Sciences, College of Natural Resources, University of Idaho.

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Lampman, R. T. 2011. Passage, migration behavior, and autoecology of adult Pacific lamprey at Winchester Dam and within the North Umpqua River Basin, Oregon, USA. Master of Science Thesis submitted to Oregon State University, Corvallis, Oregon.