

Calculating 3-Event Rolling Averages

- As part of the site-specific objectives (SSO), NPDES dischargers are required to calculate the 3-event rolling average of dissolved copper and total cyanide concentrations in each segment of the Bay, based on RMP data.
- The last three RMP water cruises (2011, 2013, and 2015) were used to update the averages.
- Sample code from R for rolling average algorithm:

```
# aggregate the results by Bay Segment
wat.data3 <- aggregate(wat.data2$Result, by = list(wat.data2$Region),
                      FUN = 'mean')
names(wat.data3) <- c('Region', 'Cu.Average')
```

Sites With Results by Year of Water Cruise & Region

Copper
(dissolved)

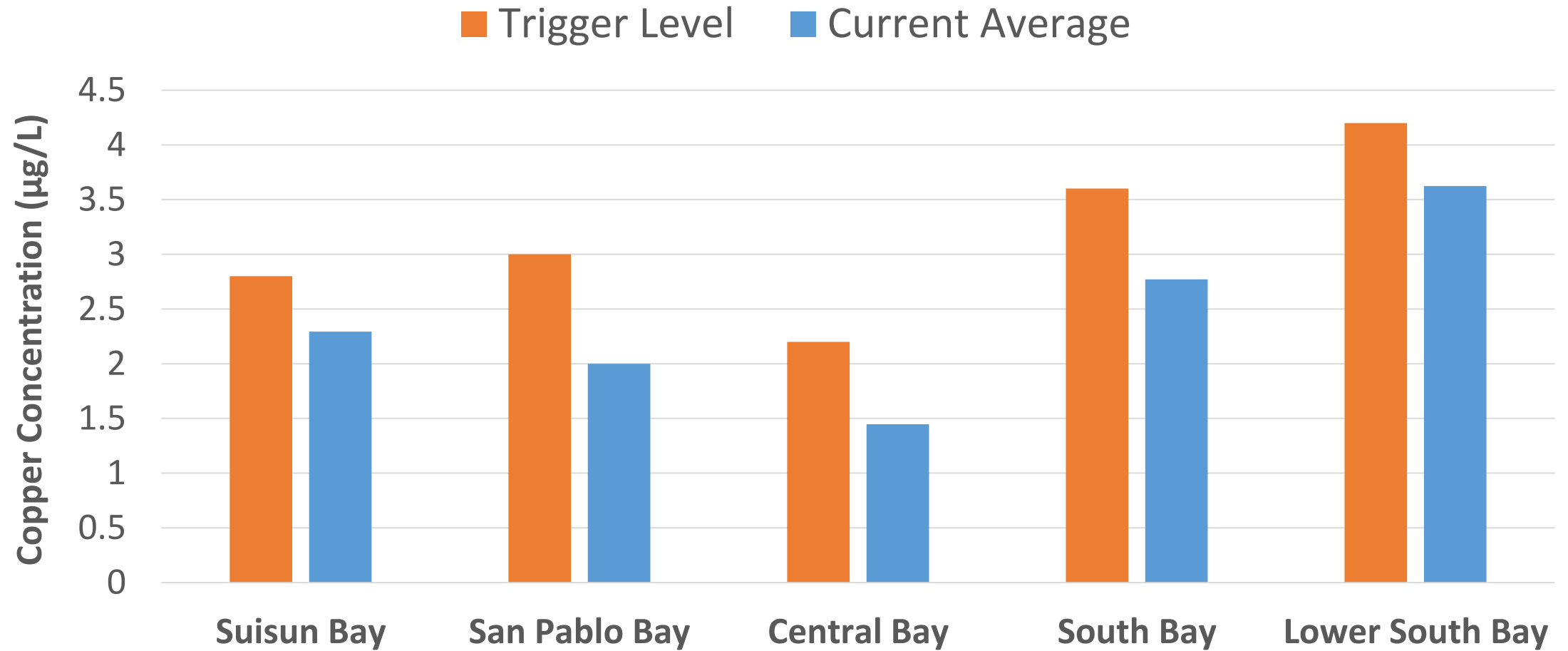
	Suisun Bay	San Pablo Bay	*Central Bay	**South Bay	Lower South Bay
2010	3	3	4	4	5
2011	3	3	4	4	5
2013	3	3	4	4	5
2015	3	3	4	4	5
Total Samples in Rolling Average	9	9	12	12	15

Cyanide
(total)

	Suisun Bay	San Pablo Bay	*Central Bay	**South Bay	Lower South Bay
2011	3	3	4	3	5
2013	3	3	4	1	5
2015	3	3	4	4	5
Total Samples in Rolling Average	9	9	12	8	15

