TO: WATER SUPPLY ADVISORY COMMITTEE (WSAC)

FROM: HEIDI LUCKENBACH

SUBJECT: UPDATE ON SOQUEL CREEK WATER DISTRICT ACTIVITIES

DATE: OCTOBER 17, 2014

Following is a list of items received by the Soquel Creek Water District Board of Directors that may be of interest to the WSAC.

- On September 30, 2014 under the item of the General Manager annual evaluation, they received a memo recapping the District's more important issues and achievements over the past year (attachment pages 167-175).
- On October 7, 2014 an item related to the peer review of hydrological studies (attachment pages 59-72). The memo ultimately called for no action, though intended to provide staff direction for additional activities related to refining the sustainable yield estimates with the groundwater model and additional studies.
- Also on October 7, 2014 an item to add USGS to the team with Hydrometrics in developing the groundwater model for the Soquel Aptos groundwater management area. The City and Central Water District are also partners in this effort.

September 30, 2014

MEMO TO THE BOARD OF DIRECTORS

Subject: 2014 General Manager's Performance Evaluation

The General Manager's anniversary of hire date is July 8. The District's contract with the General Manager calls for an annual performance evaluation by the full Board of Directors and provides that merit increases in salary may be awarded at that time as determined by a majority vote of those Board members present. Also, in the absence of any merit increase, salary adjustments to address salary compaction issues must also take place in open session. The performance evaluation is conducted in Closed Session, and action to adjust salary, if any, must be taken in Open Session. At the Board's direction, this item will be placed on the next agenda. Currently the General Manager's salary is preventing the Managers group from negotiating a new agreement. Their current agreement expired in February 2014. All Managers salaries will have to be frozen indefinitely if the Board chooses not to include a salary adjustment on an upcoming Agenda.

The following is a recap of the District's more important issues and achievements over the past year. This list of the organization's accomplishments reflect a team effort, and I wish to acknowledge the dedication and significant contributions of the District Staff and Consultants. They have worked very hard over the past year to provide professional analysis and recommendations on issues and then effectively implement the Board's policy direction.

1. Integrated Resources Planning - Conjunctive Use Program

a. Dealt immediately with the City's withdrawal from the joint desal project by developing a plan to conduct several single-topic meetings that address components of the IRP. These meetings have been open to the public and have been well attended by the community.
b. Prepared background information and developed a criteria based process for completing selection of preferred alternative(s) for supplemental supply
c. Conducted public outreach and hearings, which also involved widespread notification, development of presentation materials on the issues and alternatives, and recording public comments both by court reporter and video footage
d. Conservation Analysis – Discovered financial planning flaws in Full Toolbox program and redesigned conservation program to avoid unforeseen financial pitfalls
e. Board action to select alternatives for further evaluation
f. Moving forward with planning for feasibility studies on supplemental supply
g. The following is a list of special topic meetings staff has initiated:

- September 17, 2013 Board Meeting: Workshop focused on water supply planning goals and objectives, what's "changed" since the 2012 Integrated Resources Plan Update was approved, previous and new alternatives to consider, and screening criteria to use for subsequent alternatives analyses and evaluation.
- October 16, 2013 Board Meeting: Exploratory discussion focused on desalination options that included a presentation by representatives from Deep Water Desal on the Moss Landing proposed project and a presentation by District staff on a District-Only desalination project.
- November 5, 2013 Board Meeting: Exploratory discussion focused on surface water options that included presentations by Jerry Paul and Bill Smallman (both local citizens engaged in water supply alternatives), and an update presentation by John Ricker on the surface water exchange report. Surface water attorney Peter Kiel and Lisa McCann (Regional Water Board's water rights liaison) both teleconferenced in.
- January 7, 2014 Board Meeting: Exploratory discussion focused on reducing water demands with mandatory water rationing. This option is not a supplemental water supply option but rather a demand reduction alternative should a supplemental supply not be secured. Staff presented a phased approach to water rationing that would allow the District to accelerate water savings while it continues evaluation and pursuit of a supplemental supply.
- February 4, 2014 Board Meeting: Exploratory discussion focused on recycled water options that included presentations by Dave Smith (Managing Director of WateReuse Association), Mark Dettle (Public Works Director for the City of Santa Cruz), Todd Reynolds (Kennedy/Jenks Technical Advisor), and Bill Smallman (local citizen and engineer). The alternatives discussed included recycled water for irrigation, seawater barrier, and potable reuse (directly as well as for groundwater replenishment). This meeting also included an overview of the proposed evaluation criteria and scorecard approach for assessing alternatives.
- March 4, 2014 Board Meeting: Exploratory discussion focused on groundwater rights and management framework. Presentations were given by Russell McGlothlin (attorney with Brownstein Hyatt Farber Schreck), John Ricker (SC County Water Resources Division Director) and staff. This meeting did not go into groundwater options per se, but rather gave an overview of groundwater law in California, the County's role and responsibilities with non-municipal pumping, and the District's current and future groundwater management activities. There was also discussion on establishing a Groundwater Replenishment District and/or having the

functions be part of the existing Joint Exercise of Powers Agreement (JPA) AB3030 framework, peer review of the District's hydrological analyses, and declaration of a groundwater emergency.

