TETRA TECH

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# RECAP ON KEY FINDINGS AND RECOMMENDATIONS

## Meeting to Plan Total Maximum Daily Loads (TMDLs) For Biostimulatory Substances in Elkhorn Slough

Elkhorn Slough Reserve, Watsonville, CA
July 9, 2019

# Prior Efforts

- Summarized basis for 303 (d) listing
  - Summarized available nutrient and eutrophication data in Elkhorn Slough
  - Compared to targets in other estuaries in the US
- Provided preliminary estimate of watershed loading
- Provided preliminary estimate of mixing in estuary waters

(https://www.waterboards.ca.gov/centralcoast/water_issues/programs/tmdl/docs/elkhorn_slough/do/)

**Technical Support for Elkhorn Slough Nutrient Total Maximum Daily Load (TMDL) Development**

**September 28, 2018**



*Source: Kerstin Wasson*

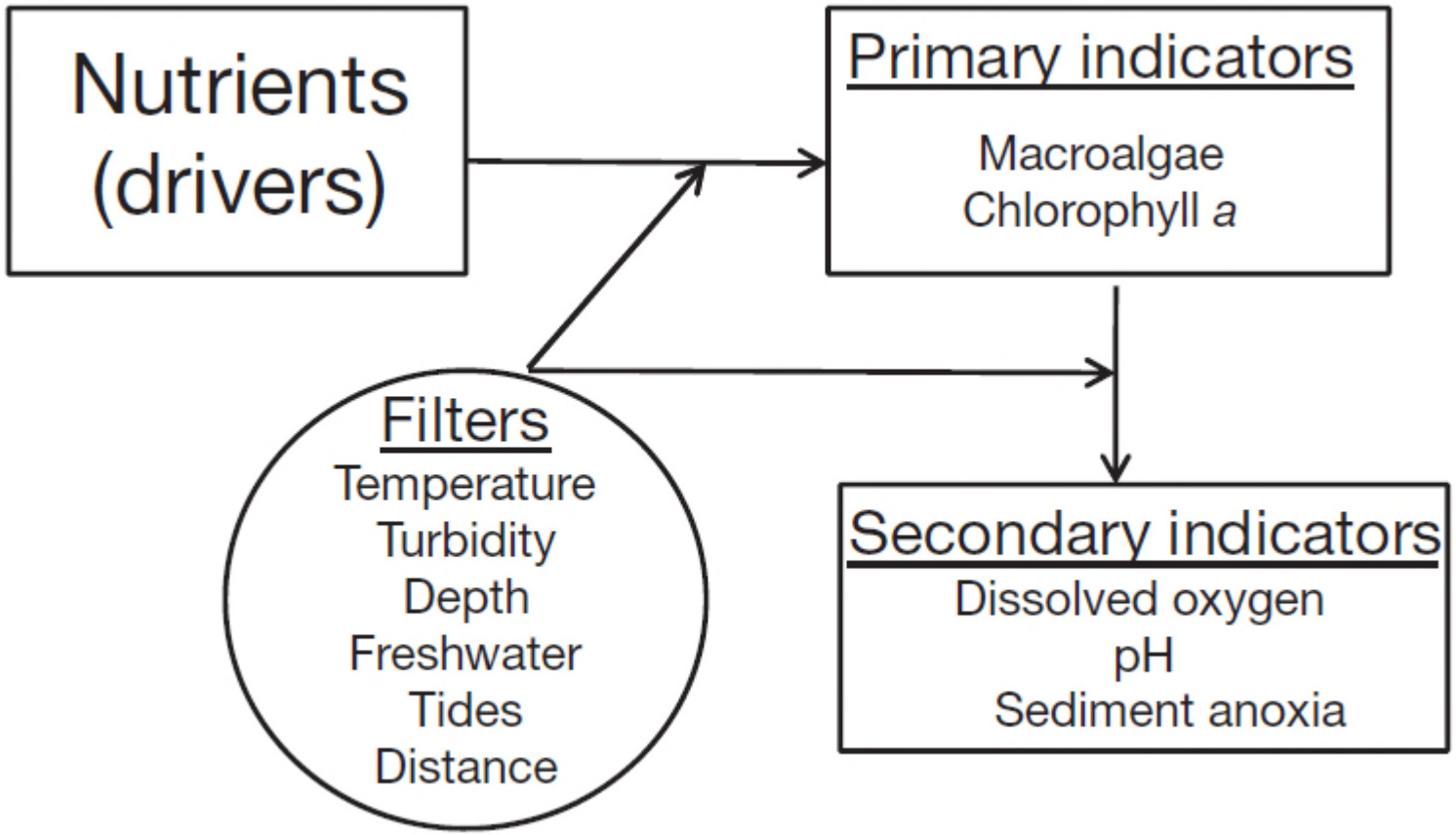
**PREPARED FOR**

**U.S. EPA Region IX**
and
**California Regional Water Quality Control Board, Central Coast Region**

**PREPARED BY**

**Tetra Tech**
Research Triangle Park, NC, Owings Mills, MD, and Lafayette, CA
**Elkhorn Slough Foundation**
Watsonville, CA

