



**RMP**  
REGIONAL MONITORING  
PROGRAM FOR WATER QUALITY  
IN SAN FRANCISCO BAY

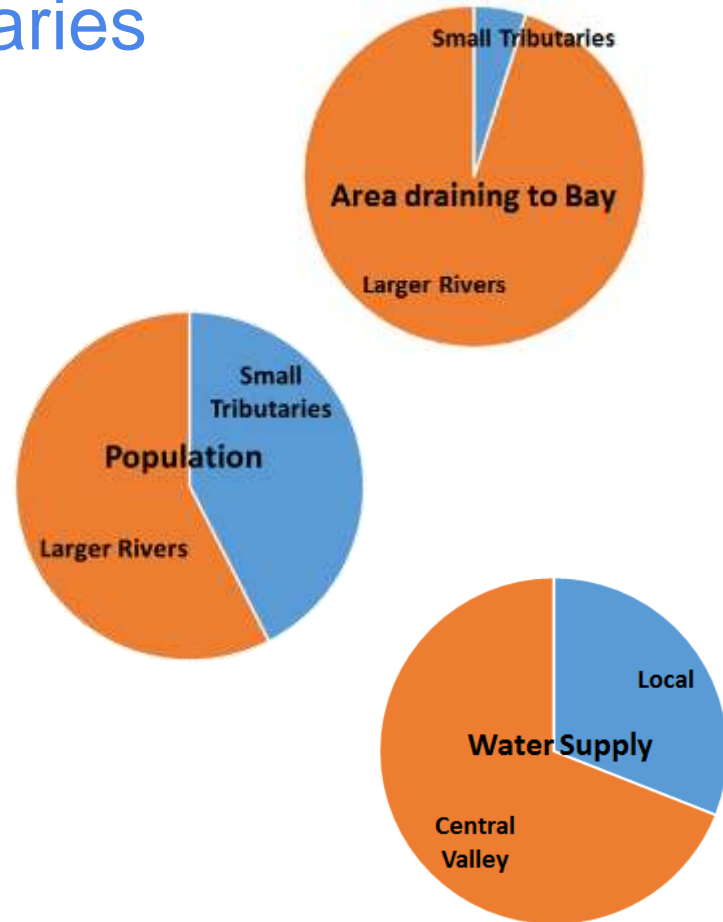
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# The Importance of Small Tributaries: What We Have Learned from 16 Years of Sediment and Pollutant Load Monitoring

Lester McKee, Alicia Gilbreath, Jing Wu, Jennifer Hunt, Don Yee,  
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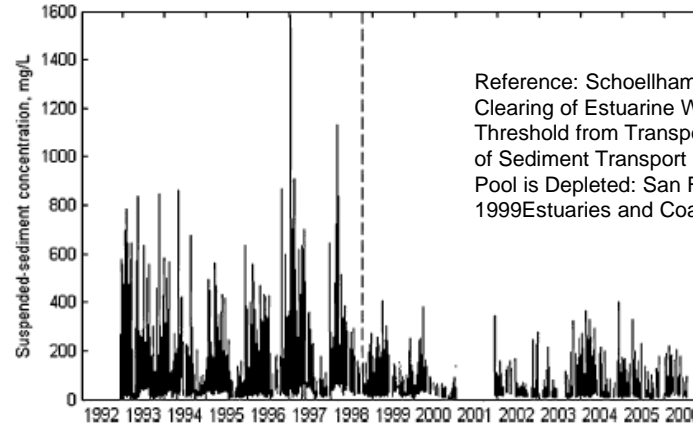
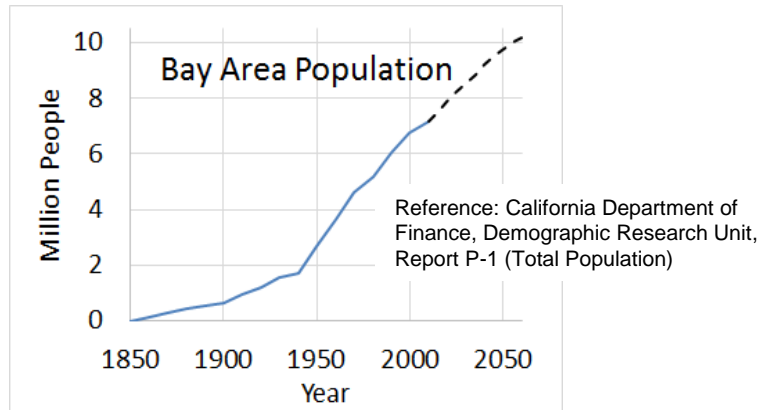
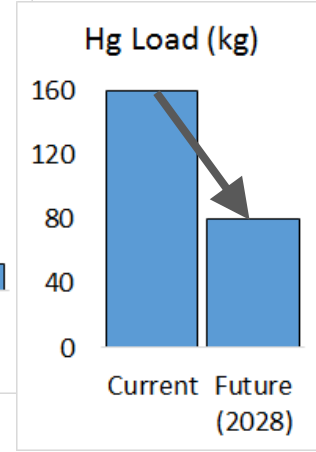
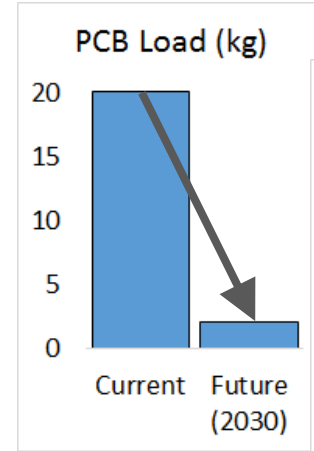
# Importance of Small Tributaries

