Economic Impacts of a Water Shortage in Sonoma and Marin Counties: Update

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Economic Impacts of a Water Shortage in Sonoma and Marin Counties: Update Executive Summary

This report updates a study originally commissioned by the SCWA and the North Bay Leadership Council (NBLC) in 2007 describing the economics of the Sonoma County Water Agency's (SCWA) market and estimating the economic impacts from a water shortage in Sonoma and Marin counties. A water shortage represents a situation where local water supply is unable to match local water demand. A water shortage could be due to an unexpected supply reduction because of political or regulatory change, a reduction in infrastructure reliability, a natural drought, or a mix of these. Sonoma County Water Agency (SCWA) provides water to both Sonoma and Marin counties. SCWA provides water to various retailers who sell to both residential and business end users.

A water shortage is being forecasted for 2009. How water demand reacts to a water shortage drives the economic impacts. Recent academic and public policy literature sources provide background for the analysis' assumptions and conclusions. Best management practices (BMPs) are meant to provide incentives for conservation, reducing demand such that explicit rate increases or quantity restrictions are not used. New regulations diverting water toward habitat and hatcheries of salmonid species are seen as the largest threat to water supply and efficient water delivery. Such diversions may create a water shortage in these counties; a natural water shortage as forecasted for 2009 augments the probability of a water shortage beyond regulatory and end user demands. Conservation alone may not mitigate these problems. Longer term solutions, through private-public funding partnerships between local governments, households and

businesses that want to participate in retrofitting their homes and structures for higher water-efficiency now available with Assembly Bill 811's passing, also provide jobs and income for business that can provide these goods and services. Job creation is even more important in a time of economic downturn for construction as an industry and these counties overall as being experienced in 2009.

The conclusions of this updated study are:

- The negative economic effects of a water shortage touch all residents and almost all businesses in Sonoma and Marin counties, including construction, wineries, professional and personal services, such as medical offices, grocery stores and restaurants;
- AB 811 provides a way for households and business to directly, by choice, participate in making their homes and business more water efficient and also create jobs for local businesses to deliver those retrofitting goods and services;
- Using best management practices (BMPs) that provide incentives to purchase local goods and services enhances the local economy while also reducing water use; and
- The economic impact estimates of a water shortage are in Table EX-1:

			-
Water	Approx. Lost	Approx. Value	Main Industries Affected
Shortage	Jobs	of Lost Output	Wineries, Restaurants,
10%	1,595	\$218 million	Construction, Medical Offices,
20%	3,160	\$422 million	Grocery Stores, Real Estate,
30%	37,347	\$5.19 billion	Hospitals, Banking,
			Employment Services

Table EX-1: Summary of Economic Impacts on Sonoma and Marin counties

More than \$5 billion in business revenues could be lost due to both job losses and reduced consumer spending from a 30% water shortage. As direct job losses create other

job losses, the direct, indirect and induced effects of a 30% water shortage could cost Sonoma and Marin counties' residents over 37,300 jobs, over 10% of the current employment total in these counties. The literature does not provide any examples of a 50% water shortage and subsequent economic effects. However, it is likely in SCWA's region that the total job losses would be over 45,000 and over \$6 billion in lost business income due to such a calamitous shortage.

Policy recommendations from this updated study are:

- Continue or begin use of tiered pricing to help fund BMP initiation and continuation and infrastructure changes in the least;
- Conservation efforts should be seen as permanent, not temporary, focused on a creating a new culture of conservation similar to recycling efforts;
- Begin any and all incentive programs for all customers to engage in BMPs;
- Partner with local businesses that can supply water conservation goods and services efficiently;
- Initiate AB 811 assessment areas and use any available federal stimulus funding for new and improved infrastructure;
- Increase promotion and education about new technologies, such as how recycled water can be used per section 5.4 of the SCWA Urban Water Management Plan; and
- Water retailers should immediately provide additional and more accessible information about water use to all end users in their billing to increase sensitivity to increasing water rates.

Economic Impacts of a Water Shortage in Sonoma and Marin Counties: Update

1. Introduction

This updated analysis estimates the economic impacts of a water shortage for both Sonoma and Marin counties. This report was initially commissioned by the Sonoma County Water Agency (SCWA) and the North Bay Leadership Council (NBLC) in 2007. A water shortage takes place when water supply is unable to match water demand. A water shortage could be due to an unexpected supply reduction because of political or regulatory change, a reduction in infrastructure reliability, or a natural drought. Sonoma County Water Agency (SCWA) provides water to Sonoma and Marin counties, and any economic impacts of a water shortage will be experienced in both counties. SCWA provides water to various retailers, who then sell to both residential and business end users. Many of these retailers, water districts, municipalities, or other direct customers have their own water management plans; SCWA has an urban water management plan that acts as the foundation for this study.

In 2009, a water shortage is expected due to a lack of rainfall and continued demand growth, including regulatory demand. Both residential and business end users are relatively insensitive to price; recent literature concludes residential customers are the most insensitive. Depending on how far reaching a water shortage is, the negative impacts could be mitigated through best management practices (BMPs); a water shortage caused by natural factors is likely to affect California as a whole, which reduces the ease of engaging in a regional market for water.

The economic impacts of water shortages bias toward business users. For Sonoma and Marin counties in sum, a 10% water shortage scenario, as much as \$218

million dollars of revenue may be lost due to higher water costs; over 1,590 residents across these counties may lose their jobs. A 20% water shortage basically doubles these figures. In a 30% water shortage scenario, assuming the losses become more exponential as suggested in the literature, the negative impacts are staggering. More than \$5 billion in revenues could be lost due to both reduced employment and residential spending. Further, as job losses create other job losses, the direct, indirect and induced effects of a 30% water shortage could cost Sonoma and Marin counties over 37,300 jobs. While the literature does not provide any examples of a 50% water shortage and such a shortage's economic effects, it is likely in SCWA's region that the total job losses would be over 45,000 and over \$6 billion in lost business income.

This update of the 2007 study is split into the following sections. First, there is a literature review focused on basic conclusions about water markets. A few key studies are discussed here, where the 2007 study's review of literature is now simply summarized. Next, a brief description of SCWA's regional water supply and demand is followed by a description of BMPs and Assembly Bill 811 (AB 811) and their ability to mitigate negative economic impacts of water shortages. The methodology and results of the economic impact analysis describe how water shortages may affect the economy. The final section provides conclusions and policy recommendations concerning infrastructure changes to enhance efficiency of water delivery and the use of best management practices to mitigate some of these negative impacts by encouraging more conservation and reducing the long-term threat of continuous water shortages.

2. Literature Review

Water Supply Basics in SCWA's Region

For the SCWA regional water system, the 2005 Urban Water Management Plan ("the Plan"), presented in December 2006, describes much of SCWA's regional characteristics and economic issues. The larger SCWA contractors also have water management plans. In the Plan, demand is seen as predictable and not necessarily a function of median income growth, lot size, type of end user, or other characteristics the academic literature suggests determines water demand. The main issue in local water markets is water resource diversions due to the salmonid species indigenous to the Russian River. As a result of this environmental issue, SCWA is planning an infrastructure expansion to supply water more efficiently. In 2009, a water supply shortage is likely due to both dry conditions and regulatory demands on current supply.

