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August 7, 2014

Jeanine Townsend, Clerk to the Board
State Water Resources Control Board
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Via email to: commentletters@waterboards.ca.gov



Re: Comments on DRAFT CONCLUSIONS OF THE AGRICULTURAL EXPERT PANEL: RECOMMENDATIONS TO THE STATE WATER RESOURCES CONTROL BOARD PERTAINING TO THE IRRIGATED LANDS REGULATORY PROGRAM

Dear Members of the Agricultural Expert Panel:

The Kern River Watershed Coalition Authority (KRWCA) is a joint powers authority serving the coalition of landowners in the Kern River watershed. In addition to facilitating regulatory compliance for coalition members and representing growers in water quality issues, our goal is to develop and implement effective, economical, and scientifically valid water quality monitoring programs for surface and groundwater in the region. Therefore, the matters of the Agricultural Expert Panel are of great importance to us and our members.

We thank you for the opportunity to comment on the DRAFT CONCLUSIONS OF THE AGRICULTURAL EXPERT PANEL: RECOMMENDATIONS TO THE STATE WATER RESOURCES CONTROL BOARD PERTAINING TO THE IRRIGATED LANDS REGULATORY PROGRAM. We appreciate the work that has been done by the panel members as you have grappled with this complicated, challenging, and important issue. We believe that our approach is consistent with the draft report in many ways, particularly in our mutual focus on management practices. Our comments on the Expert Panel's Draft Report (July 7, 2014) are summarized below, and explained in more detail in the section that follows. Overall, the Kern River Watershed Coalition Authority maintains its position that the best way to comply with its Waste Discharge Orders is to use scientifically defensible and practical tools directed at agricultural management to focus and prioritize monitoring and nitrogen management improvement efforts within its coverage area.

For over the past two years, KRWCA and its experts have:

- Reviewed a significant body of scientific literature from throughout the USA and around the world;
- Provided numerous testimony before the State and Regional Boards regarding the unique nature of agriculture in the Kern Sub-Basin;
- Developed and conducted detailed sub-watershed-wide spatial analysis, including detailed development of the NHI and its applicability;
- Assessed groundwater conditions and variations within the Kern Sub-Basin;
- Reached out to multiple growers, understood their farming operations and limitations, and assessed their capabilities to track and report, as well as monitor their respective systems; and,



- Considered the recommendations of the Nitrogen Tracking and Reporting Task Force and the Agricultural Expert Panel.

Following all these and other efforts, we remain convinced that a regionally modified Nitrogen Groundwater Pollution Hazard Index (NHI), (with potential consideration of an added N management component) coupled with an understanding of groundwater quality and associated variability, is an entirely suitable and applicable methodology to achieve compliance with ILRP regulation.

KRWCA and its experts have consistently proposed and clearly justified NHI and groundwater assessment as a suitable combined methodology for assessing groundwater vulnerability and prioritizing regulatory efforts in our comments to the RWQCB during the ILRP process. We submit that recommendations from the Agricultural Expert Panel Draft Report have not provided convincing scientific rationale that there is a more suitable method that will address groundwater protection in agricultural settings in California, nor has it provided scientific justification for its criticism of the NHI. The Agricultural Expert Panel did not provide alternative tools to comply with the regulatory questions at hand, and though the conclusions address some important issues, many of which are consistent with what the KRWCA and its experts have been saying (e.g. limitations of an N balance, inappropriateness of deep groundwater nitrate concentrations as an indicator of current surface contributions, etc.), the recommendations for use of tools/methods/approaches was limited.

SUMMARY OF COMMENTS

The KRWCA is in agreement with the following findings:

1. Using an N-balance approach is problematic because of the high number of assumptions that need to be made, the variability in N dynamics spatially and temporally, and the difficulty in interpreting results.
2. Groundwater quality data alone, especially if it is collected from first-encountered groundwater, is a poor indication of the impact of current land use activities and management on groundwater, and should not be used to trigger regulatory restrictions or reporting.
3. Monitoring effectiveness is optimized by assigning a specific use to each piece of data collected, not necessarily by increasing monitoring efforts spatially or temporally.
4. Informed and enforced planning for all farmers is likely the most effective method of achieving the goals of the ILRP.