- Drain ~8000 sqkm from the Counties around the Bay (5%)
- Home to ~6.5 Million people (42%) of the population upstream from the Golden Gate bridge
- Supply 31% of drinking water to local communities



# Regulatory and other challenges

- Permit calls for major legacy pollutant load reductions
- Population is rising - 10M by 2055
  - Great runoff and use of chemicals (e.g. emerging pollutants)
- Sediment budget is changing – trending downward
  - Sediment as a resource rather than a waste



# Sediment




# Pending major policy and management decisions

- What do we want our Bay to look like in 50 years? What can we do? What are we allowed to do?
- Which wetlands do we want to save - which can we save?
- Is habitat conversion OK? Is “filling” the Bay OK? Are indirect effects OK?
- Who will pay for restoration? The disposer? The sediment recipient?
- How should we move the sediment around?




# Sediment - what we have learned...

Information quality:

 High

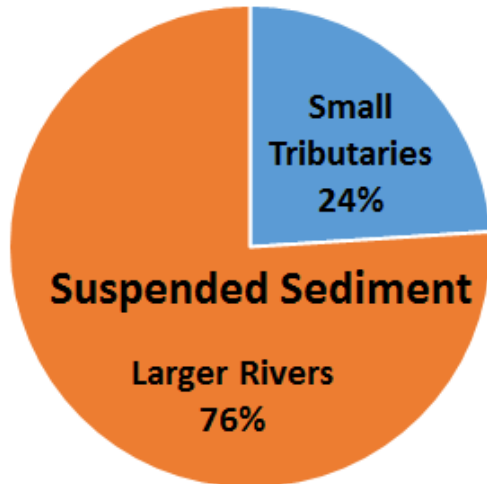
 Medium

 Low

# Management question - how much fine sediment gets into the Bay annually?

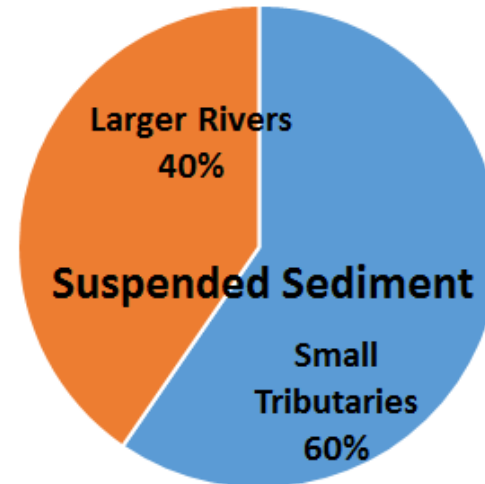
**2000**

~3 M metric tonnes

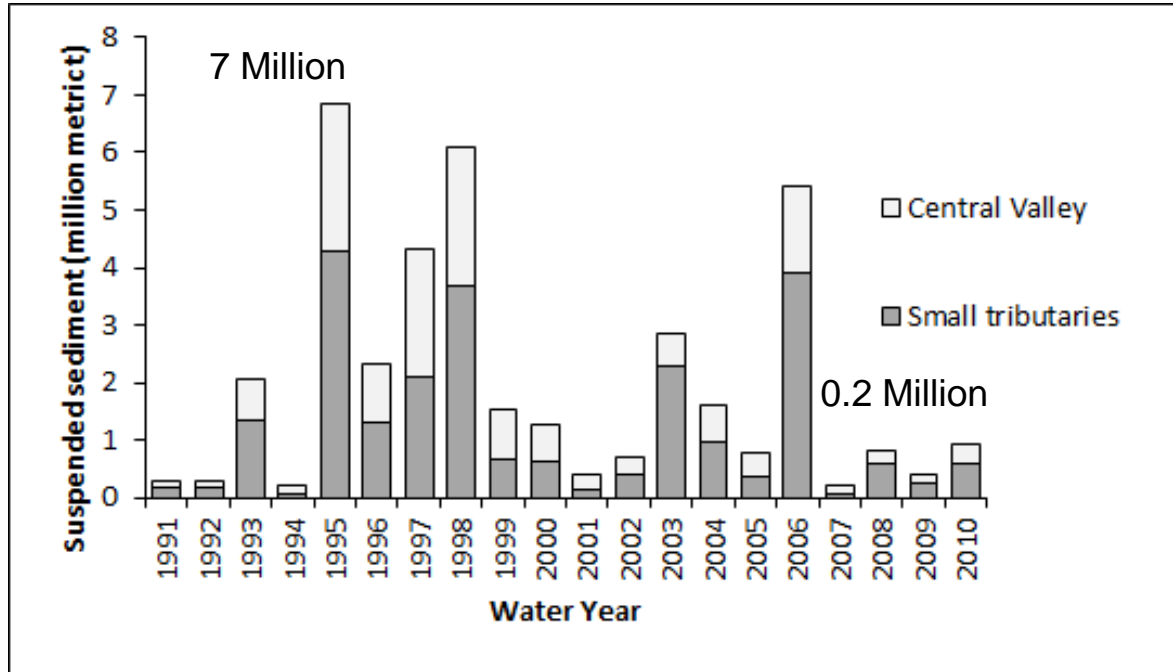


**2016**

~2.4 M metric tonnes



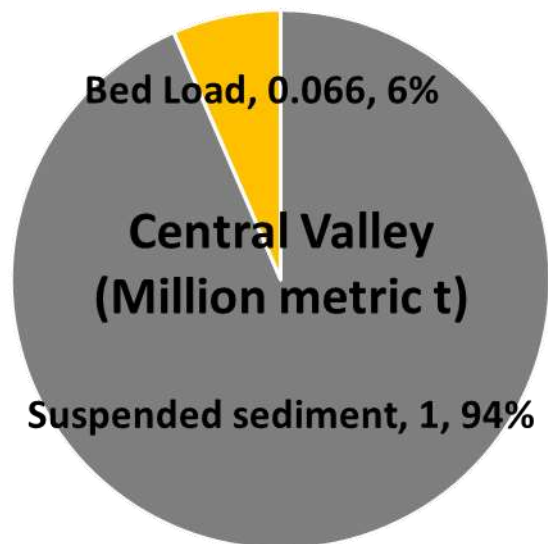
# Management question - how does fine sediment supply vary annually? 35-fold!



Reference: McKee et al., 2013. Comparison of sediment supply to San Francisco Bay from watersheds draining the Bay Area and the Central Valley of California. *Marine Geology* 345, 47-62.

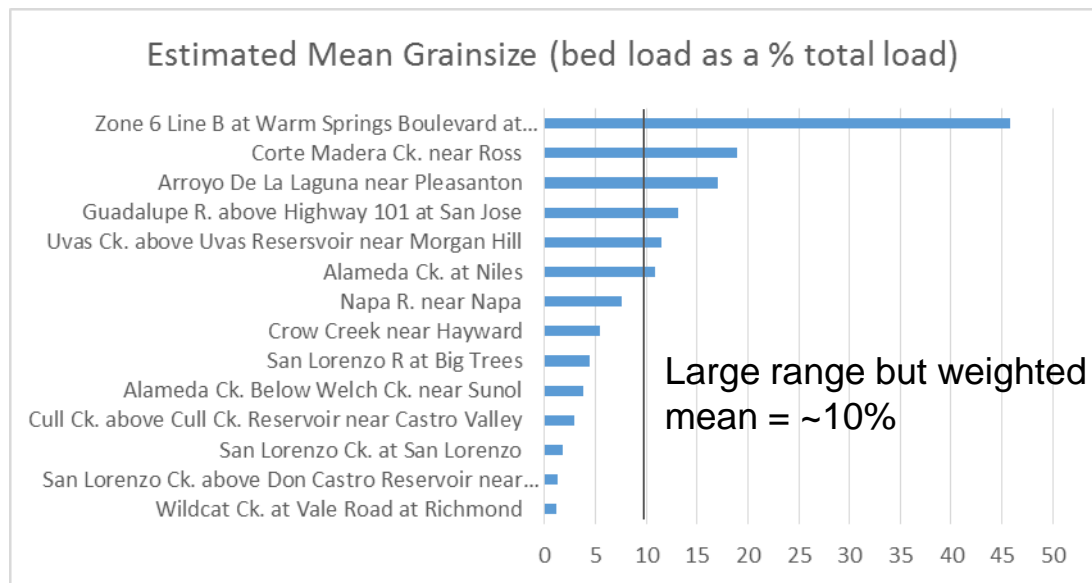


# Management question - what is the texture (grain size) of that sediment



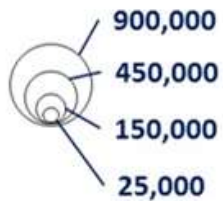
Reference: Perry, Goeden et al., 2015. San Francisco Bay Sediment: Challenges and Opportunities. State of the Estuary Poster

