# Increasing Felton Diversions to Improve System Reliability

What are the Possibilities?

Starters

- It is beneficial to increase volumes diverted from Felton to Loch Lomond.

- But these diversions are not the ultimate goal. Rather, they are a means to an end, namely improving supply reliability to Santa Cruz customers.

Distribution of Peak-Season Shortages: Current System
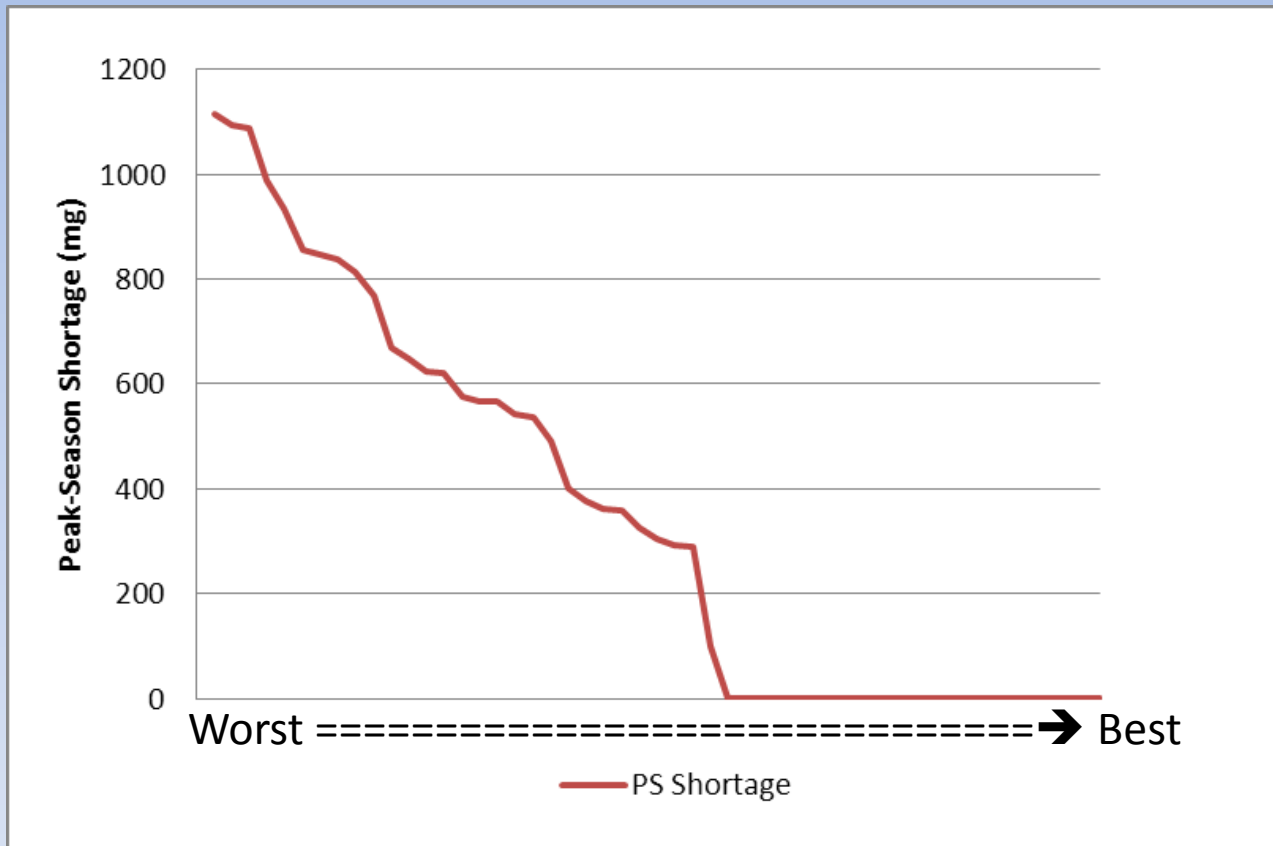
Assumes climate change and DFG-5 fish flows.

