

Water Quality Response to the Angora Fire, Lake Tahoe, CA

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Angora Fire Science Symposium

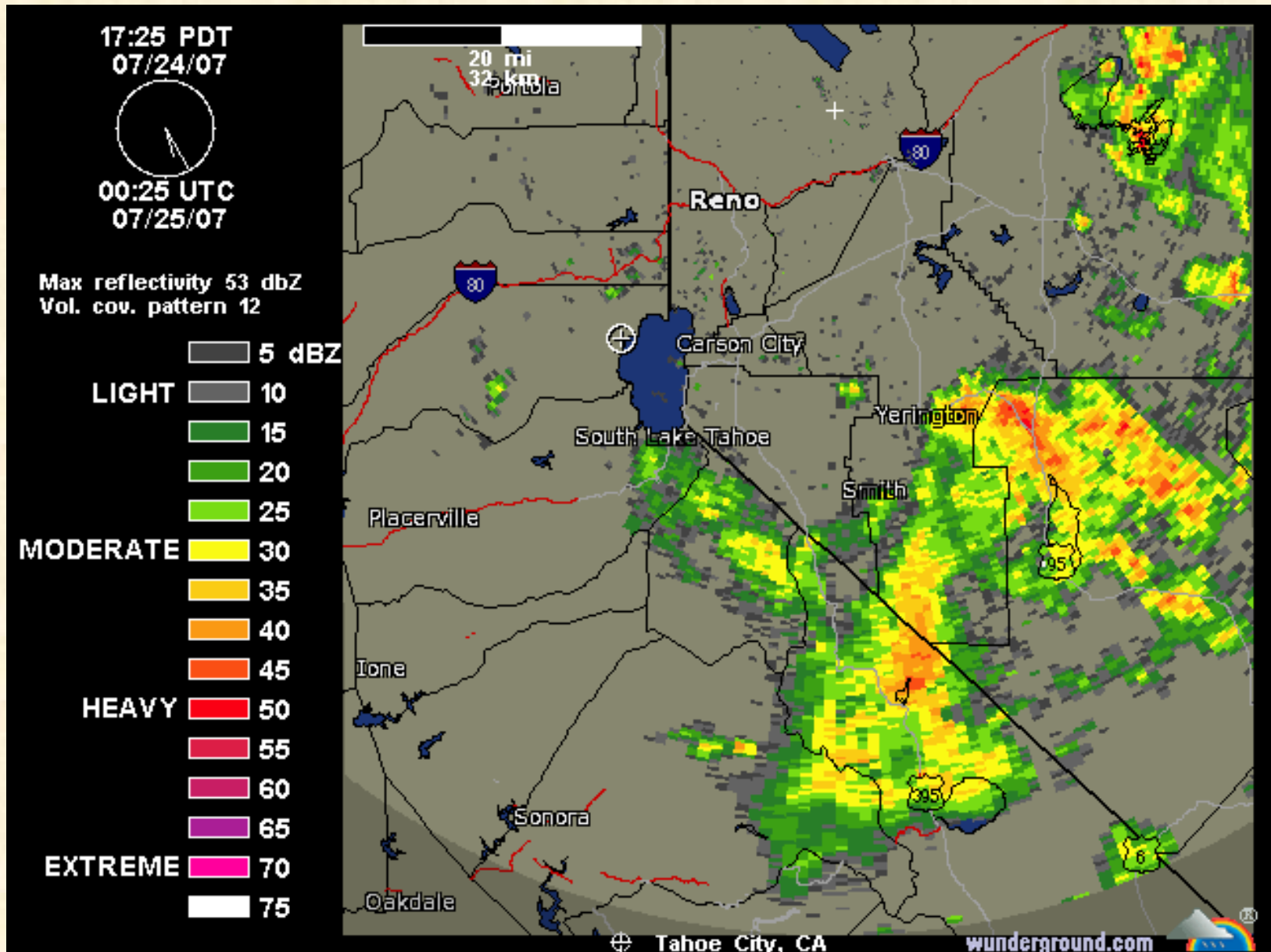
Lake Tahoe Community College, South Lake Tahoe, CA