## Small Tributaries (n=14)

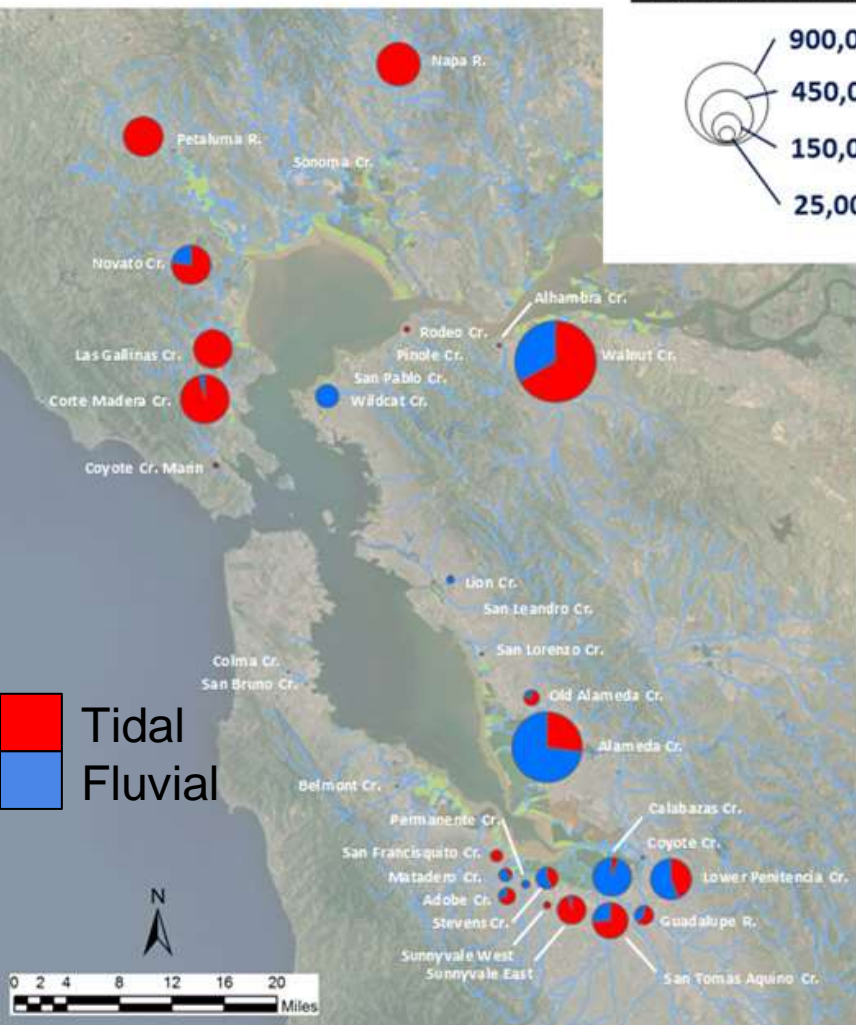


Reference: McKee et al. unpublished (FC 2.0 project funded by the EPA SF Bay Water Quality Improvement Fund)

## Total Removal (cy)



Management question: How much sediment is removed from Flood Control Channels?

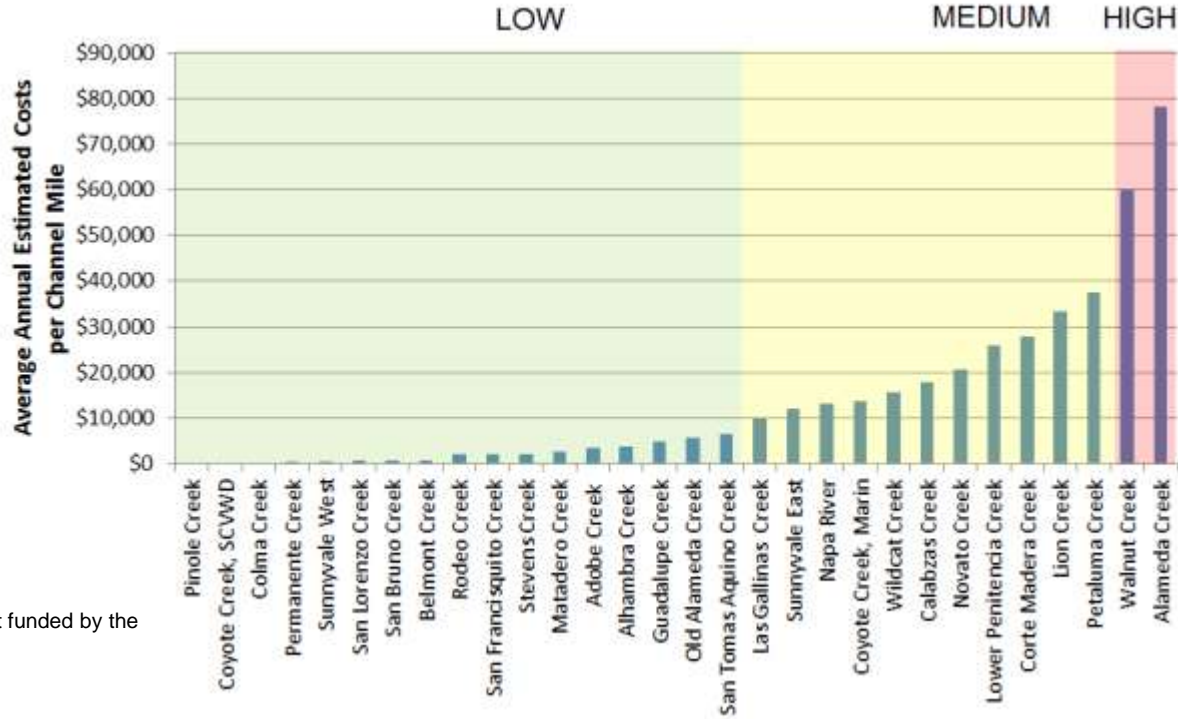


- n=30
- Since 2000
- 1.7 M CY removed
- 72% removed from tidal reaches
- 67% removed in response to climatic event
- 60% disposed in landfill or offshore