Current System Peak-Season Shortages with Overlay of Annual Felton Production, End of April Lake Contents
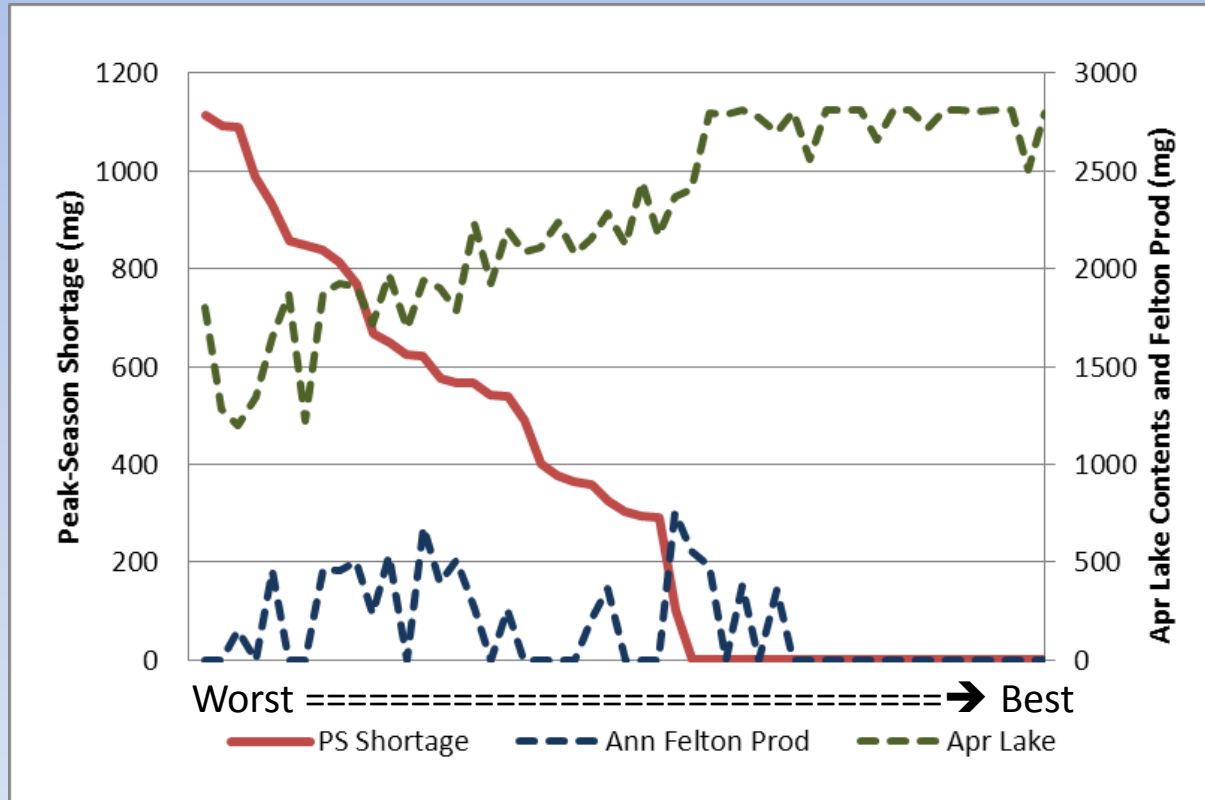
# Two Potentially-Limiting Operating Constraints

- First Flush
  - Requires that river be flushed in fall before diverting from Felton.

- Turbidity
  - No Felton diversions on storm days when river water quality is degraded.

First Flush is an Important Constraint on Felton Pumping

- If this constraint were completely removed, substantially more water could be diverted to lake, especially in driest years:

	Worst-Year Ann Felton Div (mg)	Average Ann Felton Div (mg)
Current Ops	0	400
No First Flush	520	540

How Much Does This Added Pumping Improve Lake Levels and System Reliability?