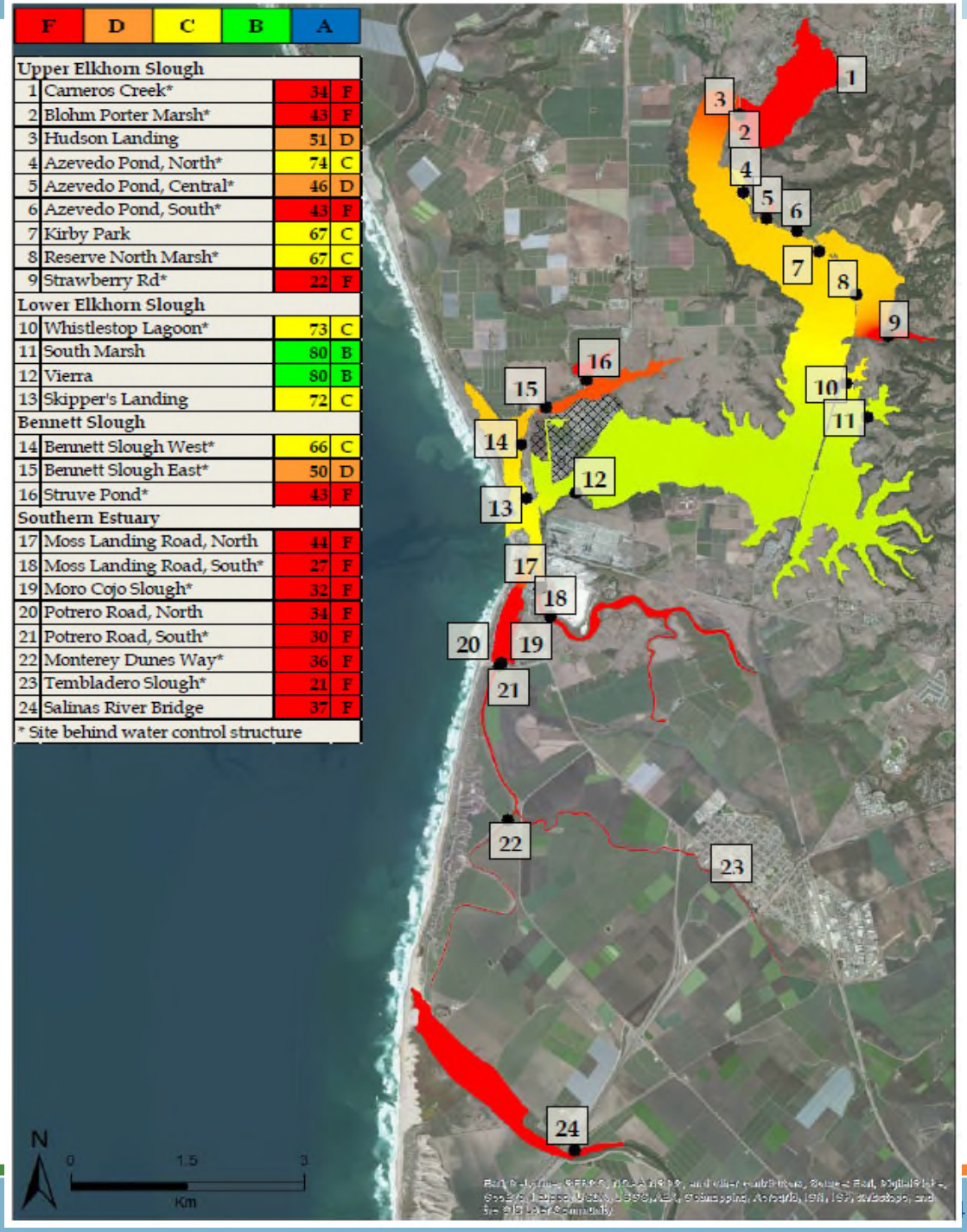
# Expression of Eutrophication




Source: Hughes et al. 2011

# Water Quality Summary

