Comments on:

Yakima Valley Groundwater Management Program, dated August 20, 2018

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Comments Dated: February 26, 2018

Statement of Qualifications:

I am a Licensed Professional Geologist (Florida P.G. #2415), and have 31 years of experience in contamination and water resources work. This included 29 years working in environmental consulting as a Senior Hydrogeologist, and almost two years as a Cleanup Site Manager with the Department of Ecology, Toxic Cleanup Program. I have a Bachelor's degree in Geology, and a Master's degree in Environmental Sciences from the Colorado School of Mines. The M.S. studies focused on hydrogeology, water quality, and environmental geochemistry. My work has included studies throughout the United States and Canada, and in the Middle East and South America. One exemplary role was as the Technical Director for the Study of the Water Resources of the Western Coastal Plain of Saudi Arabia, a 23 million dollar study of a 1,800 km long area. That study included the collection of 1,800 groundwater samples, and nitrates proved to be the number one water quality problem within that area.

Nature of the Problem

The problem of nitrates in shallow groundwater is a globally ubiquitous concern. This problem is exacerbated by a traditional separation in managing water into two area; water resources, which has traditional focused on water quantity, and contamination concerns, which are generally separated between point source and non-point source contamination sources. Slowly, the nexus of water quantity of water quality is gaining ground under a new field: Integrated Water Resources Management.

In general, the shallower the water supply well, the greater risk to the well from various sources of contamination (**Figure 1**). The deeper the well, the lower the chance of the aquifer being impacted from point and non-point sources. These principles were summarized within the Lower Yakima Valley Groundwater Quality, Preliminary Assessment and Recommendations Document dated February 2010, as follows:

> *Nitrate-nitrogen concentrations are greatest in shallow groundwater. A significant decrease in nitrate-nitrogen concentrations is found in groundwater samples collected from depths below 300 feet. The highest percentage of samples exceeding state Drinking Water Standards (l0 mg/l nitrate-nitrogen) are obtained from shallow wells (less than 300 feet deep). Most private domestic drinking water wells appear to be shallow wells.*