- March 18, 2014 Board Meeting: Staff requested that the Board provide direction and approve which back-up options that were introduced during the exploratory discussions should be brought back to the Board for the evaluations workshop. The options selected were Deep Water Desal, In-District desalination, surface water transfers, and recycled water (for seawater barrier, irrigation, and groundwater injection).
- April 1, 2014 Board Meeting: Exploratory discussion on accelerating conservation with a 'Water Use Reduction Program' (previously referred to as Phase 1) aimed at achieving a 500 acre-feet per year water savings within two years. The Board was very interested in moving forward with this type of long-term program.
- April 29 and June 3, 2014 Board Meetings: Focused on establishing a water connection moratorium or expanding the water demand offset program. Public comments were taken on 4/29 to address the aforementioned topics and a public hearing was held on 6/3 on these two issues as well on considering declaration of a groundwater emergency or water shortage declaration. The Board voted to expand the water demand offset program, declare a groundwater emergency, and declare a stage 3 water shortage emergency.
- June 17, 2014 Board Meeting: Focused on the Board adopting the declarations of the groundwater emergency and stage 3 water shortage emergency, adopting the revisions to the existing WDO program, and providing input on the CONSERVATION*plus* Program (previously known as the Water Use Reduction Program) components.
- July 15, 2014 Board Meeting: Focused on the peer review of the hydrological studies of the District and next steps to address the basin deficit and basin recovery yield. Also at this meeting, the Board kicked-off the alternatives-based evaluation of the back-up options with a staff memo related to the common criteria and conceptual technical evaluation of the alternatives. The concepts of a mid-county recycled water project and a regional recycled water project for groundwater replenishment were introduced and approved to be carried through the analysis process. The Board and Todd Reynolds (Kennedy/Jenks) discussed the next steps which included a workshop-style setting to conduct the scoring and ranking of the supply options as well as a "homework" assignment to fill out an evaluation matrix.

- August 12, 2014 Board Meeting: Focused on a public hearing for the CONSERVATION*plus* Ordinance 14-02. The Board requested that staff look more into flexibility, the method on how to determine occupancy to set long-term water budgets and also during short periods (such as summer vacations, etc.). The Board also wanted the August 26, 2014 meeting to be an opportunity for the public to comment on the CONSERVATION*plus* Program prior to the Ordinance's second reading on September 2.
- Currently preparing to present options for revising CONSERVATION*plus* and facilitating more public input at the Board's request.

2. Groundwater Management

a. Initiated monthly monitoring reports at the Board's request
b. Groundwater Management Plan Update – Reviewed and prepared for acceptance of six year update
c. Scoped project and obtained proposal for Soquel-Aptos Groundwater Model and obtained agreement from Central Water District and the City of Santa Cruz for a cost share
d. Scoped project and obtained proposal for Seawater Interface Location project at the Board's request
e. Collaborated with Stanford study to identify location of seawater interface onshore. Project will take place in October
f. Developed RFQ, completed consultant selection and completed Peer Review of District hydrology
g. Provided research and conducted public hearing for declaration of a Stage 3 Water Shortage with implementation of emergency rates
h. Provided research and conducted public hearing for declaration of a Groundwater Emergency
i. Ongoing monitoring program and presentation of annual basin status report
j. Obtained collaborative agreement to invite the City of Santa Cruz, Santa Cruz County and PVWMA to join the Basin Implementation Group
k. Monitored and provided input on Sustainable Groundwater Act legislation
l. Partnered with Central Water District and Santa Cruz County, implemented a community conversation of water supply issues through Groundwater Stakeholder meetings
m. Developed scope of work and initiated Service Area 3 Planning Study
n. Completed project to replace monitoring wells at Main St. Well (SC-18), Cherryvale Ave. (SC-10), and Porter Gulch Road (SC-11). New monitoring wells were drilled at Quail Run Road (SC-23) and Larkin Valley Tank (SC-A9)

o. Development of Private Well Monitoring Plan in cooperation with the City of Santa Cruz to monitor the effect of District and City wells on surface water, ground water and adjacent private wells

3. Conservation & Billing

a. Implemented outreach for voluntary 20% water reductions
b. Development of Mandatory Water Budget designed to reduce use by 11% per Board's request
c. County and City of Capitola Mandatory Retrofit at Time of Resale Ordinances – ordinances were coordinated and adopted and District started enforcing ordinances District-wide (previously we only provided this service in the city of Capitola)
d. Performed 560 in-home surveys, 207 landscape surveys and 300 water wise house calls for our customers
e. Performed Water Audits of all public schools in the District
f. Successfully piloted WaterSmart program and are preparing to roll program out District-wide
g. Successfully transitioned from bi-monthly to monthly billing
h. Launched e-bills to customers in order to reduce paper bills and provide more customer flexibility
i. Customers achieved a 26% reduction over last year's use in August and 34% reduction compared to the past 10 year average, year to date use is down 16%
j. Completed radio read meter installation program

4. Communications & Outreach

a. Development and rollout of new comprehensive website which has received approximately 35,700 unique hits to date
b. Developed District "Speakers Kit" and implemented media training for all management staff and Board members
c. Development of social media policy
d. Development and maintenance of District Facebook and Twitter accounts
e. Implemented monthly Water Wisdom column in Aptos and Capitola Times newspaper and wrote eight articles to date
f. Implemented monthly "e-blasts" which are currently being sent to approximately 4,500 subscribers with a 46% opening rate (industry average opening rate is 22.7%)
g. Transitioned from two page bimonthly newsletter to four page quarterly newsletter with bill inserts on months newsletters aren't scheduled
h. Presented, attended or have scheduled 59 public presentations or tabling events since January 1, 2014
i. Developed press release review process and issued 9 district press releases since January 1, 2014

j. Provided 13 television news interviews since January 1, 2014
k. Provided info or an interview for 111 print articles related to the District in the Santa Cruz Sentinel, Aptos Times, Capitola/Soquel Times, Aptos Life and Good Times since January 2014
l. Continued school and teacher training programs

5. New Service Applications

a. Provided research and options for Board consideration of water connection moratorium
b. Water Demand Offset Program – Proposed changes to existing program which will result in more meaningful, real and quantifiable projects that save or recharge water

6. Water Quality

a. O'Neill Well Iron & Manganese Treatment Plant designed, bid and under construction to be completed in spring 2015
b. Full compliance with Federal and State Drinking Water Standards and Testing Requirements
c. Prepared annual Water Quality Report and transitioned to electronic distribution with paper copies available upon request
d. Drinking Water Source Assessment completed for replacement Aptos Jr. High Well
e. Completed the first round of sampling under the US EPA's Unregulated Contaminant Monitoring Rule 3 (UCMR 3)
f. Chromium 6 – Completed pilot testing and published report. Subsequently became one of the first Districts in the state to receive a permit amendment for a full scale Chrome 6 treatment pilot plant. Raw water line and onsite piping is completed