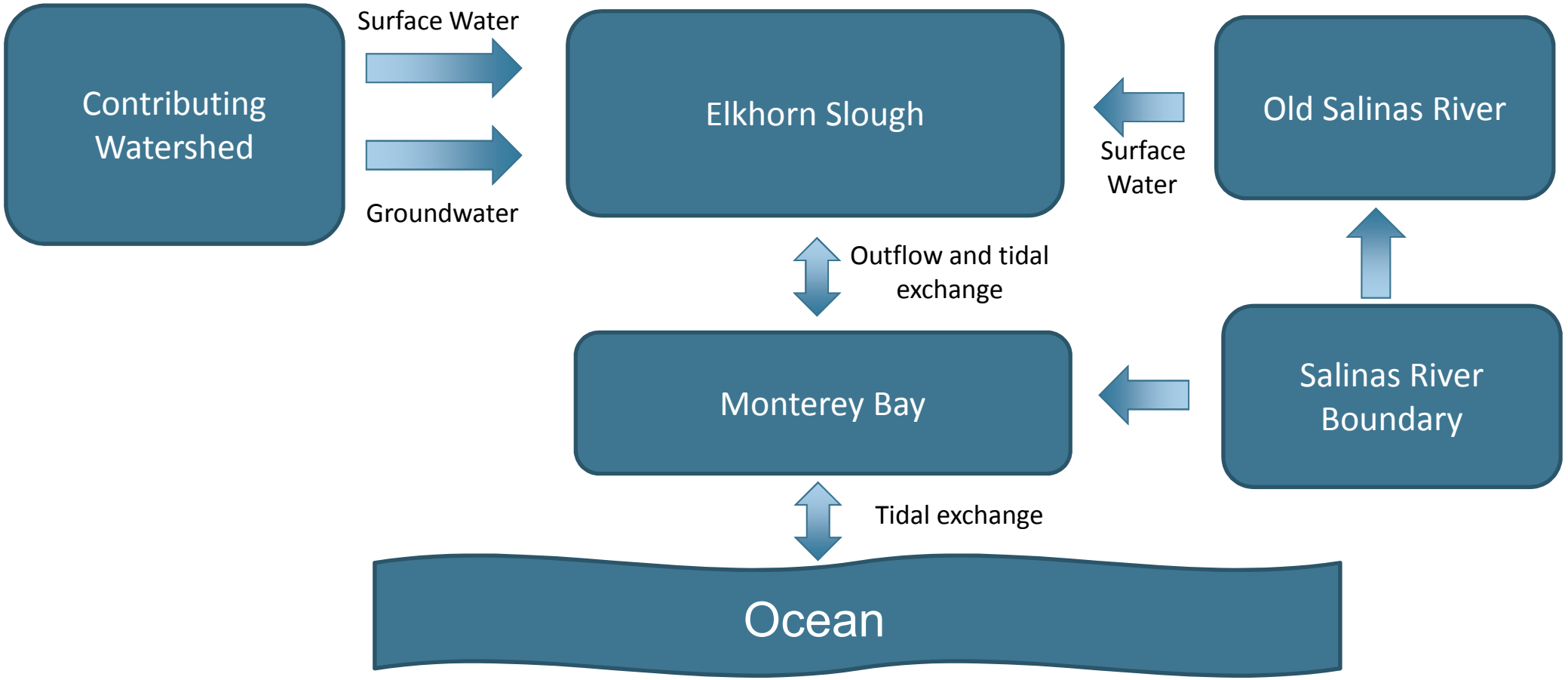
- Grades based on *Report Card of Water Quality for the Elkhorn Slough Estuary* (ESF, 2014)



