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Mr. Stephen F. Heringer, President
Reclamation District 999
38563 Netherlands Rd,
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SUBJECT: REVIEW OF WATER DIVERSION MEASUREMENT PROPOSALS AND PRACTICES

Dear Mr. Heringer:

BSK Associates, Inc. is pleased to provide the following review of existing and likely water diversion measurement requirements, current practices and implementability to address potential impacts to Reclamation District 999 and its member landowners from the various proposed water diversion monitoring requirements by the Department of Water Resources and the State Water Resource Control Board.

In summary, the current proposals are either cost-prohibitive, in the case of farm gate measurements and telemetry (at any scale), or simply un-implementable in the case of siphons, and are not locally cost effective. We recommend further engagement of the State agencies and investigation of the use of remote sensing as an alternative means of measurement.

If you have any questions regarding this analysis, please contact me at (916) 853-9293.

Sincerely,
BSK ASSOCIATES, INC.

Erik Ringelberg
Ecological Services Group Manager

REVIEW OF WATER DIVERSION MEASUREMENT PROPOSALS AND PRACTICES

Summary
The requirement to monitor and report agricultural water use, following the statutory interpretations "best available science" in the Delta under several of the proposed programs is prohibitively expensive and in some cases simply un-implementable unworkable, and loses sight of the actual monitoring needs.

Best available science does not mean using the expensive and/or fragile system that provides the greatest instantaneous accuracy, it means using the most appropriate system for the particular purpose. Appropriate is the balance between the costs to implement and maintain, and the degree of accuracy required to meet the regulatory requirements.

The unique requirements of measuring agricultural water, which is often full of debris and highly erosive sediments, having widely variable flows, and located in remote locations, often without power and communications, make this balance critical. The chronic vandalism and theft of agricultural meters and pumps exacerbates these challenges.

In just one example, in addition to the exceptional technical difficulties, the reasonableness of metering water use in the Delta must take into account that the estimated additional (incremental) *annual* cost of monitoring $36.12/affected acre,[1] water monitoring costs far greater than the cost of the water itself. The Office of the Delta Watermaster has taken a more reasonable approach for individual "farm gate" measurements, which includes[2] the alternative of using a power use conversion factor for small and older diversions and other locations that costs outweigh benefits. However in any case, diversion measurements using the common small siphons are simply un-implementable using current technologies.

It is incumbent for the State of California to bring the Department of Water Resources process in line with the State Water Board process (or at least stop holding the meetings on the same dates at the same times), to ensure the maximum social benefits at the lowest possible economic costs. A robust, cost effective, system that is comparable between locations, regions and State programs will provide the best value scientifically and socially.

It would seem that on a cost basis,[1] ease of implementation, and for regional comparability, the use of standard remote sensing techniques would be the most reasonable and in many cases, the most accurate means of assessing relative water use.

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[1] Table 4.6 Regional Incremental Costs of Measurement by Location. Independent Panel on Appropriate Measurement of Agricultural Water Use Convened by the California Bay-Delta Authority FINAL REPORT, SEPTEMBER 2003

[2] Nichole S. Baker Office of Delta Watermaster, May 3, 2011, Memo Measurement of Water Diversion

Discussion

The need to assess water use and maximize water use efficiency is a fundamental tenet of agriculture. Water agencies want to be able to deliver the legally /contractually stipulated amount at the agreed upon time at the lowest possible cost. Farmers want to be able to use the least water possible to grow a given crop at the lowest cost. Those costs are largely based on the pumping and distribution infrastructure, and associated electricity costs. There are also situations where the need to apply excess water beyond the marketable plant's immediate needs, such as to recover shallow groundwater, support streamflows, support enhanced wildlife use, support various cover crops, and to reduce salt loading.

The nature of agricultural water delivery is fundamentally different and its measurement vastly more complex and expensive than urban water delivery. A simple assessment of the systematic and widespread failure of urban water measurement, under relatively ideal conditions points to the likely failure of implementation and exorbitant costs following its application to agricultural settings. In addition to these simple pragmatic considerations, the stated need for water use data and the required accuracy point to a fundamental misunderstanding of the very nature of agricultural water use and its measurement.

