APPENDICES

HUMBOLDT BAY MUNICIPAL WATER DISTRICT

WATER RESOURCE PLANNING PROCESS AND ADVISORY COMMITTEE CHARTER

2009—2010

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Water Resource Planning Process

Mission of Humboldt Bay Municipal Water District

The District's mission is to:

1. reliably deliver high quality drinking water to the communities and customers we serve in the greater Humboldt Bay Area at a reasonable cost;
2. reliably deliver untreated water to our wholesale industrial customer(s) at a reasonable cost; and
3. protect the long-term water supply and water quality interests the District in the Mad River watershed.

Water Resource Planning Process (continued)

Desired Outcomes of Water Resource Planning

By the completion of the Advisory Committee's work, the HBMWD Board hopes to have achieved the following outcomes.

1. The community understands the issues and opportunities facing HBMWD including:

- The challenges to retaining the District's water rights
- The role that Mad River plays in the ecological and economic well-being of the North Coast
- The context within which the Board is making decisions regarding the management of the resource.

2. The HBMWD Board understands the community's:

- Priorities regarding Mad River and the use of its water
- Perceptions of the challenges and benefits of putting water rights to full use
- Proposed principles for making decisions about the water resource.

3. The District has sufficient information to make the case for 'due diligence' to the State and is in a stronger position to maintain HBMWD's control of its water resource.

4. The Board will be positioned to make decisions that broadly benefit the community. Ideally, this will include

- Providing additional protection or use for our unused water rights
- Better water management
- Sustainable growth
- Jobs
- Cost effective water management and use
- Protecting the Mad River and its fisheries
- Being able to reliably deliver high quality water at a reasonable cost to our regional customers.

5. The community has a better relationship with and more trust in the District.

Water Resource Planning Process (continued)

Process Principles

The process used to develop the recommendation regarding the water resource will have the following characteristics.

Participatory—It engages a broad spectrum of people, especially those who could be impacted by the Board's decisions, in meaningful ways through a variety of methods including face to face meetings in various locations and on-line vehicles.

Open and fair—The community understands the decision-making process and their role in it. They understand the issues and are committed to participating in the planning process.

Efficient and time bound—Participants see it as a good use of their time.

Educative—People understand the issues and challenges and are able to engage as informed participants.

Respectful—Participants listen to one another and consider each other's points of view, even when they disagree.

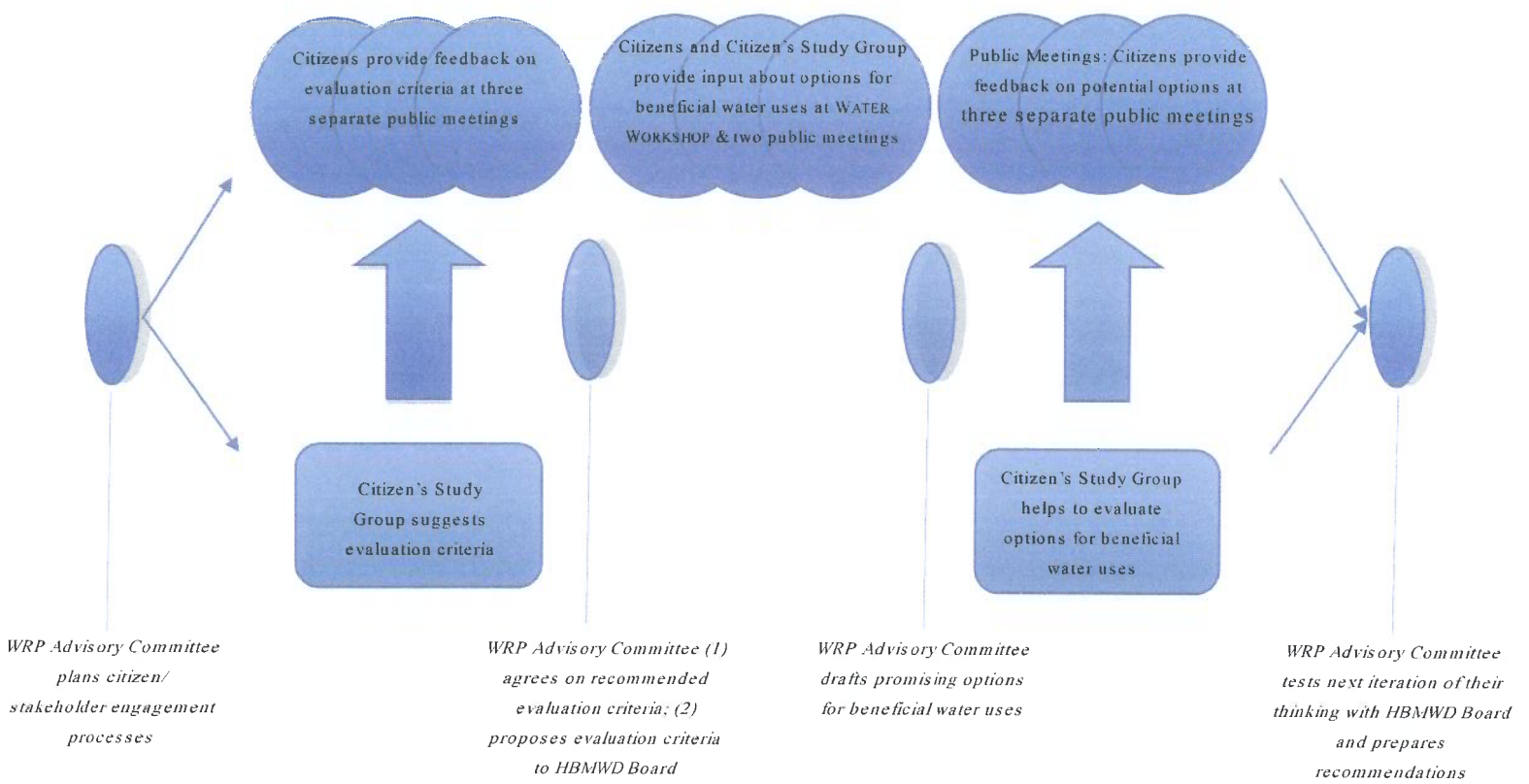
Clear—Participants understand the process and the potential legal constraints that affect the Board's decisions regarding our water rights.

Water Resource Planning (WRP) Process —Overview

Start-Up	Education and Develop Evaluation Criteria	Generate Options	Consider and Evaluate Options	Agree on Recommendations
June—August, 2009	September—December, 2009	January—February, 2010	March—June, 2010	June—August, 2010
The **WRP Advisory Committee** has… • An agreement on WRP Process and Advisory Committee Charter • An understanding of HBMWD's current situation • An agreement on a process plan to achieve the outcomes of all the phases	**Citizen's Study Group** and interested members of the public have an understanding of… • HBMWD's current situation • WRP Process • Role of WRP Advisory Committee and Citizen's Study Group The **WRP Advisory Committee** has… • An understanding of Citizen's Study Group's and public's input regarding evaluation criteria • An agreement on what criteria to recommend to the HBMWD Board • An understanding of the HBMWD Board's decision regarding evaluation criteria	**Citizen's Study Group** has an understanding of… • The criteria the WRP Advisory Committee and the HBMWD Board will use to guide their deliberations • The public's input regarding options for beneficial uses of water The **WRP Advisory Committee** has… • An understanding of the Citizen's Study Group's and the public's input regarding potential beneficial uses of water • A list of potential options for beneficial water uses	**Citizen's Study Group and the public** has an understanding of… • The Advisory Committee's "in progress" thinking on the potential options for beneficial water uses The **WRP Advisory Committee** has an understanding of… • The Citizen's Study Group's and the public's feedback on the Advisory Committee's "in-progress" thinking regarding: • Promising options for beneficial uses of water • How well the options meet the evaluation criteria • Potential trade-offs and implications • The **WRP Advisory Committee** has a rough draft of their recommendations and has tested the next iteration of their thinking with the HBMWD Board	**WRP Advisory Committee** has… • Documented descriptions of recommendations including: • Rationale for the recommendations • Cost/benefit analysis • Trade-offs • Potential short and long term implications • Impacts and suggestions for how to mitigate any potential negative impacts • An agreement on what to recommend to HBWMD Board • Presented their recommendations to the HBMWD Board

WRP process (continued)—Schematic overview of how citizens and stakeholders are involved

Start-Up	Education and Develop Evaluation Criteria	Generate Options	Consider and Evaluate Options	Agree on Recommendations
June—August, 2009	September—December, 2009	January—February, 2010	March—June, 2010	June—August, 2010



WRP Process (continued)—Overview of group roles: who is responsible for doing what

	Education & Evaluation Criteria	Generate Options	Consider and Evaluate Options	Agree on Recommendations
	September—December, 2009	January—February, 2010	March—June, 2010	June, 2010—August, 2010
Interested Members of the Public (Eight "public meetings" plus a Water Workshop)	• Learn about the issue and provide feedback on proposed evaluation criteria at three different public meetings	• Learn about water law • Participate in Water Workshop • Provide input to CSG and WRP AC regarding ideas for beneficial uses of water	• Provide feedback on draft of promising options for beneficial uses of water to AC • Check to make sure no important options are missing	
Citizen's Study Group (CSG) ((Three meetings, including a Water Workshop: includes AC (14) along with invited stakeholders (22) and randomly selected citizens (20))	• Learns about the issue • Suggests evaluation criteria	• Participates in Water Workshop and generates potential options for beneficial uses of water	• Provides feedback on how well potential options meet the evaluation criteria to Advisory Committee • Checks to make sure no important options are missing	
WRP Advisory Committee (AC)	• Gathers input on evaluation criteria from CSG • Gathers feedback on potential evaluation criteria from interested members of the public at three public meetings • Proposes evaluation criteria to HBMWD Board of Directors	• Conducts Water Workshop with content experts • Gathers input from interested members of the public and CSG regarding options for potential beneficial uses of water at Water Workshop and two public meetings	• Gathers feedback from CSG and interested members of the public on promising options for beneficial uses of water • Tests "in progress" thinking about promising options with Water Task Force* and HBMWD Board of Directors	• Prepares recommendations for HBMWD Board of Directors
Content Experts	• Help prepare Water Workshop	• Help conduct Water Workshop	• Provide feedback as requested by WRP AC	
HBMWD Board of Directors	• Receives, modifies criteria as needed, and agrees on evaluation criteria	• Participates in Water Workshop	• Provides "in progress" feedback as requested by AC	• Receives recommendations from Advisory Committee

* The Water Task Force is an ad-hoc advisory committee that works with and provides input to the HBMWD Board of Directors on matters affecting the District or the regional water system. It is comprised of two representatives from each of the District's wholesale customers (one is from management and one is an elected official). The **WRP Advisory Committee** will check in with the Water Task Force at key milestones in the WRP process and solicit their feedback.

Charter of the Water Resource Planning (WRP) Advisory Committee

Role of Advisory Committee

The role of the Advisory Committee is to:

1. **Educate** the public regarding the issues and opportunities facing HBMWD

2. Gather **input** and **feedback** from the public regarding HBMWD's water resource

3. **Develop recommendations** for the Humboldt Bay Municipal Water District Board regarding its water resource

4. More specifically **define the process** through which to accomplish the desired outcomes.

Charter of the WRP Advisory Committee (continued)

Givens

The recommendations to the HBMWD Board need to…

- Be based on the input of a well-informed public
- Be consistent with the decision-making criteria agreed on in Phase Three: Decision-Making Criteria (See page 3 and 6 in this document.)
- Be delivered to the Board in the agreed-upon time frame
- Be developed through a process that meets the process principles (See page 10 in this document.)
- Fit with current and future legal interpretations regarding water rights and uses
- Respond as much a possible to the input and feedback gathered from stakeholders and interested members of the public.

Charter of the WRP Advisory Committee (continued)

Advisory Committee Decision-Making Process

Agree on the recommendations to the HBMWD Board by consensus. In other words, every Advisory Committee member:

- Understands the decision
- Has had a chance to express his or her concerns
- States that he or she is willing to actively support the decision(s).

Every effort will be made to reach consensus. When consensus on any recommendation cannot be reached in a timely fashion and there is significant disagreement over direction, the decision will "fallback to" and be made by a super majority (two-thirds) of the full Committee. In the event of a "fallback decision," the Board will request that the broad range of thinking underlying the recommendations be reported. The HBMWD Board will make the final decision.

Quorum to conduct business is 75% (three quarters) of Committee membership.

Note: This Committee is advisory in nature and shall have no final decision-making authority. Any activity or recommendation from this Committee requiring policy direction or action shall be presented to the Board of HBMWD for their consideration.

Charter of the WRP Advisory Committee (continued)

District Board Members Role	▪ Contribute content knowledge ▪ In an environment of shared leadership, support and help the committee to carry out its charter ▪ Encourage participation and help create a civil, collaborative environment ▪ Provide or obtain resources necessary for the committee to do its job ▪ With input from the committee, plan meetings with facilitator/consultant ▪ Participate as a committee member
Committee Members Role	▪ Participate actively and fully in committee work to achieve the charter ▪ Share committee and subcommittee leadership responsibilities ▪ Surface issues and work to resolve them collaboratively ▪ Take responsibility for assignments between meetings and preparing for meetings ▪ Share insights and learnings with other committee members ▪ Actively challenge themselves to pursue fresh approaches and perspectives; explore new pathways ▪ Seek meaningful input and feedback from stakeholders and "the public" and fairly consider it ▪ Commit to follow-through on this charter until it is completed ▪ Attend all agreed-upon meetings. If a committee member is unable to participate fully and has frequent absences, the Board will replace the member. ▪ Contribute to development of meeting agendas

Charter of the WRP Advisory Committee (continued)

Consultant/Facilitator Role	▪ Contribute process knowledge and advocate for fair and effective process ▪ Help plan and facilitate committee meetings ▪ Encourage participation and help create a civil, collaborative environment ▪ Help group stay focused on task and build agreements ▪ Remain neutral and make sure each committee members ' thoughts and ideas are heard and that input and feedback from stakeholders and interested members of the public is fairly considered ▪ Help plan and facilitate meetings with stakeholder groups and interested members of the public ▪ As needed, orient small group facilitators for large meetings
Recorder Role	▪ Capture committee members' ideas on flip chart paper during meetings ▪ Document meeting notes ▪ Remain neutral and capture each person's ideas as accurately as possible ▪ Help capture thoughts and ideas during meetings with stakeholder groups and interested members of the public
District Staff Role	▪ Provide support for scheduling, provide resources as needed ▪ Provide guidance and content expertise ▪ Act as a resource for the Advisory Committee ▪ Attend Committee meetings ▪ Consult with facilitator/consultant and attorney ▪ Request content advice and expertise from the attorney with water law specialty as needed

Charter of the WRP Advisory Committee (continued)

Proposed Ground Rules

- Listen carefully — try to understand, **first**
- Ask questions to increase your understanding of others' points of view
- Keep inner dialogues, disagreements in the open
- Speak from the heart
- Agree only if it makes sense to you to do so
- Be open to divergent views
- Keep the "good of the whole" in mind at all times
- Help group stay on track
- Share the "air time."
- One speaker at a time (Avoid interrupting each other)
- End group meetings with an evaluation of how you are doing as a committee
- Have fun!!!