June 23, 2017

Installing Monitoring Equipment at Upper Angora Creek Site



Thunderstorms Threatened in July and August



Adjacent to Upper Angora Creek on July 26, 2007

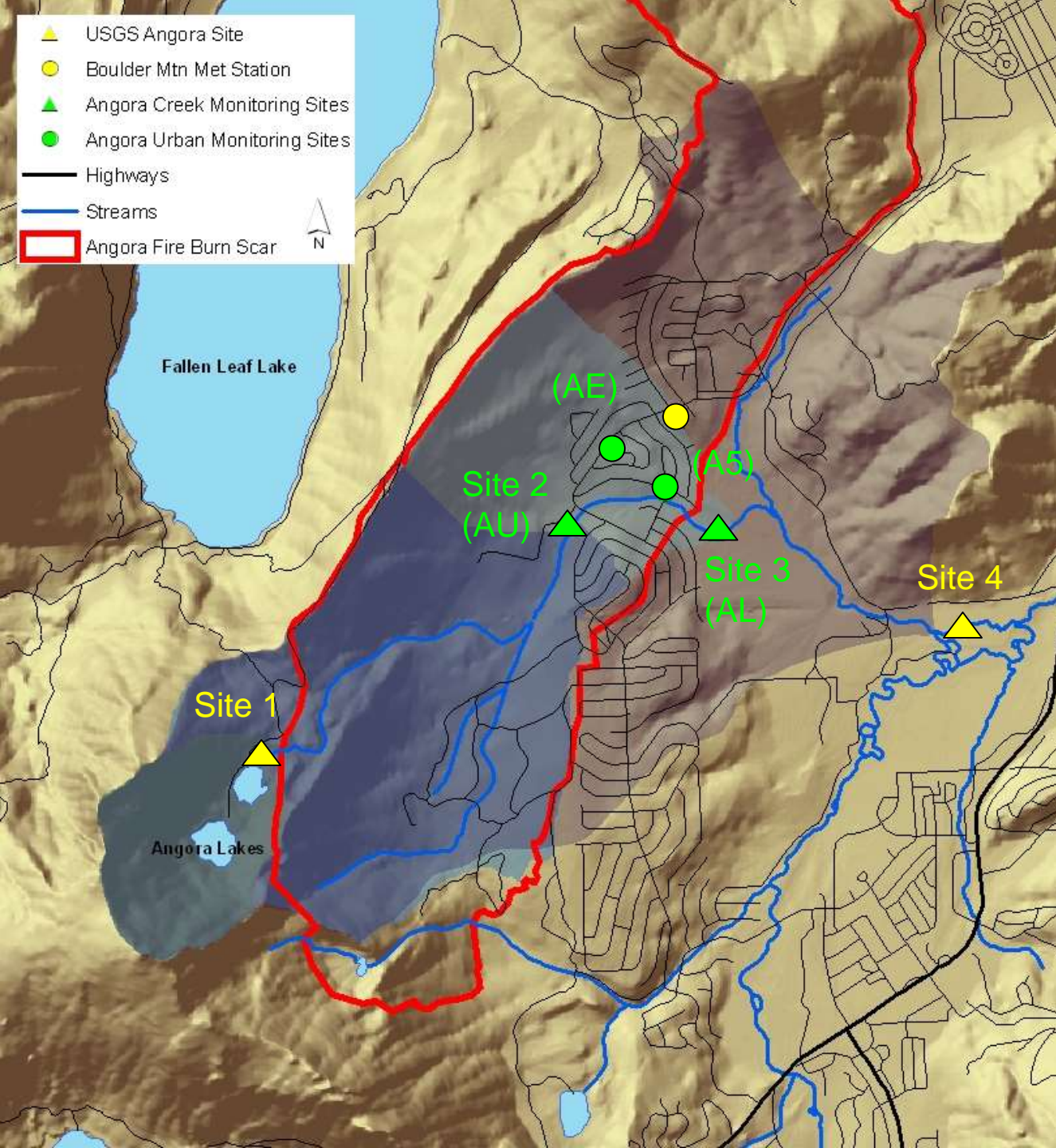


Large urban burned area, with over 300 structures lost



Urban Runoff then Passes through Angora Meadow



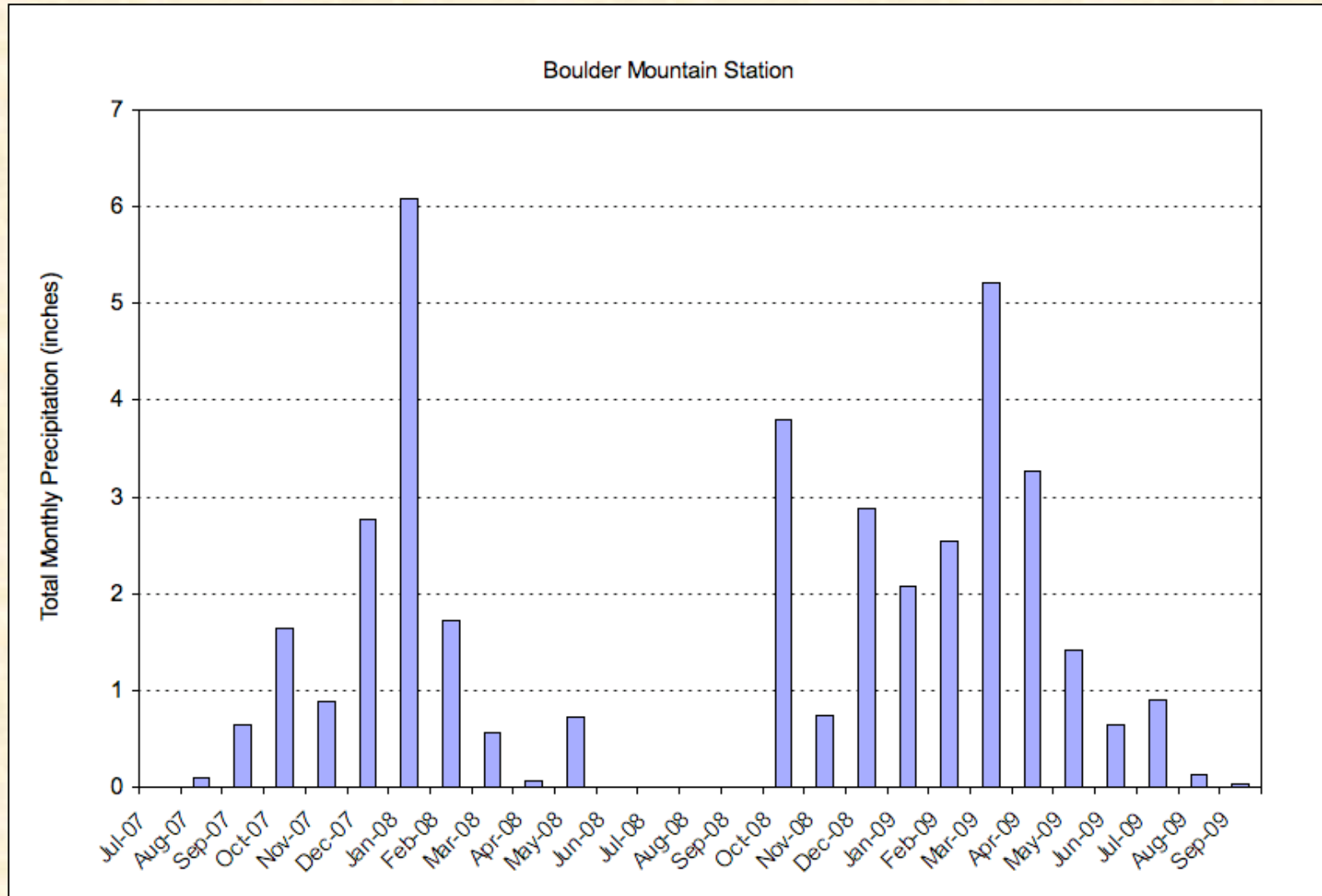


Angora Drainage Zones:

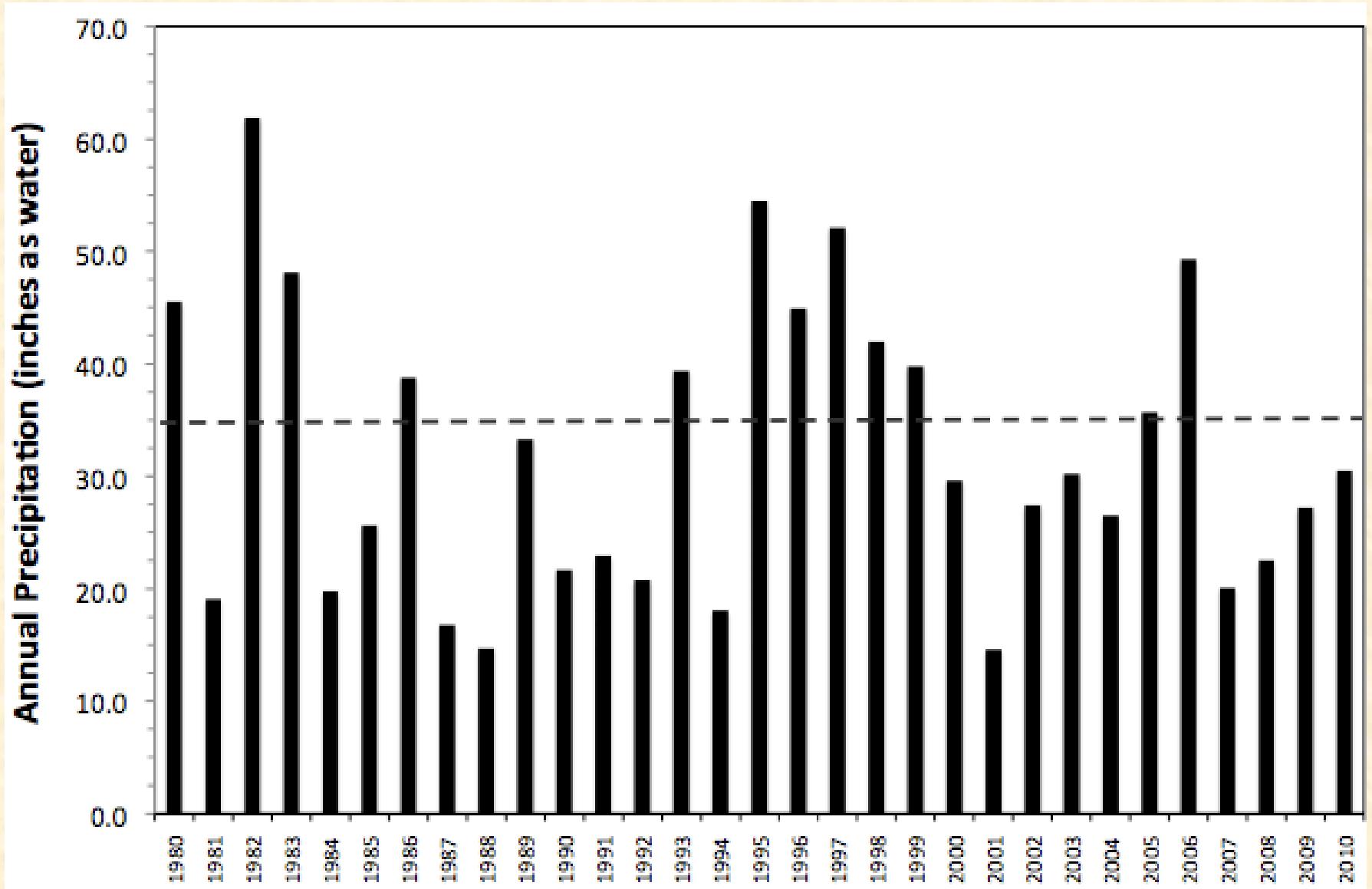
Two monitoring sites located within one selected urban drainage