End-of-April Lake Contents
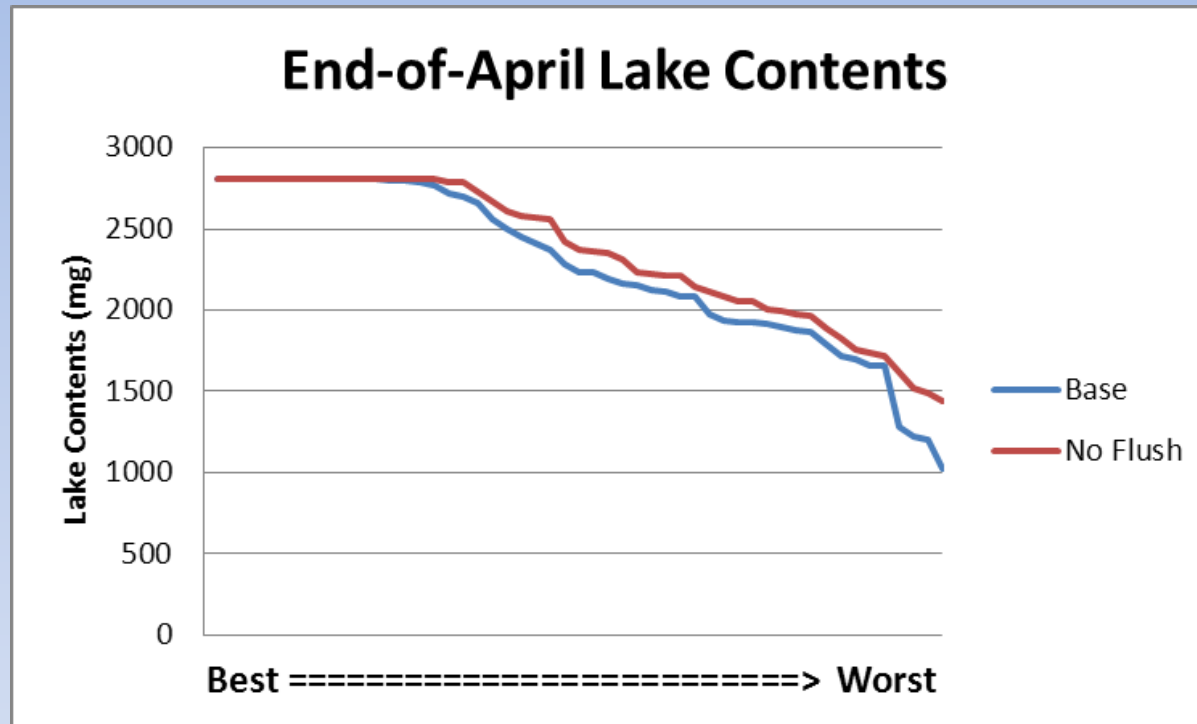
	Worst-Year PS Shortage (mg)	Average PS Shortage (mg)
Current Ops	1110	340
No First Flush	950	230

Turbidity is Not a Major Constraint on Felton Pumping

- Turbidity events generally occur in the wetter years, which are precisely those years in which the lake is more full.

- With climate change, there are many fewer turbidity events, and almost none in the driest years.

Relaxing current constraint on diverting turbid water to lake results in little additional lake fill.

Three Infrastructure Improvements to Potentially Increase Felton Diversions to Lake

- Replacement pipe

- Second pipe

- Pump improvements at diversion

How Much Does a Replacement Pipe Increase Felton Diversions?