*Historical station BC10 included; **Historical station BA30 included

Copper Results



Copper Results

DRAFT

	Region	# Samples	Trigger Level ($\mu\text{g/L}$)	Current Average Cu ($\mu\text{g/L}$) (2011, 2013, 2015 Cruises)	Previous Average Cu ($\mu\text{g/L}$) (2010, 2011, 2013 Cruises)	Change in Cu Concentration
1	Suisun Bay	9	2.8	2.29	2.22	0.07
2	San Pablo Bay	9	3	2.00	2.08	-0.08
3	Central Bay	12	2.2	1.45	1.51	-0.06
4	South Bay	12	3.6	2.77	2.84	-0.07
5	Lower South Bay	15	4.2	3.62	3.86	-0.24

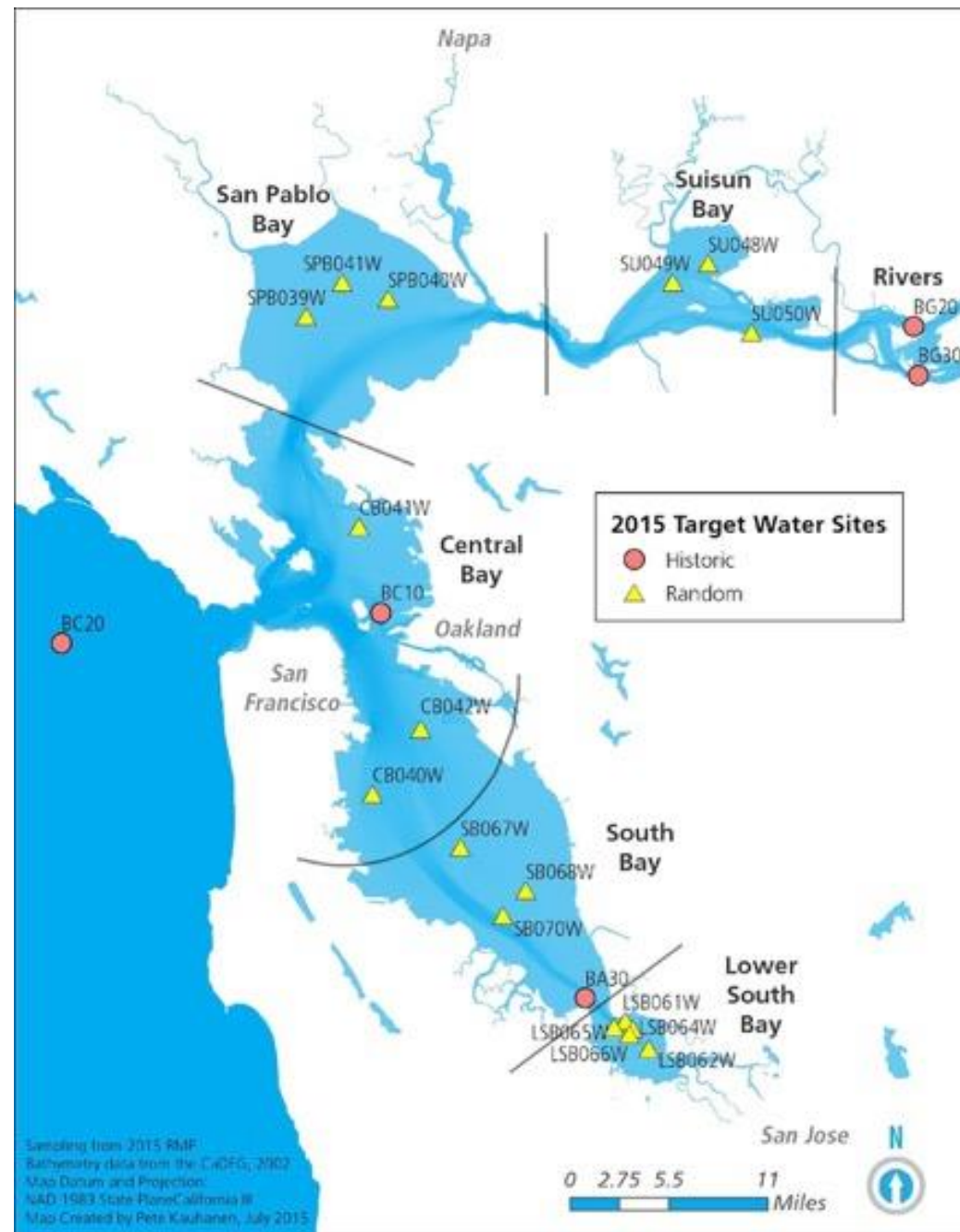
- Average copper concentrations are below trigger levels in all regions
- Most copper concentrations are decreasing
- Only region to increase in copper concentration is Suisun Bay
- Region closest to trigger level (Lower South Bay) dropped 0.24 $\mu\text{g/L}$