Meeting Procedures

- Plan outcomes and agenda for each meeting beforehand
- Review and agree on outcomes and agenda at start of each meeting
- Close each meeting by summarizing agreements, action items and evaluating team functioning
- Distribute meeting notes within seven days after meetings.
- Distribute meeting agendas prior to the meetings.

Humboldt Bay Municipal Water District
Key Challenges Facing the District and Its Customers
Increased Wholesale Costs and Retail Water Rates with "More to Come"

Introduction

Up until 1999, the District had long-term contracts with two Industrial Customers on the Samoa Peninsula (the pulp mills) and seven wholesale Municipal Customers. Among other things, these contracts specified how the District's costs would be allocated among the nine wholesale customers.

For many years, the two pulp mills paid approximately 75% of the District's "cost-of-service" which is the total cost incurred by the District to operate, maintain, and improve the regional water system. Given this, individual rate payers within our community never really experienced the true cost of having the regional water system which has provided an abundant supply of safe, reliable drinking water for 50 years.

Loss of Industrial Customer Base

In 1993 Simpson Pulp Mill ceased operation, but they continued to pay "their share" of the regional system costs until 1999 (given a take-or-pay contract which expired in 1999).

In 1999, Louisiana Pacific (the remaining mill) entered into a short-term water supply contract with the District, given that the mill was not doing well financially and was up for sale. Over the next ten years, ownership of the original LP mill transferred four times.

In 2009 the mill ceased operation, and for the first time in 50 years, the District found itself with no industrial customer.

Cost Increases to Municipal Customers

The loss of the pulp mills triggered a significant cost shift to the District's remaining customers (the seven Municipalities). Other factors have increased the District's overall cost-of-service too, which unfortunately occurred within the same time frame. Following is a summary of the estimated cost shifts or increases which have occurred in the last ten years:

Humboldt Bay Municipal Water District
Key Challenges Facing the District and Its Customers
Increased Wholesale Costs and Retail Water Rates with "More to Come"

1. Loss of Industrial Customer Base:
   - Simpson contributed over a $1 million to the District's cost-of-service. About half of that was shifted to other customers when their contract terminated in 1999 (reason for only half is that debt service for construction of original regional water system was paid off in 1999).
   - In 2003, Samoa Pacific Cellulose (then-current owner of the LP mill) reduced their contracted volume from 22 MGD to 15 MGD, which in-turn, reduced their cost share. This shifted about $300,000 to the Municipal Customers.
   - In 2008, Evergreen Pulp Mill (then-current owner of LP mill) ceased operation, and in 2009 sold the mill to Freshwater Tissue, who intends to resume operation but as of this report has not done so. Closure of the second mill resulted in a loss of approximately $1 million towards the District's cost-of-service, much of which was shifted to the Municipalities.

2. New Regional Treatment Plant:
   In the 1990s, the Department of Health Services (now Dept of Public Health) – the State agency which regulates drinking water - *mandated* that all eight "Public Water Systems" (HBMWD and its seven Municipal Customers) address the occasional high wintertime turbidity in the Mad River source water. Following a number of years of research and study, the Municipal Customers requested that HBMWD construct a regional treatment plant to address this regulatory mandate. HBMWD constructed the Turbidity Reduction Facility which was completed in 2002. Construction cost totaled $10.5 million. This triggered a significant cost increase to the Municipalities given that it added almost $1,000,000 to the District's cost-of-service (given debt service and increased O&M costs).

3. Increased Power Costs:
   The power cost to pump water is the District's highest single operating cost. Utility electric rates increased significantly in the late 1990s after the State of California's failed attempt to deregulate the energy industry (1996 pursuant to AB 1890). PG&E rates - especially those for larger industrial customers – increased significantly

Humboldt Bay Municipal Water District
Key Challenges Facing the District and Its Customers
Increased Wholesale Costs and Retail Water Rates with "More to Come"

following the failed deregulation attempt. This triggered another increase in the District's cost-of-service of $200,000 - $300,000 per year.

4. Increased Regulatory Costs:
   The District has experienced a significant increase in its regulatory compliance and reporting requirements, which too has increased costs. The specific dollar amount is not readily available, but HBMWD believes it to be fairly substantial. Furthermore, the State has "shifted" many costs to local governments via increased fees and charges to fund State programs which used to be covered by the general fund, and the unbridled "taking" of local property taxes by the State.

5. District-Triggered Increases:
   The District itself has contributed to some cost increases, especially in regards to taking the first steps to address its aging infrastructure and to address employment issues (especially employee attraction and retention).

Cumulatively, these cost increases have resulted in a staggering increase in HBMWD's wholesale water charges to its Municipal Customers. In 1999/00, the last year the Simpson pulp mill contributed financially, the total wholesale charge to the Municipalities was $708,000. In FY 2010/11 – the first full year with no industrial customer revenues – the total charge to the Municipalities is estimated to be $4 million.

Implications of these Cost Increases for Ratepayers

Table 1 presents wholesale cost increases for three of the District's wholesale Municipal Customers - one small, one mid-size and one large customer for illustrative purposes. Wholesale costs have increased between 400% and 600% over the last ten years.

Table 1 also presents the rate impacts for an end-use customer over the same time period. The resulting monthly water charge is based on a "typical" residential customer who has a standard meter (5/8-inch) and an assumed monthly consumption of 1500 cubic-feet of water. (Note – this is somewhat higher than what many *small* households would use, with many such households using 500 -1,000 cubic-feet/mo.). The three

Humboldt Bay Municipal Water District
Key Challenges Facing the District and Its Customers
Increased Wholesale Costs and Retail Water Rates with "More to Come"

wholesale Municipal Customers shown in Table 1 are in various stages of increasing their water rates (reference notes section below).

It is important to note that HBMWD's cost of water is only part of the reason water rates have increased – the Municipalities must recover their water system costs and those too have increased over the years to varying degrees in each agency.

TABLE 1

	HUMBOLDT COUNTY					SONOMA COUNTY	
	1999	2010/11	Increase $	Increase %			2010/11
WATER CHARGES							
Annual Wholesale Costs:							
Fieldbrook CSD	$14,094	$94,322	$80,228	569%			
McKinleyville CSD	$88,140	$628,952	$540,812	614%			
City of Eureka	$338,458	$1,737,838	$1,399,380	413%			
Monthly Retail Bill (for 1500 cf):						**Retail Bill (for 1500 cf):**	
Fieldbrook CSD*	$14	**$54**	$40	283%		Santa Rosa	**$58**
McKinleyville CSD**	$18	**$31**	$13	69%		Rohnert Park	**$55**
City of Eureka***	$23	**$48**	$25	106%		City of Petaluma	**$53**
INCOME							
Median Household Income****		**$39,627**					**$62,314**
MHI as % of State MHI		**65%**					**102%**
Water Rate as % of MHI		**1.6%**					**1.1%**

Notes:

* *Data from proposed Fieldbrook CSD 2010 rate increase.*

** *Data from current McKinleyville CSD rates, new rate increase is still in process.*

*** *Data from proposed City of Eureka 2010 rate increase.*

**** *2008 Census Data (latest data available).*

The cost for the Fieldbrook CSD customer would be approximately $54, for a Eureka customer $48/mo, and for a customer of McKinleyville CSD, $31/mo (McKinleyville's charge does not yet reflect their pending rate increase).

Also presented are retail water charges for three communities in neighboring Sonoma County (for 1500 cubic-feet/mo). Rates for customers in these communities are $58 in Santa Rosa, $55 in Rohnert Park, and $53 in Petaluma.

Humboldt Bay Municipal Water District
Key Challenges Facing the District and Its Customers
Increased Wholesale Costs and Retail Water Rates with "More to Come"

Humboldt County residents' water bills used to be much lower than water bills in neighboring counties like Sonoma, but that is no longer the case. Monthly water bills in our community are now comparable to what customers are paying in those communities; however, our Median Household Income (MHI) is much less. The MHI for Sonoma County is higher than Humboldt County's by 57% ($62,314 vs. $39,627). Humboldt County's MHI was only 67% of the State's MHI, while Sonoma County's was much higher at 102% of the State's MHI. An annual water bill as a percentage of the county's MHI is 1.6% in Humboldt County versus 1.1 % in Sonoma County's. In summary, residents in our community are seeing water bills comparable to communities in Sonoma County, yet the MHI in Humboldt County is significantly less than the MHI in Sonoma County.

Increased utility rates, as well as the ability of customers within our community to pay higher rates, are an important issue to understand and address.

Furthermore, utility rates do not yet reflect increased costs that HBMWD and the Municipalities will face over the coming years to address the aging infrastructure within our Cities and Districts.

Infrastructure Replacements will Trigger Additional Cost Increases

The regional water system is 50-years old and infrastructure replacements need to commence soon to ensure a reliable water supply to the community. As introduced in the main body, the District is developing a 20-year Capital Improvement Plan which will be completed soon.

It is anticipated that the CIP projects will cost many millions of dollars over the 20-year planning horizon. A key issue for the District and its Municipal customers is how to pay for these costly infrastructure projects, especially in light of the lost industrial customer base. ***Additional water revenues must be secured, or costs and rates will increase appreciably again over the coming years.***

Humboldt Bay Municipal Water District
Key Challenges Facing the District and Its Customers
Increased Wholesale Costs and Retail Water Rates with "More to Come"

To illustrate the nature of the CIP projects, following are three high priority projects.

Replace water line to serve Blue Lake and FG-CSD

($1.5 - $2 million)

The existing pipeline is in good shape, but the bridge which supports it – the Annie-Mary rail bridge – is not. It is in a state of disrepair, is not being maintained, and is vulnerable in a seismic event

Replace ~ 2 miles of water line on Samoa Peninsula

($2.75 million)

The Techite pipeline is highly susceptible to seismic events and very difficult to repair. It is no longer produced, repair parts are not available, and there have numerous lawsuits over its use in the water and wastewater industries.

Humboldt Bay Municipal Water District
Key Challenges Facing the District and Its Customers
Increased Wholesale Costs and Retail Water Rates with "More to Come"

Install new laterals in the existing Ranney Collector Wells

($1.5 -$3.0 million per Collector)

The Collectors are perhaps the most important part of the drinking water system. They draw water from an aquifer below the bed of the Mad River which results in naturally filtered water that is very high in quality.

The laterals are a series of perforated pipes which collect the filtered water. They are 50-years old and have deteriorated. HBMWD proposes a programmatic approach to install new laterals in each Collector.

Humboldt Bay Municipal Water District
Overview of District's Water Rights and Implications if not Used

Shortly after the District was formed in the late 1950's, the District applied to the State of California for "appropriative water rights" for the District's new regional water system. The District's original applications envisioned two phases of development of the regional water system. "Phase 1" proposed 50,000 acre-feet of storage at Ruth Reservoir, and a subsequent "Phase 2" expansion was proposed to increase Ruth Reservoir to 120,000 acre-feet.

Two water rights permits were issued to the District by the State for a total of 120,000 afa (acre-feet per annum) of storage and 200 cubic feet per second (cfs) of direct diversion. (Note: 200 cfs = 129 Million Gallons per Day (MGD) the units the District uses for its customer deliveries). The original permits specified that construction work shall be completed by July 1967, and that "complete application" of the water shall be made by July 1970. Complete application meant that all water under permit (the 120,000 acre-feet of storage and 200 cfs diversion) was supposed to be put to what is called "full beneficial use" in California water law.

The District proceeded with and completed "Phase 1" construction. "Phase 1" of the regional water system included Ruth Reservoir at 50,000 acre-feet (later modified to 48,030 AF), and diversion and delivery works in Humboldt County capable of supplying 116 cfs (which equates to 75 MGD).

The District did not achieve "complete application" of water under permit by July 1970 as required in its original permits. The District was not alone in that most Municipalities do not meet the term specified in their original water rights permits. The State understands that it takes time to develop projects and put water to full beneficial use, and they routinely granted 10-year time extensions to permit holders.

Between 1970 and 2000, the District applied for three successive ten-year extensions of its water rights permits, thereby allowing additional time to put the appropriated water to full beneficial use. The State approved three ten-year extensions, the most recent one taking the permit to term to December 2000.

Humboldt Bay Municipal Water District
Overview of District's Water Rights and Implications if not Used

In 1999, the District submitted an application for another 10-year extension of its original permits (which still assumed Phase 1 and Phase 2 development). The District quickly learned that was no longer a tenable option. By that time, the Simpson Pulp mill was closed and the one remaining mill had reduced their water use. This resulted in a significant reduction in total water deliveries, and associated, beneficial use of water under the District's permits. The second change was that the Division of Water Rights and State Water Resources Control Board were evaluating extension requests much more critically, especially if a permit holder had not demonstrated clear progress toward completing the project and putting water to use.

After much work – involving legal research, projections of future Municipal water supply needs, and negotiations with senior staff at the Division of Water Rights - the District decided to amend its extension request. The District requested a 25-year permit extension (vs. the customary 10 years) for "Phase 1" development only, thereby giving up rights associated with "Phase 2" development. In 2004, the State Water Resources Control Board approved the District's amended extension request for 25 years (to December 31, 2029) and revoked rights associated with "Phase 2" development. The District's current permitted rights are for 48,030 acre-feet of storage at Ruth Reservoir and 116 cfs diversion (75 MGD).