7. Capital Improvement Program (Significant projects not otherwise listed)

a. Soquel Drive Cast Iron Main Replacement construction completed
b. Bye Way Main Replacement and Cliff Court Main Abandonment Project construction completed
c. Aptos Jr. High Well Replacement bid and completed
d. Main Street Well Rehabilitation and Pumping Equipment Replacement completed
e. Oakhill & Poplar Area Main Replacement Project designed, bid and under construction

f. McGregor Drive Pump Station designed, bid and starting construction in October
g. Aptos Pump Station designed and bid
h. Headquarters Master Plan – Consultant selection; relocation of records to new storage area and proceeding with demolition of Rosedale House; RFQ for architectural services

8. Organization Development & Personnel

a. Finalized and obtained Board approval for Memorandum Of Understanding (MOU) Between Soquel Creek Water District and Mid Management Employees Bargaining Unit
b. Develop job description, pay range and classification Human Resource Manager and successfully recruited for the position
c. Initiated quarterly meetings with bargaining groups to build relationships and stay abreast of problems
d. Completed revision of Customer Service Field Worker I/II Job Description
e. Negotiated settlement with former employee that avoided labor practices lawsuit
f. Developed job description, pay range and classification for Geographic Information Systems (GIS) Analyst
g. Developed job description, pay range and classification for Water System Operator/Instrumentation Technician
h. Revision of Certification Requirements for Senior Construction & Maintenance Worker Job Descriptions
i. Initiated a review of all job descriptions and entire District structure
j. Reviewed and revised Employee Handbook

9. Financial

a. Revised Financial Policy
b. Expanded long term investments to include federal bonds and laddered certificate of deposits for an increased return on investment
c. Successfully cut approximately $2 million from 2014-15 budget in order to meet debt coverage
d. Met all department and legal deadlines in the absence of the finance manager since April 2014. Board approved interim employee, but that position has not needed to be filled

10. Collaborative Efforts with Other Agencies (not otherwise listed)

a. Private Well Water Conservation Pilot Project (partnering with Resource Conservation District of Santa Cruz County) – Small group of interested private well owners have volunteered to track their water use and install water savings devices and measures at their homes.

b. Regional Recycled Water Plan grant application – partnered with City of Santa Cruz, Scotts Valley and Santa Cruz County
c. Santa Cruz Integrated Regional Water Management (partnering with the majority of water municipalities in the area, County of SC, and several non-profit organizations (NGOs)) – to develop a framework and address the region's water shortage challenges and create a plan of strategies, policy initiatives, and project for our region. Adopted updated plan in 2014
d. Collaborating with Resource Conservation District-UC Santa Cruz on Recharge Suitability and Runoff Analysis study
e. Co-hosted and co-presented with Scotts Valley, the City of Santa Cruz, Central Water District and Pajaro Valley Water Management Agency at ACWA Region 5 Spring Program
f. Developed Water Conservation Outreach program in partnership with Ecology Action, City of Santa Cruz and Scotts Valley Water District – Conducting numerous tabling events throughout the County to educate and increase awareness on our water conservation programs and our community's water shortage challenges.

11. Legislative Efforts

a. Northern California Water Bond Coalition – Continued active involvement, including lobbying, testifying at public hearings and regional coordination
b. ACWA State Legislative Committee – represent the District and Region 5 (San Francisco to Santa Barbara) on legislative committee and take part in regional caucuses on issues such as the water bond and groundwater legislation
c. ACWA Drought Action Group – Taj Dufor served as Vice Chair for group which issues 2014 Drought Impacts and Strategies for Resilience report including recommendations to guide ACWA's efforts at the state and federal level to advance actions to reduce impacts of drought

12. Miscellaneous

a. Prepared for and held twenty-one Public Board Meetings, five public Basin Implementation Group (BIG) meetings and four public Well Stakeholder Group meetings. By the end of September in a typical year we would hold thirteen Board meetings through September and two BIG meetings. Meetings typically had enough attendance that those meetings had to be coordinated and held offsite. For the meetings so far this year staff has prepared nearly 5,200 pages of material for the Board's review.
b. Revised out of date record retention and document destruction policy
c. Implemented Board consent agendas

By _____
Kim Adamson
General Manager

October 7, 2014

MEMO TO THE BOARD OF DIRECTORS

Subject: Agenda Item No. 6.1 — Peer Review of Hydrological Studies: Comparison of Yield Estimates and Refining Estimates with Groundwater Model and Additional Studies

Attachments:

1. Memorandum by Todd Engineers- Peer Review of Technical Water Resources Studies Prepared for Soquel Creek Water District—Summary of Yield Estimates

2. Memorandum by HydroMetrics WRI- Peer Review of Sustainable Yield Estimates- Refining Estimates with the Groundwater Model and Additional Studies

Background

At the June 18, 2013 board meeting, staff was directed to begin the process for a peer review of the hydrologic studies completed by HydroMetrics, WRI. The Board has relied on such studies to make critical water policy decisions, and a peer review was needed to reaffirm the basis for such decisions.

On September 3, 2013, the Board authorized the solicitation of qualifications from various firms specializing in groundwater hydrology. A selection committee reviewed six statements of qualifications and on January 21, 2014, the Board approved a scope of work submitted by Todd Groundwater to perform a peer review of past District hydrological studies.

Peer Review

On May 20, 2014 Mr. Gus Yates of Todd Groundwater presented the draft copy of the peer review report that he prepared for the District. The draft report found:

- There are no fatal flaws in the hydrological work for the District by HydroMetrics WRI.
- For some steps of the hydrological analysis, conservative assumptions were made that may have led to an estimate of available yield too low. Alternative assumptions could also be applied that are not necessarily more accurate but that could corroborate the original results or help better characterize uncertainty.
- The biggest challenge for managing groundwater resources in the Soquel-Aptos basin is not weaknesses in technical analysis but weakness in correlations between pumping, water levels and water quality. Data for those variables often do not

exhibit the patterns expected from the physical laws governing groundwater flow. As a practical matter, this circumstance underscores the need for an adaptive management approach (approach the District is currently undertaking).