SCWA's water system is made up of "contractors" or water districts and various other customers. These serve both distribution and retail functions for SCWA to deliver water to end users. Most contractors have their own water management plans, based on receiving supply from SCWA and using specific district-supply otherwise when available. In Sonoma County, the Russian River is the main source of water. One of the reasons Lakes Mendocino and Sonoma were created was to supply water to SCWA. Water released from each dam for supply is controlled by SCWA; groundwater, surface water and recycled water make up the other sources within each district and for the counties. Lake Pillsbury and the Potter Valley Project are used by PG&E to divert water from the Eel River. This water is used by PG&E to generate electricity. The water then flows into Lake Mendocino where it is used to supplement flows in the Russian River. Groundwater sources are the main sources in the unincorporated portions of SCWA's region. The town of Sebastopol is not a SCWA contractor, and manages its own water

sources and uses. SCWA also has three conventional groundwater wells that supplement supply the supply from the Russian River. In Marin County, reservoirs are the main source of water. The Russian River, through SCWA, supplements these as the municipal water districts in Marin do not have groundwater available for distribution. There is a planned desalination plant for the San Quentin peninsula to augment supply for Marin.

Recycled water is mainly used for agricultural purposes. Using recycled water helps reduce the effects of peak demands on other water sources. The Plan identifies seven wastewater systems or treatment plants that can provide recycled water in the SCWA region. These plants must maintain a minimum quality standard to disperse treated water; SCWA estimates that by 2030 over 4,200 acre-feet of water per year will come from recycled water (over 1.4 billion gallons per year). Recycled water is a major part of projected supply for SCWA.

Water demand is measured by gallons consumed per day per end user, where acre-feet (acft) measures supply; the conversion is approximately 325,000 gallons of water per acft supplied.

Water Demand Basics in SCWA's Region

To link future water demand to potential supply, the Plan has ways to deal with an unexpected, adverse shock to water supply¹. These include both an expansion of pipeline and reservoir use as well as establishing a specific hatchery for salmonid species as to not reduce water delivery for environmental reasons. Concerning recycled water, expansion costs would be likely covered by grants or rate increases. Best management practices (BMPs) are meant to provide incentives for conservation, reducing demand such that

¹ These ways are located in more detail on page 4-25 of the Plan.

explicit rate increases or quantity restrictions are not needed. There are two tiers of BMPs. Tier 1 includes the installation of low-flush toilets, high-efficiency appliances, plumbing retrofits, and other end-user practices and purchases to voluntarily conserve water. Tier 2 BMPs include financial incentives to conserve, including direct rebates on Tier 1 installations and additional retrofits such as irrigation meters and upgrades². The Plan suggests that the implementation of BMPs along with local supply and recycled water will assure that water supply will match demand through 2030.

In the case of a forecasted supply shortfall, the SCWA has a water shortage contingency plan, a three-step process to begin conservation efforts³. The first is notifying water retailers and the public of a possible water shortage. The second is to ask end users for voluntary demand reductions, and elicit the help of water retailers in encouraging water conservation; this help could also come in the form of water retailers maximizing the use of local water sources. The final step is to further publicize the water shortage and ask specific users, such as agricultural businesses, to reduce their demand from groundwater sources that otherwise supplement SCWA's supply as much as possible. Recycled water use could help this final step, especially for agricultural water demand.

SCWA can also charge higher rates for districts that demand more than their allocation, increases that are passed on to end users⁴. Wholesale rates are based on quantity delivered, and are set to maintain a prudent reserve for SCWA, accumulated

² For SCWA, tables 6-1 and 6-2 in the Plan summarize the recommended BMPs.

³ This contingency plan is outlined in more detail in Appendix C of the Sonoma County Water Agency's 2005 Urban Water Management Plan ("the Plan").

⁴ A list of major SCWA customers and interview questions and answers from the 2007 study are in the Appendix.

revenues used to fund infrastructure expansion and retrofitting. Revenue bonds are another financing mechanism. Rates are set every spring for the following fiscal year.

There is now a forecasted water shortage for 2009. To meet forecasted water demand, best management practices will begin in early 2009. However, the continued threat of more regulations that creates water shortage conditions is real and acts as the largest threat to the Plan's long-term assumptions beyond episodic dry years. Demand is assumed to be highly predictable and stable over the long run. Figures A1 through A4 in the Appendix show SCWA's demand evolution for its major customers since 1980.

Assembly Bill 811 and Job Creation

California passed a piece of legislation in July 2008 that allows cities and counties to create benefit assessment districts where property owners can decide to borrow local government money to pursue energy and water efficiency upgrades to their homes and businesses. (Press Democrat, October 6, 2008) In short, this bill allows homeowners and businesses to choose to finance water and energy efficiency upgrades to their structures. The funding is through a "loan" from the local governments and paid back through a property tax assessment specific for these retrofit efforts. AB 811 provides a way to use property taxes to pay for projects that enhance energy and water efficiency. Assembly Bill 32 (AB 32) is aggressive legislation aimed at reducing carbon emissions for the state of California to 1990 levels by 2020. Ultimately, a water shortage will place a heavier burden on residents and businesses in terms of conservation or direct cost increases for water that originates elsewhere. Through proper planning and use of funding, AB 811 projects provide jobs in the near future and mitigate water shortage threats in the long

term. These jobs include plumbers, general contractors and landscape contractors to provide goods and services which reduce water use both indoors and out.

Recent Literature

The initial study from 2007 has more details on some of the works in the References section below. In short, those studies provide the following conclusions and insights:

- End users of water can be made more sensitive to price through better education and more accessible billing information provided more frequently;
- Rate increases are efficient methods of providing incentives for conservation;
- Excess revenues to water utilities derived by rate increases should be used to fund best management practices toward long-term conservation;
- Evidence from recent studies, including from the 1977-78 drought in Marin County, show that end users are willing to pay now for capital improvements to avoid the costs of water shortages later; and
- Water impact fees on developers have little effect on urban development growth.

Some additional works on water economics and water shortages are as follows. A recent text by Robert A. Young (2005), called <u>Determining the Economic Value of</u> <u>Water: Concepts and Methods</u>, provides a comprehensive summary and survey of the academic literature and how water markets work. This book is recommended for anyone in water management. Young (2005) looks at water's value to entities that produce water, such as SCWA, to the environment and society as a whole, to irrigation efforts, industrial users, residential users, and other public goods related to water, mainly sewage. In all cases, the ideas are built on a foundation of basic economics where a market exists. "An exclusive focus on the necessity of water for life as the basis for designing allocative institutions tends to obscure the fact that in most societies only a tiny fraction of water is used directly for preserving human life. Most direct water use is for convenience, comfort and aesthetic pleasure" (Young, 2005, p.9)

Recognition that water consumption is used for purposes other that preserving life means substitutes for water exist. However, we know there are only a few. People should be willing to pay for that pleasure. Society, however, considers water a quasipublic good and pricing is generally regulated to satisfy demand rather than what the market would bear otherwise. As this study continues, the themes of lack of responsiveness to price and some unwillingness to accept higher water rates are in direct contention with one another.

Other studies were chosen from the academic literature on water markets, where few provide hard estimates of a water shortage's economic impact. A recent study was done by the San Francisco Public Utilities Commission (SFPUC, 2007). This SFPUC study is specific to economic impacts from a water shortage and germane to this study given Sonoma and Marin counties' proximity to the Bay Area. The SFPUC study has an academic feel and references other recent academic literature on water markets⁵. The SCWA retailers' plans, similar to the Plan in their conclusions, are also briefly summarized.