Appendices

- Cu & CN⁻
 - 2011, 2013, 2015 Water Cruise Site Maps
 - Copper Data

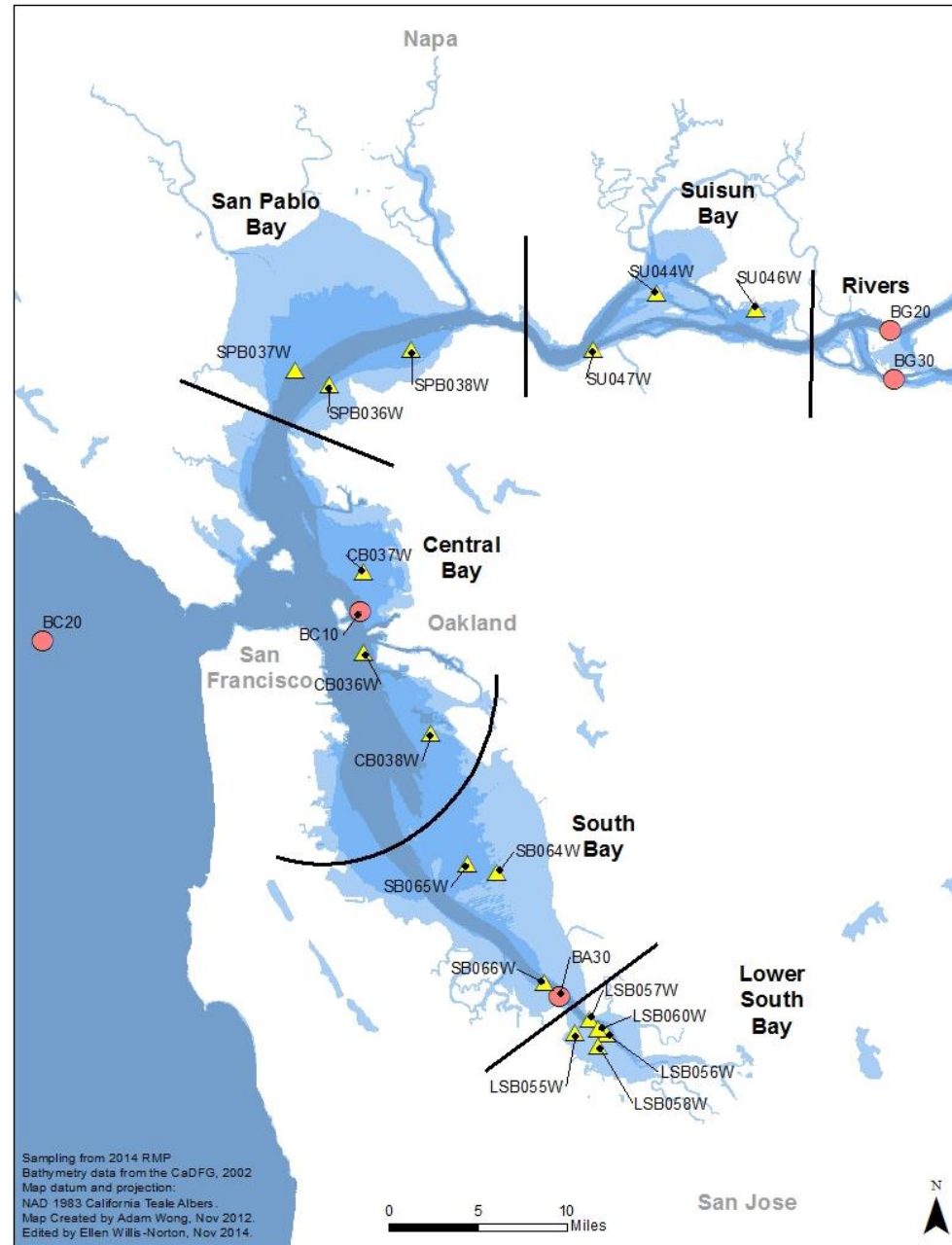
'15 Water Cruise Map

- Cu & CN⁻:
 - Not river sites (BG20 & BG30)