Indeed, the scientific and technical community has already assessed these differences and come to the opposite conclusions. The following are a simple series of key findings from the Water Board's cited documents[3] used to illustrate the differences between the best available science and the policy recommendations. There are in fact numerous more technical analyses that come to the same findings, but these are presented as they are readily available to the reviewers:

> "Any implementation approach must be adaptive, include appropriate exemptions, and allow for local flexibility and creativity."
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> "Changes in methodology are not recommended at this time, since current practices—whether estimated or directly measured — a re considered sufficient to support both water transfers and efficient on-farm water management practices. More over, roughly 90% of all farm-gate deliveries are already measured at an accuracy of ± 6% by volume."
>
> "The Panel's recommended approach—using satellite-generated remote sensing to measure crop consumption—is expected to yield significantly better estimates than current practices."

Jack Keller articulated some of the fundamental challenges associated with agricultural water delivery, including: "Consequently, agricultural water measurement devices must handle a variety of flow rates under very difficult conditions. For example, while a water meter may work adequately at the beginning of the irrigation season when flow rates are high and debris is low, later in the season they may not work at all because flow rates

[3] Independent Panel on Appropriate Measurement of Agricultural Water Use Convened by the California Bay-Delta Authority FINAL REPORT, SEPTEMBER 2003

have been reduced below the operating range of the device or because aquatic weeds foul the impeller. Because agricultural delivery flow rates, system configurations, and water quality varies so much, agricultural water end user measurement defies a "one size fits all" solution."

> "As the Authority drafts its implementation approach, the Panel recommends it consider the following: (1) the need to accompany any measurement requirements with an appropriate set of available exemptions, variances and "secondbest" approaches; (2) the importance of focusing on how measurement "data" will be turned into "information" useful to governmental and private entities; and, (3) the necessity to provide staffing adequate to carry out certain labor-intensive measurement requirements or to implement approaches that allow requirements to be satisfied in a way that minimizes the labor involved."
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> "The Panel has some concern that certain measurement costs included in the analysis (particularly those for groundwater and crop consumption) may have been underestimated by the Technical Team. The Panel urges the Technical Team to either re-review their cost estimates or indicate that further refinement may be required."
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> "However, the Panel believes that the costs associated with changing those farm gates still at the basic level outweigh the benefits. Panel members also note the following: • The basic level of farm-gate measurement (which relies on estimated flow rates) is typically accurate to within ± 15% by volume."

These citations identify the need for a flexible, cost-effective and scientifically driven process. In counterpoint, the cited Policy for Maintaining Instream Flows in Northern California Coastal Streams Draft Revised April, 2010, State Water Resources Control Board, California Environmental Protection Agency, requires continuous, electronic in-line flow metering, with no standard exemptions, with the stated intent of providing real-time transmission. This is exactly the kind of inflexible, expensive and technically indefensible approach that should not be taken. It is unclear how this interpretation of the diversion requirements is reconciled with Water Code section 10608.4 (j): Support the economic productivity of California's agricultural, commercial, and industrial sectors, and subdivision (k): "Locally cost effective" means that the present value of the local benefits of implementing an agricultural efficiency water management.

Finally, the issue of continuous reporting of the data raises an additional and even more onerous and technically challenging element. The use of a flow totalizer or other logging instrument has a starting volume and an ending volume for each time period, which is typically calculated manually to arrive at the total volume used in a given period. Thus using the standard electronic reporting systems, these totalizers would provide a number without meaning. In order to continuously report these data in a meaningful way, the equipment has to be upgraded to a vastly more sophisticated and expensive system.

Then there is the actual transmission of the data. In the typical remote and without power locations of the Delta, the flow metering system would require a high security fence, solar power, backup power supply, electronic logger, and self-contained telemetry system. The purchase, installation and maintenance cost for which is all well beyond, estimated at 325-500%, the cost of the water it is measuring on an annual basis. For the typical portable siphon used throughout the Delta, these installations would require a trailer-mounted secure system at even greater cost.

As a result of our analysis of the above factors, I recommend that the District continue to coordinate with the Water Board and in particular, the Delta Watermaster to develop some sort of reasonable interpretation of the water reporting statutes that is achievable, and reflective of the other economic requirements under those statutes and other State mandates. To that end is appears, given the currently available information, that standard remote sensing techniques are a robust, cost effective, system that is comparable between locations, regions and State programs. These techniques were investigated in the cited[4] materials, but not described further in the polices, or proposed for use.

[4] Independent Panel on Appropriate Measurement of Agricultural Water Use Convened by the California Bay-Delta Authority FINAL REPORT, SEPTEMBER 2003