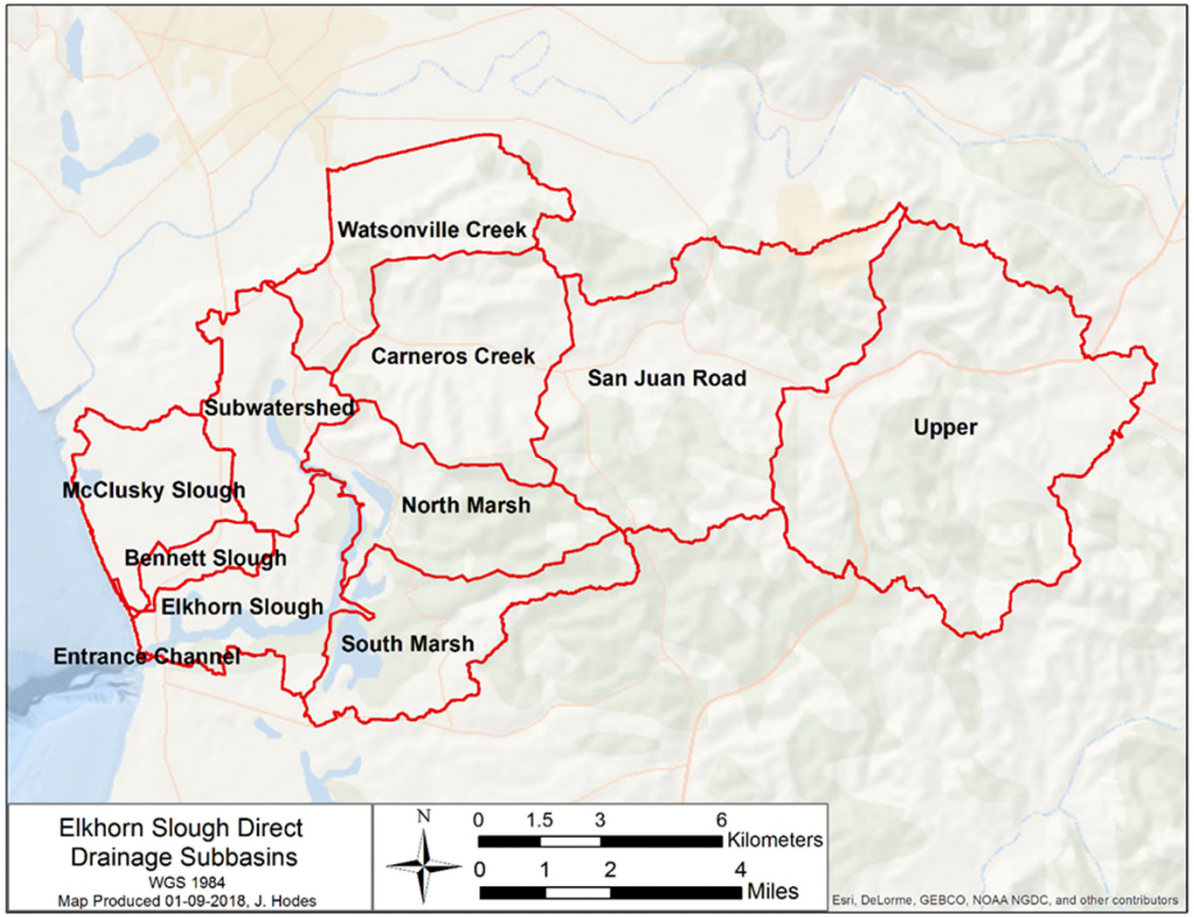
# Nutrient Targets Reported in the Literature

| Analyte Name | Literature Targets for other Estuaries |
|---|---|
| Ammonia (NH3) as N, Un-ionized | 0.025 mg/L |
| Chlorophyll a | 8-15 ug/L |
| Floating Algae | 30-50% |
| Macroalgal Cover | <30-<50% |
| Nitrogen, Total | 0.65-1.0 mg/L |
| Oxygen, Dissolved | 4.8-7 mg/L |
| Phosphorus as P | 0.10-0.20 mg/L |