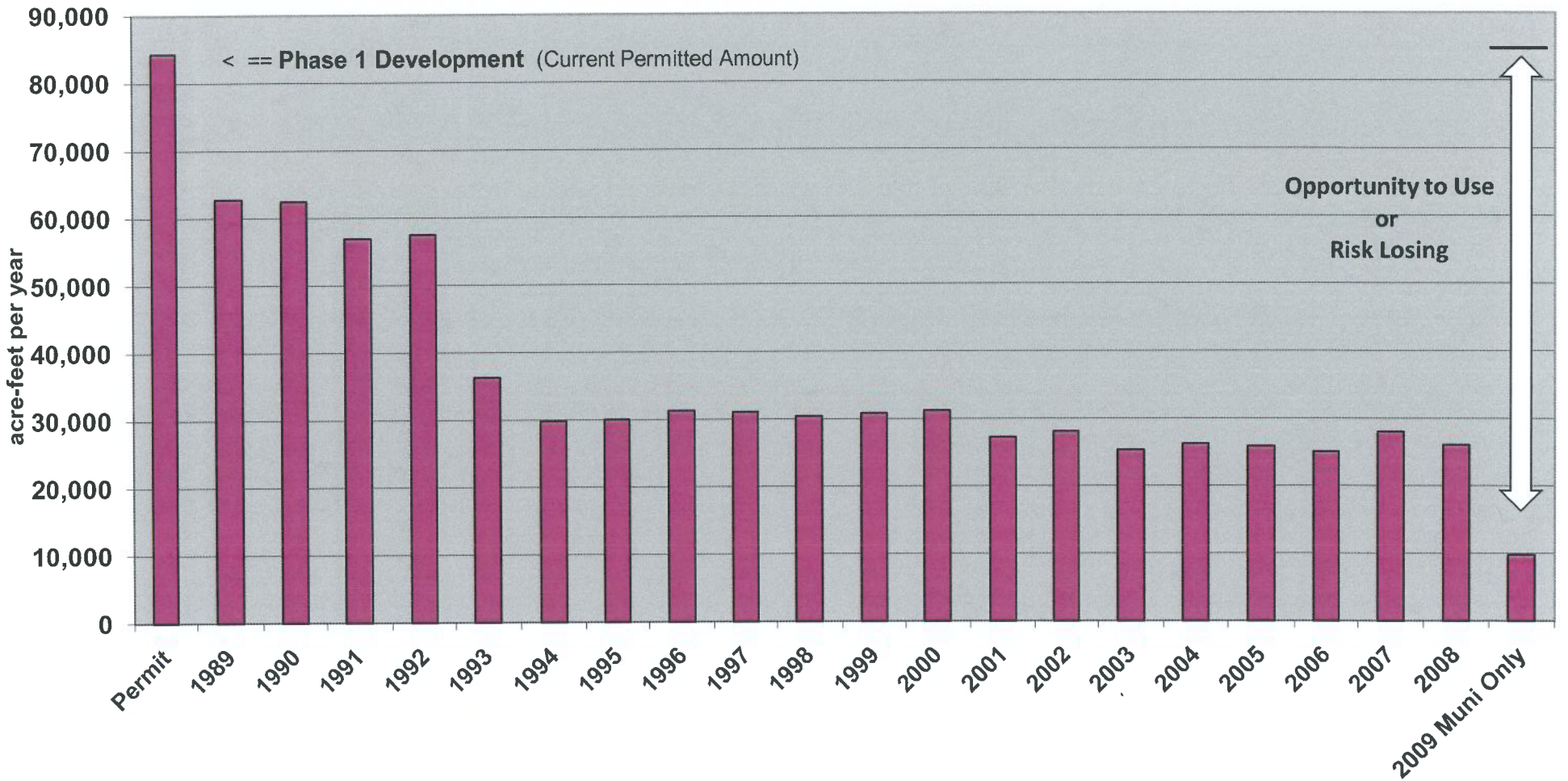
At that time, senior staff at the Division of Water Rights put the District on notice stating they expect to see significant progress toward full beneficial use upon expiration of the next permit term. One senior staff threatened "licensing", which is the final step in the appropriative water right process. Licensing confirms the amount of water that has been "perfected" (meaning actually used). Any rights to the water above the amount licensed, would be lost by the District.

Since the last permit extension was granted, the second pulp mill ceased operation resulting in another appreciable reduction in water use under the District's water rights permits. Graph 1 shows the amount of permitted diversion (acre-feet/year) compared to the District's actual annual diversions. As shown, there is a significant gap between the permitted use and that which the District is currently using. The District must put this available water to beneficial use during the current permit term or risk losing it at some point in the future.

Humboldt Bay Municipal Water District
Overview of District's Water Rights and Implications if not Used

Graph 1

Annual Permitted Diversion versus Actual Diversions over Recent Years



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July 23, 2010

Carol Rische
General Manager
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828 Seventh Street
P.O. Box 95
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Re: Proposed Recommendations of Advisory Committee

Dear Carol:

In my role as special counsel to the Humboldt Bay Municipal Water District (District) it has been my privilege to provide legal advice to the Board of Directors regarding the way(s) in which the District may retain local control of its water rights. As part of that effort, the District recently requested that I review the proposals currently being evaluated by the Advisory Committee through the Water Resources Planning process to determine: (i) whether any or all of the proposals comply with California law, and (ii) whether (and to what extent) the proposals secure local control of the District's water rights for the foreseeable future. This letter summarizes my conclusions.

As I understand the matter, the Advisory Committee is currently evaluating four types of proposals for the District to make increased use of its water rights. First, the Advisory Committee is considering projects that would increase the consumptive use of water within the District's boundaries (e.g., new water-intensive businesses). Second, the Advisory Committee is considering selling water (not water rights) to public agencies located in other areas of California in order to generate revenues for the District. Such sales would only occur if the buyer is willing to agree to stringent conditions that would protect the District's water rights. Third, the Advisory Committee is considering projects that provide additional water for environmental restoration or enhancement in the Mad River watershed. Fourth, the Advisory Committee is considering other projects at Ruth Lake or in the watershed that would either provide additional recreational opportunities or that would generate additional hydroelectric power.

Although the projects being considered by the Advisory Committee are still at the conceptual level, these projects are sufficiently well-developed to allow me to evaluate whether they are legally viable and whether they can help the District maintain local control of its water rights. In terms of legal viability, all of the proposals being considered by the Advisory Committee could

be legally implemented by the District. Under the Municipal Water District Law, the District has broad authority to serve water for consumptive and non-consumptive purposes (including recreation and environmental purposes). Some of the proposals might require additional permitting, but that does not, of course, mean that those proposals are not legally viable. For instance, serving water outside the District's existing boundaries will require a modification in the District's water rights for the period of the transfer. Similarly, increasing releases from Ruth Lake to improve or enhance the Mad River watershed would also require a modification of the District's water rights from the State Water Resources Control Board for the period of the transfer but would also probably require permits from the California Department of Fish & Game and the National Marine Fisheries Service.

Moreover, in terms of securing (or even enhancing) local control over the District's water rights, implementing any of these proposals would serve to advance local control over the District's water rights. All of these proposal would put additional water to use, either within the District or within the service area of another public agency. Putting additional water to use would make it more difficult for either the State of California or those outside the District to make claims that the District's water rights should be limited to the quantities currently needed in the absence of the two pulp mills. In particular, putting water to use by means of a transfer outside the District preserves the District's water rights while generating funds that could be used for operation and maintenance or capital expenses. Such a transfer should include a number of provisions that would prevent the buyer from becoming dependent on the transfer, such as preventing the transferred water from being included in an urban water management plan or water supply assessment.

For these reasons, I believe that the proposals currently being evaluated by the Advisory Committee could generally be implemented in a legal manner and would serve to enhance local control over the District's water rights.

Please feel free to call if you or the Board of Directors have any questions. I would be happy to meet with the Board of Directors, the Advisory Committee or others to discuss this letter if that would serve to advance the District's effort.

Very truly yours,

David R.E. Aladjem

Cumulative summary of feedback on the meetings held during HBMWD's Water Resource Planning process 2009-2010

Introduction

In Spring, 2009 the Humboldt Bay Municipal Water District Board of Directors established a Water Resource Planning Advisory Committee of 14 stakeholders. Between Fall, 2009 and Summer, 2010 the Advisory Committee hosted eight public meetings and one Water Workshop that was also open to the public. They also met twice with a Citizen's Study Group comprised of invited stakeholders and citizens who were randomly selected from voter rolls. Some members of the CSG also attended the Water Workshop.

At each of these 11 meetings participants were asked to rate how well the meeting had achieved the outcomes; what the most valuable aspect of the session was; what worked about the meeting; and to note any suggestions they might have for future public processes. This is a summary of the feedback from all of those meetings.

The total number of participants who rated the achievement of written feedback at these meetings was **228**. A total of **230** provided written feedback.

How well did all the meetings achieve their outcomes? **Average = 4.4**

Not at all			Somewhat				Achieved them
1 (0)	2 (3)	2.5 (2)	3 (12)	3.5 (8)	4 (96)	4.5 (6)	5 (102)

Please note that the numbers in parentheses below are the number of times an aspect of the meetings was mentioned. Quotes after the categories are intended to be illustrative of the range of comments made.

What was the most valuable aspect of these sessions? What worked about these sessions?

Education (163)

"Clearly stated the problem"..."learning background of the Water District"..."learned things I didn't know"..."background information appreciated"..."summarizing what the options are"..."being able to ask more about specific ideas"..."good overview presentation by Board, committee members, and staff"..."more information/more new ideas and more clarity on subject"..."hearing and discussing the various pros and cones of the different options"..."I did appreciate all the information available on the website"

Process in general (format, facilitation, recording) (149)

"democratic process at its best! Thank you."..."good moderation! Great facilitators!"..."recorders"..."reporting out after small group meetings"..."table cloths – ability to write on them"... "Great facilitation"..."balance between presentation and discussion"..."table

talk"..."format of speakers and buzz..."finishing a very fine process that you started with the public"..."well organized public involvement methodology"

Small group discussions/rotating tables (117)

"Changing tables"..."small group discussions, being turned loose to discuss ideas"..."small groups switching to talk about multiple topics"..."speaking with board members and advisory committee members at the tables"..."sharing ideas in small groups and then sharing with the larger group"..."mixing led to a dissemination of ideas"

Collaborative, open, respectful atmosphere (60)

"Openness of input, felt valued, congenial and productive meeting"..."lots of positive discussion"..."respectful environment..."very open feeling, participatory"..."cooperation"..."willingness of crowd to participate"..."general objectivity"... "group collaborations"..."the amazing talent, respect that the entire room has for one another"

Community involvement, input and dialogue (40)

"Obtaining public input"..."broad participation"..."collaboration with others from community"..."wide variety of participants and interests"..."to hear/discuss multiple viewpoints"..."public participation"..."citizens involvement"..."the Board's willingness to seek the public's input"

Suggestions for future public processes?

More publicity/outreach (29)

"Outreach to more people for more involvement"..."outreach to the greater community to understand why exporting may make sense"..."greater public exposure via local media"

Water Resource Planning Workshop

January 19, 2010
Humboldt Bay Municipal Water District

Introduction
HBMWD's Situation and its Implications

Introduction

- Last year, HBMWD gave 30-40 presentations throughout the community regarding:
  - the District
  - our unique situation given loss of the pulp mills
  - implications for our customers, ratepayers and the community
- Today, not enough time to present all of the background information

Today's Focus

1. Background- just enough to "set the stage"
   (many avenues available to learn more if interested)
2. Implications of HBMWD's situation
3. Options available to the District
4. Information and perspectives to support consideration of those options
5. Discussion and public input

Introduction - Who we are

- Local public agency formed to provide the water supply needs of our community
- HBMWD built and operates a regional water system
- HBMWD operates at the ***wholesale*** level:
  - we deliver water to our ***Municipal Customers;***
  - who then deliver it to residents and businesses in our community

Introduction - HBMWD's Customers

- City of Arcata
- City of Blue Lake
- City of Eureka
- Fieldbrook-Glendale CSD
- Humboldt CSD
- Manila CSD
- McKinleyville CSD

Quick Trip Back in Time ...
Formation of HBMWD
"By our Community, for our Community"

- District formed in 1956
- Initiated by community and business leaders for the benefit of our community
- ***Overwhelming support:***
  - 89% voted to form District
  - 69% voted for bonds to build regional water system

Reason District Formed in 1950s

- To provide a reliable drinking water supply for cities of Eureka and Arcata
- To attract pulp mills *here*:
  - provide local economic benefit;
  - utilize a waste product of the timber industry;
  - improve air quality (since waste product burned in tee-pee burners)
- Pulp mills necessary component – if they did not locate here, regional system would not be built


Humboldt Standard

TWO PULP MILLS ANNOUNCE THEY WILL BUY WATER HERE

Two Components of Regional System

1. **Source of Supply** - Ruth Lake
2. **Delivery Systems** - Two separate and distinct systems (the "pumps and pipes")
   - Industrial System – supplies untreated water to customers on Samoa Peninsula
   - Domestic System – supplies treated drinking water to Municipalities

Delivery System Capacity
(how much water they can deliver)

Industrial System - 60 MGD

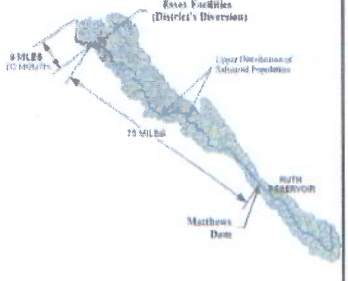
vs.

Domestic System - 20 MGD

Key Point: Most of *delivery* capacity is on the *Industrial System* (75% of it)

Source of Supply – Ruth Lake

- Reservoir in upper watershed captures small percentage of watershed run-off
- Water stored at Ruth is released in summer & fall and flows down Mad River
- Water diverted at Essex to serve community's water supply needs



Many Benefits during 50 Years of Service to Community

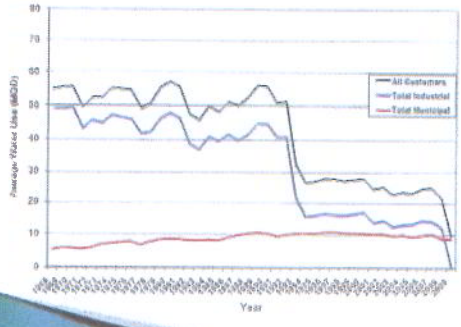
- *Highly reliable water supply and delivery system*
- *High quality source water* – given the watershed and natural filtration process for drinking water
- *Environmentally-friendly system*
  (no out-of-basin water transfer; little impact to natural hydrograph of Mad River; enhanced flow in summer/fall which benefits fisheries)
- *Efficient and cost effective system for ratepayers* compared to separate systems in each community
- *Strong and effective partnership* with wholesale customers and other stakeholders in community

12 13

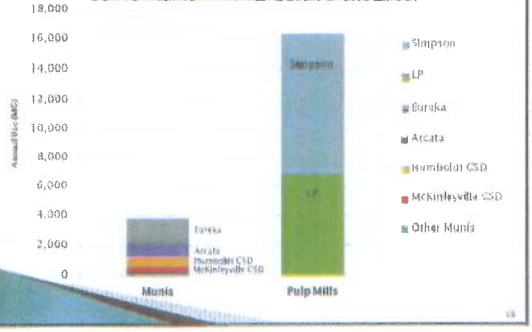
But...
HBMWD Faces Major Challenges

- Significant loss of customer base
- Aging Infrastructure - the regional water system is now 50 years old

Loss of Industrial Customer Base



Let's put that Loss in Perspective
The Mills *used 4-5 five times* total Municipal Use in *entire* Region



Implications of this Loss ....