Reference: Pearce and Doehring et al. unpublished (FC 2.0 project funded by the EPA SF Bay Water Quality Improvement Fund)

# Management question: what is sediment removal from flood control channels costing us?

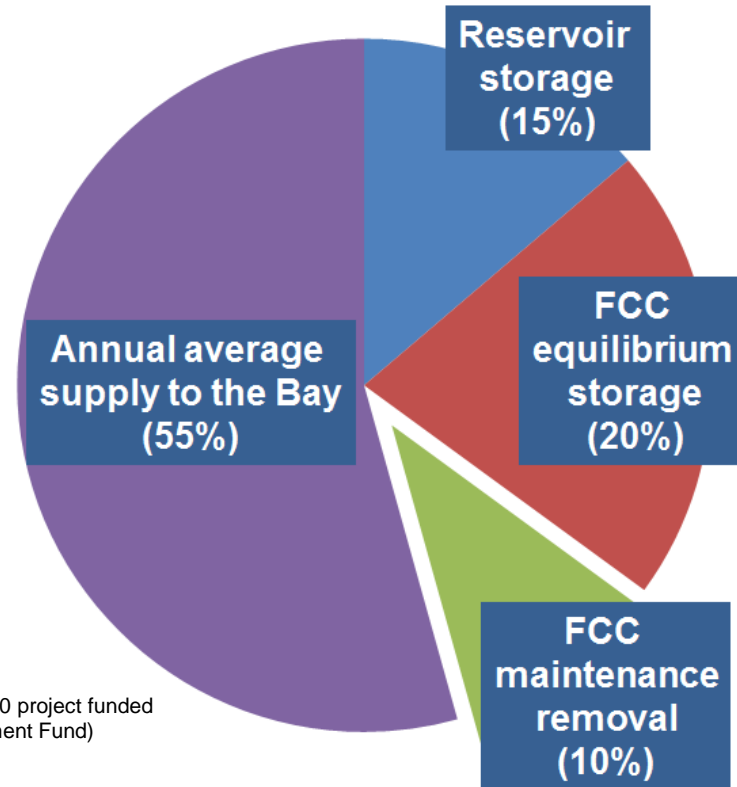
- 5.7 M CY removed since 1973
- \$115 M (not inflation adjusted)
- Average = \$20/CY
- Currently, FCC managers are paying



Reference: Pearce and Doehring et al. unpublished (FC 2.0 project funded by the EPA SF Bay Water Quality Improvement Fund)

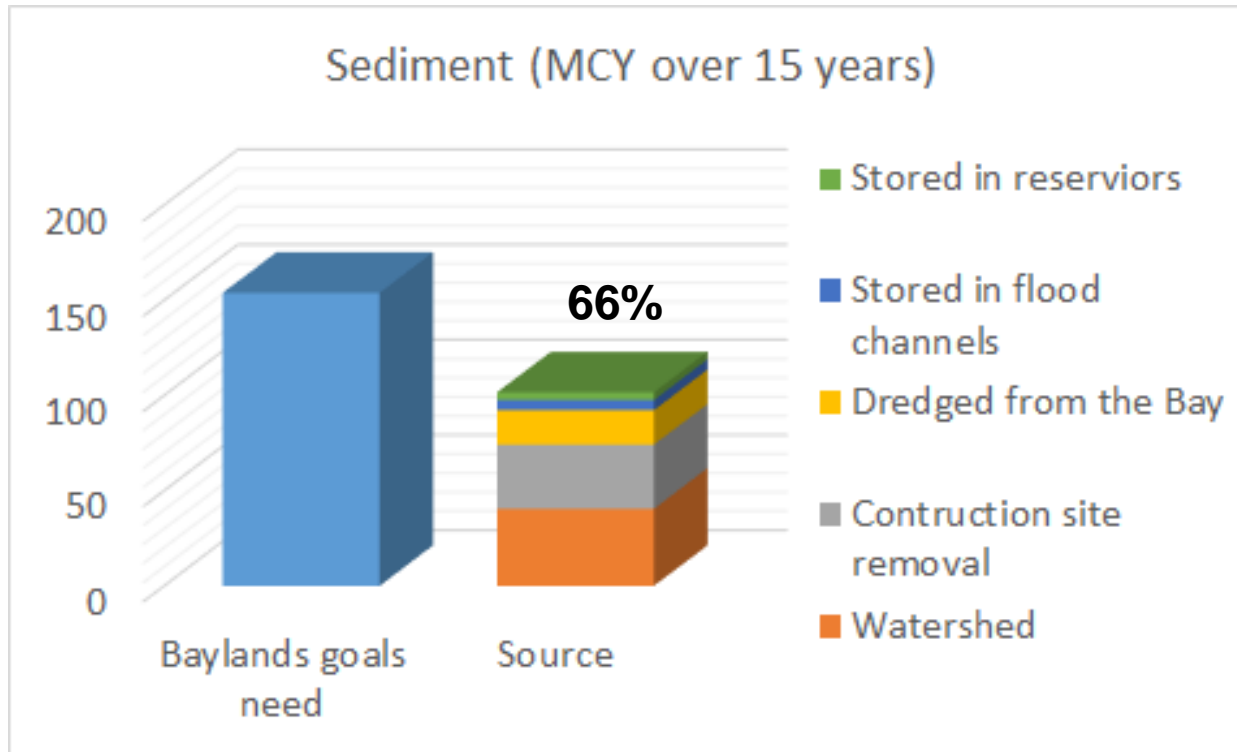
# Management question: What is the fate of our small tributaries sediment?