# Conceptual Representation of Water Flows

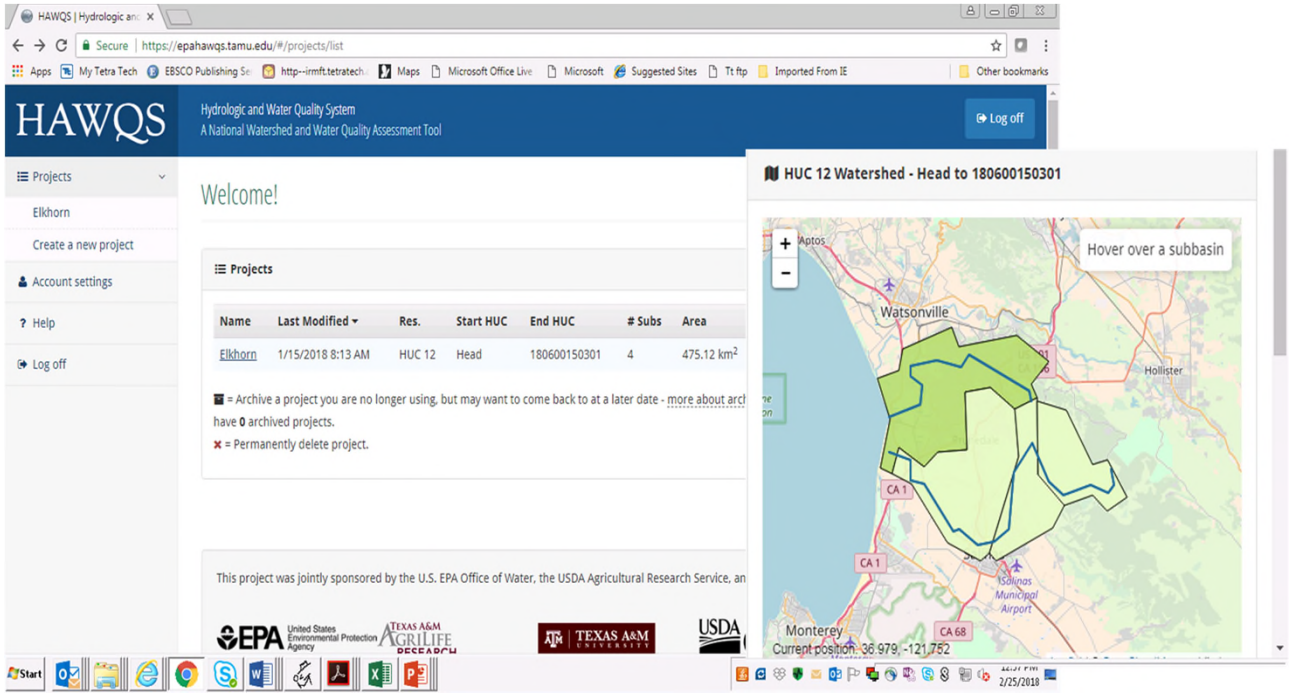


# Elkhorn Slough Subbasins



# Nutrient Load Estimation

- STEPL model: Spreadsheet Tool for the Estimation of Pollutant Load (Tetra Tech, 2017) is a simplified spreadsheet model of pollutant loading.
- HAWQs model: uncalibrated watershed model contained in the EPA Hydrologic and Water Quality System (HAWQS; https://epahawqs.tamu.edu). HAWQS is a web-based interactive water quantity and quality modeling system that employs as its core modeling engine the Soil and Water Assessment Tool (SWAT).