- Challenges with respect to our water rights which are held for benefit of our community
- Significant cost increases to HBMWD's wholesale Municipal Customers, with corresponding increases in end-use water rates
- Challenges with respect to how to fund costly infrastructure replacements

Water Rights

- State in essence "owns" surface water resources, and grants entities (such as HBMWD) the right to use this water for a specific purpose (called "beneficial use")
- HBMWD holds permits which allow use for municipal and industrial purposes
- If an entity does not fully use the water under permit, the State may revoke the right to use that water ("use-it-or-lose it" principle)

Significant Cost Increases

HBMWD Costs to Municipal Customers

- 1999 = $708,000
- 2008/09 = $2,200,000 (tripling in 10 years)
- 2009/10 = $3,500,000 (given loss of second mill, after cost cuts by HBMWD)
- 2010/11 = Likely $3,900,000

Many Reasons for Cost Increases

- Loss of Pulp Mills:
  - contributed $1-$2 million to HBMWD's "base" costs of regional water system
- New regional treatment plant => $10.5 million
- Significant increase in power & regulatory costs

Future Increases Likely to be Significant Given Infrastructure Needs

Utility Ratemaking Basics:

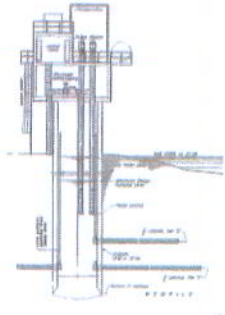
- HBMWD and Munis are public entities = *not-for-profit*
- Water (and sewer) rates *must* be *cost-based*
- Rates must cover the full cost of providing service
- Most agencies have not built into rates capital replacement costs

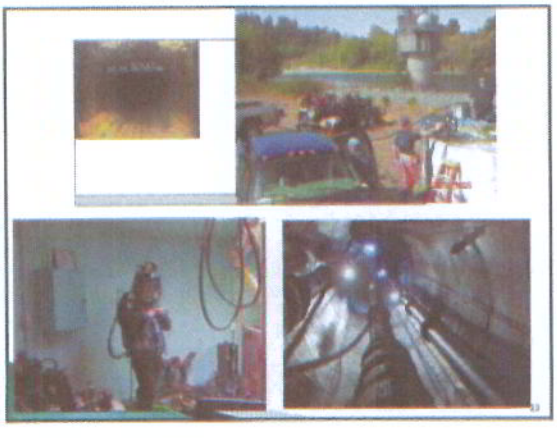
HBMWD Example

- Slough Crossing (Pile bent Replacement)
- Cost = $1.1 million
- Munis paid $400,000
- Mill paid $700,000

HBMWD Capital Improvement Plan

- 20-Year CIP nearly done
- Many high priority projects
- One of the highest priorities: replacement of Ranney laterals
  - $1.5 -$3.0 million each





Other Important Projects

- New water line to serve Blue Lake and FG-CSD (existing one on Annie-Mary rail bridge)
- Replacement of Techite line on Samoa Peninsula

And if Infrastructure Not Addressed Leaks or possibly Failure

Rate Impacts to End-use Customers

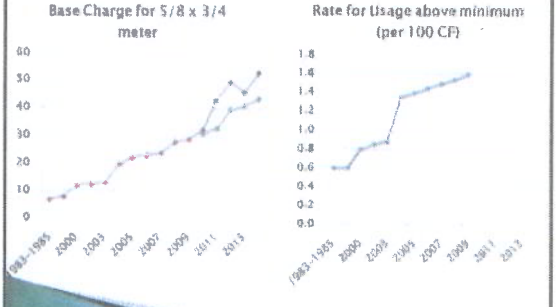
- Case Study: Fieldbrook-Glendale CSD
- Perspectives: Humboldt CSD

Fieldbrook-Glendale CSD

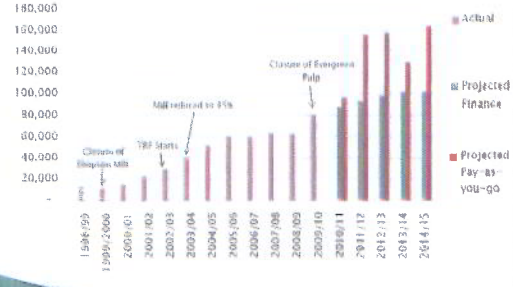
Infrastructure needs too

- Just replaced roof on storage reservoir
- Additional reservoir needed
- Potentially need new booster station too

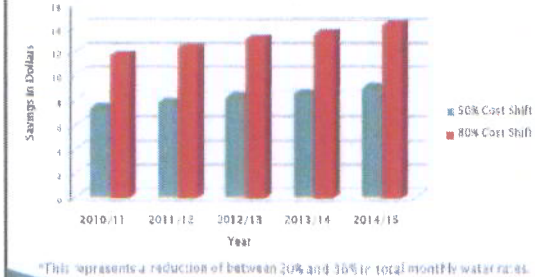
Fieldbrook/Glendale CSD Retail Rates



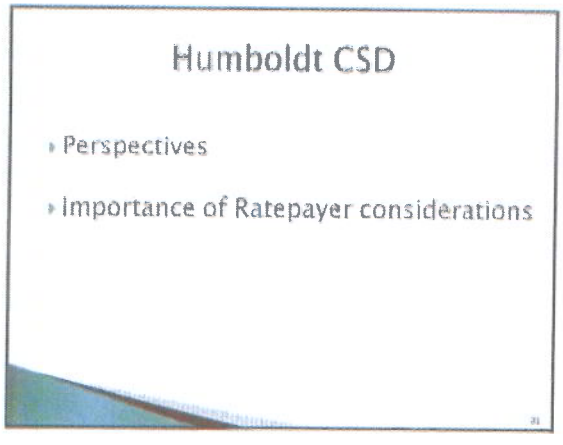
HBMWD Wholesale Water Charges to FG-CSD



Potential Reduction in Monthly Costs if Enough Water is Sold (whether locally or exported)



*This represents a reduction of between 30% and 35% in total monthly water rates.


Humboldt CSD
Perspectives
Importance of Ratepayer considerations

Water Resource Planning Workshop

January 19, 2010
Humboldt Bay Municipal Water District

WATER RIGHTS and OPTIONS

David Aladjem – Downey Brand LLP
Paula Whealen – Wagner & Bonsignore Engineers

WATER RIGHTS 101
BASIC PRINCIPLES

- California's Dual System of Water Rights
  - Appropriative and Riparian
- "First in time is first in right"
- "Use it or lose it"
- All uses must be reasonable and beneficial

BASIC PRINCIPLES

- Balance consumptive and environmental uses for the public interest
  - Municipal (drinking water)
  - Industrial (pulp mills)
  - Environmental (fish and habitat)
  - Recreation (people)
  - Hydropower

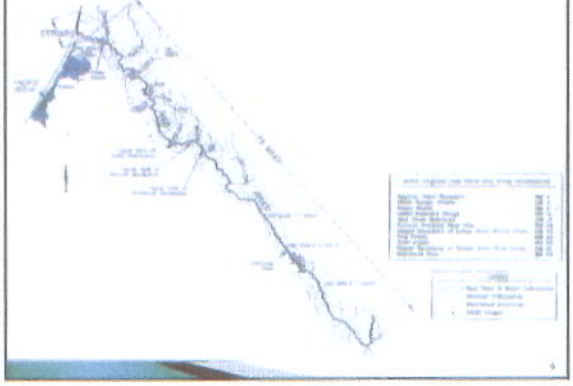
FREQUENTLY ASKED QUESTIONS

- What is the difference between a water right permit and a water right license?
- What are the components of a water right?
- Can water rights be lost or taken away?
- Can we transfer water without losing it?
- Does "area of origin" doctrine protect HBMWD?

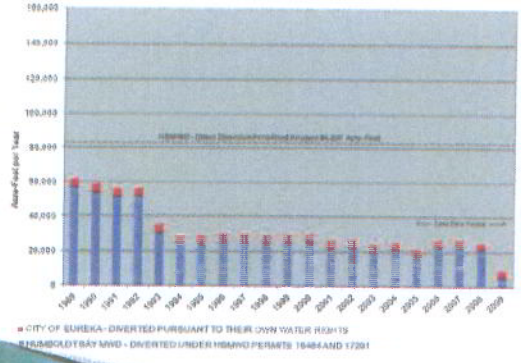
HBMWD'S WATER RIGHTS

- Storage in Ruth Lake
  - 48,030 acre-feet
- Direct Diversion from Mad River
  - About 84,000 acre-feet (75 mgd) annually
- Hydropower
- Permitted Points of Diversion
  - Ruth Lake and Essex Operations Center
- Permitted Place of Use
  - Within HBMWD boundaries and around Ruth Lake

Mad River Watershed



Humboldt Bay MWD Actual Diversions



THE DELTA and COMPREHENSIVE WATER PACKAGE

- Water supply reliability
- Reductions in per capita urban uses
- Funding for local projects

WATER RIGHTS 201
STRATEGY DEVELOPMENT

HBMWD has two broad options:

- Option 1 – License amount of water used to date and forfeit unused portion
  - Can be done anytime prior to 2029
  - No new permit terms or condition
  - At some point, growth will be limited

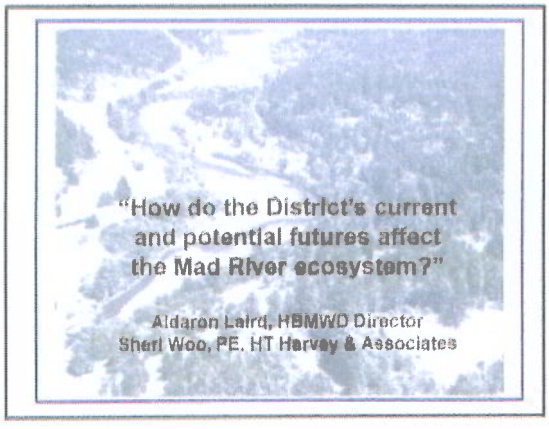
- Option 2 – Attempt to use full amount under permit between 2010 and 2029
- *Goal: To increase use by 60,000 acre-feet annually by 2029*
  - 60,000 af = amount required for 18,000 acres of rice
  - 60,000 af = amount required for 35,000 acres of wine grapes (about 50% of the vineyard area in Sonoma County)
  - 60,000 af = over 3 times the amount of beer produced annually in USA
  - 60,000 af = water needed to supply a city of 300,000 people (twice the size of Santa Rosa)

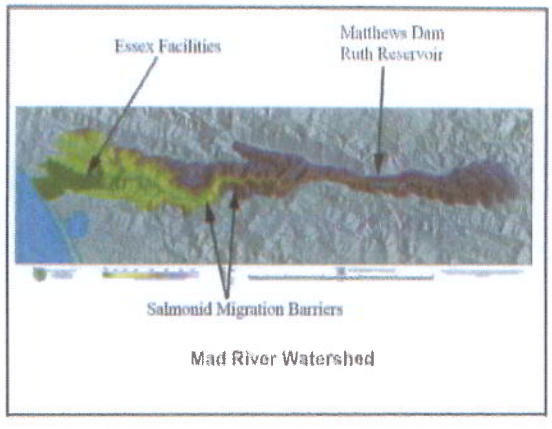
Potential Future Uses of Water

- Option 2A – Instream Purposes
  - Increased flows in the Mad River
  - Increased estuarine flows
- Option 2B – Within HBMWD Service Area
  - Domestic
  - Industrial
  - Aquaculture / Silviculture

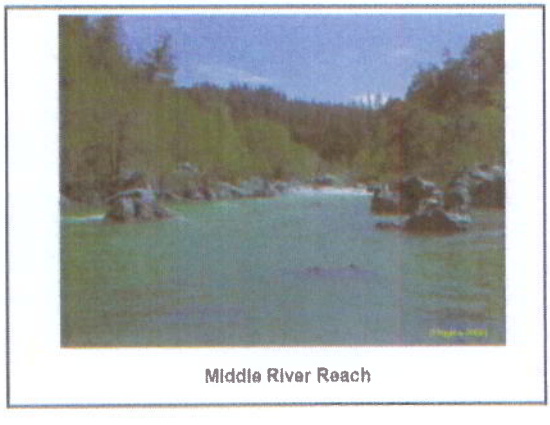
- Option 2C – Outside of HBMWD Service Area
  - Within Mad River watershed
  - Within adjacent watersheds
  - Other locations
- Option 2D – Combination of the Above


QUESTIONS & COMMENTS

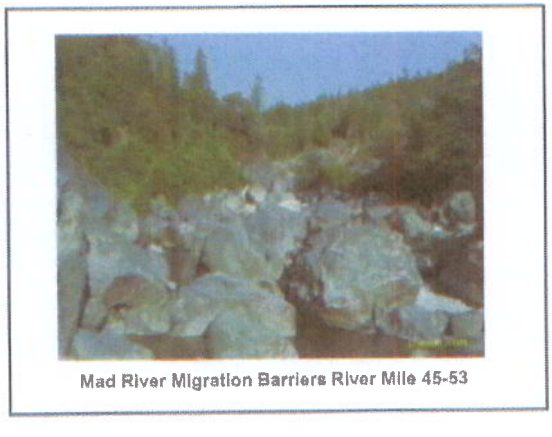





Lower River Reach


Middle River Reach


Middle River Reach-Summer Steelhead Holding Area


Mad River Migration Barriers River Mile 45-53

Mad River below Matthews Dam

Closure of the mouth

- Natural regime
  - Eureka-Sweasey Dam 1938-1961
  - HBMWD-Matthew Dam 1961-2009

Low flow discharge

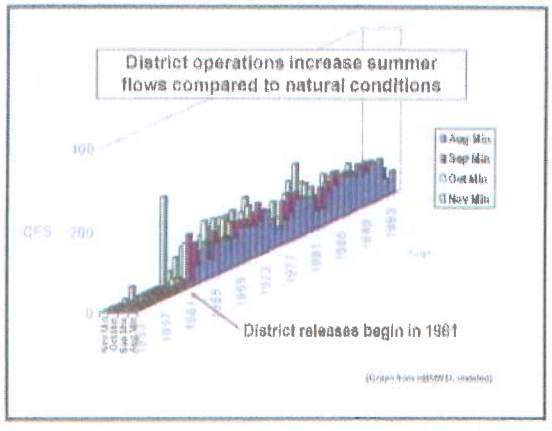
- Natural regime
  - Eureka-Sweasey Dam 1938-1961
  - HBMWD-Matthew Dam 1961-2009