We submit the following observations and suggest that some findings need further clarification, discussion, and/or completion:

1. The lack of clarity regarding groundwater vulnerability assessment, in addition to the broad recommendations provided by the Nitrogen Tracking and Reporting Task Force, is indicative of the need for 1) more review and consideration of pertinent scientific literature on groundwater nitrate pollution in agricultural areas similar to California; 2) more thoughtful planning and consideration of how the Expert Panel recommendations can be used by coalitions to inform decisions.



2. The general discouragement of using indices such as NHI:
 - a) Is not congruent with the Expert Panel's recommendations to identify and prioritize areas or "sources" of groundwater quality impairment;
 - b) Does not consider the ancillary advantages of using such tools to educate and incentivize growers; and
 - c) Does not consider the potential for additions and/or modifications that can be made to such indices to tailor them to specific objectives and/or regional areas.
3. Though irrigation volume and its associated efficiency is a key factor influencing nitrate leaching risk and should be an integral part of irrigation planning, the Expert Panel does not address how to reconcile this concept with the fact that most growers do not know precisely how much water they apply. Installing meters and/or utilization of other measurement methods to collect that data would be a major infrastructure change of great effort and expense.
4. The finding that simple nitrogen reporting as recommended by the Expert Panel would not require mapping or spatial analysis efforts may be true for individual growers, but would most likely not be true for coalitions, who are encouraged by the Expert Panel to handle many regulatory tasks.

COMMENTS

A more detailed explanation of comments is provided below. Italics indicate text directly copied from the Expert Panel Draft Report text.

AGREEMENT WITH FINDINGS

1. **Using an N-balance approach is problematic because of the high number of assumptions that need to be made, the variability in N dynamics spatially and temporally, and the difficulty in interpreting results.** The Expert Panel states that *"The further one moves from the field into research and academia, testimony indicates that the idea of accounting for harvested nitrogen sounds more and more simple."* We agree that simple illustrations of the N cycle that depict it as a type of "bank account" where inputs can be reconciled with outputs are misleading and technically inaccurate. The use of an N-balance approach as a regulatory mechanism is fraught with error, misrepresentations and variability. This is supported by decades of scientific literature and in-field examples.
2. **Groundwater quality data, especially if it is collected from first-encountered groundwater, is a poor indication of the impact of current land use activities and management on groundwater, and should not be used to trigger regulatory restrictions or reporting.** This is especially true in the Kern Sub-basin where there is deep groundwater, and our previous comments have detailed how this and other factors contribute to a temporal and spatial disconnect between what happens on the surface and what is observed in groundwater. These and other limitations (particularly, the higher the efficiency of irrigation, the higher the N and salt concentrations in deep percolation) make first encountered groundwater quality data a questionable source of information on which to base assessments of vulnerability and other objectives of the ILRP.



Our work, spanning more than 2 years, also supports the finding: *"The data that is currently available regarding nitrate levels in groundwater often comes from data sources of poor quality"*. We agree with the statement, *"Current groundwater conditions should not trigger reporting or regulation of above-ground activity"*. Current groundwater conditions, in many cases, do not reflect current land use practices directly above them because of deep aquifers, the changing depth of groundwater, multi-dimensional movement of water through aquifers, and influences from surface water and groundwater banking recharge/extraction projects.

3. **Monitoring effectiveness is optimized by assigning a specific use to each piece of data collected, not necessarily by increasing monitoring efforts spatially or temporally.** Monitoring should be refined to that which is meaningful and scientifically defensible. Monitoring for the sake of monitoring is wasteful of resources that could be dedicated to truly protecting groundwater. Furthermore, the effectiveness of both monitoring and reporting can be sabotaged by unnecessary complexity. The Expert Panel states that *"The current regulatory approach requires the regulated community to carry out enormous data collection and investigative efforts with questionable utility and no indication that they will be successful in protecting groundwater quality."* This questionable approach was also apparent in the Nitrogen Tracking and Reporting Task Force Final Report, which called for significant data collection, but did not explain how the data would be used.
4. **Informed and enforced planning for all farmers is likely the most effective method of achieving the goals of the ILRP.** All farmers should have good N and irrigation management plans. Both are equally important. Nitrogen management is not more important than irrigation management respective to leaching. All groundwater is vulnerable to some degree, if excess nitrogen is applied, and if irrigation methods/inefficiencies/distribution uniformities provide for excessive or frequent deep percolation to carry the excess nitrogen below the root zone. All farmers should demonstrate good management; however we have shown that certain combinations of crop, soil type, irrigation system, nitrogen management, and other factors commonly have an increased risk of nitrogen leaching, meriting an increased focus on the part of coalitions and growers (and lesser focus in lower risk areas), which can contribute to a more cost-effective effort overall.