	Worst-Year Ann Felton Diversion (mg)	Average Ann Felton Diversion (mg)
Current Ops	0	400
Current Ops & Rep Pipe	0	530
No First Flush	520	540
No 1st Flush & Rep Pipe	650	700

How Much Does Replacement Pipe Help Lake Levels and System Reliability?
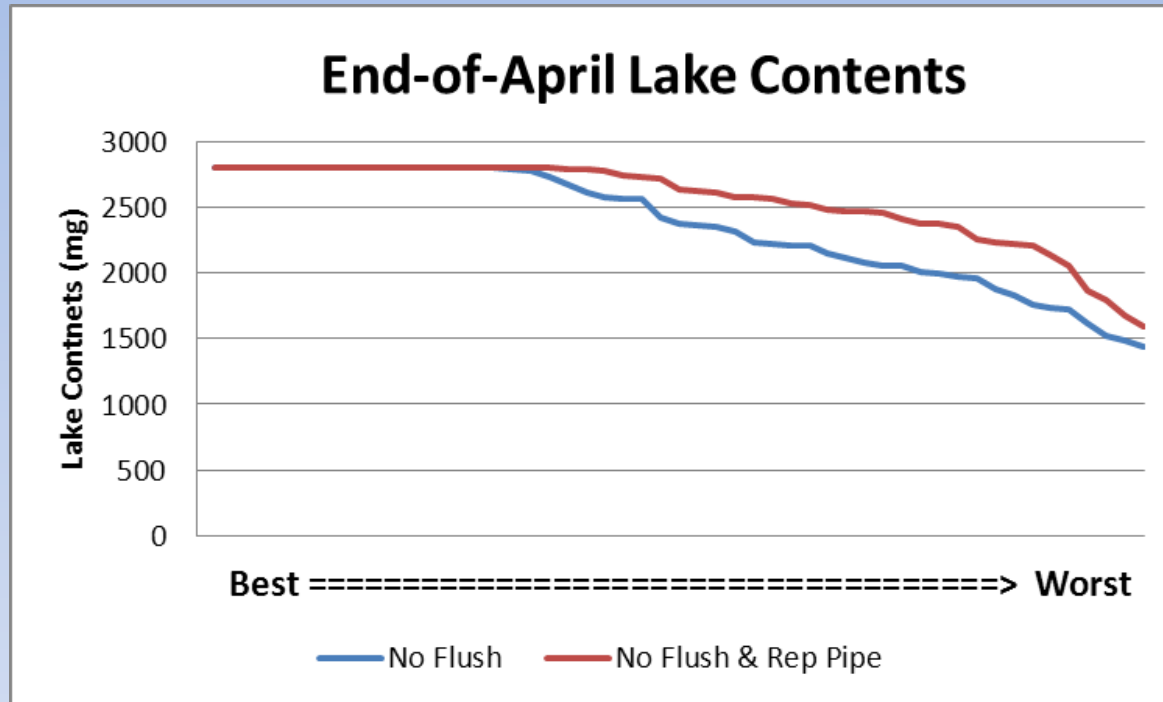
End-of-April Lake Contents

	Worst-Year PS Shortage (mg)	Average PS Shortage (mg)
No 1st Flush	950	230
No 1st Flush & Replacement Pipe	780	130

How Much Does a Second Pipe Increase Felton Diversions?

	Worst-Year Ann Felton Diversion (mg)	Average Ann Felton Diversion (mg)
Current Ops	0	400
Current Ops & 2nd Pipe	0	530
No First Flush & No Turb	520	540
No 1st Flush & No Turb & 2nd Pipe	650	730

	Worst-Year Ann Felton Diversion (mg)	Average Ann Felton Diversion (mg)
Current Ops	0	400
Current Ops & Rep Pipe	0	530
No First Flush	520	540
No 1st Flush & Rep Pipe	650	700

How Much Does 2ⁿᵈ Pipe Improve System Reliability?

	Worst-Year PS Shortage (mg)	Average PS Shortage (mg)
No 1ˢᵗ Flush & No Turb	950	230
No 1ˢᵗ Flush & No Turb & 2nd Pipe	780	130

	Worst-Year PS Shortage (mg)	Average PS Shortage (mg)
No 1ˢᵗ Flush	950	230
No 1ˢᵗ Flush & Replacement Pipe	780	130

How Much More Do Pump Upgrades Improve Reliability?