Boulder Mtn meteorological station located within urban drainage

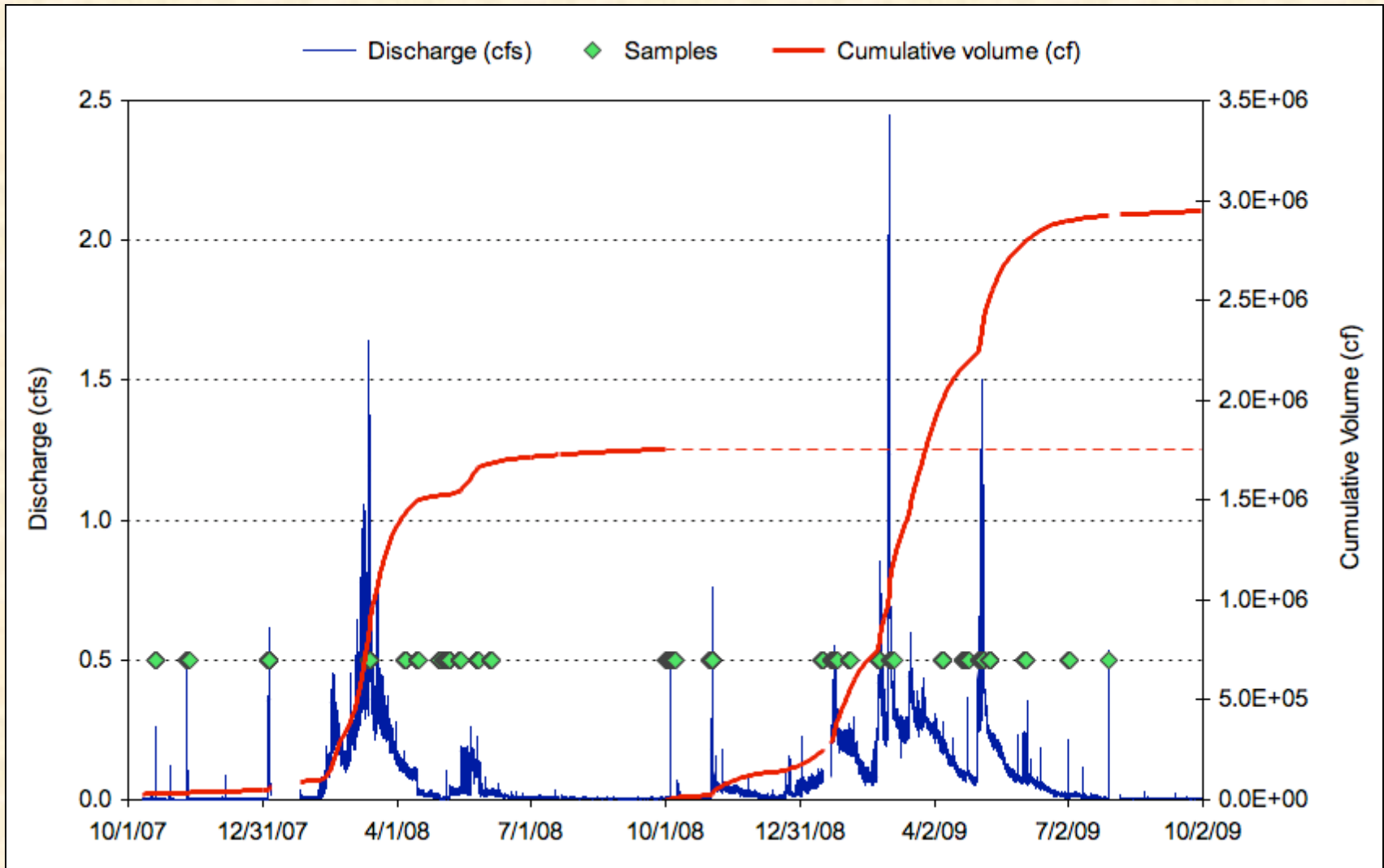
Angora Area Monthly Precipitation



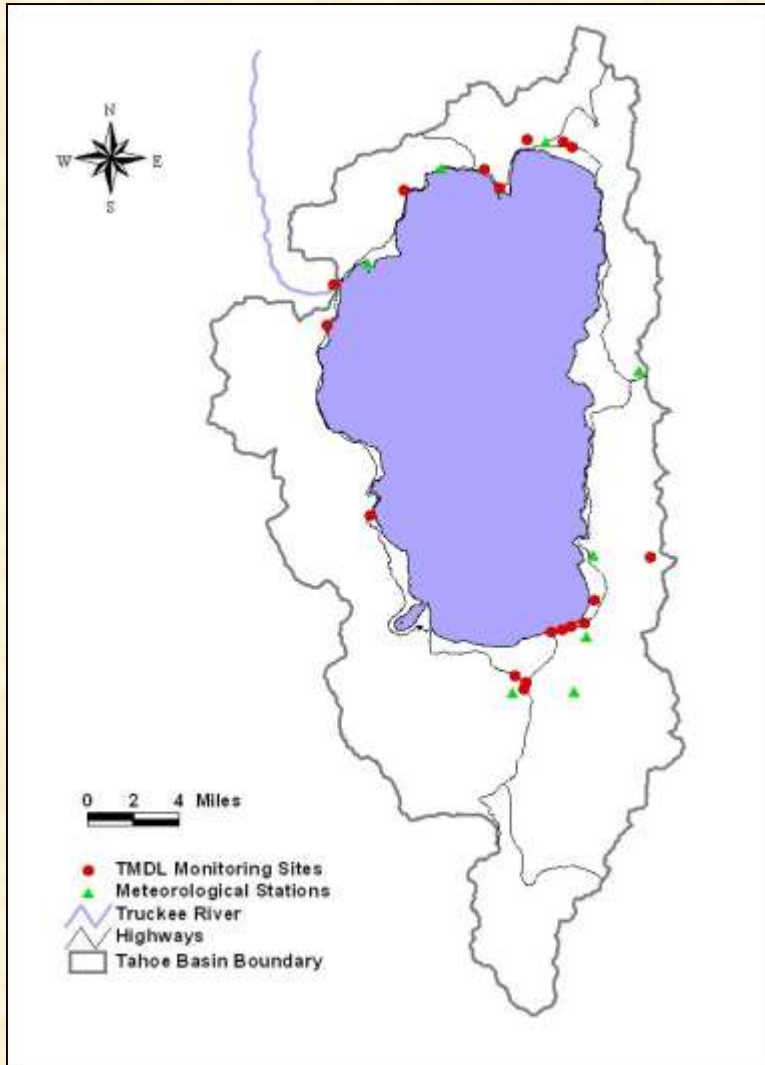
Annual Precipitation Totals at Nearby Fallen Leaf Lake



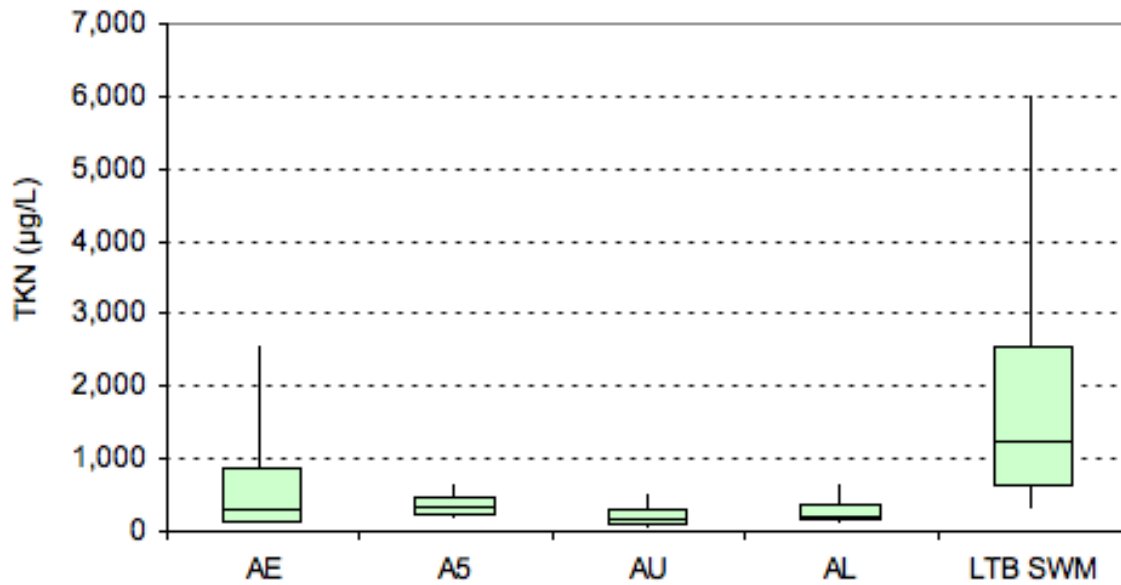
Angora Urban (AE) Sampling, WY2008 thru WY2009