Mr. Yates in his presentation summarized that the work that HydroMetrics has been doing is high quality, acceptable, professional work. In reviewing the data, he did not find any fatal flaws. He focused on the uncertainty issues and whether there are alternative estimates of protective levels of outflows and yield. While agreeing the basin is in overdraft, there was a discrepancy in the calculated basin deficit. The Board asked Mr. Yates to review and clarify this information. He was also asked to include additional assessments in the final report.

On July 15, 2014, Mr. Yates presented the final version of his review for the Board's consideration. The Board accepted the final report that included the following:

- The alternative yield estimate is 100 AFY greater than the HydroMetrics, WRI yield estimates for both the Purisima and Aromas areas. This puts total yield at 4,200 AFY vs. 4,000 AFY.
- The yield results in an estimate of total historical accumulated deficit slightly greater than 12,100 AF.
- A 98% septic return flow assumption was applied to the historical deficit calculations, to be consistent with the estimates of sustainable yield.
- A recommendation to investigate septic system return flow percentage was made.

Based on the final report, there are still discrepancies between Todd Groundwater's and HydroMetrics' calculation of the accumulated deficit. In addition, both Todd Groundwater and HydroMetrics recommended that the Board reevaluate their decision to exclude future septic recharge from recovery predictions based on current information. The Board requested Todd Groundwater and Hydrometrics to collaborate and provide visuals (Attachment 1) to succinctly present the differences in the estimated sustainable yield so the Board can more easily understand how big a difference this is. In addition, the Board requested identifying areas of disagreement and which assumptions led to those disagreements, which items would be resolved by a groundwater model and which would be additional separate research projects. This information is contained in the two attached memos.

Next Steps in Hydrological Analyses: Refinement of Estimates with the Groundwater Model and Additional Studies (Attachment 2)

The development of a groundwater model through the Soquel-Aptos Basin Implementation Group will be the primary tool to quantify the Basin's sustainable yield. This model will replace the water balance approach that was peer reviewed by Todd Groundwater. HydroMetrics' attached memo includes a table of the recommendations and

refinements to assumptions that were proposed, how they will be incorporated into the model/additional studies, and the timeframe to conduct such work.

A technical advisory group (TAC) will also be convening to review and provide advisement into the development of all the groundwater model inputs and the additional studies recommended by the peer review.

The consultants will be in attendance to walk through the information for the Board.

POSSIBLE BOARD ACTION

1. Informational Item – No action required

2. Provide staff direction for additional activities related to refining the sustainable yield estimates with the groundwater model and additional studies.

By _____
Kim Adamson
General Manager

TODD GROUNDWATER

September 8, 2014

MEMORANDUM

To: Kim Adamson and Taj Dufour, Soquel Creek Water District

From: Gus Yates, Todd Groundwater

Re: Peer Review of Technical Water Resources Studies Prepared for Soquel Creek Water District—Summary of Yield Estimates

The final version of my peer review of technical studies was discussed at the District board meeting on July 15, 2014. The Directors requested a summary of remaining differences between groundwater yield estimates developed by HydroMetrics WRI (HMWRI) in the technical studies and alternative estimates I developed as part of the peer review. The Directors also requested simple graphics illustrating the differences. Since that meeting, Cameron Tana of HydroMetrics and I have collaborated on developing the requested summary, which is attached as a pair of tables and a pair of graphs.

The attached tables present the derivation of the sustainable pumping yield estimate for the District as a sequence of adjustments to total rainfall recharge. The values for the HMWRI and Todd estimates are listed in parallel columns, with brief explanations of items that differ. Additional explanation is available in the final peer review memo. One table is for the Purisima area, and the other is for the Aromas area. Similarly, the two graphs are for the Purisima and Aromas areas, respectively. The graphs are X-Y plots with sustainable yield on the X axis and the recovery pumping yield on the Y axis (assuming recovery pumping eliminates the existing cumulative storage deficit within 20 years). The HMWRI and Todd estimates of yield are shown a representing the upper and lower bounds of the "plausible yield range". The solid green line on each graph quantifies how an increase in the estimated sustainable yield corresponds to an increase in the amount of water that can be pumped while still recovering from the cumulative storage deficit (recovery yield).

Features of the tables and graphs that differ from the final peer review memo include the following:

- Existing septic system return flow within the SqCWD service area is included in the sustainable yield estimate. Previously, it had been assumed that those residences would be connected to a sewer system. The new assumption increases the yield estimates, particularly for the Aromas area.
- My initial calculations of alternative yield resulted in estimates that were too large to be consistent with observed historical storage depletion. That implied that although my various adjustments to factors that affect sustainable yield were

individually plausible, they probably are not all simultaneously true. The final peer review memorandum discussed this issue with respect to the Purisima area, where a rough estimate of current cumulative storage deficit (about 5,000 acre-feet) corresponded to a sustainable yield of about 3,050 acre-feet per year (AFY). I subsequently contoured Aromas area water levels and the results similarly constrained the alternative estimate of sustainable yield to about 1,700 AFY. For the Aromas area, I also evaluated SqCWD pumping during historical periods of generally rising or falling water levels at coastal monitoring wells, and that analysis also supported a yield no larger than 1,700 AFY.

- The graphs indicate that total sustainable yield (Purisima plus Aromas) ranges from 4,330 AFY to 4,750 AFY and available yield during the recovery period ranges from 3,200 AFY to 4,250 AFY.

If you or the Directors have any questions about this summary, please do not hesitate to contact me.