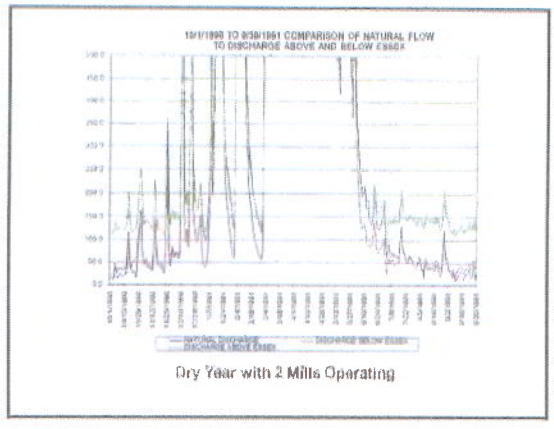
1870 U.S. Coast & Geodetic Survey

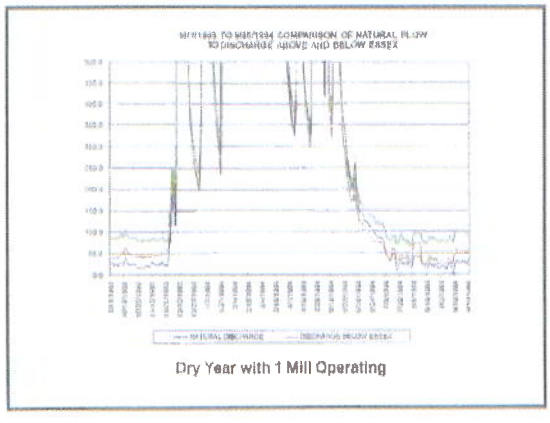
City of Eureka's Sweasey Dam 1938-1962 (operational)
1971 (removed) diversion rate of 5 cfs

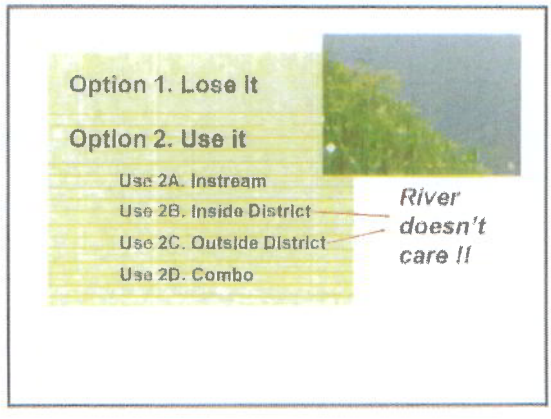
Matthews Dam and Ruth Reservoir, River Mile 84

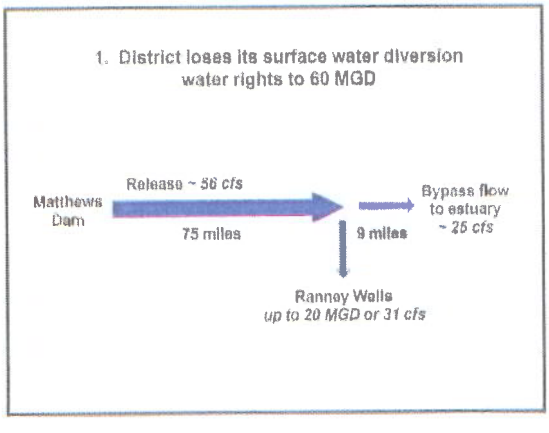
Units

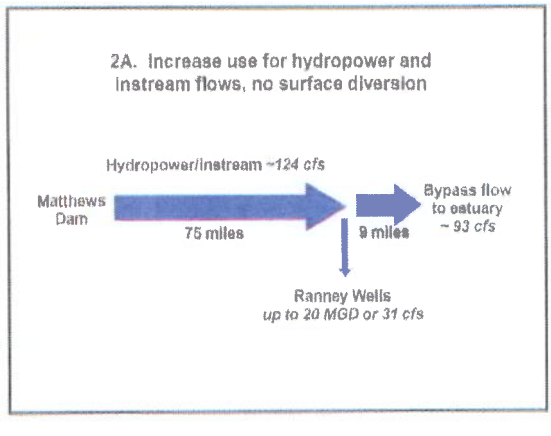

District operations increase summer flows compared to natural conditions
CFS
District releases begin in 1961


Dry Year with 2 Mills Operating

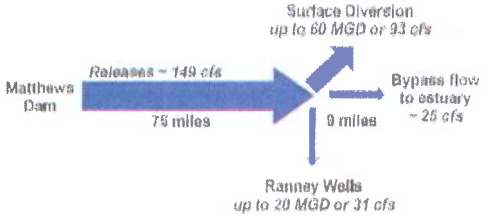

Dry Year with 1 Mill Operating

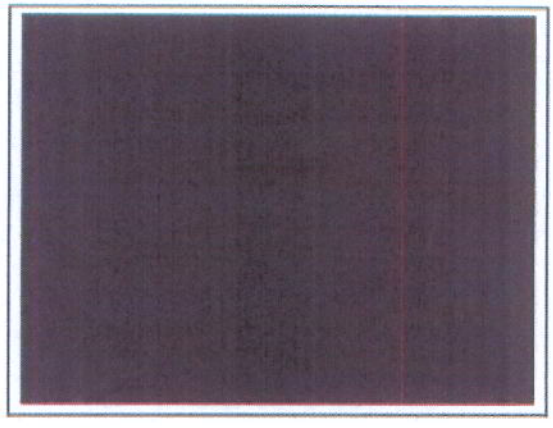

Option 1. Lose It
Option 2. Use it
Use 2A. Instream
Use 2B. Inside District
Use 2C. Outside District
Use 2D. Combo
River doesn't care !!

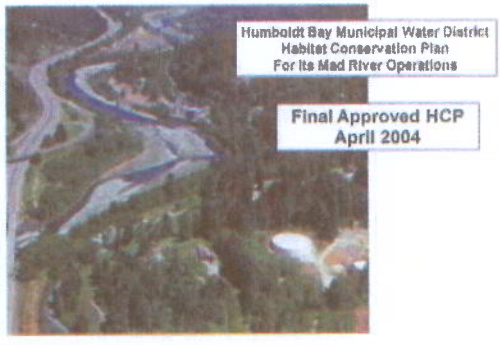

1. District loses its surface water diversion water rights to 60 MGD
Matthews Dam
Release ~ 56 cfs
75 miles
9 miles
Bypass flow to estuary ~ 25 cfs
Ranney Wells
up to 20 MGD or 31 cfs

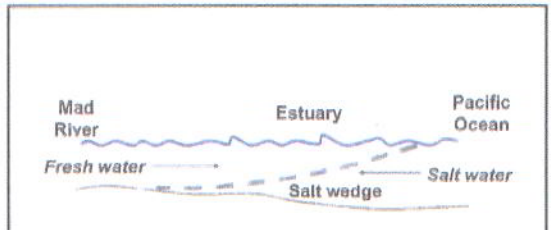

2A. Increase use for hydropower and instream flows, no surface diversion
Hydropower/instream ~124 cfs
Matthews Dam
75 miles
9 miles
Bypass flow to estuary ~ 93 cfs
Ranney Wells
up to 20 MGD or 31 cfs

2B/2C. Fully use District's water rights, summer time operations









the redwood coast

Water Resource Planning Workshop

January 19, 2010

Humboldt Bay Municipal Water District

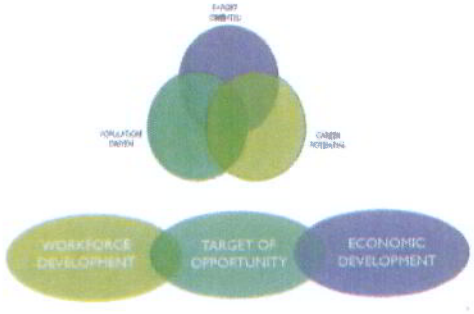
Water and Economic Development in Humboldt County and the Redwood Coast Region

Jacqueline Debets – Humboldt County Economic Development

This Presentation

- Industries are growing here
- Assets and liabilities for those industries
- How can water as an economic asset
- Industries and businesses that use lots of water for possible location here
- Questions and discussion

What industries should we focus on?



Redwood Coast Region: People-commerce tends to move from the mountains west

Five quality factors identify Targets of Opportunity

Expanding Opportunity	Job Growth Firm Growth
Growing Quality	Job Quality...higher and increasing wages
Improving Competitiveness	Strong and/or growing regional specialization
Career Potential	Occupational dynamics and distribution
Key Linkages	Important relationships and common needs

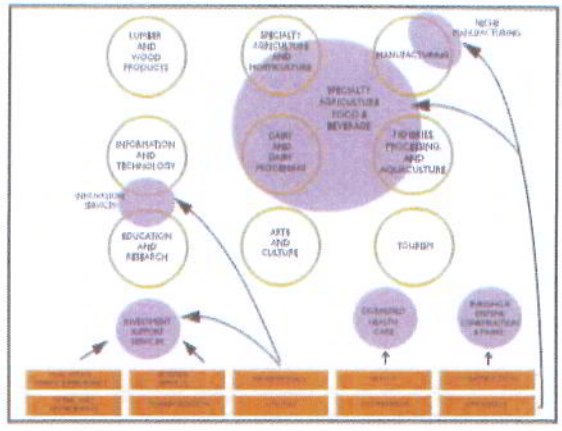
Six Targets of Opportunity

- Diversified Health Care
- Building and Systems Construction and Maintenance
- Specialty Agriculture, Food, and Beverage
- Investment Support Services
- Management and Innovation Services
- Niche Manufacturing

How much do the Targets matter?

Criteria	Region	Targets
Job growth	4%	37%
Firm growth	1.5%	23%
Wage growth	6%	10-26%

Together, the Targets of Opportunity Industries contributed 39% of the jobs and 53% of the wages in the region's private sector over the last 15 years.



Growing Occupations by Title

Redwood Coast Growing Occupations by Target Area

	12	11	8	5	4	2
	14	17	12	10	8	10

Assets for Industries/Businesses

- Natural amenities desirable to talent workforce
- Small town communities
- Diversity of industries
- Culture of entrepreneurship
- Air transportation
- Community values
- Natural resources, including water
- Long growing season and micro-climates
- HSU, CR, K-12 quality of education access

Economic Development Assets

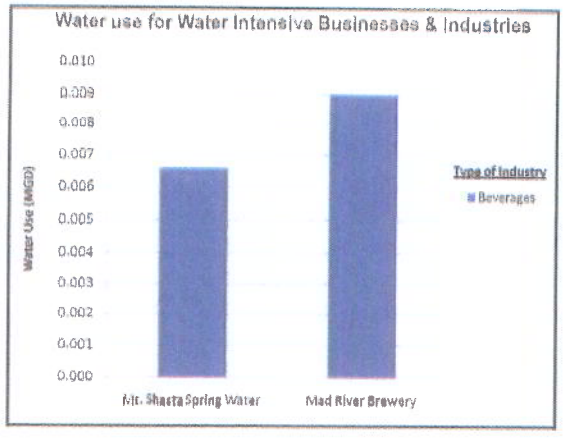
- Enterprise Zone
- Foreign Trade Zone
- Substantial lending capital
  - EDA RLF at RREDC
  - Loan funds at AEDC
  - Recycling Market Development Zone
  - Headwaters Fund RLF
- Small business start up and expansion assistance
- Industry cluster stimulation projects

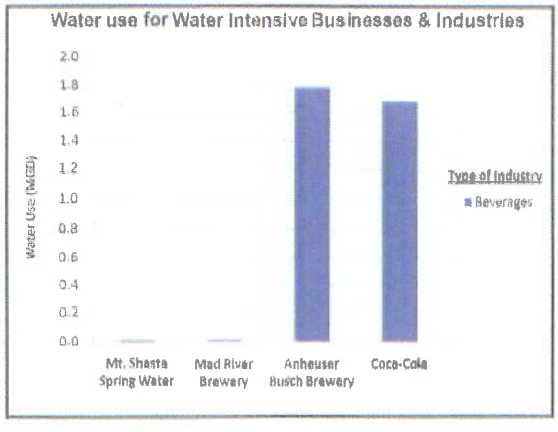
Liabilities for Industries/Businesses

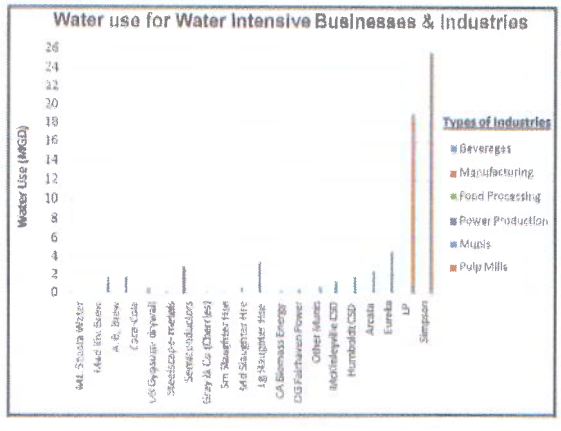
- Transportation
  - Interstate trucks cannot ship in/out
  - Railroad is down
  - Port is not viable for shipping currently
- Limited broadband access and threats to service
- Community values
- Low population density
- Remoteness from urban area
- Past dependence on resource extraction
- Aging infrastructure
- Access to land for development (or permitting)

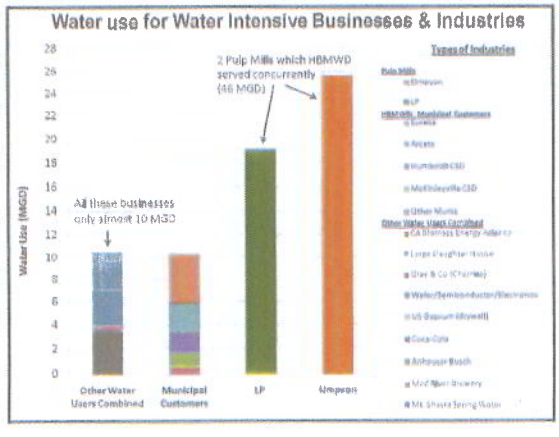
Balance Sheet of Assets and Liabilities

ASSETS	LIABILITIES
• Quality of life, place	o Transportation
• Natural resources	o Broadband limits
• Culture of entrepreneurship	o Low population density
• Diversity of industries	o Remoteness from urban area
• Education system	o Past dependence on resource extraction
• Airport	o Aging infrastructure
• Economic development	o Access to land









Likely industries to grow here with water access

- Specialty agriculture…water needed outside district
- Municipal…water needed outside district
- Beverage water for export
- *Others?*
- *Will they use what the pulp mills did?*

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OFFICE FOR ECONOMIC & COMMUNITY DEVELOPMENT

MEMORANDUM

To: Jacqueline Debets and Carol Rische, Humboldt Bay Municipal Water District

From: Adrienne Harling, OECD Competitive Intelligence Research Service

Date: January 7, 2010

Subject: Research Summary (Update)

Question: For several known water-intensive businesses, what is their daily water use, non-water related driving factors for determining facility location (including sensitivity to freight costs), and potential issues relating to discharge/waste products?