SFPUC (2007) estimated the economic impact of a water shortage in the Bay Area, defined as San Francisco, Alameda, San Mateo and Santa Clara counties. Their

⁵ This study can be found at the Bay Area Economic Forum's website: <u>http://www.bayeconfor.org/pdf/HetchHetchyDroughtImpacts-SFPUC-FINAL.pdf</u>

conclusions parallel the academic literature above. Residential consumption is larger than for any other final customers. Diversity exists in both demand and sources of supply. Economic losses are reduced by using pricing based on water shortages or rationing, but either management practice forces lost jobs for residents and lost revenues for businesses. The larger the water shortage, the disproportionately larger the losses; business users are assumed to be more sensitive to price and thus more willing to reduce their labor force due to water scarcity. SFPUC's methodology is the basis of the economic impact analysis of this study.

Hyland and Miles (2008) is an analysis of a water shortage in Queensland, Australia. Queensland, which has a large agricultural sector, is also experiencing rapid population growth. This study makes the case for end-use efficiency, or making more out of every drop of water by the end user. Southeast Queensland is expecting a long-term change in supply conditions, basically less rain, such that desalination and recycled water are now necessary, albeit expensive alternatives. Education and water restrictions reduce demand in the interim. This study also suggests that Queensland must plan now for longterm climate change on reducing rainfall in all areas.

SCWA's Retailers Water Management Plans and the Literature's Lessons

Most of SCWA's customers also have urban water management plans. If retailers do not already have rate increases in place, rate changes are either coming soon or being discussed. Also, demand is predicted to 2020 in most plans with little uncertainty. The literature, including the water management plans of the districts and SCWA, build upon major themes concerning conservation efforts and using of rate-based conservation if needed. While many factors exist concerning water demand characteristics, residential customers are highly insensitive to price regardless of their income levels or property sizes. The use of AB 811 to create public-private partnerships between households, businesses and local governments creates an innovative way to finance conservation efforts for those property owners that choose to participate.

Price discrimination, charging two different prices for the same water to different consumers, should take place when possible. Further, changing the way water bills are presented to final consumers may influence their sensitivity toward price, which stimulates conservation through either best management practices or rate tiers more effective. The following section provides estimates of the economic impact of a hypothetical water shortage.

3. Economic Impact Methodology and Analysis

Because the direct customers of SCWA are water retailers, SCWA acts as both supplier and wholesaler, where the smaller water districts are distributors/retailers. Water distribution is regulated and depends on long-term demand forecasts to determine the necessary supply. In economics, supply is generally an upward-sloping relationship between price and quantity supplied; as prices rise through demand increasing (water use rising during a heat wave for example), for-profit companies use price as an incentive to produce a higher quantity. In the case of SCWA and its retailers, rates are regulated to reflect delivery costs and also forecasted expansion costs when excess revenues are generated. However, tiered rates reflect potential demand being greater than projected demand and supply.

In simple two-tiered pricing, the supplier sets the water rate up to a certain amount of usage, and then, after a threshold quantity is demanded, a larger rate is charged per unit. Retailers may also charge different final consumers, residents versus businesses, different rates. According to economic theory, the supplier gain more revenue by price discriminating than having one rate alone; assuming the same cost structure exists regardless of final consumer, revenues rise when price discrimination takes place correctly, when it segments the market between price insensitive customers and those who are more sensitive.

What drives low price sensitivities in water demand -- the amount of reduced water usage when water rates rise -- is that few substitutes exist for water. Second-tier users, those who consume more than the first-tier quantity limit, are willing to pay a higher rate and assumed to be relatively price insensitive. As stated in section 2, academic studies have shown that the price elasticities of water demand for residential and business customers have different values: residential users are less sensitive to rate changes. Business users are more sensitive to price; firms that are water-intensive users (golf courses, heavy manufacturing, construction) are less sensitive to price than other businesses⁶. The following section uses both data and methodology from SFPUC (2007). Assuming customers in the Bay Area have similar demand characteristics to those in Sonoma and Marin counties, the analysis below identifies direct, initial job and residential spending losses from a water shortage, but also estimates the direct, indirect and induced economic impacts from those initial losses.

⁶ Factors that determine water demand beside rates, such as customer income, lot size, number of bathrooms in a home, etc., affect individual demand and are data not available without a survey instrument.

Methodology

Suppose SCWA faced a shortage of available water due to less than forecasted precipitation. According to the Plan, tier 1 BMPs would attempt to increase conservation efforts, followed by tier 2 BMPs. If both these efforts failed to reduce estimated water demand to a level that allowed the delivery of water to meet overall demand, rate-based measures would then be enacted to reduce consumption more directly. Assuming water utilities set new rates after determining the reduced supply, rates would naturally rise as a reflection of water scarcity.

The economic impact analysis measures the economic gains or losses in a chain of events beginning with an initial "shock." There are three categorical effects. First are the **direct effects**. Jobs and spending are lost directly due to business users of water shifting expenditures away from hiring labor and paying for water instead. Wages lost from these job losses imply less spending by households. The **indirect effects** come from this resultant reduction of spending by directly affected households and businesses, reducing income to more supporting businesses, creating even more job losses. The **induced effects** are additional job and income losses from the indirectly-affected workers and firms reducing their spending on their supporting industries. The sum of these effects represents the overall economic impacts. Figure 3.1 illustrates the economic impact idea while the order of events for a business (agricultural, commercial, industrial) consumer is shown in Table 3.1.



Figure 3.1: Economic Impact Concept

Like a rock dropped into a pond, the direct effects begin the process at the center (the water shortage), and the indirect and induced effects are the ripples from that center. The assumption is that a wage is paid to every employee and a percentage of that wage is going to be spent locally. This multiplicative process reflects the fact that job reductions in one sector of the economy creates additional job losses in other sectors based on spending reductions across all markets. Job losses in this study are amalgamated into three business sectors: industrial (manufactured goods-producing and natural resource extraction), commercial (services producing) and agricultural, similar to the SFPUC study though adding the agricultural sector. The economic impact of a water shortage is estimated using a combination of data from sources such as those in the SFPUC study, data provided by either SCWA or found at the Department of Water Resources (DWR)

website, and current data for employment, wages, and spending for Sonoma and Marin

counties from the Employment Development Department (EDD) of California.

	Step in Process	Parameter Representing Step
1	Water Shortage Occurs	Percentage of Supply Lost
2	Value of Water rises	Water rates rise
3	Costs of Water to Businesses Rise	Total Water Demand
4	Reduce water demand	Demand Elasticity
5		Production Elasticity
	Reduce Labor by some amount	between Water and Labor
6	Reduce Payrolls to Pay for Larger	
	Water Bill	Reduced Wages
7	Lost Jobs and Income Reduce	
	Spending	Direct Effects
8	Reduced Spending reduces Jobs in	
	Supporting Industries	Indirect Effects
9	Reduced Spending from Indirect	
	Losses Jobs in remainder of economy	Induced Effects
10	Economic Impact the sum of these	
	effects in terms of jobs and gross	Total Economic Impact:
	income	Residential Customers

 Table 3.1

 Economic Impact Logic for Business Customers

A water shortage reduces the amount of water available to businesses, increasing water's value. This increase in value, changes their demand for water due to a lack of substitutes, increasing total costs. The data on workers in each category is split according to the North American Industrial Classification System (NAICS) codes that represent "industrial", "agriculture", and "commercial" businesses per SFPUC (2007); total employment and wages are available from the Employment Development Department (EDD) of California for both Sonoma and Marin counties. Based on the average percentage of water demand by end-user category from DWR and SCWA data, a water shortage is assumed to reduce expenditures on water by both residential and business customers such that spending and jobs are affected directly.