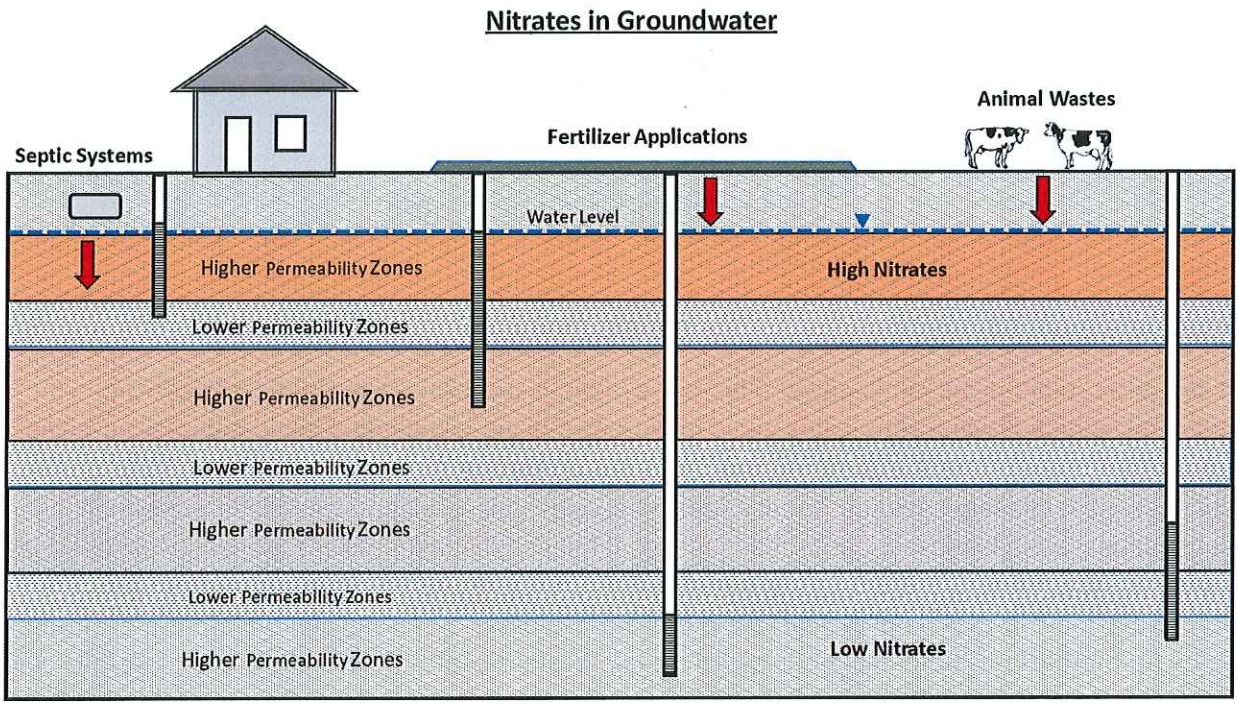

Figure 1: Conceptual Schematic of Distribution of Nitrates in Groundwater

Shallow groundwater is not necessarily easy to define. In assessing individual wells, the top of the well screen or open interval (not total depth of the well) is the critical depth of concern. However, a well that has a total depth of less than 100 feet would have contamination risks much higher than a deeper well. In addition to depth, the number and thickness of lower permeability beds is a critical component of risk to a well. Another factor effecting risk to wells is the potential presence of improperly constructed wells or boring that have breached separating low permeability strata (**Figure 2**). In this case, deeper wells can still have a risk of contamination from surficial releases, especially if there is a downward hydraulic gradient between aquifer zones.

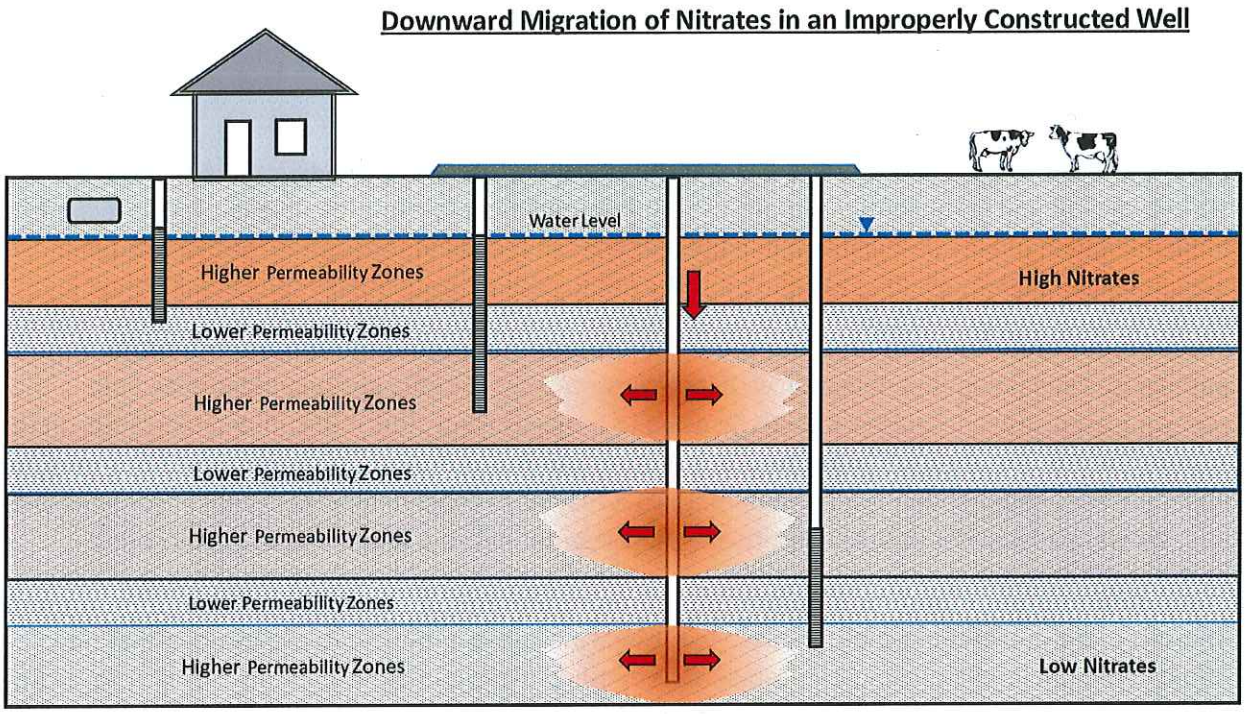

Figure 2: Conceptual Schematic of Downward Migration of Nitrates in an Improperly Constructed Well

Potential Solutions

The program document included the following recommendations:

- *Support the implementation phase of the GWMA*
- *Continue groundwater and soil monitoring*
- *Promote voluntary source reduction strategies for all nitrate sources*
- *Continue education and public outreach strategies for all Lower Yakima Valley residents, including homeowners and farmers*
- *Improve irrigation efficiency*
- *Develop and support research about innovative nitrate reduction strategies*
- *Consider incentives that support nitrate reduction*
- *Explore technology to utilize nutrients as energy*
- *Enhance and streamline regulatory and enforcement mechanisms*
- *Maintain the established GIS database*

The program document also stated:

Implementation

The next phase of the GWMA program is implementation. The GWAC's completed work from the assessment and planning phase provides a solid foundation for this next phase. Within this document are specific recommendations for reducing nitrate concentrations in groundwater.