FINDINGS THAT NEED FURTHER CLARIFICATION AND CONSIDERATION

1. **The lack of clarity regarding groundwater vulnerability assessment, in addition to the broad recommendations provided by the Nitrogen Tracking and Reporting Task Force, is indicative of the need for:**
 - a) **More review and consideration of pertinent scientific literature on groundwater nitrate pollution in agricultural areas similar to California; and,**
 - b) **More thoughtful planning and consideration of how Expert Panel recommendations can be used by coalitions to inform decisions.**

While we agree with the Expert Panel's finding that, *"The ILRP's focus on groundwater vulnerability confounds the spatial delineation of "risk of nitrate leaching below the crop root zone" with the concept of "impact to groundwater" at some undefined point within the aquifer"*, we submit that both of these aspects of vulnerability must be understood to focus regulatory efforts that will ultimately achieve the goals of the ILRP. Though no singular tool likely exists that can evaluate both nitrate leaching risk and impact to groundwater, tools have been developed to assess these



separately, and when used in combination, can provide a powerful means of directing regulatory efforts to where they are most needed.

There are many different tools, technologies and approaches to evaluating and protecting groundwater from nitrate pollution in agricultural settings. This variety of methodologies has emerged because different regions require different approaches. While there is no one-size-fits-all method, coalitions can benefit from widely published literature that describes these methods and documents their applicability in different scenarios. There is significant scientific literature published within North America and from other parts of the world that provide useful insights into applicability and success of these approaches in agricultural settings similar to California (NRC, 1993; US EPA, 1993; USGS 2002; Liggett and Talwar, 2009; Corwin et al, 1997). This scientific literature is a valuable resource for developing scientifically sound methodologies that may not be perfect, but help to focus monitoring and field study efforts where regulation will be the most beneficial, cost-effective, and impactful.

2. The general discouragement of using indices such as NHI:

- a) Is not congruent with the Expert Panel's recommendations to identify and prioritize areas or "sources" of groundwater quality impairment;**
- b) Does not consider the ancillary advantages of using such tools to educate and incentivize growers; and,**
- c) Does not consider additions and/or modifications that can be made to such indices to tailor them to specific objectives.**

Though these tools may indeed be poor proxies for answering specific questions pertaining to optimal nitrogen management, they are indeed valuable approaches that can be used by coalitions to manage and interpret large datasets with efficiency and most importantly, meaning. They can be used as they were intended to be used – to guide, but not provide absolute answers.

The Expert Panel states numerous times throughout the report, *"The Regional and State Water Boards need some metric (index or tool) to evaluate the effectiveness of fertilizer management programs. However, deep groundwater nitrate levels, examined over periods of less than 10-20 years, cannot be expected to demonstrate such an impact. A different metric must be used."* The Expert Panel does not provide any recommendation on what that metric should be; however, if no recommendation is provided, some suggestion should be made on the relative validity and applicability of approaches that are already available and modifiable to specific conditions.

Because the Expert Panel has recognized that *"there are no direct or surrogate measurements currently available that can be used to either accurately determine flux of nutrients from the root zone or distinguish good practices from bad management practices,"* it seems reasonable that "proxies" are highly informative and necessary to some degree. From a practical perspective, indices that consider field management in particular, have been repeatedly proven as the best approach to gain insight on how these management practices can be improved to reduce nitrate leaching potential. Interpretation of these indices is based on concepts that have been proven and documented in the scientific literature for decades. These studies are not listed here, but are



reviewed in the Kern River Watershed Coalition Authority (KRWCA) comments submitted to the Expert Panel on May 5, 2014.