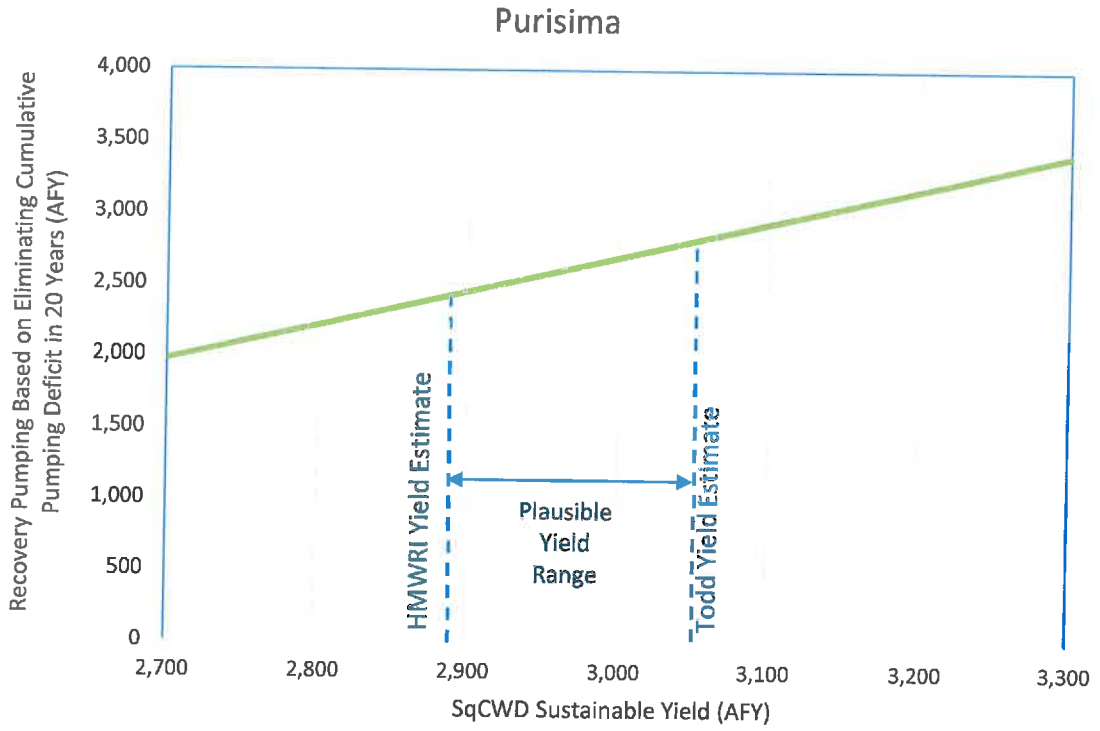
SqCWD Yield Comparison: Aromas Area

Aromas Water Balance Component	HMWRI (2012)	Todd (2014)	Notes for Todd Estimate
Aromas area recharge from precipitation (afy)	4,200	4,200	
Modeled protective outflows to ocean - 70th percentile (afy)	-1,950	-1,950	
Flow to Pajaro Valley	-370	-271	70th percentile outflow.
Total Yield Available for Consumptive Use (afy)	1,880	1,979	
Non-SqCWD consumptive use (afy)	-754	-673	Higher estimate of septic return flow partially offset by lower estimate of irrigation return flow (same as used for SqCWD below).
Total yield available for SqCWD's consumptive use (afy)	1,126	1,306	
SqCWD outdoor use (%)	30%	30%	
SqCWD indoor use (%)	70%	70%	
SqCWD septic parcels (%)	30%	30%	
SqCWD sewered parcels (%)	70%	70%	
Outdoor return flow (%)	20%	10%	Assumes greater use of drip and water conservation.
Septic return flow (%)	75%	98%	Assumes no ET loss of septic percolation.
Sewer return flow (%)	0%	0%	
SqCWD overall return flow (%)	22%	24%	
Total yield available for SqCWD delivery (afy)	1,438	1,708	
Subtotal for outdoor use (afy)	431	512	Follows from above assumptions.
Subtotal for indoor use to septic (afy)	301	358	"
Subtotal for indoor use to sewer (afy)	706	838	"
SqCWD outdoor return flow (afy)	86	51	"
SqCWD septic return flow (afy)	226	350	"
SqCWD sewer return flow (afy)	0	0	
SqCWD water pipe leak (%)	0%	7%	Average annual leak rate (SqCWD).
SqCWD water pipe leak (afy)	0	129	
SqCWD pumping yield (afy)	**1,438**	**1,836**	Maximum yield consistent with well locations and cumulative historical storage deficit is about 1,700 afy.