The "production elasticity" represents how businesses respond to a change in water costs in reducing their work force, which means fewer jobs and incomes during a water shortage. As water shortages worsen, businesses are assumed to be more sensitive in terms of reducing labor to pay for water; as the water shortage worsens, the losses increase. The SFPUC study (2007) suggests that a water shortage of 30% would increase the responsiveness of businesses to cutting labor to continue purchasing water, causing massive job losses.

For residential impacts, the logic is similar. Instead of shifting labor expenses, the residential customer is assumed to reduce expenses otherwise. This shift causes a reduction in final goods demand. The chain of events for the residential customer from higher water rates to reduced spending and the subsequent economic impacts is in Table 3.2.

The major difference between the business and residential consumer of water is the production elasticity figure. For residential customers, an increase in the cost of water has both substitution and income effects. Water consumption is likely to be reduced as water rates rise, but the income effect is assumed to reduce the consumption of other goods as water rates rising erode household incomes. The residential reductions in spending are from this income effect.

	Step in Process	Parameter Representing Step
1	Water Shortage Occurs	Percentage of Supply Lost
2	Value of Water rises	Water rates rise
3	Costs of Water to Residents Rise	Total Water Demand
4	Reduce water demand	Demand Elasticity
5	Reduce Spending on other Goods and	Reduced Spending
	Services to Pay for Larger Water Bill	
6	Reduction of spending reduces	Impact Multipliers
	income to firms, jobs lost	
7	Lost Jobs and Income Reduce	Direct Effects
	Spending	
8	Reduced Spending reduces Jobs in	Indirect Effects
	Supporting Industries	
9	Reduced Spending from Indirect	Induced Effects
	Losses Jobs in remainder of economy	
10	Economic Impact the sum of these	Total Economic Impact:
	effects in terms of jobs and gross	Residential Customers
	income	

 Table 3.2

 Economic Impact Logic for Residential Customers

Table 3.3 shows the initial effects calculation on job and spending losses. For business consumers of water, the logic from the water shortage to lost jobs and revenues is as described in steps 1 through 5 in Table 3.1 above. For residential consumers, steps 1 through 5 in Table 3.2 are also numerically estimated in Table 3.3. The columns in Table 3.3 are set up to describe the logic of the initial shock from a water shortage. The first column provides large business groups affected by water shortage, where Marin County does not show agriculture as initially affected⁷. The two-digit NAICS code aggregation is used later. The columns in Table 3.3 are set up to describe the logic of the industrial sectors affected by water shortage. The first shortage. The first column provides the industrial sectors affected by water shortage, where Marin County does not show agriculture as initially affected. The second column has either the total payroll in those sectors in 2006 or total water

⁷ The assumption is that most of Marin's agriculture is in unincorporated areas and owns its own water sources through groundwater wells. Also, the size of Marin's agricultural sector is small enough to ignore initially and is captured otherwise in the economic impact analysis below.

consumption by county from SCWA. Column 3 has either the 2006 employment level by aggregated sector or the percentage of residential water consumption of the total in column 2. Column 4 shows the estimated production elasticities from SFPUC (2007), how each business grouping switches from buying labor to buying water as water rates rise. Notice there are two figures, one for both 10% and 20% water shortages, and a much larger figure for a 30% water shortage; this quantum change follows the SFPUC study and the literature⁸.

Column 5 shows the estimated demand elasticities for each business sector and residential demand from SFPUC (2007), or how sensitive each business sector and residents are to water rate changes in their demand for water; notice all business sectors and residents are relatively insensitive. For the business sector estimates, columns 7 through 9 are calculations based on the previous columns to the left: column 6 is column 2 divided by column 3, or the average wage or salary paid in that sector for the business consumers of water. Using column 6 as the denominator, the initial job losses data for businesses in columns 7 through 9 are found by the following algebra:

 $[Col 2 \times Col 4 \times (1 - Col 5) \times Water shortage \%] / Col 6 = Job Losses (Equation 1)$

For Equation 1, the bracketed calculation determines how much less businesses will pay for labor under each water shortage conditions, and the division problem provides equivalent job losses to a reduction in expenditures on labor to purchase water

⁸ This quantum change is meant to mock non-linear changes after a certain water shortage percentage. As can be imagined, after a certain loss of water supply, water rates are likely to move exponentially upward with commensurate economic effects on all of society.

in 2006 dollars. For residential customers, the logic is more simplistic, as shown in Equation 2, as the residential figures are also in 2006 dollars.

 $\frac{\text{(Water Shortage \%)}}{\text{Column 5}} \times \text{(Water Shortage \%)} = \text{Reduced Residential Spending}$ (Eq 2)

This calculation determines how much less residential consumers of water spend on other goods during a water shortage. Both these calculations assume residential and businesses incomes are stable, such that water demand is changing only due to the water shortage. The bolded figures in Table 3.3 are the initial inputs for the complete economic impact estimates.

In 2009, the local economy is in recession. A water shortage would exacerbate deleterious economic conditions on all residents and businesses. It is important to recognize that these job losses are coming when jobs are already being shed by local firms, and these estimates may also represent the loss of businesses because the cost of water forces a firm to close its doors. A 50% scenario is not explicitly shown because there is no literature on such losses. The Summary at the end of this section provides an extension of the 30% shortage as a prediction if such a calamity befell this region.

	Update	d Initial Losses of ,	Jobs and Spending	by Business	and Res	idential	End Users		
1	2	3	4	5	6		7	8	9
				Water			Initial	Initial	Initial
Sonoma County	Payroll 2008	Employment 2008	Production	Demand			Job Losses	Job Losses	Job Losses
Business Sector	(estimated)	(estimated)	Elasticity	Elasticity	Avg \$/e	mployee	10%	20%	30%
Tu du stuist			(10%, 20%)/ 30%						
NAICS 21-33	\$1,753,790,298	36,362	0.114/0.483	0.3	\$	48,231	290	580	3688
Commercial	¢4 605 080 641	127 247	0.025/0.286	0.2	¢	24 200	294	7(0	10 71 5
NAICS 42-81	\$4,095,080,041	157,247	0.033/0.380	0.2	Ф	54,209	384	/09	12,/15
Ag									
NAICS 10-20	\$	6,006	0.114/0.483	0.1	\$	27,172	62	123	783
							Initial	Initial	Initial
	Total Water	% of water			Es	st. Water	Expenses	Expenses	Expenses
Residential	Demand 2007	total demand				Demand	Lost 10%	Lost 20%	Lost 30%
	\$ 19,931,708	0.6892		0.176	\$13,	,736,933	\$780,508	\$3,122,030	\$7,024,568
				Water			Initial	Initial	Initial
Marin County	Payroll 2008	Employment 2008	Production	Demand			Job Losses	Job Losses	Job Losses
Business Sector	(estimated)	(estimated)	Elasticity	Elasticity	Avg \$/e	mployee	10%	20%	30%
Tu du stuist			(10%, 20%)/ 30%	-	-				
Industrial NAICS 21 22	\$ 610 702 656	0.770	0 114/0 493	0.3	¢	62 152	100	201	1 275
NAICS 21-55	\$ 010,702,030	9,119	0.114/0.465	0.5	Φ	02,433	100	201	1,275
Commercial									
NAICS 42-81	\$4,836,107,675	96,462	0.035/0.386	0.2	\$	50,119	236	473	7,822
							Initial	Initial	Initial
	Total Water	% of water			Es	st Water	Expenses	Expenses	Expenses
Residential	Demand 2007	total demand			1	Demand	Lost 10%	Lost 20%	Lost 30%
	\$ 7,846,499	0.783		0.176	\$ 5.	,123,764	\$51,238	\$409,901	\$1,383,416