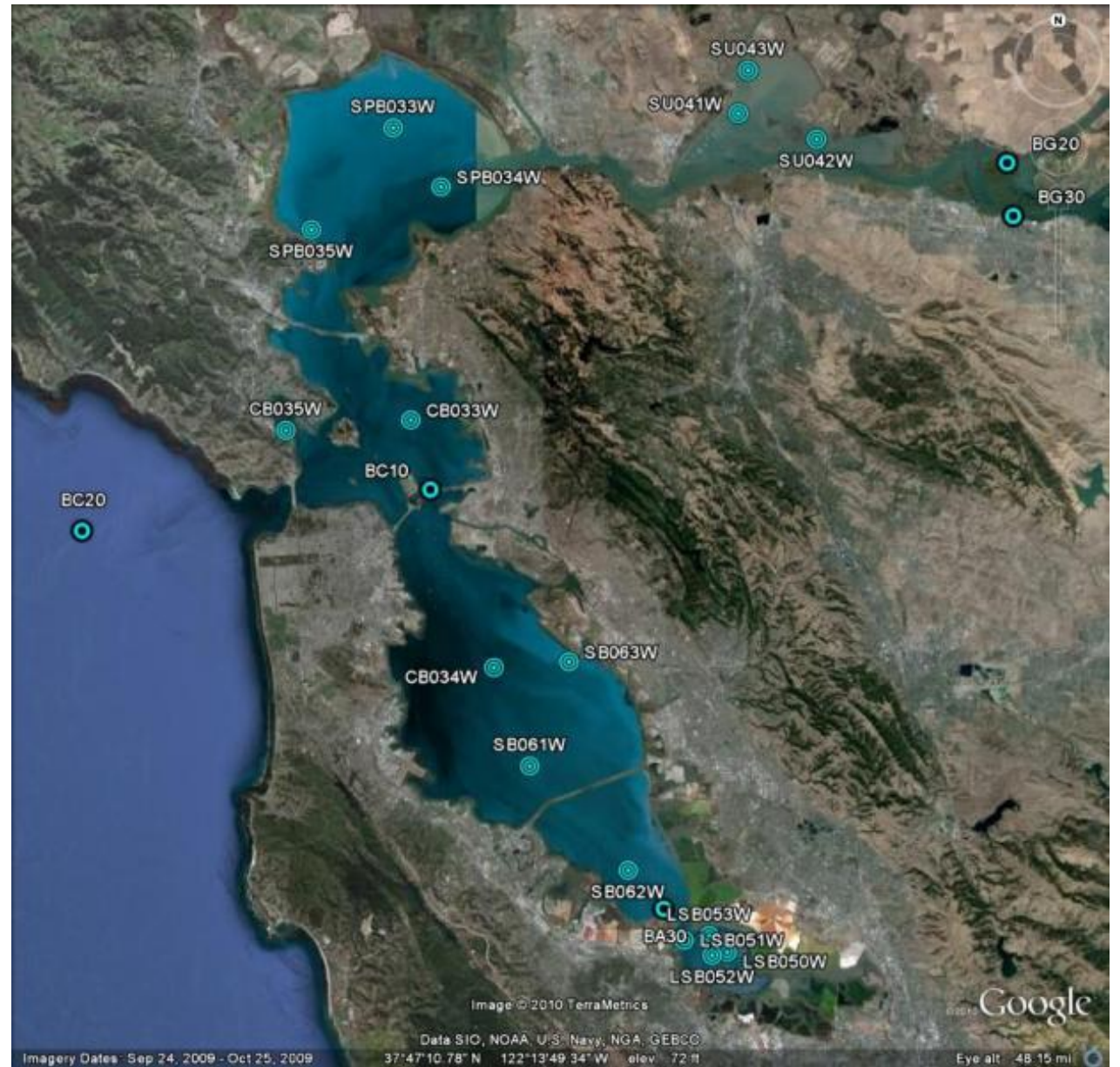


'13 Water Cruise Map

- CN⁻: missing south bay sites
 - Kept historical site BA30



'11 Water Cruise Map



Copper Data

Site Code	Region	Collection Date	Parameter	Qualifiers	Result	MDL	Units
BA30	SB	9/14/11	Copper	D,VIP		4.16	0.0202 ug/L
BC10	CB	9/16/11	Copper	D,VIP		1.5	0.0202 ug/L
BC20	CB	9/19/11	Copper	D		1.2255	0.0202 ug/L
CB033W	CB	9/16/11	Copper	D,VIP		1.04	0.0202 ug/L
CB034W	CB	9/16/11	Copper	D,VIP		2.16	0.0202 ug/L
CB035W	CB	9/19/11	Copper	D		1.51	0.0318 ug/L
LSB050W	LSB	9/13/11	Copper	D,VIP		7.95	0.0202 ug/L
LSB051W	LSB	9/14/11	Copper	D,VIP		2.8385	0.0202 ug/L
LSB052W	LSB	9/13/11	Copper	D,VIP		3.37	0.0202 ug/L
LSB053W	LSB	9/14/11	Copper	D,VIP		3.7	0.0202 ug/L
LSB054W	LSB	9/13/11	Copper	D,VIP		3.88	0.0202 ug/L
SB061W	SB	9/15/11	Copper	D,VIP		2.12	0.0202 ug/L
SB062W	SB	9/15/11	Copper	D,VIP		2.95	0.0202 ug/L
SB063W	SB	9/15/11	Copper	D,VIP		1.97	0.0202 ug/L
SPB033W	SPB	9/20/11	Copper	D		2.8045	0.0318 ug/L
SPB034W	SPB	9/20/11	Copper	D		2.47	0.0318 ug/L
SPB035W	SPB	9/20/11	Copper	D		2.07	0.0318 ug/L
SU041W	SU	9/21/11	Copper	D		2.35	0.0318 ug/L
SU042W	SU	9/21/11	Copper	D		2.14	0.0318 ug/L
SU043W	SU	9/21/11	Copper	D		2.08	0.0318 ug/L
BA30	SB	7/31/13	Copper	None		3.153333333	0.04 ug/L
BC10	CB	8/2/13	Copper	None		1.3	0.04 ug/L
BC20	CB	8/5/13	Copper	None		0.64	0.04 ug/L
CB036W	CB	8/2/13	Copper	None		1.31	0.04 ug/L
CB037W	CB	8/5/13	Copper	None		1.26	0.04 ug/L
CB038W	CB	8/2/13	Copper	None		1.76	0.04 ug/L
LSB055W	LSB	7/31/13	Copper	None		3.46	0.04 ug/L