- Beverages
  - Beer Breweries
    - Anheuser Busch, Fairfield, CA
      - Source: phone interview by Pat Kaspari (Humboldt Bay Municipal Water District) of Phil Bennett (Anheuser Busch, 707-429-7595), December, 2009.
        - Produce 4.2 Million barrels of beer per year (1 barrel=31 gallons)
        - ***Use 1.78 Million Gallons of water per Day***
        - One of the largest breweries in the country; a similar sized facility is not likely to be built in California anytime soon
        - A more realistic size for a new facility would be 0.5 Million barrels per year, using an estimated 6 barrels of water per barrel of beer (332,143 gallons per day)
    - Mad River Brewery, Blue Lake, CA
      - Source: phone interview by Pat Kaspari (HBMWD) of Kevin Fischer (Mad River Brewery, 707-668-4151), December 2009.
        - ***Use ~9000 Gallons of water per day***
  - Coca-Cola
    - Bottling Facility in Downey, California
      - Source: phone interview by Adrienne Harling of Coca-Cola quality control manager at the Downey facility (Coca-Cola, 562-803-8100)
        - Use 70,000 gallons of water per hour (they are a "very large" production facility – defining their output volume was considered confidential).

        - Their bottled water product *Dasani* is produced at the same facilities as the other Coca-Cola soft drink products.
        - Transportation cost and availability plays a "huge role" in where facilities are located. Rail access is not necessary.
    - Bottled Water
        - Fiji-Roxane (by Crystal Geyser), 760-764-2885
            - Source: telephone interview with representative of Fiji-Roxane by Adrienne Harling on December 23, 2009
                - Did not have specific figures about daily water use, but did indicate that they only use spring water.
        - Mt Shasta Spring Water Co Inc, Mount Shasta, CA 530-926-5854
            - Source: Phone interview with Mark (Mt Shasta Spring Water) by Adrienne Harling on December 23, 2009
                - Regional operation with 15,000 customers
                - Bottle 3 and 5 gallon containers
                - Use 2.4 Million gallons of water per year
                - Adrienne's math (please check for errors): ***0.0066 Millions of gallons per day***
- Gypsum Board
    - US Gypsum (Fremont, CA 510-794-6282)
        - Source: April 15, 2004 letter from Parsons Brinckerhoff Quade & Douglas, Inc. to the Humboldt Bay Municipal Water District
            - Average water usage: ***0.30 mgd***
            - Peak water usage: ***0.90 mgd***
        - Source: email between Marie Liscom and Carol Rische on December 14, 2009
            - In 2005 US Gypsum's water use was ***500,000 gallons of water per day***
- Aquaculture
- Solar Hot Water Systems
    - Fafco Inc, Chico CA
        - Source: phone interview of representative of Fafco, Inc. by Adrienne Harling on December 21, 2009
            - Representative explained that they don't use very much water and that hot water system manufacturing is not water intensive in general.
- Power Generation
    - Source: April 15, 2004 letter from Parsons Brinckerhoff Quade & Douglas, Inc. to the Humboldt Bay Municipal Water District
        - "a power plant generating a continuous average of 10MW would require approximately ***20 mgd*** of water. Estimates for a future power plant project in Humboldt County forecasted as much as ***30 mgd***, again depending on the water source and cooling system design."
    - California Biomass Energy Alliance, Somis, CA 805-386-4343
        - Source: telephone interview of Phil Reese (CBEA) by Adrienne Harling on December 23, 2009
            - Water use would be about 10th on the list of considerations for developing a new biomass plant.
            - Driving factors for developing a new plant are 1) getting a long term contract with a buyer (like PG&E) that is high enough to pay for

permitting and building, 2) difficulty of permitting new plant (they tend to get a lot of opposition) and 3) availability of wood waste (needs 10,000 tons of wood waste per year per MW)
        - Water use: a plant between 20 and 50 MW would use 9 acre feet per year per MW in a cool climate. In a hot climate, a plant of the same size would use 15 acre feet per year per MW. 1 acre ft. = 325,000 gallons
        - Adrienne's math based on cool climate numbers (please check for accuracy!): ***A 20 MW plant would use 180 acre feet of water per year=58,500,000 gallons of water per year=160,273 gallons per day***
        - Building a plant smaller than 20MW is not feasible because "economies of scale work too much against you"
        - Another potentially more feasible possibility is to expand an existing plant
    - DG Fairhaven Power
        - Source: 2009 Retail Water Rate Study for Humboldt Bay Municipal Water District as cited in email from Carol Rische to Adrienne Harling on December 28, 2009
            - 15,252,200 CF in 2008
- Metals Manufacturing
    - Company: Steelscape
        - Source: April 15, 2004 letter from Parsons Brinckerhoff Quade & Douglas, Inc. to the Humboldt Bay Municipal Water District
            - ***Average Water Usage: 0.13 mgd***
            - ***Peak Water Usage: 0.40 mgd***
- Food Processing
    - Source: Morrison, Jason, Mari Morikawa, Michael Murphy, and Peter Schulte. 2009. Water Scarcity & Climate Change: Growing Risks for Business & Investors. Oakland: Pacific Institute and Boston: Ceres. http://www.pacinst.org/reports/business_water_climate/full_report.pdf
        - Uses water as a product ingredient, washing, cleaning, pasteurization (steam)
        - High wastewater discharge
    - Source: Mannapperuma, Jatal D., E.D. Yates and R. Paul Singh. 1993. Survey of Water Use in the California Food Processing Industry. 1993 Food Industry Environmental Conference. http://www.p2pays.org/ref/13/12908.pdf

Product	Flow Gallons per ton	BOD lb per ton	TSS lb per ton
Apple Sauce	275		
Apricots	2,992	39.0	9.0
Artichokes	766	3.3	3.9
Asparagus	808		
Brussels Sprout	813		
Cheese	1,700	1000	29.0
Cherry	11,932	102	21.0
Frozen Fruits	1,780		
Garlic	2,800	1.8	
Meat	4,000		
Mushrooms	1,818	1.8	0.8
Mushrooms*	781		
Onions	1,000		
Pears	4,174	11.0	6.0
Pumpkins	3,690		
Raisins	2,000	75.0	15.0
Seafood	2,700	12.9	7.9
Seafood*	2,662		4.0
Specialty	3,514		12.7
Vegetable Oils	2,111	1.1	0.3
Yams	6,094	8	3.0
Yams*	4,186	39.8	22.3
Zucchini	7,975	340	104.0

* Data from two different plants

-
- Cherries
  - Gray & Co, Forest Grove, OR
    - Source: telephone interview of Chad Duherst (Gray & Co, 503-357-3141) by Adrienne Harling (HSU Office for Economic Community and Business Development) on December 17, 2009.
      - Produce 50-60,000 lbs of canned maraschino cherries in one production day
      - ***Use 60-70,000 gallons of water per day (average) and 100,000 gallons of water per day (peak)***
      - Primary considerations for siting a new facility (and they are looking to relocate) are:
        - Disposal of wastewater (high in sulfur and sugar content)
        - Availability of natural gas
        - Access to rail
        - Trained labor (specialized skills required)
        - Access to/expense of water not a driving factor
      - Lack of access to full size trucks is a major disadvantage to attraction to area; they ship out 4-5 truckloads per day of product
- Meat
  - Harris Ranch Beef Company, Selma, CA, 559-896-3081
    - Source: phone interview of representative of Harris Ranch Beef Company by Adrienne Harling on December 23, 2009

    - General rule of thumb: 450-500 gallons of water per head (for slaughter plants using water conservatively)
    - Small facilities may do 200 head per day, medium may do 1200 per day, and large plants may do 7000 per day.
    - Adrienne's math based on 475 gallons of water per head (check for accuracy!): ***for small slaughterhouse: 95000 gallons of water per day, for medium slaughterhouse: 570000 gallons of water per day, for large slaughterhouse: 3,325,000 gallons of water per day.***
    - Driving site considerations are proximity to feed lots and ability to transport animals from feed lots to slaughter facility; this factor is more important than transportation to customers
    - Rail is not used for transport
- Silicon wafer/semiconductor and electronic parts manufacturing
    - Source: Morrison, Jason, Mari Morikawa, Michael Murphy, and Peter Schulte. 2009. Water Scarcity & Climate Change: Growing Risks for Business & Investors. Oakland: Pacific Institute and Boston: Ceres. http://www.pacinst.org/reports/business_water_climate/full_report.pdf
        - Requires "ultra-pure water for wafer manufacturing; Freshwater for scrubbing and cooling; a typical fab can use as much as ***3 million gallons of water per day***"
        - Discharge amount is high and the wastewater contains heavy metal and toxic chemicals

Estimated Value of Services

Humboldt State University is offering Competitive Intelligence Services free of charge to qualifying businesses until January 1, 2010. Then, we will implement a fee schedule for these services at approximately 40% of what it would cost from an independent source. We estimate that the value of the services we have provided, as described in this memo and if provided through an independent source, is approximately $1800.

Because Humboldt State University is dedicated to community and economic development of the North Coast, we intend to secure grant support for this service on an ongoing basis to keep the fees as low as possible. Therefore, the estimated value of this research assignment provided by our office after December 2009 would be $720. Please consider budgeting for Competitive Intelligence Research Services in the future.

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OFFICE FOR ECONOMIC & COMMUNITY DEVELOPMENT

MEMORANDUM

To: Jacqueline Debets, Humboldt Bay Municipal Water District

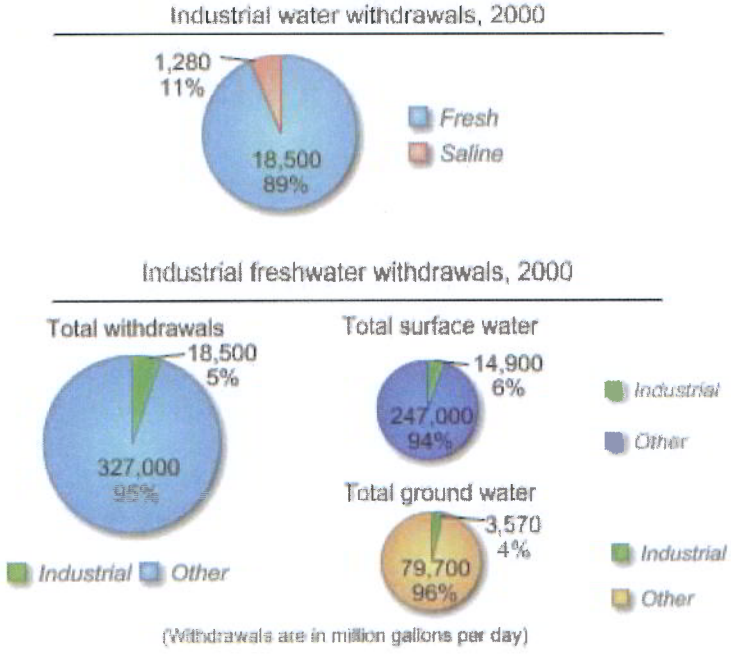
From: Adrienne Harling, OECD Competitive Intelligence Research Service

Date: October 28, 2009

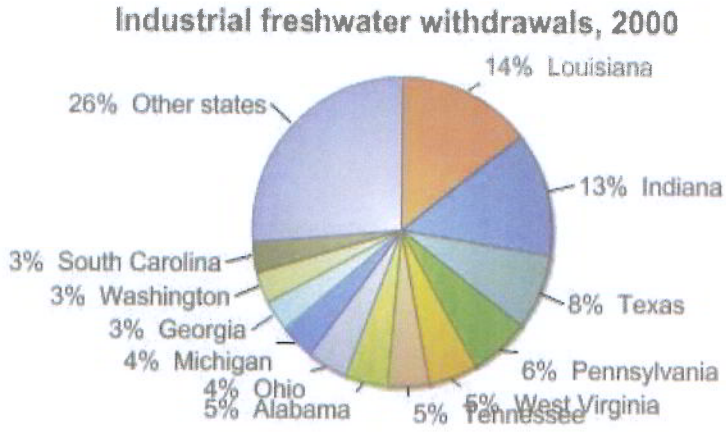
Subject: Research Summary

What industries/products are the most water-intensive within the United States?

Overview of Industrial Water Use on a National Level (Source: 2)

- In 2000, total US industrial water withdrawals were an estimated 19,700 Million gallons per day, with 18,500 (89%) freshwater and 14,900 Mgal/d surface freshwater.
- 

- The states using the most industrial freshwater are Louisiana (14%), Indiana (13%), and Texas (8%).



Water-Intensive Industries (National)

- Overview:
  - Industrial water use reporting on the national level is limited:
    - "The USGS Water Use Program does not provide industrial water-use estimates by industry at the national level" (Source: 3)
    - Corporate reporting on water use is inconsistent and "lack of context in water reporting undermines the understandability and usefulness of the data provided" (Source: 1)
  - Appendix A of Source 6 has a detailed analysis of the water footprint intensity for eight water-intensive industries
  - ***The following industries are generally identified as being the most water-intensive: Apparel, Automobile, Beverage, Biotech/Pharmaceutical, Chemical, Forest Products, Food Manufacturing, High-technology/Electronics, Metal Mining, Refining, Utility, Paper Products, Coal Products*** (Sources: 1, 3, 4, 5)
  - ***"Raw material production is generally the most water-intensive segment of industries' value chains, such as in apparel, food, and beverage manufacturing".*** (Source: 6)
- Specific Industries:
  - Beverages
    - "Beverage manufacturing requires high quality source water, putting the water use of this industry in direct competition with local populations and their drinking water needs." (Source: 6)
    - "It takes roughly 20 gallons of water to make a pint of beer, as much as 132 gallons of water to make a 2-liter bottle of soda, 39000 gallons of water to produce the average domestic car, including the tires and about 5000 gallons of water to grow a day's good for a family of four." (Source: 7)
    - "The total water involved in producing beer is overwhelmingly used on the farm rather than in the brewery" (Source: 8)
    - "In South Africa, the total water footprint is equivalent to 155 litres of water for every 1 litre of beer...with the vast majority of water use (98.3%) associated with crop production, both local and imported" (Source: 8)

