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TECHNICAL MEMORANDUM

To: Ron Duncan, Soquel Creek Water District

From: Cameron Tana

Date: July 15, 2015

Subject: Updated Sustainable Yield Estimates and Pumping Goals to Achieve Recovery

Water Year 2014 Annual Report and Review (HydroMetrics WRI, 2015) references updated estimates for Soquel Creek Water District's (SqCWD) pumping yield in its summary of the status of the *Groundwater Management Plan* (SqCWD and Central Water District, 2007) Basin Management Objective 1-1 to pump within the sustainable yield. The current estimates for pumping goals based on sustainable yield are updated from the groundwater pumping goals presented in the *2012 Integrated Resources Plan Update* (IRP, SqCWD, 2012). This technical memorandum summarizes the update in the pumping yield estimates.

APPROACH FOR PUMPING GOAL ESTIMATES

Different estimates for pumping goals apply in different time periods. The post-recovery pumping yield is the long-term pumping yield after groundwater levels recover to protective elevations that are estimated to protect the groundwater supply aquifers from seawater intrusion over the long term (HydroMetrics LLC, 2009a and HydroMetrics WRI, 2012). The pre-recovery pumping goal is the pumping goal below the long-term pumping yield that will recover groundwater levels to protective elevations within twenty years.

The post-recovery pumping yields for the Purisima and Aromas areas are estimated using a water balance approach for each of the areas (HydroMetrics WRI, 2012). The water balance includes components such as outflows out to offshore, recharge estimates, and return flow estimates. SqCWD's post-recovery pumping yields were developed from this water balance assuming pumping by other parties would not change. Also, climate change impacts (related to recharge and sea level rise) were not considered in the water balance for estimating the post-recovery pumping yield.

The pre-recovery pumping goal was estimated based on calculating the cumulative deficit for when SqCWD pumping in the Purisima and Aromas areas was above the post-recovery (long-term) pumping yield. The pre-recovery pumping goal in each area is less than the post-recovery pumping yield for each area such that the cumulative pumping deficit would be eliminated in twenty years.

BASIS FOR UPDATED YIELD ESTIMATES

The post-recovery pumping yield is updated from the 2012 IRP based on a change in the assumed use of septic systems within SqCWD. The estimate for post-recovery pumping yield used in the 2012 IRP assumed no return flow from septic systems based on SqCWD Board policy to encourage the conversion from septic systems to sewer for water quality purposes (HydroMetrics WRI, 2012). During the peer review of the technical work for developing sustainable yield estimates (Todd, 2014), SqCWD obtained information from the County that there are no plans to convert these areas to sewer so SqCWD decided it would be more realistic to assume continued return flow from existing septic systems.

The estimates of post-recovery pumping yield based on the updated assumption were presented together with the estimates used in the 2012 IRP in Tables 10 and 11 of the 2012 HydroMetrics WRI report. Those estimates are summarized in Table 1.

Table 1. Summary of 2012 IRP and Updated Estimates for Post-Recovery Pumping Yield

Acre-feet per year	Assuming No Septic Systems in SqCWD Area in Future (2012 IRP)	Assuming Existing Septic Systems in SqCWD Area (Current)
Purisima	2,800	2,890
Aromas	1,200	1,440
Total	4,000	4,330

UPDATES OF PRE- RECOVERY PUMPING GOALS

The update to the post-recovery pumping yield necessitates an update to the pumping goal for recovery because recovery pumping is based on pumping less than the post-recovery pumping yield enough to eliminate the cumulative pumping deficit. The cumulative pumping deficit does not change with the updated assumption because the calculation of cumulative pumping deficit used for the pre-recovery pumping goal in the 2012 IRP assumed return flow from existing septic systems within the SqCWD area during the past as that was the historical condition. The cumulative pumping deficit in acre-feet (af) was updated to reflect pumping totals through Water Year 2013. The cumulative pumping deficit in each area is divided by 20 years to calculate the amount below the post-recovery pumping yield that is the pre-recovery pumping goal in acre-feet per year (afy) as shown in Table 2.