The following statement by the Expert Panel seems contradictory to other portions of its report. *"The measurements currently most used for determining risk are proximity or operation within an impaired water body and the use of a risk calculation such as NHI or Nitrate Loading Factor. Both of these tools use output values to trigger a lower or higher regulatory burden, but do not give the grower much flexibility to adopt practices or otherwise make changes to operations to reduce risk or exposure. For example, a grower cannot readily change his/her crop, soil type, or irrigation source [sic]..."*

First, the NHI was never intended to trigger regulatory burden. In fact, it was developed to avoid that particular result. Second, no analytical tool can give growers the flexibility to make changes to operations that are largely unmodifiable (e.g. soil type, permanent crop type)

NHI and other tools, however, are particularly useful because they help to determine what specific factor is contributing to N leaching risk, and what management changes can then be made to alter that factor. The Expert Panel lists some of these types of management choices later in the report on page 25. For example, a grower could lower his/her NHI score on a particular field by focusing on those management practices that influence the factor that contributes most to an elevated score. Examples of the management choices that address specific leaching factors are provided in Wu et al. (2005). In this way, tools such as NHI (when used in its most basic form or enhanced/modified further) can be used to incentivize growers to reduce their N leaching risk, and give them the information they need to do it.

The Expert Panel states, *"At best the current tools should serve as basin, region, or coalition wide, high-level indicators of risk or as an education and awareness tool to bring attention to the magnitude of the growers' subsequent irrigation and fertilization strategies."* The benefit of using NHI is precisely this - as a coalition wide indicator of risk, and an education and awareness tool.

The Expert Panel expresses the need to estimate the probability, *"in a qualitative, comparative manner,"* of nitrate leaching below the root zone, and the need to be *"congruent with the State and Regional Water Boards' need to prioritize regulatory oversight and assistance efforts in these areas."*

If estimating the probability of nitrogen leaving the crop root zone in a qualitative, comparative manner is the objective, then this accurately describes the spatial identification of relative nitrate leaching risk, which is the purpose of the NHI. It is qualitative and comparative, and does not seek an unreasonable degree of precision. Though it does not currently consider applied nitrogen, this is a parameter that could (and likely should) be integrated into NHI. This is something that KRWCA is already investigating as a proposed addition to the tool.

The NHI tool, like other indices that measure nitrate leaching risk, was developed in a general fashion and is likely more applicable when it is modified for specific and/or regional purposes. Numerous studies indicate that DRASTIC, for example, an index and overlay method that uses hydrogeologic properties to estimate groundwater pollution potential, produces much better results when it is modified for specific regions and/or purposes (NRC, 1993; Javadi et al, 2011; Neshat et al, 2013). Overlay and index methods are particularly conducive to additive factors; another layer can be added to refine results for a specific purpose. In this way, prioritization of areas can be facilitated, which is another application of NHI.



The Expert Panel also states, *“Coalitions should define a process/procedure that they can use to identify the location of the source of water quality impairment. Many tools are available, and others can be developed. However, the Panel believes that all tools will only provide guidance, as opposed to certainty.”* The Expert Panel’s language on this is somewhat confounding given that there is no one particular source of water quality impairment when it comes to non-point source pollution.

Again, the purpose of using a tool such as NHI is expressly what is described by the Expert Panel above – for providing guidance, not certainty, in identifying the most likely and/or immediate location and source of water quality impairment. Such tools necessarily require additional information and interpretation, and were never intended to be applied without this context. However, clarification should be provided by the Expert Panel on how, specifically, “sources” of water quality impairment are to be identified without using such tools.

In addition, the recommendation above suffers from the same problem identified by the Expert Panel with the current regulatory approach; it is not clear if *“the location and source of water quality impairment”* (if there is one that is identifiable) is a point or area at which the risk to root zone nitrate leaching risk is relatively great, or if “location and source” indicates factors within the vadose zone that contribute to groundwater quality impairment. If a point on the land surface is what is intended, the assumed connectivity and impact to groundwater might not be actual because of the complicated nature of time lags, horizontal water movement, etc. If the “source” refers to the whole system below a point on the land surface, including the vadose zone, then groundwater vulnerability assessment should be conducted.