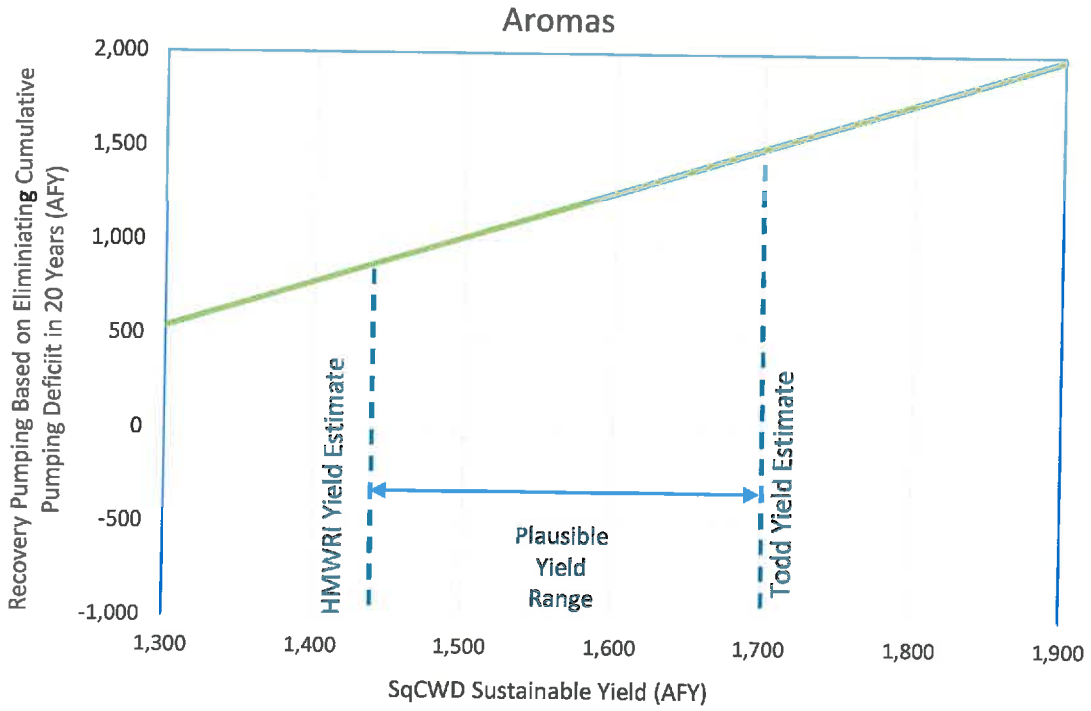
SqCWD Yield Comparison: Purisima Area

Purisima Water Balance Component	HMWRI (2012)	Todd (2014)	Todd w Possible Reductions (2014)	Notes for Todd Estimate
Purisima area recharge from precipitation (afy)	6,600	6,600	6,600	
Subtract recharge west of SC-1	-1,200	-889	-889	Sum of outflow estimate and 70th percentile of historical Santa Cruz pumping.
Modeled protective outflows to Ocean - 70th percentile (afy)	-775	-775	-775	
Increased ocean outflow Santa Cruz (afy)			-170	Reduction needs to be estimated by additional cross-sectional modeling
Increased ocean outflow SqCWD Purisima (afy)			-388	Reduction needs to be estimated by additional cross-sectional modeling
Decreased coastal plain recharge(afy)			-204	Reduction needs to be estimated based on evaluation of shallow coastal plain hydrogeology
Total yield available for consumptive use (afy)	4,625	4,936	4,174	
Non-SqCWD consumptive use (afy)	-1,992	-1,606	-1,606	Higher estimate of septic return flow partially offset by lower estimate of irrigation return flow (same as used for SqCWD below).
Total yield available for SqCWD's consumptive use (afy)	2,633	3,330	2,568	
SqCWD outdoor use (%)	30%	30%	30%	
SqCWD indoor use (%)	70%	70%	70%	
SqCWD septic parcels (%)	6%	6%	6%	
SqCWD sewered parcels (%)	94%	94%	94%	
Outdoor return flow (%)	20%	10%	10%	Assumes greater use of drip and water conservation.
Septic return flow (%)	75%	98%	98%	Assumes no ET loss of septic percolation.
Sewer return flow (%)	0%	0%	0%	
SqCWD overall return flow (%)	9%	7%	7%	
Total yield available for SqCWD delivery (afy)	2,890	3,572	2,755	
Subtotal for outdoor use (afy)	867	1,072	826	Follows from above assumptions.
Subtotal for indoor use to septic (afy)	111	138	106	"
Subtotal for indoor use to sewer (afy)	1,912	2,363	1,822	"
SqCWD outdoor return flow (afy)	173	107	83	"
SqCWD septic return flow (afy)	84	135	104	"
SqCWD sewer return flow (afy)	0	0	0	
SqCWD water pipe leak (%)	0%	7%	7%	Average annual leak rate (SqCWD).
SqCWD water pipe leak (afy)	0	269	207	
SqCWD pumping yield (afy)	**2,890**	**3,841**	**2,962**	Maximum yield consistent with cumulative historical storage deficit is about 3,050 afy.

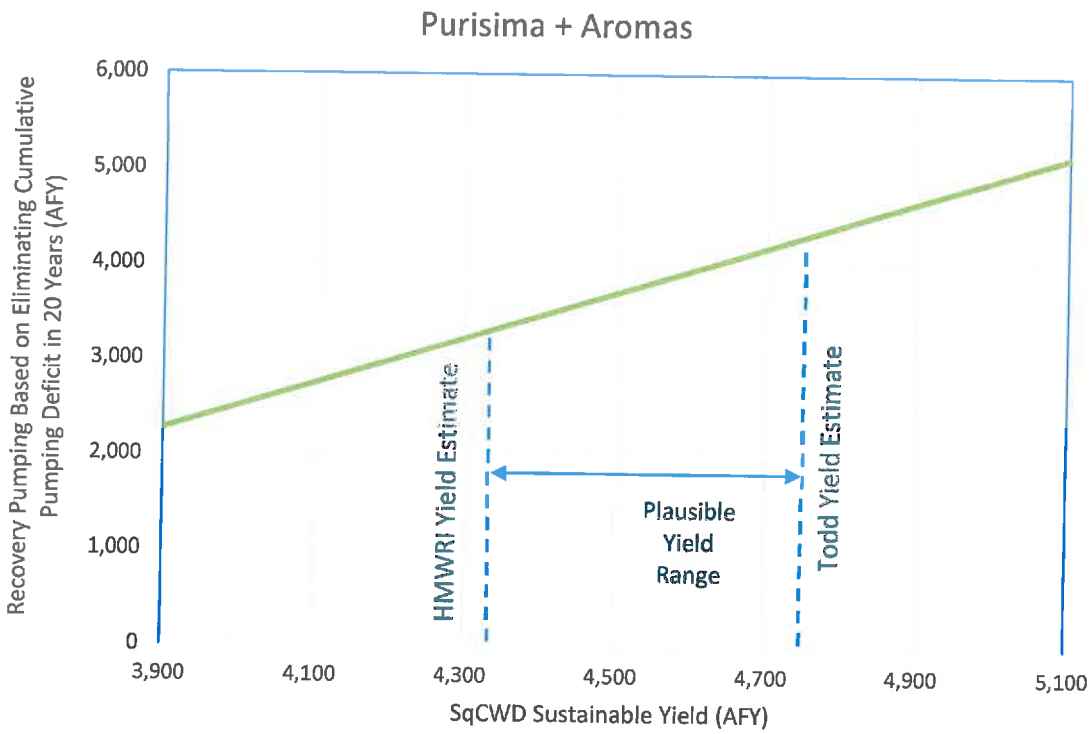
Ranges of Sustainable Yield and Recovery Pumping



Notes: Yield includes septic system recharge. Recovery pumping based on 1984-2011 deficit.