Tahoe Stormwater Monitoring



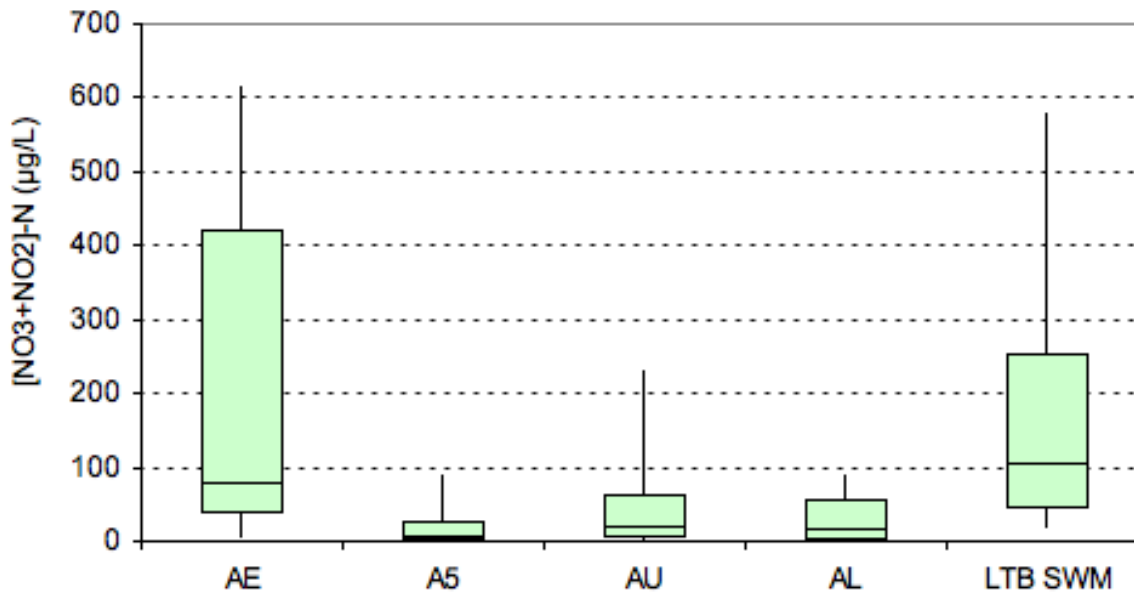
- Program was started as a TMDL technical study.
- Lake Tahoe Basin stormwater monitoring (LTB SWM) program.
- Precursor to Tahoe RSWMP, collected data for several years from more than sixteen sites.



Angora versus Tahoe Basin Stormwater EMCs

TKN & NO₃-N

WY2003 thru
WY2009



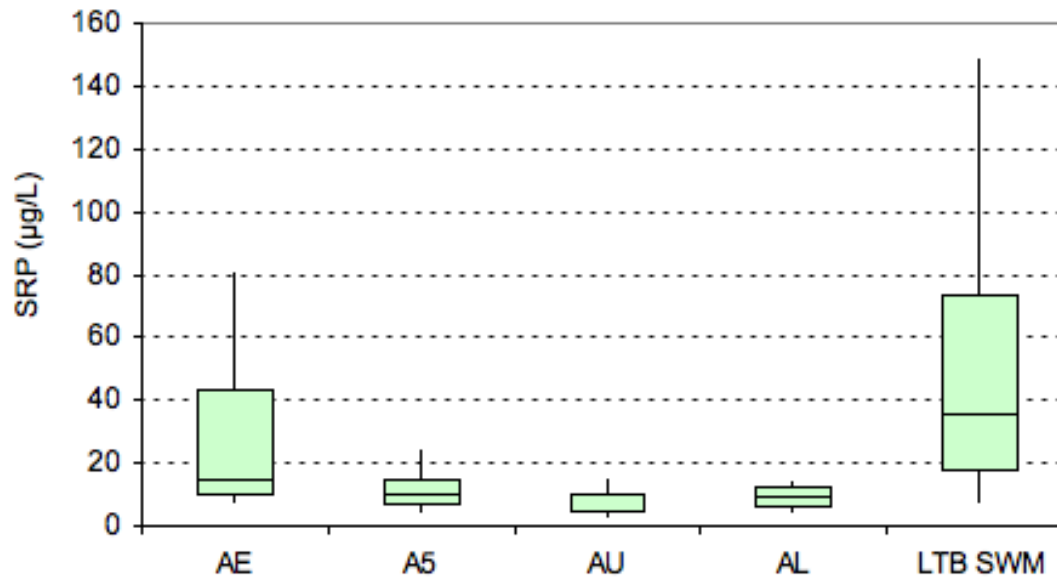
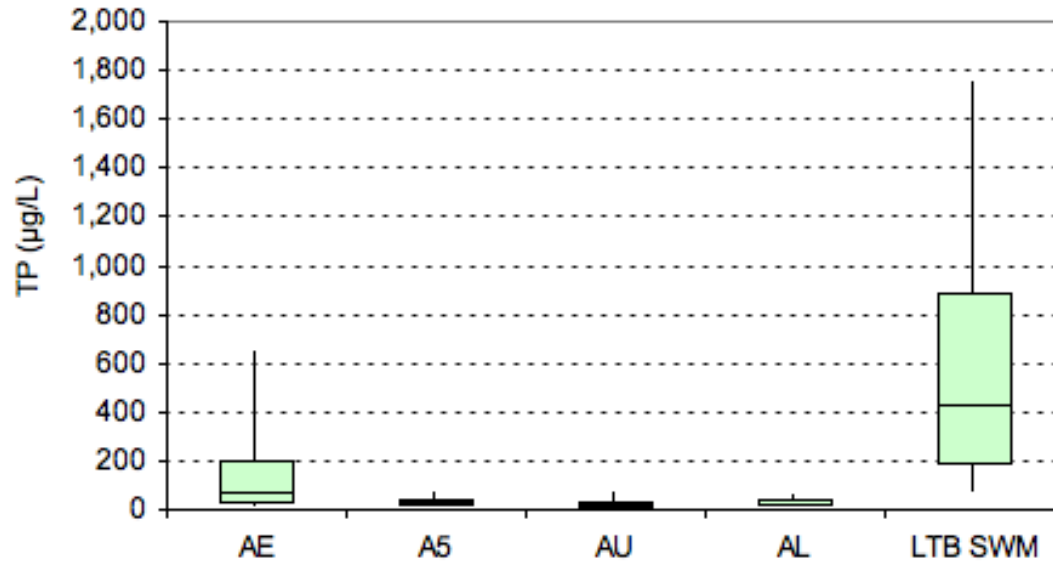
Boxes show medians
and quartiles,

whiskers show 10th
and 90th percentiles.