LSB056W	LSB	7/30/13	Copper	None		4.27	0.04 ug/L
LSB057W	LSB	7/31/13	Copper	None		3.06	0.04 ug/L
LSB058W	LSB	7/30/13	Copper	None		4.56	0.04 ug/L
LSB060W	LSB	7/30/13	Copper	None		3.76	0.04 ug/L
SB064W	SB	8/1/13	Copper	None		2.57	0.04 ug/L
SB065W	SB	8/1/13	Copper	None		3.12	0.04 ug/L
SB066W	SB	8/1/13	Copper	None		2.93	0.04 ug/L
SPB036W	SPB	8/6/13	Copper	None		1.84	0.04 ug/L
SPB037W	SPB	8/6/13	Copper	None		1.84	0.04 ug/L
SPB038W	SPB	8/6/13	Copper	None		1.77	0.04 ug/L
SU044W	SU	8/7/13	Copper	None		3.59	0.04 ug/L
SU046W	SU	8/7/13	Copper	None		1.4	0.04 ug/L
SU047W	SU	8/7/13	Copper	None		2.4	0.04 ug/L
BA30	SB	8/26/15	Copper	VIL		2.35	0.004 ug/L
BC10	CB	8/27/15	Copper	VIL,JU		1.25	0.02 ug/L
BC20	CB	8/28/15	Copper	VIL		0.62	0.02 ug/L
CB040W	CB	8/27/15	Copper	VIL		1.68	0.02 ug/L
CB041W	CB	8/28/15	Copper	VIL		1.13	0.02 ug/L
CB042W	CB	8/28/15	Copper	VIL		1.45	0.02 ug/L
LSB061W	LSB	8/26/15	Copper	VIL		2.13	0.004 ug/L
LSB062W	LSB	8/26/15	Copper	VIL		2.46	0.004 ug/L
LSB064W	LSB	8/26/15	Copper	VIL		2.57	0.004 ug/L
LSB065W	LSB	8/26/15	Copper	VIL		2.62	0.004 ug/L
LSB066W	LSB	8/26/15	Copper	VIL		3.73	0.004 ug/L
SB067W	SB	8/27/15	Copper	VIL		2.25	0.004 ug/L
SB068W	SB	8/27/15	Copper	VIL		3.04	0.004 ug/L
SB070W	SB	8/27/15	Copper	VIL		2.64	0.004 ug/L
SPB039W	SPB	8/31/15	Copper	VIL		1.555	0.02 ug/L
SPB040W	SPB	8/31/15	Copper	VIL		1.62	0.02 ug/L
SPB041W	SPB	8/31/15	Copper	VIL		2.03	0.02 ug/L
SU048W	SU	9/1/15	Copper	VIL		2.63	0.02 ug/L
SU049W	SU	9/1/15	Copper	VIL		1.87	0.02 ug/L