Notes: Yield includes septic system recharge. Recovery pumping based on 1984-2011 deficit.



Notes: Yield includes septic system recharge. Recovery pumping based on 1984-2011 deficit.

HydroMetrics WRI

1814 Franklin St, Suite 501
Oakland, CA 94612

TECHNICAL MEMORANDUM

To:	Kim Adamson and Taj Dufour, Soquel Creek Water District
From:	Cameron Tana and Derrik Williams
Date:	October 3, 2014
Subject:	Peer Review of Sustainable Yield Estimates – Refining Estimates with the Groundwater Model and Additional Studies

The final version of Todd Groundwater's peer review of HydroMetrics WRI's technical studies related to sustainable yield estimates was discussed and approved by the SqCWD Board of Directors on July 15, 2014. The Board requested that the two firms collaborate on a simplified executive summary describing differences in our estimates. The result of this collaboration is Gus Yates' memorandum from September 8 titled *Peer Review of Technical Water Resources Studies Prepared for Soquel Creek Water District—Summary of Yield Estimates*. Part of the Board's request was to identify which differences would be resolved by a groundwater model, and which would require separate research projects. This memorandum responds to this request with a plan for refining the sustainable yield estimates considering the peer review.

GROUNDWATER MODEL VS. WATER BALANCE APPROACH

Development of a groundwater model has been undertaken by the Soquel-Aptos Basin Implementation Group. The groundwater model will be the primary tool for accurately quantifying the Basin's sustainable yield. The groundwater model's main benefit is not resolving differences in estimates of specific water balance components. The main benefit is that the model will integrate the components of the water balance while honoring principles of groundwater flow and the hydrogeology of the basin. The model will simulate groundwater level response to changes in pumping to better guide SqCWD in planning for recovery of the basin's groundwater levels to protect against seawater intrusion. The current estimate of sustainable yield using the water balance approach does not

calculate water level response and instead uses the cumulative pumping deficit as a proxy for recovery. The water balance approach also assumes that pumping is distributed to maximize use of yield estimated by the water balance while the model will calculate yield based on specified pumping locations.

CALIBRATED WATER BALANCE COMPONENTS IN THE GROUNDWATER MODEL

The groundwater model will incorporate similar components to those used in the water balance approach, but all components will be refined as part of the groundwater model effort. Some components will be inputs into the groundwater model, and the groundwater model will be calibrated to calculate other components, particularly the flows used in the water balance. The model will calculate head dependent flows such as flow to Pajaro Valley and underflow entering the basin from west of well SC-1. The model will also calculate the outflows to the ocean needed to achieve and maintain protective levels. These modeled flows will be calibrated to groundwater level data.

The groundwater model calibration will also improve and refine some water balance components such as precipitation recharge and groundwater supported baseflow. This will improve the sustainable yield estimate by incorporating time dependent recharge and baseflow, rather than average numbers.

RE-EVALUATING INPUTS TO GROUNDWATER MODEL

Some of the water balance components are inputs to the groundwater model. All of these components will be re-evaluated as part of groundwater model development. One of these components is return flow (return flow from outdoor use, return flow from septic, return flow from pipe leaks), for which there are major disagreements between the HydroMetrics WRI water balance estimate and the Todd Groundwater alternative estimates. These assumptions will be inputs to the groundwater model and the differences will not be resolved by the model itself. Therefore, the assumptions included in the model for this component need to be re-evaluated for the groundwater model with a literature review as suggested by the peer review and any available local data. For example, SqCWD has provided an estimate of pipe leaks in its system of approximately 7%, which should be included in the model input. However, the groundwater model will differ from the water balance approach in that the re-evaluated return flow

assumptions will be used in the groundwater model based on a geographic distribution of land use. With that input, the groundwater model will be able to estimate how much of return flow contributes to what is available for wells to extract given the locations and depths of the wells.

Estimates for other water balance components used as input to the model will be re-evaluated during groundwater model development. These include the proportion of outdoor versus indoor water use by land use, and non-water agency pumping estimates. Most of the water use factors are based on estimates compiled in the 1990s. We will do a literature review to update the estimates and incorporate any available local data. For the groundwater model, non-agency water use will be applied based on a geographic distribution of land use and will be able to assess effects of pumping given estimated pumping locations.

ADDITIONAL STUDIES TO SUPPLEMENT GROUNDWATER MODEL

Todd Groundwater recommended additional studies to reduce uncertainties in the estimates for sustainable yield. We see value in these studies in conjunction with development of the groundwater model, not necessarily for revising the yield estimate based on the water balance approach.

The first suggestion is to modify the cross-sectional models along the diagonal planes of the Purisima units to re-evaluate the protective elevations. If protective elevations are revised, the basinwide model simulations will be used to assess the sustainable yield. The basinwide model will be constructed to represent the diagonal planes of the Purisima unit and can also be used to estimate the coastal outflow needed to achieve and maintain these new protective elevations. Outflows could be estimated based on the modified cross-sectional models for comparison with outflows from the original cross-sectional models, but we recommend using the calibrated groundwater model to evaluate the effect of revised protective elevations on the sustainable yield. The basinwide model could also assess the outflow needed to maintain protective elevations at City of Santa Cruz wells, whether they use the estimates developed by cross sectional models or the City's more conservative proposed target elevations.

The cross-sectional models can be modified in a 3 month time period. For use with the groundwater model, the protective elevations need to be evaluated by December 2015. However, the District already manages its basin to protective

elevations, so evaluating any potential change to those protective elevations should be expedited. One possible goal is to complete the evaluation by March 2015, in time for use in the Water Year 2014 Annual Report and Review.

The other recommendation is to compile groundwater elevation data for shallow monitoring wells in the coastal plain area and compare them with creek elevations to evaluate whether shallow groundwater discharges to creeks. This will provide additional data for model calibration, especially if the model is developed as an integrated surface water-groundwater GSFLOW model. Including these data will make the model more defensible for evaluating sustainable yield, especially considering the uncertainty about return flow which may contribute to shallow groundwater discharge to creeks. Compiling these data are not part of the approved groundwater model scope and cost estimate. It would take 1-1.5 months to complete the task and it is suggested that it is completed before the GSFLOW development task in the groundwater model (Task 2B) as it may inform the conceptual model for surface water-groundwater interaction. Task 2B is scheduled to begin April 2015.