 Table 3.3

 Updated Initial Losses of Jobs and Spending by Business and Residential End Users

Sources and Notes: Column 2 data: Payroll (EDD), Total Water Demand (SCWA); Column 3 data: Employment (EDD), 2003 % residential water (DWR); Column 4, 5 production elasticities and water demand elasticities (SFPUC, 2007); Columns 7 through 9 author calculations as shown. The **bolded** figures are used as inputs to estimate the data in Tables 4.4 through 4.9 below.

Results

The economic impact estimates detailed below need some explanation. First, the results are shown at a high level of aggregation, which is the NAICS codes' two-digit aggregation. These categories capture many different industries related to a single business theme. For example, "Construction" relates to single-family dwelling, multi-family dwellings, heavy construction, and commercial space; it also refers to renovation work, plumbing, electricians, etc. While most are self-explanatory, "FIRE" refers to Financial, Insurance, and Real Estate services; "TPCU" refers to Transportation, Communications, and Public Utilities. Also, "Personal and Prof Serv" refers to personal and professional services; the bulk of employment in Sonoma and Marin counties is in this category, which accounts for the relatively large effects to this business sector.

There are many industries affected in specific, from wineries to dentists to teachers to restaurants. Because water is ubiquitous in its use, the effects are spread over all Sonoma and Marin residents and businesses; the economic impact details show the effects are widespread on both the revenues of firms (value of output lost) and employment (number of jobs lost) of workers. Notice there are direct, indirect and induced losses in each table.

There are new tables in this section from the original 2007 study. Table 3.10 provides a tax impact analysis for Sonoma and Marin counties. Tables 3.11 and 3.12 provide a list of industries that are affected by a water shortage in terms of both jobs and business revenues. Also, wineries were combined with grape farming in the "Agriculture" category of Tables 3.4 through 3.9; in the 2007 report, wineries were in "Manufacturing".

Table 3.4

Economic Impacts on Business Revenues for Region, Sonoma and Marin Counties ⁹
Losses from a 10% Water Shortage (\$000s)

	Totals	_		
Business Sector	Direct	Indirect	Induced	Total
Agriculture (Ag)	\$20,320	\$1,115	\$287	\$21,722
Mining + Nat Gas (Ind)	0	45	50	95
Construction (Ind)	34,909	703	251	35,863
Manufacturing (Ind)	19	1,953	1,417	3,389
Trade (Com)	21	2,753	1,596	4,370
TCPU (Com)	12	1,552	994	2,558
Personal and Prof Services (Com)	45,316	19,115	20,999	85,430
FIRE (Com)	42,959	10,520	5,939	59,418
Other Services (Com)	351	0	4,029	4,380
Government (Com)	11	453	857	1,321
Totals	\$143,918	\$38,209	\$36,419	\$218,546

Sonoma County						
Business Sector	Direct	Indirect	Induced	Total		
Agriculture (Ag)	\$20,320	\$1,104	\$264	\$21,688		
Mining + Nat Gas (Ind)	0	43	50	93		
Construction (Ind)	24,137	305	154	24,596		
Manufacturing (Ind)	18	1,542	1,086	2,646		
Trade (Com)	19	2,196	886	3,101		
TCPU (Com)	11	1,010	650	1,671		
Personal and Prof Services (Com)	25,290	10,432	12,983	48,705		
FIRE (Com)	14,471	3,792	3,544	21,807		
Other Services (Com)	324	0	2,122	2,446		
Government (Com)	10	211	502	723		
Totals	\$84,600	\$20,635	\$22,241	\$127,476		

|--|

Business Sector	Direct	Indirect	Induced	Total
Agriculture (Ag)	\$0	\$11	\$23	\$34
Mining + Nat Gas (Ind)	0	2	0	2
Construction (Ind)	10,772	398	97	11,267
Manufacturing (Ind)	1	411	331	743
Trade (Com)	2	557	710	1,269
TCPU (Com)	1	542	344	887
Personal and Prof Services (Com)	20,026	8,683	8,016	36,725
FIRE (Com)	28,488	6,728	2,395	37,611
Other Services (Com)	27	0	1,907	1,934
Government (Com)	1	242	355	598
Totals	\$59,318	\$17,574	\$14,178	\$91,070

⁹ In Tables 3.3 to 3.9, the 2-digit NAICS code industries are shown in their entirety, where each business sector is categorically Industrial (Ind), Commercial (Com) or Agricultural (Ag).

Table 3.5

Economic Impacts on Business Revenues for Region, Sonoma and Marin Counties Losses from a 20% Water Shortage (\$000s) Totals

	Totals			
Business Sector	Direct	Indirect	Induced	Total
Agriculture (Ag)	\$40,319	\$2,222	\$577	\$43,118
Mining + Nat Gas (Ind)	1	92	101	194
Construction (Ind)	69,925	1,237	488	71,650
Manufacturing (Ind)	78	3,932	2,802	6,812
Trade (Com)	91	5,446	3,086	8,623
TCPU (Com)	50	3,019	1,941	5,010
Personal and Prof Services (Com)	117,445	37,100	40,885	195,430
FIRE (Com)	51,800	16,607	11,539	79,946
Other Services (Com)	1,514	0	7,770	9,284
Government (Com)	45	896	1,662	2,603
Totals	\$281,268	\$70,551	\$70,851	\$422,670

Sonoma County							
Business Sector	Direct	Indirect	Induced	Total			
Agriculture (Ag)	\$40,319	\$2,200	\$535	\$43,054			
Mining + Nat Gas (Ind)	1	89	101	191			
Construction (Ind)	48,273	626	311	49,210			
Manufacturing (Ind)	73	3,106	2,199	5,378			
Trade (Com)	76	4,383	1,793	6,252			
TCPU (Com)	44	2,041	1,315	3,400			
Personal and Prof Services (Com)	51,130	21,145	26,288	98,563			
FIRE (Com)	30,970	7,830	7,177	45,977			
Other Services (Com)	1,296	0	4,296	5,592			
Government (Com)	39	431	1,016	1,486			
Totals	\$172,221	\$41,851	\$45,031	\$259,103			