In summary, the Expert Panel has been charged to, and expresses the need for a tool to estimate leaching in a qualitative and comparative manner, identify likely sources of N leaching, and prioritize areas that should receive regulatory focus (not burden or further restrictions). These objectives seem to align precisely with the objectives of NHI, so we are unclear why its use is discouraged, if not for vulnerability assessment, at least for these purposes. The alternative of reporting applied N is likely necessary, but is equally limited and potentially misleading if used without the benefit of irrigation volume/efficiency and other management factors. This limitation is discussed in more detail below.

3. **Though irrigation volume (and ultimately efficiency) is a key factor influencing nitrate leaching risk and should be an integral part of irrigation planning, the Expert Panel does not address how to reconcile this concept with the fact that most growers do not know precisely how much water they apply, and installing meters to collect that data would be a major infrastructure change of great effort and expense.** We call attention to this because throughout the Expert Panel report, applied water is recognized as a key factor influencing nitrate leaching, yet it is not fully addressed in the irrigation management plan recommendations. While the Expert Panel acknowledges that many growers don’t have meters and therefore don’t know precisely how much water they are applying, it does not address how this incongruity would play out in the irrigation management plans. One recommendation is to *“keep records on all irrigation inputs (flows and volumes) and timing. This requires a means of measuring or reasonable estimation of the flow rates and volumes into individual fields – **which is a major advancement for most farmers**”* (bold and underline retained from report). This “detail” does not get due attention in the recommendations.



Applied water volume and timing of applications, with a knowledge of soil moisture holding capacity and evapotranspiration is a necessary and integral part of an irrigation plan, and it is unclear how the Expert Panel recommends addressing the lack of infrastructure needed to collect and use that information for planning.

The following statement by the Expert Panel is somewhat misleading because it is incomplete: *"For any given crop, the probability of nitrogen leaving the crop root zone via deep percolation increases with increasing nitrogen input."* While this is a true statement, it is incomplete because the probability of nitrogen leaving the crop root zone via deep percolation also increases with increasing applied water. As the Expert Panel stated in the Key Points Regarding Application of Management Practices (page iv of Executive Summary), *"The only way to reduce nitrate deep percolation from crop root zones is to reduce the volume of deep percolation water (irrigation or rainfall), and to also match the available nitrogen management to the plant needs."* Therefore, reporting N applied alone can lead to misleading interpretations of how N is managed and how much risk it poses to groundwater quality.

The following paragraph from the report further supports the fact that most growers do not have the information they need to do a complete irrigation management plan:

Applied water volumes to individual fields are not known in many cases with a high degree of accuracy. Many irrigation districts in California are currently struggling to meet a +/- 12% accuracy standard for measurement of annual volumes at district turnouts. Once district water is beyond the turnout, it is often split, applied to a large number of fields, mixed with groundwater in common pipe systems, and is generally not measured to individual fields.

Again, we question why the Expert Panel acknowledges that most growers do not know precisely how much irrigation water is applied, yet does not address this in irrigation management plan recommendations. According to the information from Dr. Letey (page 7 of report), irrigation water applied is a key factor in estimating nitrogen leaching.

4. **The finding that simple nitrogen reporting as recommended by the Expert Panel would not require mapping or spatial analysis efforts may be true for individual growers, but would most likely not be true for coalitions, who are encouraged by the Expert Panel to handle many regulatory tasks.** For these efforts, coalitions will certainly be more efficient and accurate with mapping and spatial analysis. In fact, one could argue, depending on the size and nature of the coalition, that these tasks would be so cumbersome without mapping and spatial analysis that they would be next to impossible. The spatial component of all environmental data is increasingly important to all aspects of regulation, including but certainly not limited to surface and groundwater quality. In addition, many data sets from government agencies are in spatial format, which increases their analytical utility. The benefits of spatial analysis are too numerous and rich to explain here; however, spatial analysis should not be dismissed as an unnecessary burden, but embraced as a powerful tool for managing environmental data.



We appreciate the opportunity to review the Expert Panel Draft Report and provide comment. We hope our comments are beneficial to the finalization of your recommendations and thank you in advance for your thoughtful consideration of our comments and this supporting information.

If you have any questions or would like to discuss these comments in further detail, please contact me at anytime.

Sincerely,

Nicole Bell,
Manager
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