- Data on reservoir storage and flood control channel equilibrium storage are really just our current best guesses



Reference: McKee et al. unpublished (FC 2.0 project funded by the EPA SF Bay Water Quality Improvement Fund)

# Management Question: How much sediment is needed and do we have enough?



Preliminary information cobbled together from multiple sources: Most numbers that make up this chart are not the result of consensus and will be subjected to ongoing review. A strategy is needed on how to respond to whatever turns out to be the final working draft of the comparison between what is needed and where, what is available and from source, and how to get it from where it is to where it is needed.

# PCBs



# Major policy and management decisions

- Which tributaries need greater management effort?
- Where in tributaries will management effort likely be more cost effective?
- Which management actions may help to reduce PCB loads?
- How will management be paid for?



# PCBs in tributaries - what we have learned...

Information quality:

 High

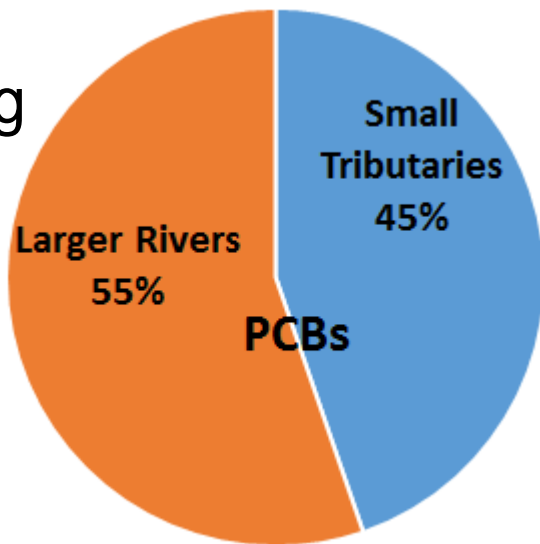
 Medium

 Low

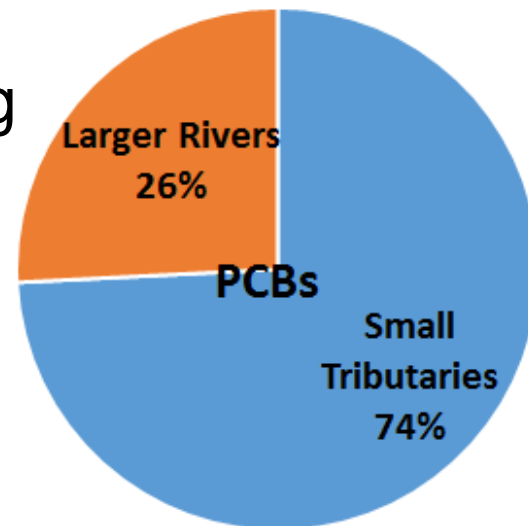


# Management question - What are the loads of PCBs entering the Bay?

**2000**  
~76 kg



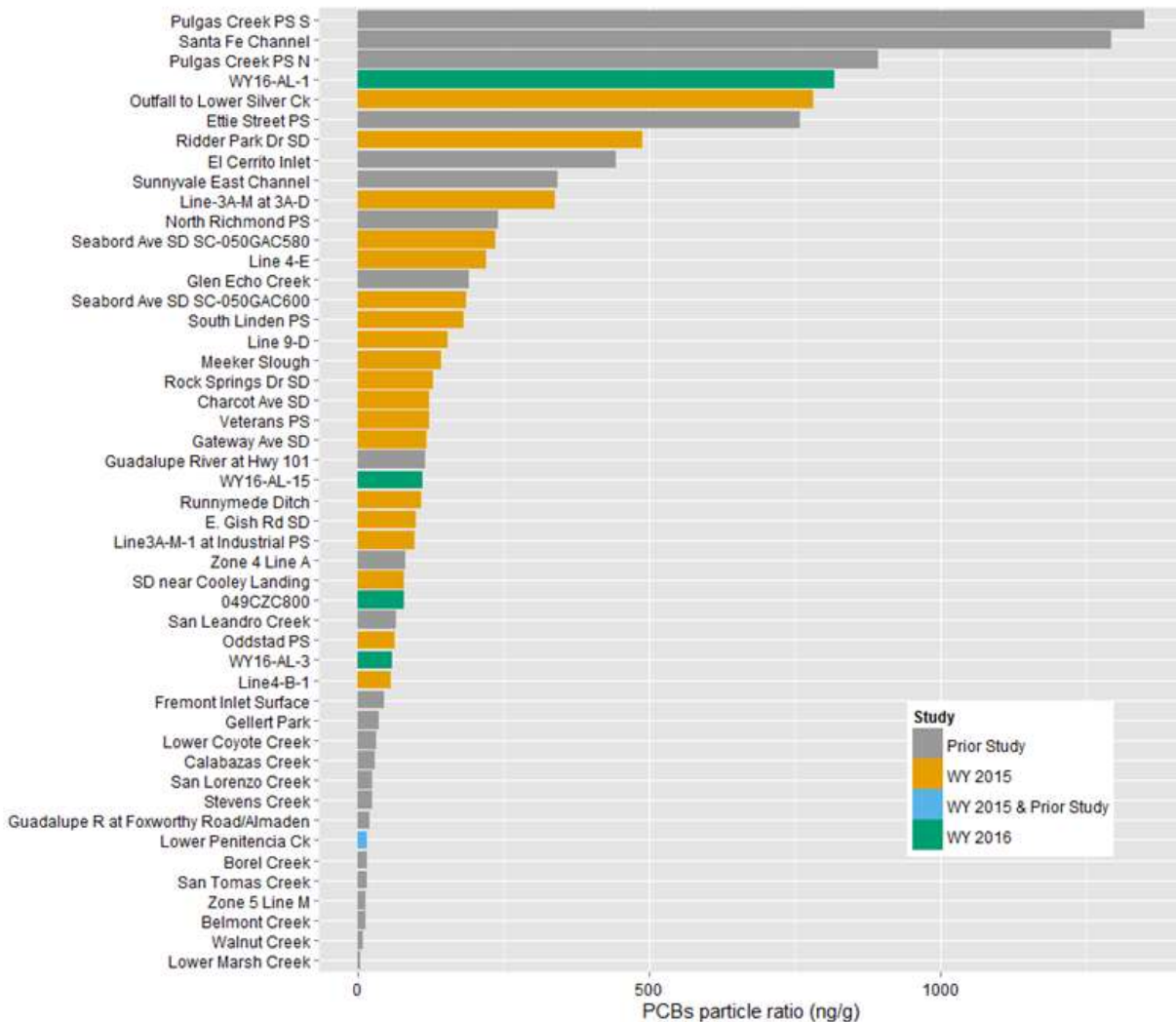
**2016**  
~31 kg



Reference: McKee, L.J., Gilbreath, A.N., Hunt, J.A., Wu, J., and Yee, D., 2015. Sources, Pathways and Loadings: Multi-Year Synthesis with a Focus on PCBs and Hg. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Sources, Pathways and Loadings Workgroup (SPLWG), Small Tributaries Loading Strategy (STLS). SFEI Contribution No. 773. San Francisco Estuary Institute, Richmond, CA.

[http://www.sfei.org/sites/default/files/biblio\\_files/MYSR%20Final%20Report.pdf](http://www.sfei.org/sites/default/files/biblio_files/MYSR%20Final%20Report.pdf)



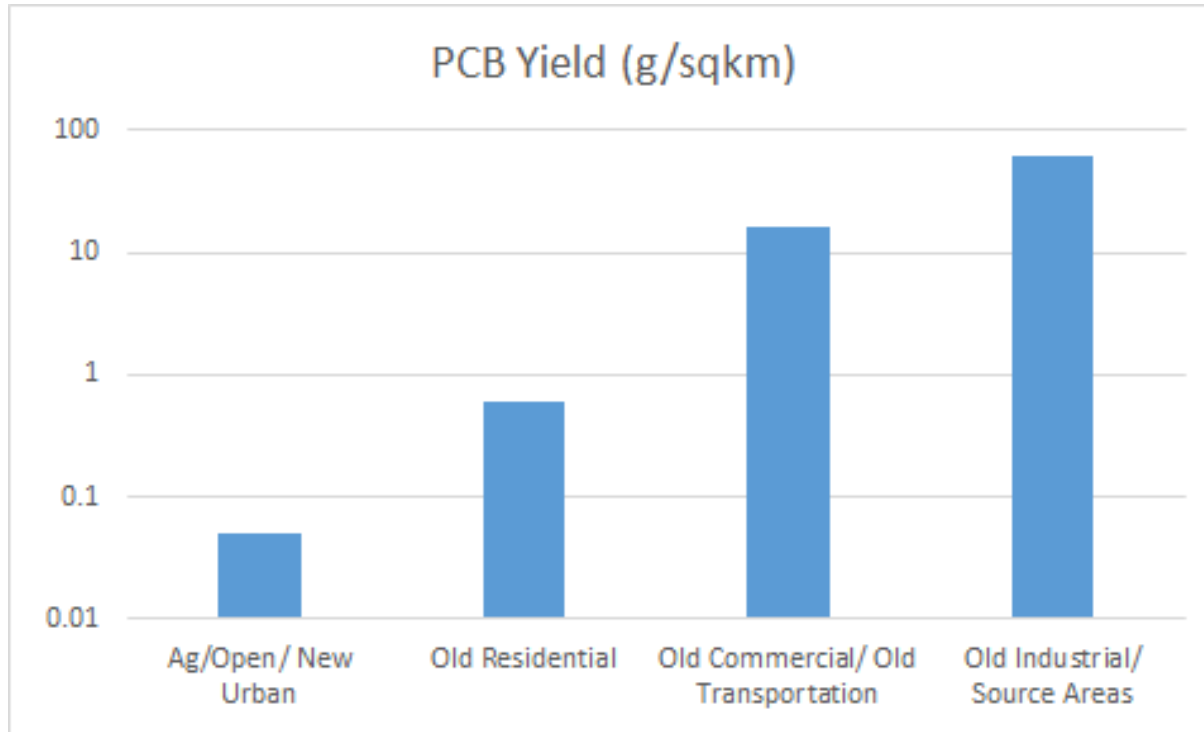


Management question - Which tributaries need greater management effort?