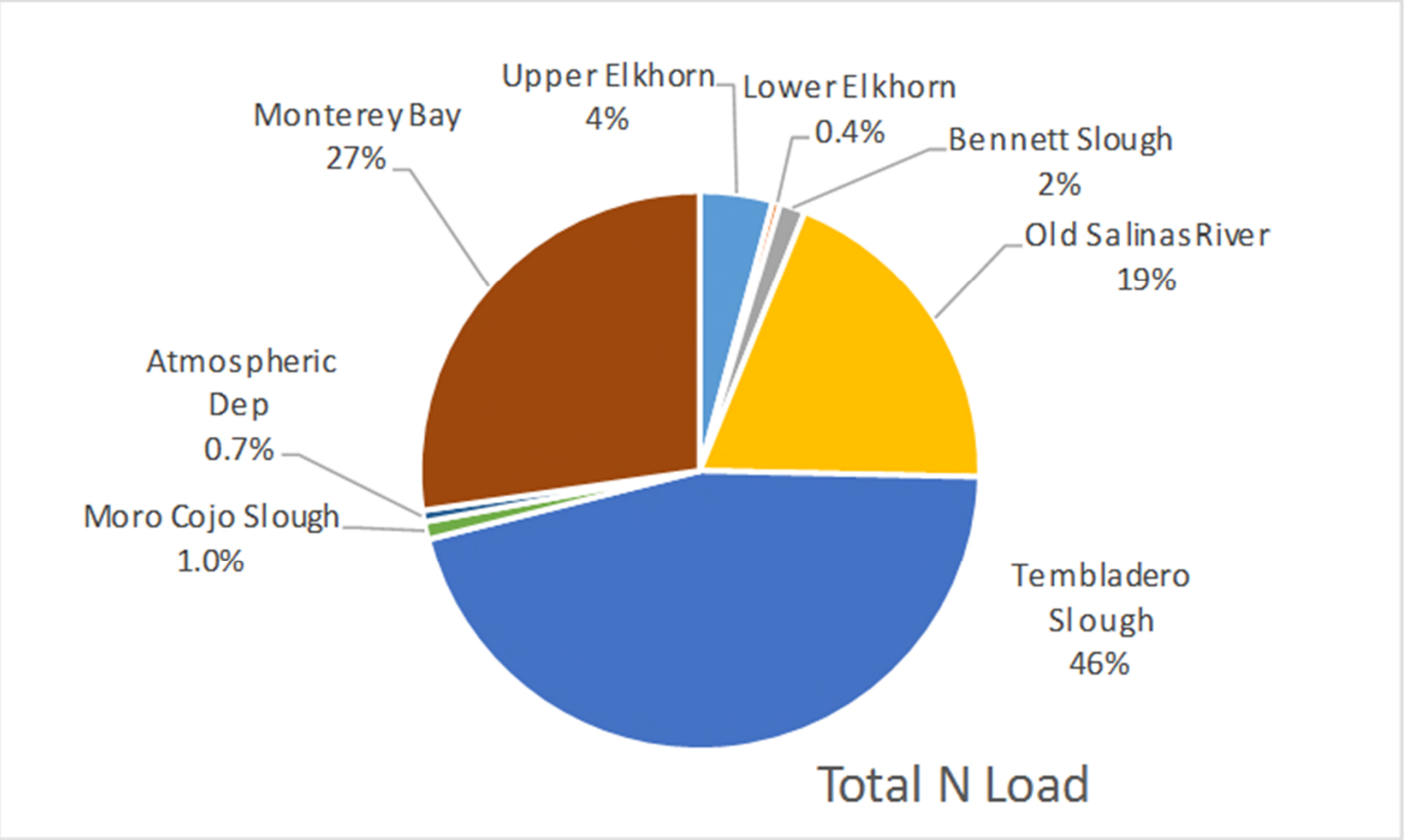


# Preliminary Nutrient Loads from Old Salinas River, Tembladero Slough, and Moro Cojo Slough: Estimates Using Flows and Concentrations

| | Flow (AF/yr) | Total N (mg/L) | Total P (mg/L) | Total N Load (lb/yr) | Total P Load (lb/yr) |
|---|---|---|---|---|---|
| Old Salinas River | 5,129 | 35.04 | 0.53 | 488,479 | 7,403 |
| Tembladero Slough | 15,376 | 27.80 | 0.58 | 1,161,733 | 24,396 |
| Moro Cojo Slough | 4,495 | 2.13 | 0.59 | 25,962 | 7,258 |
| Total | 25,000 | | | 1,676,175 | 39,057 |