        - 75 liters of water are required for once glass (250 ml) of beer (largely from producing the barley). (Source: 16)
    - Apparel
        - "Cotton production is the most water-intensive value chain segment for the apparel sector....Cotton is a hugely thirsty plant requiring 25 cubic meters of water for each 250 grams of cotton produced – the amount needed for the average T-shirt." (Source: 6)
        - "Freshwater is an essential resource for textile processing such as dyeing or bleaching. Yet, a large percentage of textile/garment manufacturing operations are located in water-scarce regions such as Southeast Asia, India and other areas where local communities lack access to reliable and affordable drinking water." (Source: 6)
        - One cotton shirt requires 2700 liters of water (Source: 16)
    - High-Tech/Electronics
        - "The most significant portion of the industry's water footprint [is] associated with semiconductor manufacturing. Intel and Texas Instruments alone used more than 11 billion gallons of ultra-pure water for cleaning and rinsing in the production of silicon chips in 2007." (Source: 6)
        - "Electronic waste (e-waste) can cause extensive contamination of groundwater resources and local ecosystems, which, in turn, can lead to health concerns, regulatory controls, and adverse reputational impacts....e-waste is concentrated with heavy metals, such as chromium, zinc, lead, copper, manganese, selenium, and arsenic that leach into groundwater sources more than other municipal solid wastes." (Source: 6)
    - Food
        - "Roughly 70 percent of the water used globally is for agriculture, with as much as 90 percent of water dedicated to agriculture in developing countries." (Source: 6)
        - One 100 gram apple requires 70 liters to produce; one glass of apple juice (200 ml) costs about 190 liters of water. (Source: 16)
        - One kg of beef costs 15500 liters of water to produce (Source: 16)
        - One kg cheese requires 5000 liters of water (Source: 16)
    - Biotechnology/Pharmaceuticals
        - "Because of the high concentration of chemicals and microbial organisms in wastewater released in manufacturing processes, leaks into natural water resources and surrounding ecosystems can be quite harmful. Such spills can severely damage companies' reputation and brand image. For example, in 2007 pharmaceutical giant Merck agreed to pay $20 million in assorted fines, environmental improvements and cleanup costs as a consequence of polluting Wissahickon Creek in Pennsylvania with a chemical discharge that resulted in fish kills and fouled drinking water supplies." (Source: 6)
    - Forest Products
        - "[Forest Products] is very water and energy intensive, especially in pulp and paper manufacturing. In the United States, for instance, the forest products sector is the third-largest water user among industrial manufacturers. Pulp and paper manufacturing is also the third-largest consumer of fossil energy among U.S. manufacturing sectors, representing 12 percent of total energy

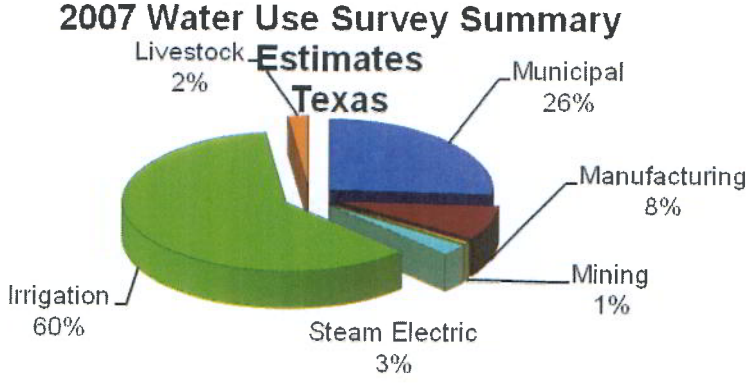
consumption by U.S. manufacturing industries in 2002. Paper and pulp manufacturing also produces a significant amount of wastewater." (Source: 6)
        - "[Water Footprint Network] states that the paper industry uses 10 liters of water to produce a sheet of A4". (Source: 14)
    - Metals/Mining
        - Mining locations are determined by the location of ore and therefore cannot be relocated on the basis of water availability. (Source: 6)
    - Electric Power/Energy
        - "The electric power industry requires a consistent supply of water, and accounts for 39 percent of total freshwater withdrawals in the U.S. Fossil fuel plants and nuclear power plants require about 140 liters and 200 liters of water per kilowatt-hour of electricity produced, respectively." (Source: 6)
        - "Heated discharges from power plants have a harmful effect on water quality and local ecosystems." (Source: 6)

Selected State Information on Industrial Water Use/Water-Intensive Industries

- Louisiana (Source: 4)
    - "Industry in Lousiana withdrew approximately 3100 Mgal/d of water in 2005", with 2800 Mgal/d from surface water sources.
    -

Standard Industrial Classification	Surface Water Withdrawls (Mgal/d)
Oil and Gas Extraction	2.58
Nonfuels/nonmetals mining	.05
Food Products	25.88
Paper products	109.08
Chemicals	2218.84
Petroleum refining	486.02
Primary metals	1.00

- Indiana (Source: 9)
    - "Indiana water users withdraw approximately 10,700 million gallons of water per day from our ground and surface water resources. Surface water for energy production (water used for cooling in coal-fired power plants) accounts for the largest part (65%) of the state's total reported water use. Indiana continues to rank among the highest industrial self-supplied water users in the U.S. (2,300 Mgal/day)..."
- Texas (Source: 10)
    -



Last updated on 08/28/2009 - Estimates may be revised as additional or more accurate data becomes available through survey responses.

- California (Source: 15)
  - Industrial water use in 2000: 665,000 Acre Feet/Year
  - California's most water intensive industries in 2000 were: Refining (84 Thousand Acre Feet (TAF)), High Tech (75 TAF), Fruit and Vegetable Processing (70 TAF), Beverage Processing (57 TAF), Textiles (29 TAF), Paper (22 TAF), Fabricated Metals (20 TAF), Dairy Processing (17 TAF), and Meat Processing (15 TAF)
  - **Table C-1 Water Use Coefficients by SIC Code, Industrial Sector**

SIC	Description	Gallons per employee per day (GED)[1]
20	Food and kindred products	1,967
21	Tobacco manufactures	N/A
22	Textile mill products	1,530
23	Apparel and other textile products	37
24	Lumber and wood products	2,144
25	Furniture and fixtures	53
26	Paper and allied products	1,000
27	Printing and publishing	98
28	Chemicals and allied products	833
29	Petroleum and coal products	11,399
30	Rubber and misc. plastics products	120
31	Leather and leather products	32
32	Stone, clay, glass, and concrete prod.	1,304
33	Primary metal industries	1,318
34	Fabricated metal products	738
35	Industrial machinery and equipment	110
36	Electrical and electronic equipment	284
37	Transportation equipment	228
38	Instruments and related products	142
39	Misc. manufacturing industries	86

[1] Based on a 225-day year

Other regional campaigns for attracting water-intensive industry

- Milwaukee, WI.
  - See http://water.mpw.net/files/MWW_for_Business.pdf for their brochure advertising their water resources to businesses
- Dayton, OH (Source: 5)
  - "The Dayton municipal water system sees daily consumption of about 70 million gallons, with an additional total capacity of 100 million gallons daily."

- Dayton Development Coalition has launched a campaign to attract industry to their water abundance (called H20pen for business)
- "IT, food and beverage, utilities, those are just a few [water intensive industries] that just jump out"
- "It's not just business. Those involved hope to capitalize on the recreation possibilities of a river system 'that's still flowing in the warmer months'"
- An idea to host an annual water conference/trade show came up in recent discussions by business development participants in the area.
- See http://www.h2openforbusiness.com/, and http://www.getmidwest.com/regionOverview/watersupply.cfm?sectionID=ro&subNavID=10&subNav2ID=0) to see more details about the H20pen for business campaign

Information about non-use value of freshwater resources

- Decreasing water use is a trend within water-intensive industries (Sources: 12, 13, 14)
- See http://www.csc.noaa.gov/coastal/economics/index.htm for an overview of economic valuation of non-use values of environmental resources
- Direct Utility Avoided Costs/Environmental Benefits Models: "The purpose of the Direct Utility Avoided Costs and Avoided Benefits Studies project was to conduct research and develop a model that will assist water utilities with calculating avoided costs and developing methods to quantify for the first time the environment benefits and costs associated with implementation of water efficiency programs": http://www.cuwcc.org/resource-center/technical-resources/bmp-tools/direct-utility-ac-eb-models.aspx (Source: 17)

Sources:

1. Pacific Institute's Corporate Reporting on Water: A Review of Eleven Global Industries (http://www.pacinst.org/reports/water_reporting/corporate_reporting_on_water.pdf)
2. USGS Summary of industrial water withdrawals, 2000 (http://ga.water.usgs.gov/edu/wuin.html)
3. email correspondence on October 29, 2009 between Adrienne Harling (researcher) and Nancy Barber (USGS Water Use Team)
4. Water Use In Louisiana, 2005 (http://la.water.usgs.gov/pdfs/WaterUse2005.pdf)
5. Gnau, Thomas. August, 2009. *Abundant water supply could open up opportunities for region.* Cox News Service (press release). Retrieved from Factiva.com on October 29, 2009.
6. Morrison, J., Morikawa, M., Murphy, M., and Schulte, P. 2009. *Water Scarcity & Climate Change: Growing Risks for Businesses & Investors.* Pacific Institute. http://www.pacinst.org/reports/business_water_climate/full_report.pdf)
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8. Targeted News Service. August 18, 2009. *Water Footprint of Beer More on the Farm than in the Brewery.* Retrieved from Factiva.com on October 29, 2009.)
9. Indiana Water Program overview http://www.iwrrc.org/
10. 2007 Texas Water Use Summary Estimates (Texas Water Development Board) http://www.twdb.state.tx.us/wrpi/wus/2007est/2007wus.htm
11. California Urban Water Conservation Council http://www.cuwcc.org/default.aspx
12. Adams, Barry. October 24, 2009. *Boiling it down: Brewers are trying to reduce water use while keeping the beer flowing.* Wisconsin State Journal. Retrieved from Gale Company and Resource Center on November 4, 2009.

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14. Toland, Justin. March 2009. *How big is your water footprint?* Pulp & Paper International 51(3): p32. Retrieved from Gale and Company Resource Center November 4, 2009.
15. Gleick, Peter H., Haasz, Dana, Henges-Jeck, Christine et al. November 2003. *Waste Not, Want Not: The Potential for Urban Water Conservation in California.* Berkeley, CA: Pacific Institute.
16. Water Footprint Network Product Gallery http://www.waterfootprint.org/?page=files/productgallery
17. California Urban Water Conservation Council http://www.cuwcc.org/

Estimated Value of Services

Humboldt State University is offering Competitive Intelligence Services free of charge to qualifying businesses during the first year of the Competitive Intelligence Research Service. After this pilot year, we will implement a fee schedule for these services at approximately 20% of what it would cost from an independent source. We estimate that the value of the services we have provided, as described in this memo and if provided through an independent source, is approximately $2400.

Because Humboldt State University is dedicated to community and economic development of the North Coast, we intend to secure grant support for this service on an ongoing basis to keep the fees as low as possible. Therefore, the estimated value of this research assignment provided by our office after December 2009 would be $480. Please consider budgeting for Competitive Intelligence Research Services in the future.

Session notes for
"How do the District's current and potential futures affect the Mad River?"

Aldaron Laird, HBMWD Director
Sheri Woo, PE, HT Harvey & Associates

These notes are intended to provide additional information that we were unable to fit into our 30 minute presentation.

Our approach to evaluate the potential environmental effects of the water use options was to:

- Identify the flows that would likely occur in the river under each option
- Create an effects evaluation table, with options/flows as column headers, and environmental resources as rows
- List the unknowns and areas of uncertainty that are important

From morning sessions, we learned that we have identified 2 options of water rights and 3 types of water uses:

1) License now and forfeit the unused water

2) Use our water right fully, which includes:

   2A. Increase water use for instream purposes
   2B. Increase water use within the HBMWD service area
   2C. Increase water use outside of the HBMWD service area
   2D. Combination of uses

(We are limiting ourselves to evaluating effects during summer because District operations have little hydrologic effect on winter flows.)

From the standpoint of flow in the river, the 5 scenarios are really only 3 because once the flow is diverted, the river doesn't "care" what happens to it, and because Use 2D is within the range of flows that would result from Uses 2A and 2B/2C. Therefore, the 3 options from the river's perspective are:

1. Store the water in Ruth Reservoir, and release only that flow needed for municipal use and minimum bypass flows.

2A. Release water from Ruth Reservoir for hydropower, instream beneficial use, and municipal use, with no flow being diverted by the District's surface diversion facility.

2B/2C. Release water from Ruth Reservoir for diversion down river at the District's surface diversion facility, for some type of consumptive use either in or outside of the District's service area as well as for diversion for municipal use and minimum bypass flows.

Based on the geography of the river and the District's operations, we view the river as two distinct reaches, 1) the "upper river" that is the 75 miles from Matthews Dam to Essex, and 2) the "lower river" that is the 9 miles from Essex to the ocean, including the estuary.

Units: when talking about the District's operations, we think in terms of MGD. But hydrologists generally use cubic feet per second (cfs) when talking about river flows. The attorneys use acre-ft per year. Conversion is MGD x 1.55 = cfs.

Table 1. Approximate flows due to District operations.

Type/purpose of flow	Flow in MGD	Flow in cfs
Maximum surface diversion at Essex	60	93
Flow used by municipalities via Ranney wells at Essex	20	31
Minimum bypass flow required by District's permits	16	25

Minimum bypass flows are set at "natural conditions" or 25 cfs whatever is less. For this analysis, we assume bypass flows are 25 cfs.

We present flows in a table and graphically (see PPT slides).

Table 2. How summer flows would change from current conditions under 3 water uses options. The District currently releases up to 31 cfs for municipal use plus ~25 cfs for bypass flow. **NOTE:** All flows are approximate because tributary flows and summer baseflows have not been considered; our purpose is to provide a general view of flow controlled by the District under these options.

Option	Flow resulting from option in "upper river" from Ruth Reservoir to Essex	Flow resulting from option in "lower river" from Essex through the estuary
1. Store the water in Ruth Reservoir, and release only that flow needed for municipal use and minimum bypass flows.	No change in current release from Ruth (~56 cfs)	No change in bypass flows (~25 cfs)
2A. Release water from Ruth Reservoir for hydropower, instream beneficial uses, and municipal use, with no flow being diverted to the District's surface diversion facility	Release 93 cfs to generate hydropower and instream flow including 31 cfs for municipal use, for a total of 124 cfs	Flow to lower river and estuary increased to ~62-118 cfs.
2B/2C. Release water from Ruth Reservoir for diversion down river at the District's surface diversion facility and Ranney wells as well as for bypass flows	Release an additional 93 cfs, plus 56 cfs for municipal and bypass flows, for a total of approx 149 cfs	No change in bypass flows (~25 cfs)

Important points from Table 1 and PPT slides:

- River "sees" no difference between 2B and 2C. Once water is diverted, river "doesn't care" if the use is local or outside of District service area.
- One option (Option 2A) can potentially affect the estuary
- Even under the "forfeit the unused water right" option (Option 1), the river still will flow in the summer because the District must supply the municipal customers and the minimum bypass flow requirement. So there will be no return to "natural" conditions when the upper river would become dry in the summer, and the mouth would close.

To systematically evaluate the potential ecological effects of these options, we created a table with the options as the column headers, and environmental resources that could experience effects (impacts and benefits) as the row headers.

We filled out the table based on 1) the District's approved Habitat Conservation Plan (the "HCP"), and 2) on personal communications with scientists and engineers with specific experience on the Mad River. The scientists and engineers who generously gave time and thought to potential effects are:

- Neal Carnam, Winzler & Kelly
- Randy Klein, Redwood National Parks
- Bill Trush, McBain & Trush
- Frank Shaughnessy, Humboldt State University
- Dennis Halligan, Stillwater Sciences
- Phillip Bairrington, California Department of Fish and Game

Any errors in these session notes are ours, not theirs!