Marin County					
Business Sector	Direct	Indirect	Induced	Total	
Agriculture (Ag)	\$0	\$22	\$42	\$64	
Mining + Nat Gas (Ind)	0	3	0	3	
Construction (Ind)	21,652	611	177	22,440	
Manufacturing (Ind)	5	826	603	1,434	
Trade (Com)	15	1,063	1,293	2,371	
TCPU (Com)	6	978	626	1,610	
Personal and Prof Services(Com)	66,315	15,955	14,597	96,867	
FIRE (Com)	20,830	8,777	4,362	33,969	
Other Services (Com)	218	0	3,474	3,692	
Government (Com)	6	465	646	1,117	
Totals	\$109,047	\$28,700	\$25,820	\$163,567	

Table 3.6

Economic Impacts on Business Revenues for Region, Sonoma and Marin Counties Losses from a 30% Water Shortage (\$000s) Totals

Totals						
Business Sector	Direct	Indirect	Induced	Total		
Agriculture (Ag)	\$256,617	\$14,884	\$5,687	\$277,188		
Mining + Nat Gas (Ind)	2	852	966	1,820		
Construction (Ind)	444,296	18,099	5,421	467,816		
Manufacturing (Ind)	182	37,456	29,346	66,984		
Trade (Com)	224	45,164	35,088	80,476		
TCPU (Com)	119	35,477	21,254	56,850		
Personal and Prof Services (Com)	1,829,237	460,772	453,673	2,743,682		
FIRE (Com)	985,163	259,890	129,097	1,374,150		
Other Services (Com)	3,651	0	89,282	92,933		
Government (Com)	110	11,644	18,676	30,430		
Totals	\$3,519,601	\$884,238	\$788,490	\$5,192,329		

Sonoma County						
Business Sector	Direct	Indirect	Induced	Total		
Agriculture (Ag)	\$256,616	\$14,578	\$5,100	\$276,294		
Mining + Nat Gas (Ind)	2	830	964	1,796		
Construction (Ind)	306,952	7,870	2,965	317,787		
Manufacturing (Ind)	164	26,831	20,960	47,955		
Trade (Com)	172	32,533	17,092	49,797		
TCPU (Com)	99	20,735	12,536	33,370		
Personal and Prof Services (Com)	836,340	223,551	250,542	1,310,433		
FIRE (Com)	466,080	102,378	68,400	636,858		
Other Services (Com)	2,915	0	40,946	43,861		
Government (Com)	88	4,881	9,682	14,651		
Totals	\$1,869,428	\$434,187	\$429,187	\$2,732,802		

Marin County						
Business Sector	Direct	Indirect	Induced	Total		
Agriculture (Ag)	\$1	\$306	\$587	\$894		
Mining + Nat Gas (Ind)	0	22	2	24		
Construction (Ind)	137,344	10,229	2,456	150,029		
Manufacturing (Ind)	18	10,625	8,386	19,029		
Trade (Com)	52	12,631	17,996	30,679		
TCPU (Com)	20	14,742	8,718	23,480		
Personal and Prof Services (Com)	992,897	237,221	203,131	1,433,249		
FIRE (Com)	519,083	157,512	60,697	737,292		
Other Services (Com)	736	0	48,336	49,072		
Government (Com)	22	6,763	8,994	15,779		
Totals	\$1,650,173	\$450,051	\$359,303	\$2,459,527		

Table 3.7 Economic Impacts on Employment for Region, Sonoma and Marin Counties Losses from a 10% Water Shortage Totals

lotals					
Business Sector	Direct	Indirect	Induced	Total	
Agriculture (Ag)	56	12	5	73	
Mining + Nat Gas (Ind)	0	0	0	0	
Construction (Ind)	341	6	2	349	
Manufacturing (Ind)	0	12	7	19	
Trade (Com)	0	19	10	29	
TCPU (Com)	0	12	7	19	
Personal and Prof Services (Com)	377	201	271	849	
FIRE (Com)	153	54	31	238	
Other Services (Com)	0	0	8	8	
Government (Com)	0	2	9	11	
Totals	927	318	350	1,595	

Sonoma County					
Business Sector	Direct	Indirect	Induced	Total	
Agriculture (Ag)	56	12	4	72	
Mining + Nat Gas (Ind)	0	0	0	0	
Construction (Ind)	250	3	1	254	
Manufacturing (Ind)	0	10	5	15	
Trade (Com)	0	17	7	24	
TCPU (Com)	0	8	5	13	
Personal and Prof Services (Com)	259	124	178	561	
FIRE (Com)	65	28	23	116	
Other Services (Com)	0	0	6	6	
Government (Com)	0	1	5	6	
Totals	630	203	234	1,067	

Marin County				
Business Sector	Direct	Indirect	Induced	Total
Agriculture (Ag)	0	0	0	0
Mining + Nat Gas (Ind)	0	0	0	0
Construction (Ind)	91	4	1	96
Manufacturing (Ind)	0	2	2	4
Trade (Com)	0	3	4	7
TCPU (Com)	0	4	2	6
Personal and Prof Services (Com)	118	77	93	288
FIRE (Com)	88	26	8	122
Other Services (Com)	0	0	3	3
Government (Com)	0	1	3	4
Totals	297	117	116	530

Table 3.8 Economic Impacts on Employment for Region, Sonoma and Marin Counties Losses from a 20% Water Shortage Totals

lotais					
Business Sector	Direct	Indirect	Induced	Total	
Agriculture (Ag)	111	25	10	146	
Mining + Nat Gas (Ind)	0	0	0	0	
Construction (Ind)	683	11	4	698	
Manufacturing (Ind)	0	23	14	37	
Trade (Com)	1	38	20	59	
TCPU (Com)	0	23	12	35	
Personal and Prof Services (Com)	876	389	530	1,795	
FIRE (Com)	204	90	61	355	
Other Services (Com)	0	0	16	16	
Government (Com)	0	3	16	19	
Totals	1,875	602	683	3,160	

Sonoma County

Business Sector	Direct	Indirect	Induced	Total
Agriculture (Ag)	111	24	9	144
Mining + Nat Gas (Ind)	0	0	0	0
Construction (Ind)	500	6	3	509
Manufacturing (Ind)	0	19	11	30
Trade (Com)	1	33	14	48
TCPU (Com)	0	16	9	25
Personal and Prof Services (Com)	525	252	361	1,138
FIRE (Com)	139	58	46	243
Other Services (Com)	0	0	11	11
Government (Com)	0	2	10	12
Totals	1,276	410	474	2,160

Marin County

Business Sector	Direct	Indirect	Induced	Total
Agriculture (Ag)	0	1	1	2
Mining + Nat Gas (Ind)	0	0	0	0
Construction (Ind)	183	5	1	189
Manufacturing (Ind)	0	4	3	7
Trade (Com)	0	5	6	11
TCPU (Com)	0	7	3	10
Personal and Prof Services (Com)	351	137	169	657
FIRE (Com)	65	32	15	112
Other Services (Com)	0	0	5	5
Government (Com)	0	1	6	7
Totals	599	192	209	1,000

Table 3.9 Economic Impacts on Employment for Region, Sonoma and Marin Counties Losses from a 30% Water Shortage Totals

	Totals			
Business Sector	Direct	Indirect	Induced	Total
Agriculture (Ag)	705	173	93	971
Mining + Nat Gas (Ind)	0	3	3	6
Construction (Ind)	4,337	163	45	4,545
Manufacturing (Ind)	1	226	149	376
Trade (Com)	1	309	219	529
TCPU (Com)	1	274	139	414
Personal and Prof Services (Com)	13,787	4,829	5,787	24,403
FIRE (Com)	3,689	1,356	649	5,694
Other Services (Com)	1	0	179	180
Government (Com)	1	43	185	229
Totals	22,523	7,376	7,448	37,347