Angora versus Tahoe Basin Stormwater EMCs

TP & SRP

WY2003 thru
WY2009



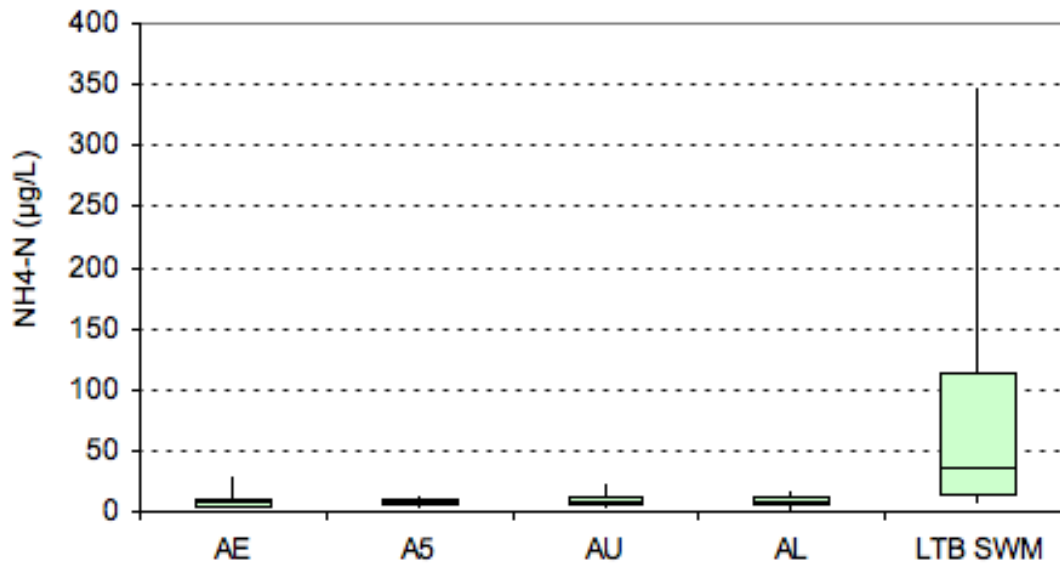
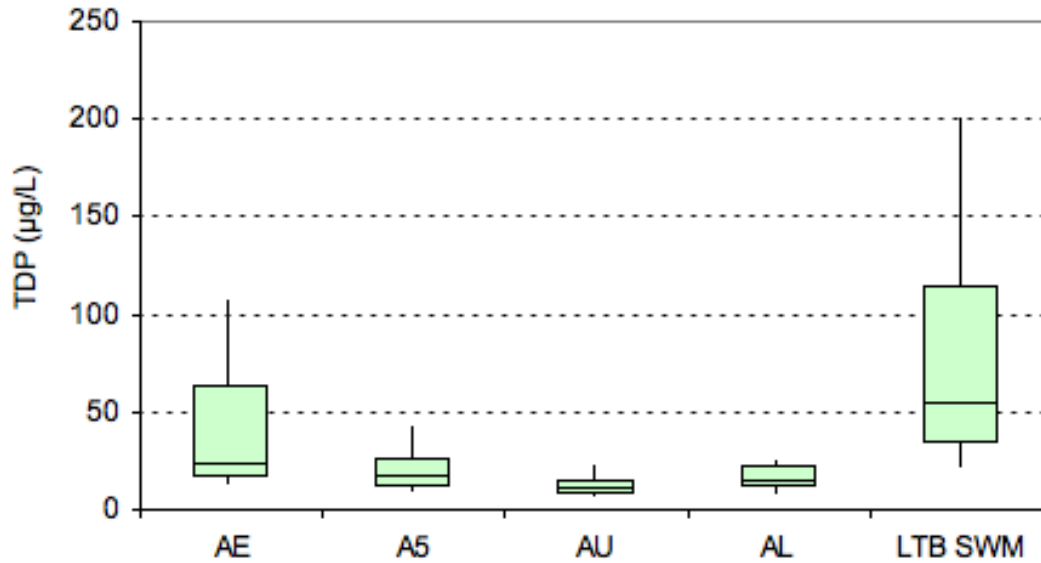
Boxes show medians
and quartiles,

whiskers show 10th
and 90th percentiles.

Angora versus Tahoe Basin Stormwater EMCs

TDP & NH₄-N

WY2003 thru
WY2009



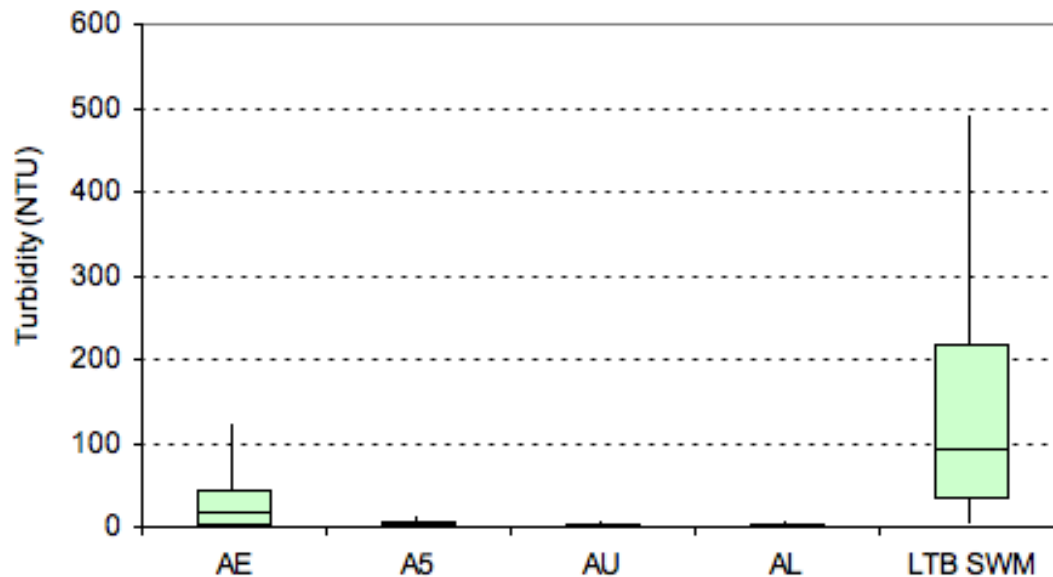
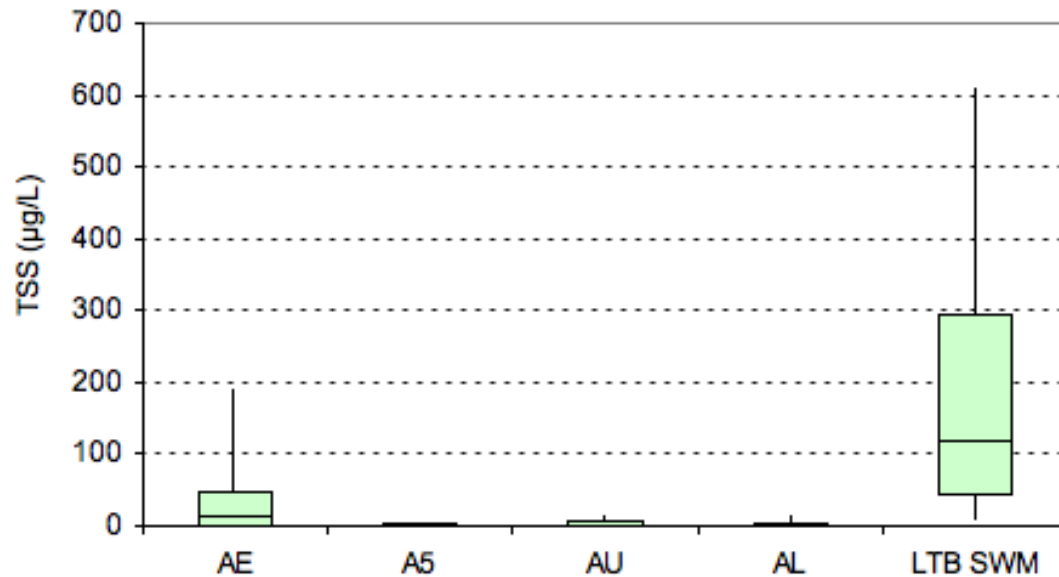
Boxes show medians
and quartiles,

whiskers show 10th
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Angora versus Tahoe Basin Stormwater EMCs