Table 2. Calculation of Updated Pre-Recovery Pumping Goal

	Purisima	Aromas	Total
First Year of Deficit	1980	1983	
Cumulative Deficit through WY 2013 (af)	9,600	11,700	21,300
Annual Pumping Below Post-Recovery Yield (afy)	480	590	1,070
Pre-Recovery Pumping Goal (afy)	2,410	850	3,260

Note: Cumulative deficits rounded to nearest hundred acre-feet and pre-recovery pumping goal rounded to nearest ten acre-feet per year

RANGE OF ALTERNATE PUMPING YIELDS AND GOALS

In its peer review, Todd (2014) concluded that the updated estimates for post-recovery pumping yield and recovery goal presented in Table 1 and Table 2 were on the low end of the plausible range and presented estimates representing the upper end of the plausible range. However, both the estimates in Table 1 and Table 2 and Todd's estimates are based on outflows offshore that protect the groundwater supply aquifers against seawater intrusion in 70% of the model runs used to estimate the outflows. SqCWD determined that this level of risk was appropriate for planning level guidelines recognizing that pumping goals would need to change if data indicate seawater intrusion advancing into the groundwater supply aquifers. The 2012 HydroMetrics WRI report also documented potentially more conservative estimates of pumping yields based on the outflows offshore that are protective in 90% of the model runs. Table 3 shows the associated recovery pumping goals for this range of pumping yields. The Todd estimate was evaluated against historical pumping to define the upper limit for the post-recovery pumping yield. We have not done something similar for pumping yields based on the 90th Percentile Outflow and such an analysis may show that the estimate for pumping yield is unreasonably low. Also note that the relationship between post-recovery pumping yield and recovery pumping goals in acre-feet per year (afy) shown in Table 3 is different than what Todd presented as Todd only calculated cumulative deficit in acre-feet (af) that would have occurred from 1984 to 2011.

Table 3. Pre-Recovery Pumping Goals Based on Range of Post-Recovery Pumping Yield

	Todd 2014		**HydroMetrics WRI 2012 (70th Percentile Outflow)**		**HydroMetrics WRI 2012 (90th Percentile Outflow)**	
	Purisima	**Aromas**	**Purisima**	**Aromas**	**Purisima**	**Aromas**
Post-Recovery Pumping Yield (afy)	3,050	1,700	2,890	1,440	2,590	740
First Year of Deficit	1982	1985	1980	1983	1978	1970
Cumulative Deficit through WY 2013 (af)	4,240	3,840	9,600	11,700	20,200	37,800
Pre-Recovery Pumping Goal (afy)	2,840	1,510	2,410	850	1,580	0[1]

Note: Cumulative deficits rounded to nearest hundred acre-feet and pre-recovery pumping goal rounded to nearest ten acre-feet per year

[1] Based on the cumulative deficit for 90th percentile outflow, 50 years would be required to recover the basin with no Aromas pumping

Future Estimates of Pumping Yields and Goals

We recommend that future estimates of post-recovery pumping yield and pre-recovery pumping goals be based on the groundwater model currently under development instead of the water balance approach described above. The use of the groundwater model for this purpose is described in more detail in a HydroMetrics WRI memo titled *Peer Review of Sustainable Yield Estimates – Refining Estimates with the Groundwater Model and Additional Studies* (2014).

In the July 9, 2015 Board workshop, it was requested that effects of assuming reduced pumping from other pumpers and climate change 30 years into the future on post-recovery pumping yield and pre-recovery pumping goals be estimated. For the groundwater model, updated estimates for pumping from other pumpers will be used for future simulations and simulations of different climate change scenarios will be performed. Therefore, future groundwater management planning can be done based on those simulation results. However, we understand the District would like an idea of the effect of these factors on yield and pumping goal estimates in the interim and we will work with District staff to develop assumptions to incorporate in the water balance approach.

References

HydroMetrics LLC, 2009b, *Groundwater levels to protect against seawater intrusion and store freshwater offshore,* prepared for Soquel Creek Water District, January.

HydroMetrics WRI, 2012, *Revised Protective Groundwater Elevations and Outflows for Aromas Area and Updated Water Balance for Soquel-Aptos Groundwater Basin,* letter to Laura Brown, Soquel Creek Water District, March 30.

———, 2014, *Peer Review of Sustainable Yield Estimates – Refining Estimates with the Groundwater Model and Additional Studies,* Technical Memorandum to Kim Adamson and Taj Dufour, Soquel Creek Water District, from C. Tana and D. Williams, October 8.

———, 2015, *Soquel-Aptos Area Groundwater Management Annual Report and Review, Water Year 2014*, prepared for Soquel-Aptos Groundwater Management Committee, May.

Soquel Creek Water District and Central Water District, 2007, *Groundwater management plan -2007 Soquel-Aptos area,* Santa Cruz County, California, April.

Soquel Creek Water District, 2012, *2012 Integrated Resources Plan Update*, September 18.

Todd Groundwater, 2014, *Peer Review of Technical Water Resources Studies Prepared for Soquel Creek Water District—Summary of Yield Estimates*, technical memorandum to Kim Adamson and Taj Dufour, Soquel Creek Water District, from G. Yates, September 8.