In our presentation, we focused on the most important or surprising findings, but we present the complete evaluation tables here. We evaluated possible effects by location, the upper river (Table 3) and the lower river and estuary (Table 4).

Assumed:

- Continued operation of Matthews Dam and Ruth Reservoir to supply municipal customers
- Winter flows remain relatively unaffected by Matthews Dam and Ruth Reservoir (our concerns are primarily summer flows and effects)

Table 3. Possible environmental effects from water use options on the "upper river" of the Mad River

Environmental resources potentially affected	1.Release only that flow needed for municipal and minimum bypass flows. No surface diversion.	2A. Release for hydropower, instream flow beneficial uses, and municipal use. No surface diversion.	2B/2C. Release for surface diversion and municipal use wells and minimum bypass flows.
Hydrology	Releases to supply municipal Ranney wells (31 cfs) and minimum bypass flows (25 cfs), summing to 56 cfs	Would have higher flows than current or natural conditions during summer. The approximate maximum release from Ruth Reservoir is 124 cfs.	Dependent on flows required for the surface diversion, but range would be a maximum of 149 cfs
Geomorphology	No major geomorphic changes expected because geomorphic changes result primarily from large winter flows.	Again, no major geomorphic changes expected because geomorphic changes result primarily from large winter flows.	Again, no major geomorphic changes expected; any changes would be within range of those resulting from Options 1 to 2A.

Environmental resources potentially affected	1.Release only that flow needed for municipal and minimum bypass flows. No surface diversion.	2A. Release for hydropower, instream flow beneficial uses, and municipal use. No surface diversion.	2B/2C. Release for surface diversion and municipal use wells and minimum bypass flows.
Salmonid access to tributaries	Less flow and/or dry conditions would decrease access. Could exacerbate fish decline if tributary conditions are poor	Unknown if higher summer flows could significantly increase access between mainstem and tributaries, or allow summer steelhead to migrate farther up river than RM 53.	Any changes would be within range of those resulting from Options 1 to 2A.
Salmonid mainstem rearing habitat (District augments natural flow June through Oct, spawning occurs Nov through April)	Under natural hydrology the river above RM 61 often dried up. Any flow greater than natural flow will increase mainstem habitat area and depth of summer steelhead holding pools	Additional flow may increase mainstem habitat, but other habitat requirements need to be met such as substrate, cover, lack of predation, over-fishing. Higher flows could negatively affect pool thermal stratification, affecting adult summer steelhead and rearing juvenile salmonids.	Any changes would be within range of those resulting from Options 1 to 2A.
Riparian habitat area and quality	Riparian zone fairly narrow due to channel confinement. No change is expected with 56 cfs released from Matthews during the low flow season.	Additional summer flow is not expected to increase riparian area in upper confined reach but in the unconfined reach near Blue Lake, riparian habitat could increase.	Any changes would be within range of those resulting from Options 1 to 2A.
Water quality, especially temperature and algae	Water released from Matthews Dam will have a limited effect on water temperature downriver. Released water warms as if flows down 75 mi reach. Increased flows likely inhibit toxic algae growth.	Water released from Matthews Dam will likely have a limited effect on water temperature downriver even with additional flow. Released water warms as if flows down 75 mi reach. Increased flows would continue to inhibit toxic algae growth.	Any changes would be within range of those resulting from Options 1 to 2A.
Non-salmonid freshwater and riparian species of concern such as red-legged frog, green sturgeon, lamprey, willow flycatcher.	No change is expected with 56 cfs released from Matthews during the low flow season.	Additional flow could benefit some species, but many other factors affecting them. Currently, these species are declining even though the District has provided more summer flow since 1962, than under pre-District natural conditions.	Any changes would be within range of those resulting from Options 1 to 2A.

Environmental resources potentially affected	1.Release only that flow needed for municipal and minimum bypass flows. No surface diversion.	2A. Release for hydropower, instream flow beneficial uses, and municipal use. No surface diversion.	2B/2C. Release for surface diversion and municipal use wells and minimum bypass flows.
Invasive species of concern such as bullfrogs, New Zealand mudsnail	Negative effects on bullfrogs would be beneficial to red-legged frogs and juvenile salmonids. Timing of flows might be able to benefit red-legged frogs at expense of bullfrogs.	Higher flows could increase bullfrog habitat with no other control measures, which would negatively affect salmonids, red-legged frogs, and other native species.	Any changes would be within range of those resulting from Options 1 to 2A.

Table 4. Possible environmental effects of water use options on the "lower river" and estuary of the Mad River

Environmental resources potentially affected	1. Release only that flow needed for municipal and minimum bypass flows. No surface diversion.	2A. Release for hydropower, instream flow beneficial uses, and municipal use. No surface diversion.	2B/2C. Release for surface diversion and municipal use.
Hydrology	Approx 56 cfs before Ranney wells at Essex, and 25 cfs after the wells (minimum bypass flows are 25 cfs)	Assuming no surface diversion, but subtracting the 31 cfs for municipal uses, could be as high as 93 cfs.	Dependent on instream flow released but range could be a approximately 25 cfs.
Geomorphology	Minimum bypass flows required downstream of Essex is natural flows or 25 cfs whichever is lower. Estuary would remain open	Mouth would remain open. Possible deepening of channel. Pool habitat unlikely to increase substantially. Indirect geomorphic changes could result if higher flows support riparian forests or adjacent wetlands.	Any changes would be within range of those resulting from Options 1 to 2A.
Salmonid access to tributaries	Less flow and/or dry conditions would decrease access. Could exacerbate fish decline if tributary conditions are poor	Increased flow could allow easier early season upstream migration. Unknown if higher summer flows could significantly increase access between mainstem and tributaries.	Any changes would be within range of those resulting from Options 1 to 2A.

Environmental resources potentially affected	1. Release only that flow needed for municipal and minimum bypass flows. No surface diversion.	2A. Release for hydropower, instream flow beneficial uses, and municipal use. No surface diversion.	2B/2C. Release for surface diversion and municipal use.
Salmonid mainstem rearing habitat	Under natural flows, freshwater to the estuary was minimal. The mouth would often close in late summer when freshwater inflow is minimal or non-existent. Bypass flows increase freshwater inflow, improve water quality, and keep the mouth open.	Additional flow may increase mainstem habitat, but other habitat requirements need to be met such as substrate, cover, lack of predation, over-fishing. May allow early season migration. Possible increase in benthic invertebrates, more food for juveniles.	Any changes would be within range of those resulting from Options 1 to 2A.
Riparian habitat area and quality	No change is expected with 56 cfs released from Matthews during the low flow season.	Additional flow throughout the summer could increase riparian habitat with a higher water table.	Any changes would be within range of those resulting from Options 1 to 2A.
Water quality, especially temperature, salinity, and algae	Water released from Matthews Dam will have a limited effect on water temperature downriver. Increasing flow above natural levels maybe diluting nutrient levels and maintaining water quality to prevent toxic algae "blooms" in the Mad River	Increased flow would likely inhibit toxic algae growth. Higher flows could negatively affect pool thermal stratification, affecting adult summer steelhead and rearing juvenile salmonids. Depending on instream flow released, would likely decrease salinity and potentially reduce brackish water habitat	Any changes would be within range of those resulting from Options 1 to 2A.
Non-salmonid freshwater and riparian species of concern such as red-legged frog, green sturgeon, lamprey, willow flycatcher.	No change is expected with 56 cfs released from Matthews during the low flow season.	Additional flow could benefit some species, but many other factors affecting their habitat and populations. Currently, these species are declining although the District provides more water during summer than under pre-District natural conditions.	Any changes would be within range of those resulting from Options 1 to 2A.

Environmental resources potentially affected	1. Release only that flow needed for municipal and minimum bypass flows. No surface diversion.	2A. Release for hydropower, instream flow beneficial uses, and municipal use. No surface diversion.	2B/2C. Release for surface diversion and municipal use.
Estuarine species of concern long fin smelt and tidewater goby	No change is expected with 56 cfs released from Matthews during the low flow season.	Additional flow will likely increase estuary habitat area, move the salt-fresh water boundary farther down river, reduce salinity and increase dissolved oxygen levels.	Any changes would be within range of those resulting from Options 1 to 2A
Invasive species of concern such as bullfrogs, New Zealand mudsnail	Negative effects on bullfrogs would be beneficial to red-legged frogs and juvenile salmonids. Timing of flows might be able to benefit red-legged frogs at expense of bullfrogs.	Higher flows could increase bullfrog habitat with no other control measures, which would negatively affect salmonids, red-legged frogs, and other native species; likely have no affect on New Zealand mud snails.	Any changes would be within range of those resulting from Options 1 to 2A.

Important points of Tables 3 and 4:

- The District's water management has increased summer flows; reaches would go dry prior to District releases.
- Under the hydropower/instream flow option, more freshwater will reach estuary, affecting the location and extent of the salt wedge. Extent of effects (negative and beneficial) on various species are unknown but would have to be considered further under any option selected.
- Increased summer flows may increase salmonid habitat area but whether that would translate to higher numbers of fish is unknown. Many other factors besides flow determine salmonid production.
- Increased summer flows improve water quality, which may explain why the Mad River does not experience blue green algae blooms, but the Van Duzen and Eel rivers do.
- In any change in water management, but particularly the hydropower/instream flow option, we will need to consider that some species might be "winners" and others "losers" because their habitat requirements vary.

Citations for photographs:

Clayton undated. Wild steelhead in Smith River. Pat Clayton, Fisheyeguy Photography, image 101. http://www.fisheyeguyphotography.com/trout-photo.asp?photoid=101. Date accessed 13 January 2010.

Goldsmith undated. Tidewater goby, Greg Goldsmith, USFWS. Tidewater goby photo gallery. http://www.fws.gov/arcata/es/fish/Goby/gallery/goby_gallery.html. Date accessed 13 January 2010.

Higgins 2009. Middle reach of Mad River.

Leenders 2003. North American bullfrog. Twan Leenders. http://www.nps.gov/prsf/naturescience/bullfrog.htm. Date accessed 13 January 2010.

Humboldt Bay Municpal Water District undated. Mad River below Matthews Dam.

Menke 2008. Willow flycatcher (Empidonax traillii). USFWS National Digital Library. Item ID 120-129. Date of original 9 June 2008. Date created 15 May 2009. http://www.fws.gov/digitalmedia/cdm4/item_viewer.php?CISOROOT=/natdiglib&CISOPTR=6508&CISOBOX=1&REC=4. Date accessed 13 January 2010.

Zuspan 2008. Middle reaches of river, steelhead holding and migration barriers.

Evaluating and Selecting Water Use Options:
A graphical method using the water use options criteria

Objectives:

- Introduce kite diagram
- Short explanation of how we go from criteria to kite diagram
- Pros/cons of this graphical approach

Once we have identified water use options, we can use the criteria to produce a kite diagram, which looks like this:

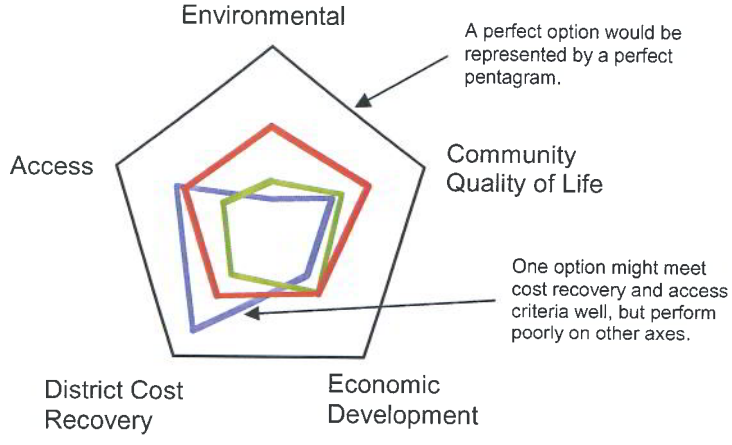

Figure 1. An example kite diagram representing how well 3 water use options (red, blue, and green options) meet the criteria within the groups we identified (environmental, community quality of life, economic development, District cost recovery, and access).

How to read a kite diagram: A perfect option would completely meet all criteria; it would be represented by the black pentagon. Less perfect (more realistic) options would be represented by pentagons inscribed inside. The colored pentagons tell us which criteria groups were not met very well; alternatively, they tell us which aspects of a water use option we could change, to approach a better, "perfect," option.

In the example kite diagram above, the blue option meets District cost recovery criteria well, but does not meet environmental criteria as well. We could then revise the blue option so that it meets environmental criteria better.

How we go from criteria to kite diagram

Overview: Sheri describes the criteria scoring sheets. Each AC member scores the options based on the criteria either together in meeting(s) or at home. Sheri and Pete Nelson (HT Harvey) crunch the data in the Raptools spreadsheet and provide kite diagram(s).

Scoring sheet for Water Use Option X (fill out a sheet for each option).

Criteria:	Fully meets	Somewhat meets	Doesn't meet
ENVIRONMENTAL			
maintain in-stream flows			
protect and maintain wildlife & fisheries			
enhance/inc habitat area/quality			
use least energy in water delivery			
ACCESS			
maintain use of as much flow as possible			
provide high qual water, meet/exceed standards			
provide sufficient water supply			
allows river/lake recreation			
protect/maintain access for Native Americans			
ECONOMIC DEVELOPMENT			
contribute to vital regional economy			
encourage tech innovation/entrepreneurship			
create or retain jobs in region			
DISTRICT COST RECOVERY			
contribute to covering District costs			
increase customer base			
decrease customer rates			
uses existing industrial infrastructure			
generates energy for use or sale			
COMMUNITY QUALITY OF LIFE			
supports and improve community health			
encourages community engagement			
inspires wide-spread community support			

What happens in the Raptools model: The "fully meets," "somewhat meets," and "doesn't meet" choices are actually numbers (2, 1, 0). The model uses a statistical approach called multi-dimensional scaling, "which is a nonparametric method that focuses the statistical analysis on the rankings of items (in this case, the scores), not on the numerical value of the score itself" (HT Harvey 2009). Statistics are performed on the rankings (the order) of the attributes, not on the numerical scores

Pros and Cons of this Graphical Approach

Advantages	Disadvantages
Allows us to compare options using numerous (20!) criteria	"Black box" model; the statistical arithmetic is hard to understand and explain
Allows us to have varying and individual opinions and scorings; uncertainty can be recognized and addressed	It is just a tool and not "the answer"; graphics can convey more certainty and validity than warranted
"Vetted" method used in fisheries resource management	Does not weight criteria (this could be an advantage!)
Kite diagrams easily understood once the "key" is understood	
It is an accepted tool in a new application, which is in keeping with our Water Resources Planning process!	