TSS & Turbidity

WY2003 thru
WY2009



Boxes show medians
and quartiles,

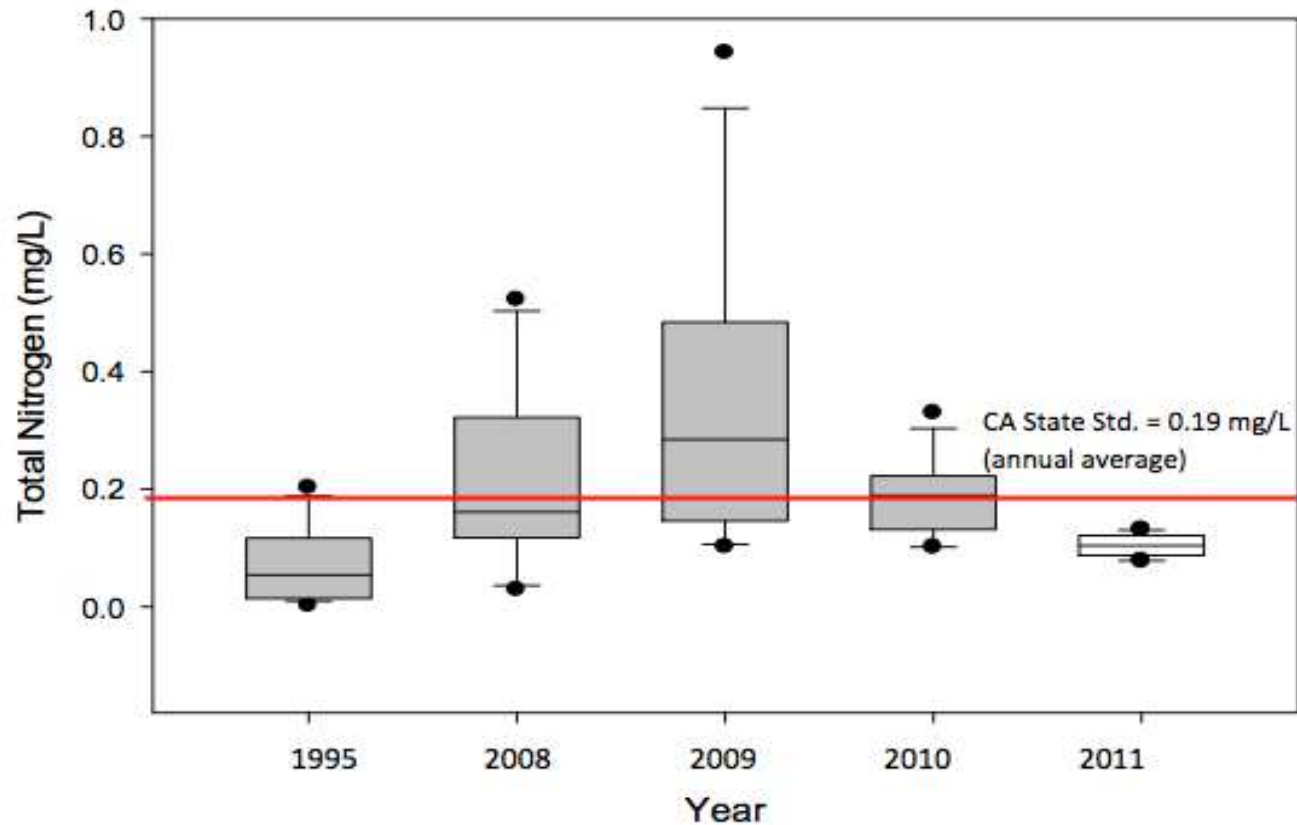
whiskers show 10th
and 90th percentiles.

Table 3-11. Increase in Upper Angora mean annual concentration relative to the baseline established using the historical LTBMU data.

The x-symbol associated with the post-Angora fire data is the relative increased concentration above the 1991-2000 baseline.

	Baseline	Post-Angora Fire		
	1991-2000	2008	2009	2010
Nitrate	6 µg N/L	12.2x	8.2x	1.3x
TKN	154 µg/L	1.0x	1.7x	1.6x
TN	160 µg/L	1.4x	1.9x	1.7x
SRP	3 µg/L	2.0x	1.7x	1.7x
TP	15 µg/L	1.3x	1.6x	1.7x
TSS	2.0 mg/L	1.9x	2.3x	1.8x
Turbidity	0.55 NTU	2.9x	4.5x	3.8x
EC	23 µS/cm	1.7x	1.8x	1.2x

Figure 3. Total Nitrogen During Spring Runoff (February - July)
Post-fire Years (2008-2011) and 1995 (reference)



Boxplot footnote: The black horizontal line across the box represents the median value of the data set. The top and bottom of each box represents the 75th and 25th percentiles respectively, and the horizontal line at the top and bottom of the vertical line represent the 90th and 10th percentiles respectively.

Figure 4. Total Phosphorus During Spring Runoff (February - July)
Post-fire Years (2008-2011) and 1995 (reference)