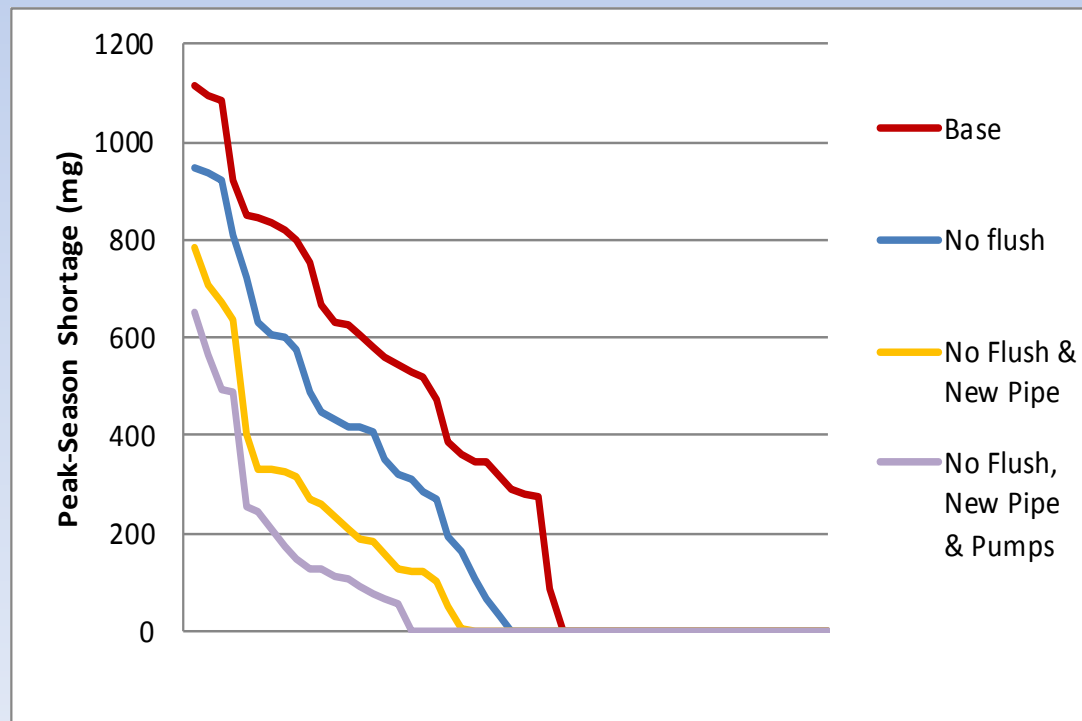|	Worst-Year PS Shortage (mg)	Average PS Shortage (mg)
Base	1,110	340
Current Ops & Rep Pipe	1,110	250
Current Ops & Rep Pipe & Pump Improvements	1,110	190
No First Flush	950	230
No 1st Flush & Rep Pipe	780	130
No 1st Flush & Rep Pipe & Pump Improvements	650	80

Bottom Line with Current Operations

- If City maintains the current first-flush constraint, infrastructure upgrades can improve system reliability, but not in the worst year.

	Worst-Year Peak-Season Shortage		Average-Year Peak-Season Shortage	
	Volume (mg)	Percent	Volume (mg)	Percent
Base	1110	57%	340	17%
Replacement Pipe	1110	57%	250	13%
Rep Pipe & Pump Improve	1110	57%	190	10%

Bottom Line: The Best Case

- Divert at Felton before first flush

- Replacement pipe

- Pump upgrades

Chart: Peak-Season Shortage (mg) plotted for four scenarios: Base, No flush, No Flush & New Pipe, No Flush, New Pipe & Pumps

Bottom Line: The Best Case

- Divert at Felton before first flush

- Replacement pipe

- Pump upgrades

	Worst-Year Peak-Season Shortage		Average-Year Peak-Season Shortage	
	Volume (mg)	Percent	Volume (mg)	Percent
Base	1110	57%	340	17%
No 1st Flush & Rep Pipe & Pump Upgrades	650	33%	80	4%