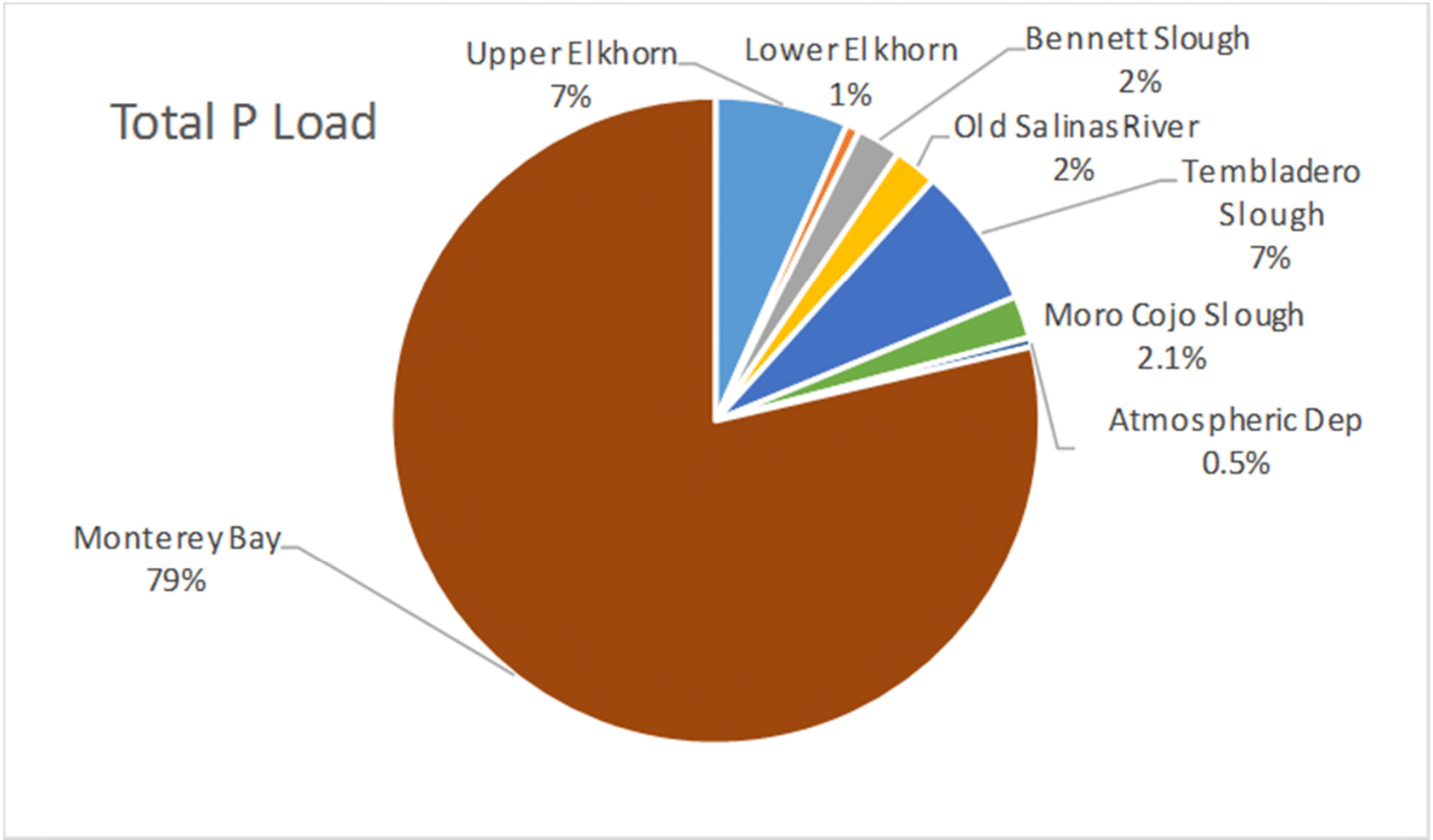
These load estimates need to be updated with a more sophisticated watershed model

# Nitrogen Load Summary Across Entire Slough*




*Contributions will vary by location

# Phosphorus Load Summary Across Entire Slough*




*Contributions will vary by location

# Recommended Next Steps in Tetra Tech (2018)

Develop watershed loading model

- Develop SWAT model of direct drainages to Elkhorn Slough

Develop receiving water model of Elkhorn Slough

- Select, update, and calibrate an estuarine hydrodynamic or tidal mixing model

Address, to the extent possible, data gaps

- Assemble additional information on contributions from Old Salinas River
- Additional information on groundwater loading and internal nutrient loading from sediments