At one of its final meetings, the GWAC recommended that Yakima County act as lead agency in future Lower Yakima Valley groundwater management.

Implementation of recommendations is subject to future funding.

I strongly disagree with a focus on reducing nitrate concentrations in groundwater. As previously stated, nitrates and other contamination in shallow groundwater systems is a ubiquitous global concern. Implementation of best management practices (BMPs) can reduce the amount of loading to aquifers of various contaminants (including nitrates), but the risk to shallow groundwater system will always exist.

The most critical concern with respect to any contamination concern is to eliminate exposure pathways. Eliminating contamination within the environment is a lofty and admirable goal, but removing exposure mechanisms to both human and ecological receptors is of critical importance. In the case of nitrates in shallow groundwater, the exposure pathway is broken by ensuring that contaminated water is not ingested. Other groundwater pathways may be of concern for other types of contaminants (e.g. shower pathway for volatile constituents); however for nitrates, ingestion is the only critical pathway of concern.

Therefore, the greatest need with respect to nitrates in shallow groundwater is ensuring that no people are drinking this water. This can be accomplished with various mechanisms. In order to clearly differentiate between recommendations pertaining to preventing consumption of contaminated groundwater and other less immediate concerns, I recommend splitting recommendations between those pertaining to eliminating potential exposures and other miscellaneous recommendations. This comment applies to the Recommend Actions section and the Executive Summary. Separating immediate concerns from less immediate concerns is important to ensure that protection of public health is of foremost priority.

The program has an exceptionally high Environmental Justice (EJ), component, as follows:

- Water wells are expensive, and the deeper the well, the more expensive.
- Poor people are less likely to afford a deeper water well.
- Poor people are less likely to afford bottled water.
- Therefore, poor people are more likely to drinking nitrate contaminated shallow groundwater.
- In addition, poor people may be less likely to have a public water supply system in rural areas which would include required water quality testing.

In my opinion, the root problem is not that there are nitrates in shallow groundwater. The root problem is that people think that shallow groundwater is a viable source of water for drinking water purposes. I would submit that it is generally inappropriate for any water wells to be constructed for drinking water purposes less than one hundred feet deep. Water quality concerns with shallow groundwater include nitrates in agricultural area, nitrates and other constituents in areas where septic systems are used, and various contamination sources from point and non-point sources in urban areas. **Very few places do not have a water quality concern with respect to shallow groundwater.**

Recommendations

I believe that public communication is a critical component of the program. If people are aware that their water supply may be contaminated, this might reduce the chance of their ingesting the water. This is particularly true if there are options for alternative drinking water supply. The following are the actions that I would give highest priority:

1. Send a mass mailing to all residents located outside of public water supply service areas within the Lower Yakima Valley. The mailing would explain the problem of nitrates in shallow groundwater, and that it is of particular danger to expecting mothers and infants. The mailing would provide a telephone number for free testing of their well water for nitrates.
2. Assign staff dedicated to collection of water samples from domestic wells for nitrate analysis. The staff should be able to respond to requests to sample within one week of a telephone request. Households with infants or expecting mothers (or women of childbearing age) would be bumped to the top of the list. Shallower wells should be given a higher priority than deeper wells. The sampling staff would maintain a database, including available well construction information.
3. Identify locations for household collection of free drinking water at each community in the Lower Yakima Valley. Once a household water supply well has been tested, the owner or resident would be provided with a document allowing them to pick up free drinking water (a reasonable weekly allotment could be calculated).
4. Begin a grant program for replacement of impacted shallow domestic wells. Such grants could be applied for by homeowners that have a shallow wells with nitrates above cleanup levels. Prioritization of grant recipients should be based on needs of the applicant. A fund for this grant can be contributed to by taxpayers and groundwater polluters. This recommendation would require legislative action.

The collection of nitrate data from domestic wells could substitute for monitoring wells, and provide much more meaningful data in terms of protection of public health than monitoring well data. Collection of additional data, including hydrogeological and water quality data should focus on areas with identified deeper nitrate contamination, with a goal of identifying potential conduits to deeper aquifer zones. Such investigations could use innovative technologies for the detailed characterization of water quality and hydrostratigraphy with depth, in order to better understand inter-aquifer communications and contaminant migration.

Once protection of public health has been ensured (i.e. no ingestion of nitrates in shallow groundwater is taking place), then, and only then, other recommendations can be given priority. These other recommendations should be prioritized. For example "Explore technology to utilize nutrients as energy" is a recommendation that would not have a high priority in terms of protecting public health and the environment.