Reference: Gilbreath, A.N., McKee, L.J., et al., 2017 in preparation. Pollutants of concern (POC) reconnaissance monitoring final progress report, water year (WY) 2016. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Sources, Pathways and Loadings Workgroup (SPLWG), Small Tributaries Loading Strategy (STLS). Contribution No. xxx. San Francisco Estuary Institute, Richmond, California.



# Management question - Where in tributaries will management effort likely be more cost effective?

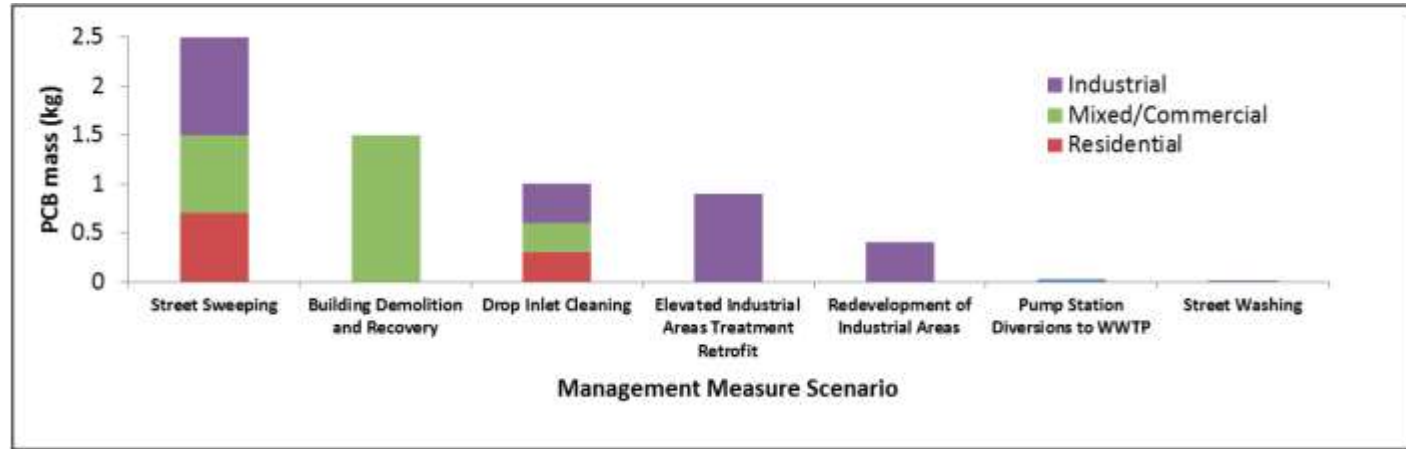


Reference: Wu, J., Gilbreath, A.N., McKee, L.J., 2016. Regional Watershed Spreadsheet Model (RWSM): Year 5 Progress Report. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Sources, Pathways and Loadings Workgroup (SPLWG), Small Tributaries Loading Strategy (STLS). Contribution No. 788. San Francisco Estuary Institute, Richmond, California. [http://www.sfei.org/sites/default/files/biblio\\_files/RWSM%202015%20FINAL.pdf](http://www.sfei.org/sites/default/files/biblio_files/RWSM%202015%20FINAL.pdf)



# Which management actions may help to reduce PCB loads?

Reference: McKee, L.J., Gilbreath, A.N., Hunt, J.A., Wu, J., and Yee, D., 2015. Sources, Pathways and Loadings: Multi-Year Synthesis with a Focus on PCBs and Hg. A technical report prepared for the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP), Sources, Pathways and Loadings Workgroup (SPLWG), Small Tributaries Loading Strategy (STLS). SFEI Contribution No. 773. San Francisco Estuary Institute, Richmond, CA. [http://www.sfei.org/sites/default/files/biblio\\_files/MYSR%20Final%20Report.pdf](http://www.sfei.org/sites/default/files/biblio_files/MYSR%20Final%20Report.pdf)



- Note this is 2013 information. The questions of opportunity (number of sites for management, the pollutant concentrations at those sites, and the most cost effective management strategy are the subjects of ongoing work by the Phase I permittees of the Bay Area

# Next steps

- Continue to improve information to support Bay sediment policy and management decisions
- RMP is continuing work on the RWSM and doing wet season stormwater sampling to identify more polluted tributary areas
- BASMAA working hard to identify key locations in watersheds for enhanced management effort
- BASMAA continuing to evaluate the potential effectiveness of management measures
- The RMP is preparing the small tributaries loadings trends strategy