Sonoma County					
Business Sector	Direct	Indirect	Induced	Total	
Agriculture (Ag)	705	164	83	952	
Mining + Nat Gas (Ind)	0	3	3	6	
Construction (Ind)	3,179	72	26	3,277	
Manufacturing (Ind)	1	170	106	277	
Trade (Com)	1	246	129	376	
TCPU (Com)	1	170	90	261	
Personal and Prof Services (Com)	8,538	2,787	3,437	14,762	
FIRE (Com)	2,081	769	439	3,289	
Other Services (Com)	1	0	109	110	
Government (Com)	1	26	99	126	
Totals	14,508	4,407	4,521	23,436	

Marin County					
Business Sector	Direct	Indirect	Induced	Total	
Agriculture (Ag)	0	9	10	19	
Mining + Nat Gas (Ind)	0	0	0	0	
Construction (Ind)	1,158	91	19	1,268	
Manufacturing (Ind)	0	56	43	99	
Trade (Com)	0	63	90	153	
TCPU (Com)	0	104	49	153	
Personal and Prof Services (Com)	5,249	2,042	2,350	9,641	
FIRE (Com)	1,608	587	210	2,405	
Other Services (Com)	0	0	70	70	
Government (Com)	0	17	86	103	
Totals	8,015	2,969	2,927	13,911	

Due to the reduced employment, spending and business revenue from a water shortage, government revenue from taxes also experiences losses. Table 3.10 is added to this update because of the current budget situation in Sacramento and the rising likelihood of continued budget cuts in the current revenue projections. A further of loss of revenue for local and state government would force even more expense reductions, and likely force more job losses.

10%	, 20% and 50% Short	age Scenari	los (3000)	
10%		Sonoma	Marin	Totals
Federal Taxes		\$10,842	\$267	\$11.109
State and Local Taxes		. ,	·	. ,
	Property	1,632	129	1,761
	Sales	2,392	-	2,392
	Income	1,442	31	1,473
	Other	1,323	8,044	9,367
	Total State and Local	6,789	8,204	14,993
Totals		\$17,631	\$8,471	\$26,102
20%				
Federal Taxes		\$21,973	\$513	\$22,486
State and Local Taxes			-	
	Property	3,292	228	3,520
	Sales	4,823	1	4,824
	Income	2,920	57	2,977
	Other	2,680	14,594	17,274
	Total State and Local	13,715	14,880	28,595
Totals		\$35,688	\$15,393	\$51,081
30%				
Federal Taxes		\$218,605	\$8,489	\$227,094
State and Local Taxes		- /		
	Property	28,923	3,353	32,276
	Sales	42,341	9	42,350
	Income	27,825	797	28,622
	Other	27,101	216,259	243,360
	Total State and Local	126,190	220,418	346,608
Totals		\$344,795	\$228,907	\$573,702

Table 3.10Estimated Tax Revenue Losses from Water Shortages on Region
Sonoma and Marin counties
10%, 20% and 30% Shortage Scenarios (\$000)

For Sonoma County, wineries, restaurants, construction and medical services are the hardest hit, specific industries. The economic rationale behind these skewed effects may be as follows. Agriculture and construction are water-intensive businesses; a water shortage is likely to hurt them more. Professional services, such as medical services, employ many people, may also be water-intensive businesses, and are relatively highwage sectors of the economy. Reduced demand for professional services, such as lawyers and accountants, leads to jobs losses, including FIRE and TCPU industries which are indirectly affected.

In Marin County, the effects are similar at the company level, less agriculture. Retail stores in Marin are also relatively high in their economic impacts versus medical services as compared to Sonoma County. Sonoma County's job losses are estimated as much larger than Marin County's, while the gross revenue losses are similar to each other. The reduction of labor in Marin is more costly that its counterpart in Sonoma County, likely due to higher wages paid in Marin on average. Also, due to financial market woes in the United States, local financial services industries, such as banking, insurance firms, and real estate services, may see even larger effects due to a water shortage forcing firms to cut even more workers from their payrolls. In comparison to the 2007 study, there would be a larger proportion of workers lost in these industries in the event of a water shortage.

The large effects estimated during a 30% water shortage reflect the literature's assumption of the production elasticity mentioned above being affected by the water shortage's magnitude as that magnitude rises. Public policy should be shaped to react to water shortages in both equitable and efficient manners. In the policy recommendations below, using BMPs with all customers and tiered rates with residential customers and

water intensive businesses is likely to shift these specific water users to employing BMPs

as a proactive measure in light of these estimates.

Table 3.11				
Main Industries Affected by Water Shortages, Sonoma	County			

Lost Gross Revenues (\$000)

Lost Gross Revenues (5000)			
	10%	20%	30%
Industry	Shortage	Shortage	Shortage
Construction	\$24,186	\$48,374	\$308,151
Wineries	21,380	42,420	270,308
Real estate	2,686	5,513	67,237
Wholesale trade	3,101	6,252	49,798
Restaurants	1,706	3,541	34,724
Car Repair	1,524	3,104	27,288
Hospitals	1,430	2,959	27,263
Medical Offices	1,415	2,944	26,884
Telecommunications	955	1,953	20,772
Investment Banks (Brokerages)	859	1,776	20,566
All Other Industries	68,234	140,267	1,879,811
Totals	\$127,476	\$259,103	\$2,732,802

Job Losses

	10%	20%	30%
Industry	Shortage	Shortage	Shortage
Wineries	66	131	838
Restaurants	35	73	719
Real estate	18	38	458
Wholesale trade	23	47	377
Employment services	15	30	326
Investment Banks (Brokerages)	12	26	318
Accounting and bookkeeping services	11	23	297
Medical Offices	14	30	274
Hospitals	11	22	201
Grocery Stores	11	22	192
All Other Industries	851	1,718	19,436
Totals	1,067	2,160	23,436

Table 3.12 Main Industries Affected by Water Shortages, Marin County

Lost Gross Revenues (\$000)

	10%	20%	30%
Industry	Shortage	Shortage	Shortage
Construction	\$10,813	\$21,718	\$138,395
Real estate services	3,314	5,730	90,352
Investment Banking (Brokerages)	2,087	2,055	42,003
Food services and drinking places	1,284	2,049	30,983
Wholesale trade	1,269	2,372	30,679
Accounting and bookkeeping services	975	1,483	25,899
Medical Offices	953	1,754	24,163
Business Consulting	567	1,292	20,724
Legal services	826	1,172	19,806
Insurance carriers	755	1,421	18,952
All Other Industries	68,227	122,521	2,017,571
Totals	\$91,070	\$163,567	\$2,459,527

Job Losses

	10%	20%	30%
Industry	Shortage	Shortage	Shortage
Restaurants	25	39	593
Real estate services	11	18	290
Employment services	8	20	271
Accounting and bookkeeping services	10	14	253
Investment Banking (Brokerages)	12	11	233
Medical Offices	6	12	164
Wholesale trade	6	12	153
Legal services	6	9	144
Advertising and related services	4	8	131
Nursing and residential care facilities	5	9	127
All Other Industries	437	848	11,552
Totals	530	1,000	13,911

Summary

In summary, the economic impact of a water shortage in the SCWA's region ranges from losses of over \$218 million in business revenues during a 10% loss of water supply to over \$5 billion if a 30% shortage takes place, including \$14.9 million and \$346 million in local and state taxes respectively. Job losses from a water shortage range from almost 1,600 jobs for a 10% loss of water supply to over 37,300 jobs if a 30% water shortage takes place. While the literature does not provide any examples of a 50% water shortage and such a shortage's economic effects, it is likely in SCWA's region that the total job losses would be over 45,000 and over \$6 billion in lost business income.