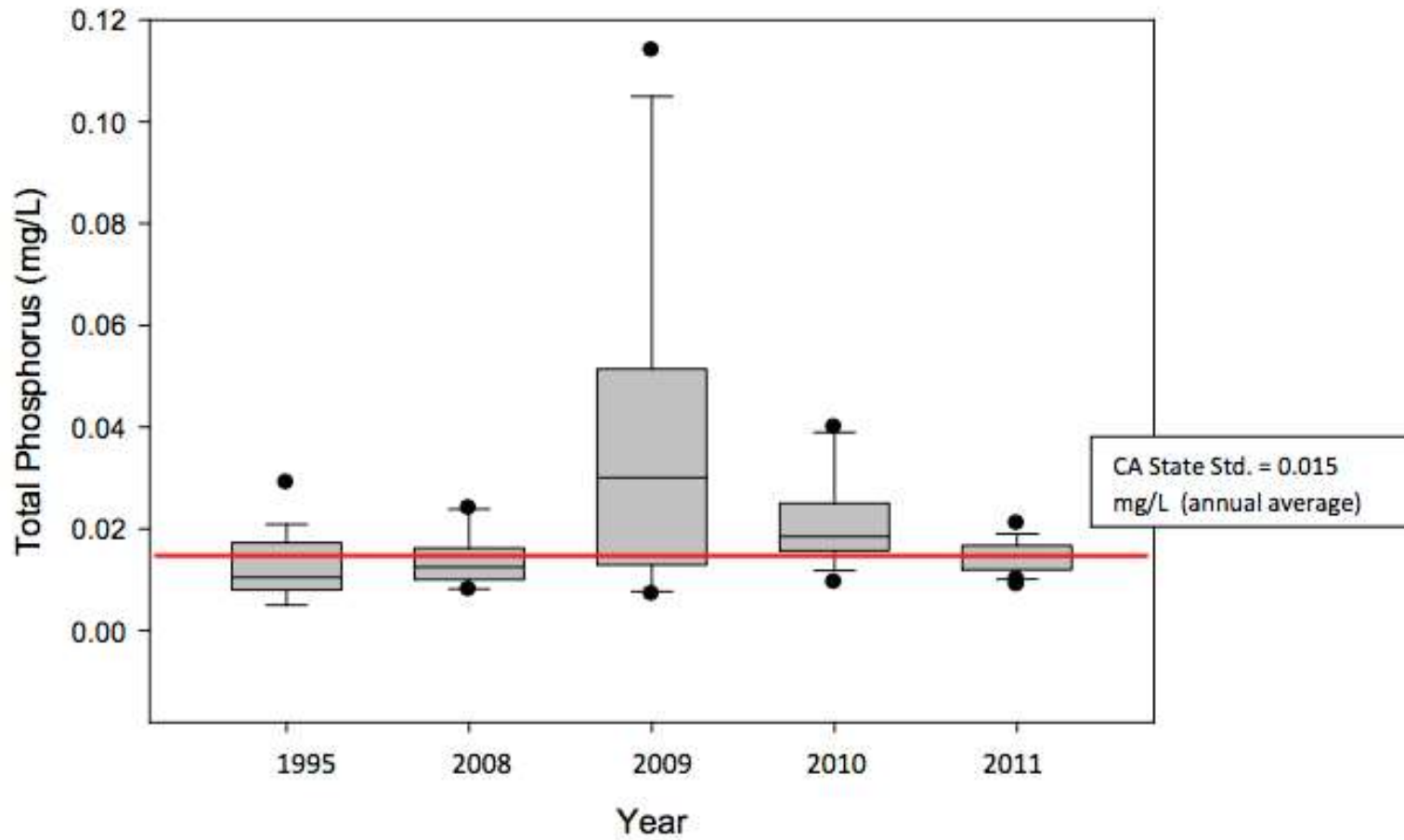
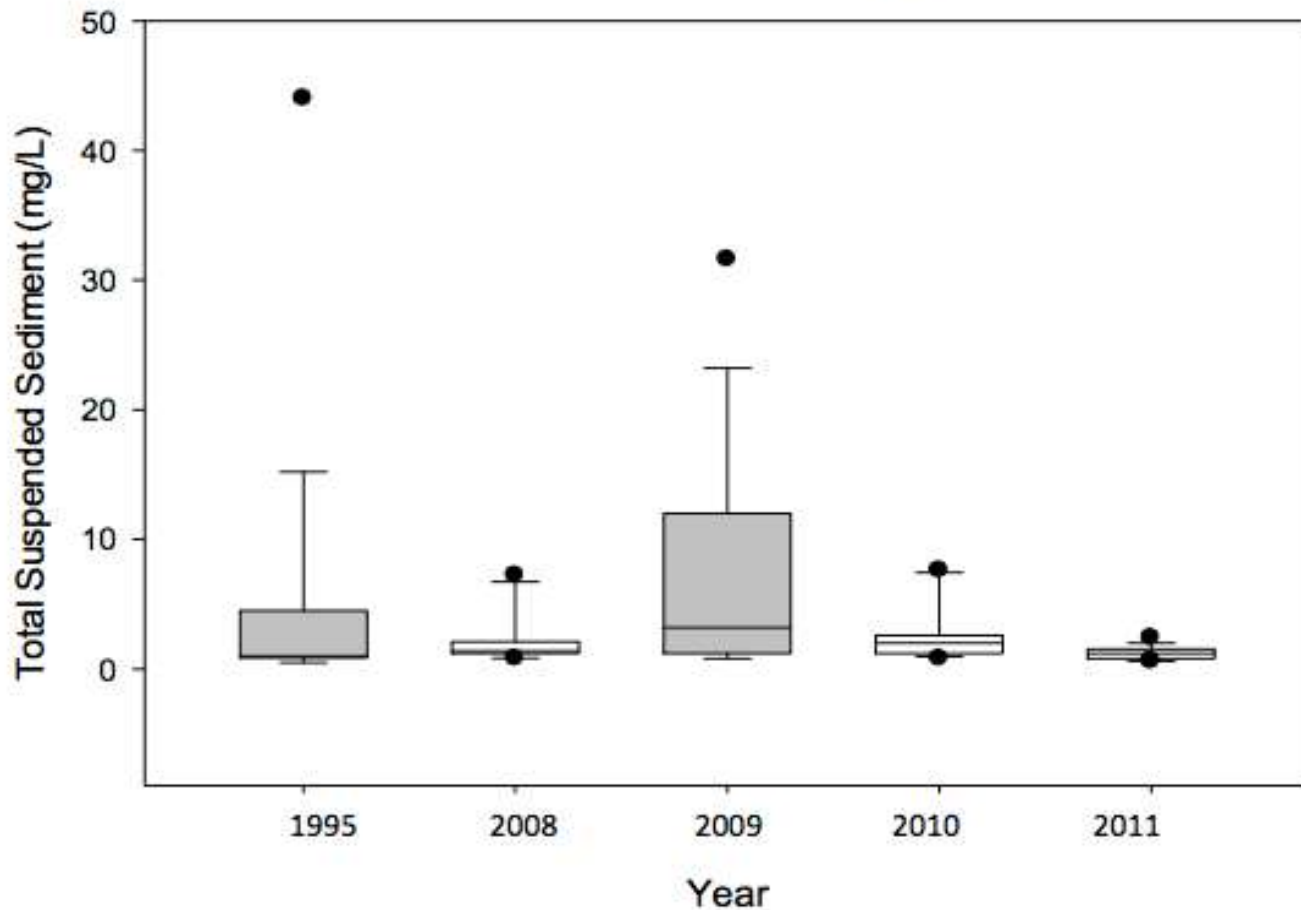
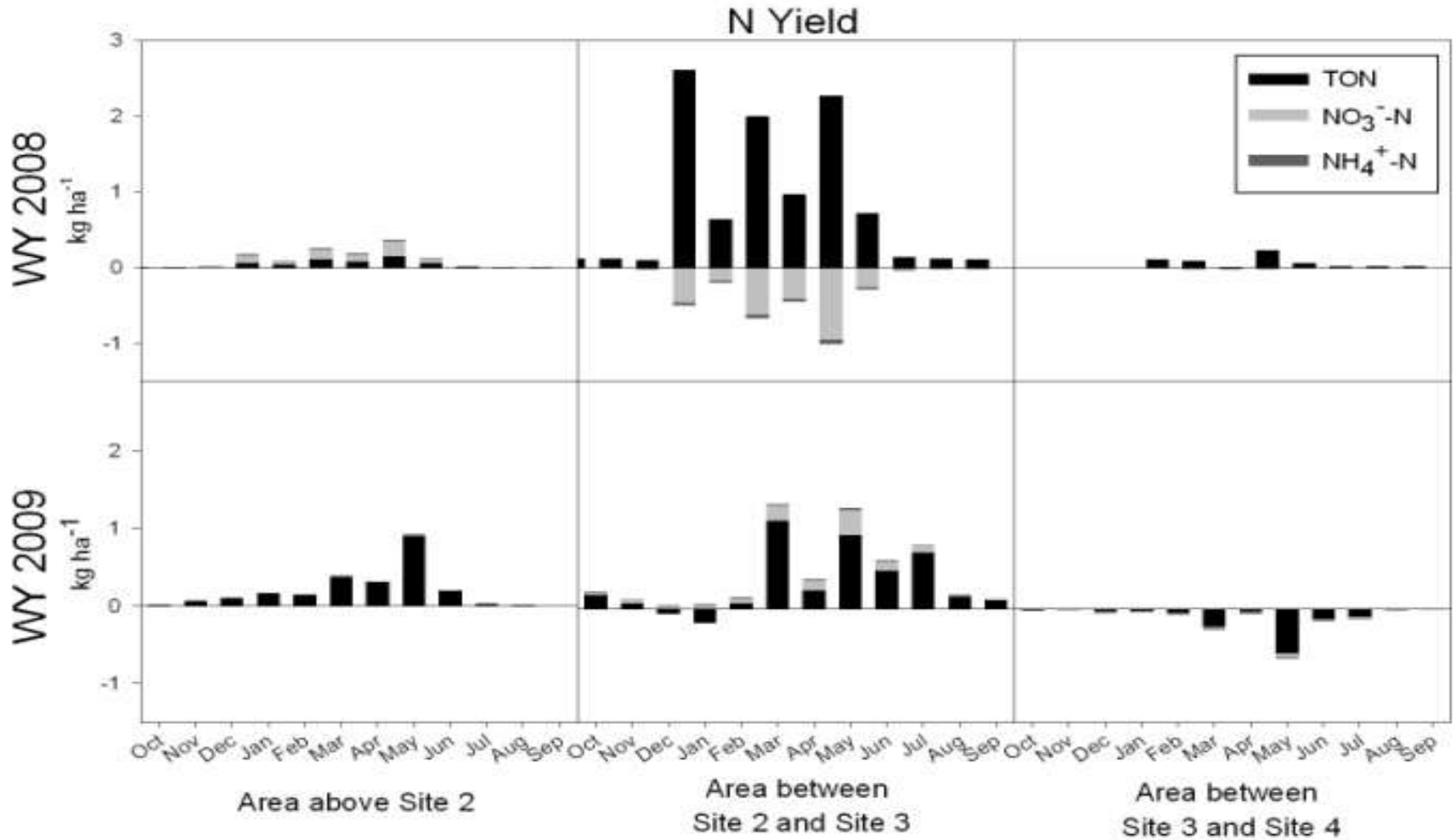


Figure 5: Total Suspended Sediment During Spring Runoff (February - July)
Post-fire Years (2008-2011) and 1995 (reference)
(CA State Std. = 60 mg/L)