SUMMARY

Using the groundwater model to evaluate sustainable yield will replace the water balance approach reviewed by Todd Groundwater. The main advantage of the groundwater model is that it will integrate the water balance while honoring principles of groundwater flow and the hydrogeology of the basin. The results of the groundwater model are more important for evaluating sustainable yield than resolving differences in estimates of individual components. However, all inputs to the groundwater model should be re-evaluated when developing the model. Throughout the model development process, a Technical Advisory Committee will provide oversight and input for the groundwater model development, including this re-evaluation of model inputs. Additional studies recommended by Todd Groundwater will also have value for strengthening the groundwater model and management of the basin. The attached table provides a summary of the model sub-tasks and additional studies that will improve sustainable yield estimates provided by the groundwater model.

Table 1. Summary of Model Sub-Tasks and Additional Studies for Estimating Sustainable Yield with Groundwater Model

Model Sub-Task/ Additional Study	Included in Model Scope?	Water Balance Components Addressed	Use in Model	Timeframe
Literature Review and Local Data Evaluation for Return Flow Assumptions (Model Task 3: Water Balance)	Yes	Return Flow from Indoor Use on Septic Return Flow from Outdoor Use Return Flow from Pipe Leaks	Geographically Distributed Model Input (recharge)	December 2014-June 2015
Literature Review and Local Data Evaluation for Non-Agency Water Use (Model Task 3: Water Balance)	Yes	Indoor and Outdoor Water Use by Land Use Non-Agency Pumping	Geographically Distributed Model Input (recharge and pumping)	December 2014-June 2015
Modify Cross-Sectional Models to Evaluate Protective Elevations	No	Outflow to Prevent Seawater Intrusion	Protective Elevations for Evaluating Simulations	January 2015-March 2015
Compile Shallow Groundwater Data	No	Flows between Creeks and Groundwater	Calibration Data for GSFLOW	March 2015-April 2015
Model Task 2B: GSFLOW	Yes	Flows between Creeks and Groundwater Recharge	Calibrated Model Output	April 2015-August 2015
Model Task 5: Simulations[1]	Yes	Outflow to Pajaro Valley Inflow from west of SqCWD Outflow to ocean	Calibrated Model Output	December 2015-February 2016

[1] Estimates of sustainable yield will be based on evaluation of simulation results in this task.

October 7, 2014

MEMO TO THE BOARD OF DIRECTORS

Subject: Agenda Item No. 6.2 — Approve Scope of Work from USGS to Attend Scoping Meetings for Support of Basin Groundwater Model

Attachments: 1. Proposal from USGS

Background

At the July 15, 2014 meeting, the Board reviewed a proposal from HydroMetrics, WRI to create a water model for the basin. The Board approved moving forward with the work and voted to propose it be done through the Basin Implementation Group (BIG). At the BIG Board meeting on August 14, 2014 the Board, made up of Directors from both Central and Soquel Creek Water Districts, approved a scope of work for Hydrometrics to develop a groundwater model for the basin. They are proposing to start with scoping activities that will be beneficial to the ultimate success of the groundwater modeling effort by ensuring that our needs are fully addressed by the model. They plan to use MODFLOW and related groundwater model codes developed by the US Geological Survey (USGS). Hydrometrics has invited the USGS to participate in this project as well. The scope of work and cost estimate included in the attached proposal (Attachment 1) is for the initial USGS effort and is in addition to the previously approved Hydrometrics proposal. The USGS proposal was approved by the BIG Board at the September 23, 2014 BIG meeting.

Peer Review

On January 21, 2014 the Soquel Creek Board initiated a peer review of Hydrometrics work for the District. The peer review was completed by Todd Groundwater, who found:

- A yield estimate 100 AFY greater than the Hydrometrics yield estimates for both the Purisima and Aromas areas. This puts total yield at 4,200 AFY vs. 4,000 AFY.
- The calculated yields result in an estimate of historical accumulated deficit slightly greater than 5,100 AF.
- A 98% septic return flow assumption was applied to the historical deficit calculations, to be consistent with the estimates of sustainable yield. This increased the accumulated deficit to 5,700 AF.

The report also makes recommendations to investigate the impacts of septic recharge. The report states that an adaptive management approach is an appropriate way to prevent seawater intrusion, but it also points out some

shortcomings and suggests that a groundwater flow model that takes into account base flow depletion would provide a better picture. The report also suggests that a groundwater model that incorporates density effects would provide more accurate estimations of the rate of intrusion and the location of the seawater-freshwater interface. Additionally, impacts of septic recharge and that could be better determined with a groundwater model. The Board has also expressed interest in locating the position of the seawater-freshwater interface, which will help make this modeling very valuable. This aspect of the modeling is not included in the attached scope since the location is currently not identified.

In addition to providing a more refined estimate of recovery time, a basin-wide groundwater model would provide information on potential for recharge using either recycled water or captured storm water. It would also advise on how much water the District could transfer back to the city in a conjunctive use scenario. This modeling would be helpful as we move forward with options for supplemental supply.

USGS Support for Groundwater Model Proposal

USGS's role for support in the groundwater model effort will largely be defined by the scoping meetings we are planning and their overall budget may be $50,000-$100,000 as reported in the August Groundwater Model memo. Because the total amount will vary depending on our needs that emerge from the scoping meeting, they suggested providing a proposal and budget to participate in the scoping meetings and then providing another proposal and budget based on the identified work from those meetings. Attached you will find a proposal for USGS to attend the scoping meetings for an estimated cost of $7,000.

POSSIBLE BOARD ACTION

1. By MOTION, approve the proposal from USGS to attend scoping meetings for the Soquel Aptos Basin Groundwater Model.

2. Take no action and provide staff further direction.

By_____
Kim Adamson
General Manager