4. Conclusions and Policy Recommendations

A water shortage is currently predicted for Sonoma and Marin counties for 2009. This report updates outlines Sonoma County Water Agency's (SCWA) regional water markets and estimates economic impacts of hypothetical levels of water shortage to Sonoma and Marin counties' customers. The literature on water economics concerning water shortages and best management practices is fairly unanimous in three basic recommendations. First, using tiered rates is an efficient way to encourage conservation onto a water market versus other options. Second, residential customers are less responsive to rate increases than business customers, thus willing to pay more for water if needed. San Francisco Public Utilities Commission's (SFPUC, 2007) recent report suggests that while all Bay Area water customers are price insensitive, residential customers are the least sensitive; water shortages cause both residents and businesses to make choices concerning the consumption of water versus other expenditures. Finally, the literature suggests that providing end users with more information about their usage on their water bills may increase customer sensitivity to rate changes and thus conserve more. AB 811 provides a way for households and business to directly, by choice, participate in making their homes and business more water efficient and create jobs for local businesses to retrofit these structures and use their property taxes to pay for it.

The economic impact of a hypothetical water shortage on Sonoma and Marin counties biases toward business users assuming all final customers face higher water rates as a result. In a 10% water shortage scenario, over \$218 million dollars of revenue may

be lost from local businesses due to reduced demand for goods, services and labor in lieu of purchasing water. Over 1,590 workers across Sonoma and Marin counties may lose their job because of a 10% water shortage. A 20% water shortage basically doubles these figures. Using the literature as a basis for assumptions, the larger the water shortage's magnitude, the more responsive businesses are to rising water costs in reducing their labor force.

In a 30% water shortage scenario, the losses are staggering. The water shortage's economic effects bias toward business end users of water. As much as \$5 billion in revenues could be lost due to production and job losses; these losses reduce spending as well as parallel residential spending shifting away from local goods and services to pay for higher water costs. The direct, indirect and induced effects of a 30% water shortage could cost Sonoma and Marin County residents over 37,300 jobs, over 10% of these counties' current employment total.

While the literature does not provide any examples of a 50% water shortage and such a shortage's economic effects, it is likely in SCWA's region that the total job losses would be over 45,000 and over \$6 billion in lost business income. These are estimates for 2009 only; many consecutive years of water shortage would be devastating to the regional economy.

In summary, this updated report suggests the following policy recommendations:

- Continue or begin use of tiered pricing to help fund BMP initiation and continuation and infrastructure changes in the least;
- Conservation efforts should be seen as permanent, not temporary, focused on a creating a new culture of conservation similar to recycling efforts;
- Begin any and all incentive programs for all customers to engage in BMPs;

- Partner with local businesses that can supply water conservation goods and services efficiently;
- Initiate AB 811 assessment areas and use any available federal stimulus funding for new and improved infrastructure;
- Increase promotion and education about new technologies, such as how recycled water can be used per section 5.4 of the SCWA Urban Water Management Plan; and
- Water retailers should immediately provide additional and more accessible information about water use to all end users in their billing to increase sensitivity to increasing water rates.

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Appendix

Interviews with Water Districts and Agencies Contacted from 2007 Study

In September and October of 2007, three questions were asked of the directors and managers of the SCWA contractors and major customers who were willing to participate. The City of Sebastopol, which is not a customer of SCWA but exists geographically in the middle of other contractors and customers, was also interviewed. Table A1 provides a list of the contractors and agencies who were interviewed and the specific person interviewed.

Table A1 Water Districts and Agencies Interviewed from Original Study

Contractors/Agencies City of Cotati Forestville Water District Geyserville Water System Marin Municipal Water District (MMWD) North Marin County Water District (NMWD) City of Petaluma City of Petaluma City of Rohnert Park Russian River Utility and Water District (RRUWD) City of Santa Rosa Sea Ranch Water Company City of Sebastopol Town of Sonoma Valley of the Moon Water District

The three questions were meant to pinpoint specific issues inside each

contractor's/customer's water management plan. The answers from those retailers that

participated are summarized in Tables A2 through A4.

1. Is water demand or supply the larger concern for the Water District over the next five to ten years?

	Which side of the water market is a larger concern over the next 3-5 years?			
Contractors/Agencies	Demand	Supply	Neither	
City of Cotati		•		
Forestville Water District			•	
Geyserville Water System		•		
MMWD		•		
NMWD			•	
City of Petaluma	•	•		
City of Rohnert Park			•	
RRUWD		•		
City of Santa Rosa			•	
Sea Ranch Water Company			•	
City of Sebastopol			•	
Town of Sonoma			•	
Valley of the Moon Water District		•		

Table A2Water Districts and Interview Answers to Question #1

2. Is using price as a management practice effective in controlling consumption in the Water District, if tiered pricing is used?

Water Districts and Interv	view Answers to	o Question #2	2	
	Are tiered rates an effective way			
	to induce conservation?			
Contractors/Agencies	Yes	No	Not Sure	
City of Cotati	•			
Forestville Water District		•		
Geyserville Water System			•	
MMWD	•			
NMWD	•			
City of Petaluma	•*			
City of Rohnert Park	•			
RRUWD			•	
City of Santa Rosa			•	
Sea Ranch Water Company		•		
City of Sebastopol			•	
Town of Sonoma	•*			
Valley of the Moon Water District	•*			

Table A3Water Districts and Interview Answers to Question #

Note: An asterisk "*" signifies that the water district has tiered rates.

3. What main impact will local growth and development have on the Water District?

Water Districts and Inter	view Answers to	Question #3	6	
	Will district economic growth have an impact on the district's water market?			
Contractors/Agencies	Yes	No	Not Sure	
City of Cotati		•		
Forestville Water District		•		
Geyserville Water System		•		
MMWD		•		
NMWD		•		
City of Petaluma		•		
City of Rohnert Park		•		
RRUWD		•		
City of Santa Rosa		•		
Sea Ranch Water Company		•		
City of Sebastopol	•			
Town of Sonoma		•		
Valley of the Moon Water District		•		

Table A4	
Vater Districts and Interview Answers to Quest	i

In summary, SCWA's water districts/contractors and other customers, as well as municipalities like Sebastopol, are worried more about supply than demand into the foreseeable future, are experimenting with or discussing tiered rates, or engaged directly in system-wide, best management practices. In short, water retailers function under their own water management plans and are following the Plan as set by SCWA short of a weather-related or regulatory shock. As shown in the figures below, demand among the major SCWA retailers has remained stable since 1980.

Demand from SCWA Customers (data from SCWA) since 1980



SCWA Water Demand by Local Agencies, 1980

Figure A1







Figure A4 SCWA Water Demand by Local Agencies, 2007