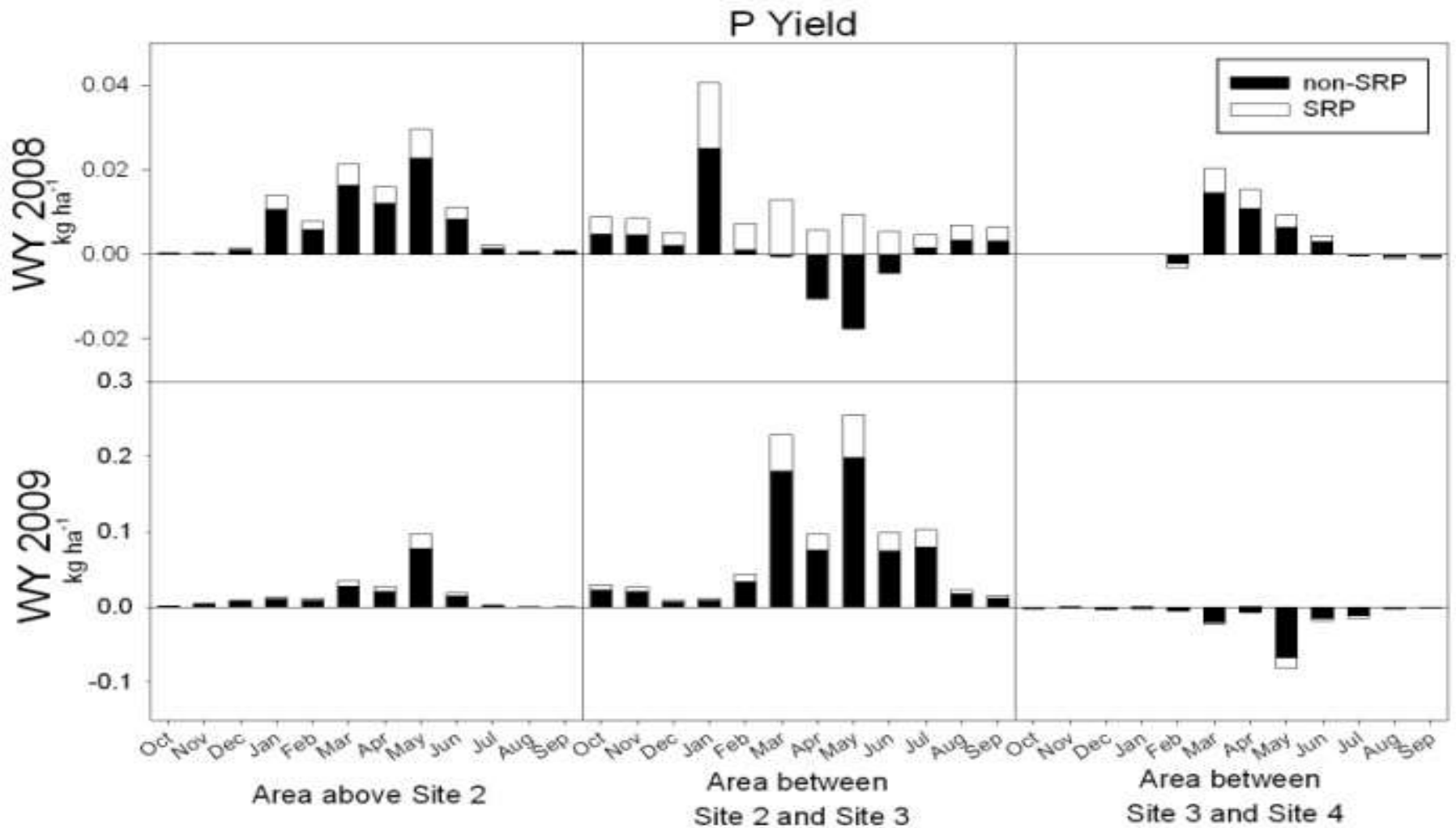


Angora Creek Nitrogen Yields (kg/ha/mo)



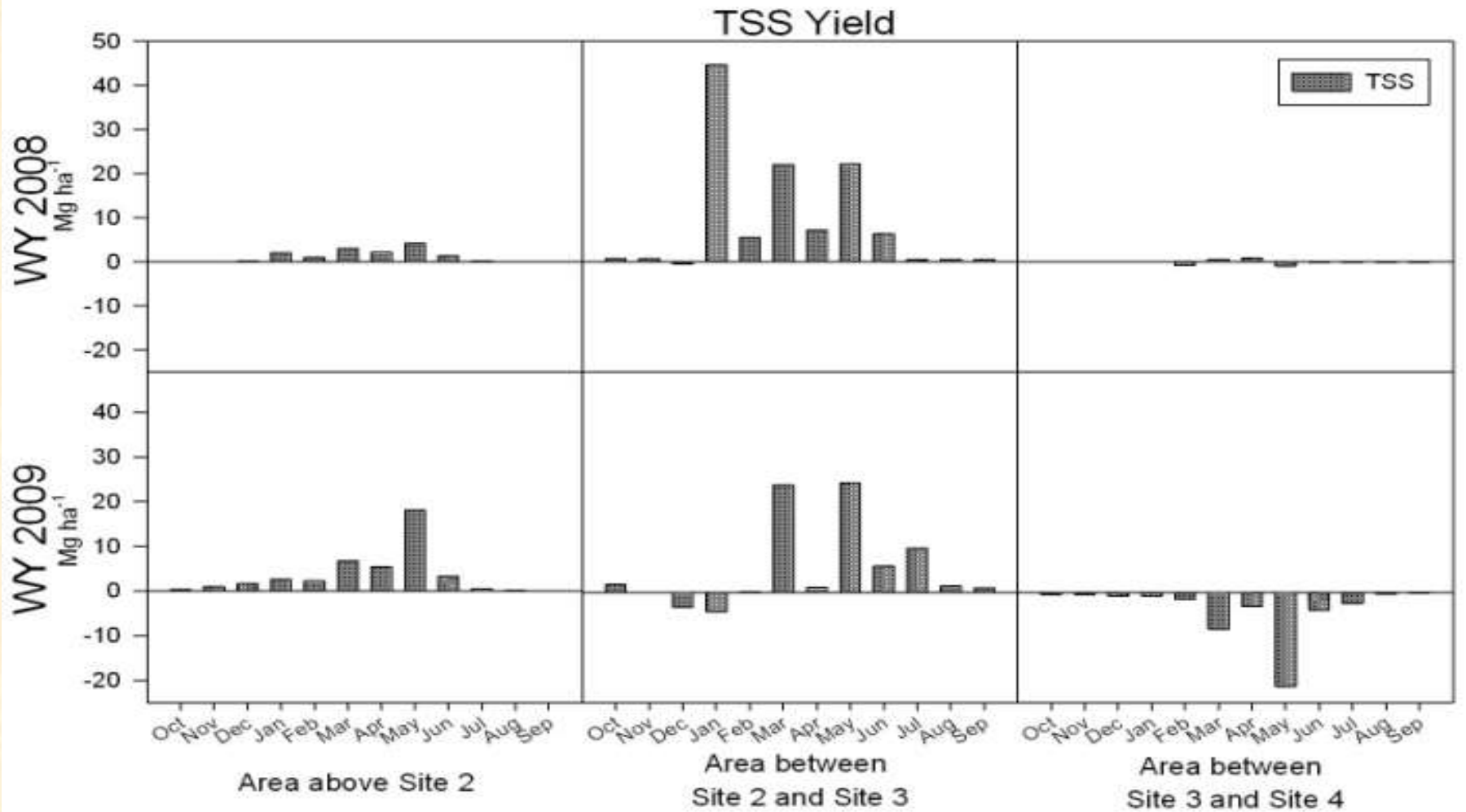
Note: positive values indicate contribution, negative values indicate retention.

Angora Creek Phosphorus Yields (kg/ha/mo)



Note: positive values indicate contribution, negative values indicate retention.

Angora Creek Sediment Yields (Mg/ha/mo)



Note: positive values indicate contribution, negative values indicate retention.

Conclusions

- No evidence of massive sediment or nutrient inputs from the burned urban area into Angora Creek.
- However, urban runoff contributed to higher concentrations in the lower Angora Creek site, compared to the upper Angora Creek site.
- Wet meadow restoration areas provided stormwater treatment to runoff from the surrounding catchment.
- Angora urban runoff and Angora Creek conditions after the fire were generally much better than has been observed at other urban sites around the Tahoe Basin.
- However, Angora loading is different from observations after the Gondola Fire; likely due to post-fire storm conditions.

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- California State Water Resources Control Board,
- Lahontan Regional Water Quality Control Board,
- California Tahoe Conservancy,
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