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COMMENTS ON TRIENNIAL REVIEW OF THE WATER QUALITY CONTROL PLAN FOR THE SACRAMENTO RIVER AND SAN JOAQUIN RIVER BASINS

I am submitting comments to the subject Basin Plan Triennial Review as a San Joaquin Valley resident who happens to be employed as a Senior Water Resource Control Engineer in the Central Valley Water Board's Fresno office. I am a California-registered civil engineer (RCE 49278) and have been employed by the Fresno office for over ten years doing mostly core regulatory work in the WDR Program (also called "Non15" Program). My comments concern the inclusion in the Basin Plan of *Guidelines for the Land Disposal of Stillage Waste from Wineries* (Stillage Guidelines). I recommend that the Basin Plan be amended to delete these guidelines due to their ineffectiveness in protecting the beneficial uses of groundwater underlying stillage disposal operations. I recommend the Central Valley Water Board assign high priority to this issue, as it concerns water quality protection, regulatory program effectiveness, and greenhouse gas emission reduction.

Detailed Description of the Issue. The Basin Plan incorporates the Stillage Guidelines by reference (Appendix 33). Waste discharge requirements (WDRs) for the land disposal of stillage typically contain discharge specifications that implement the operational procedures contained in the Stillage Guidelines (e.g., stillage depths and rest periods as functions of time of year). As explained below, these guidelines are primarily geared for nuisance prevention, and are not adequate to ensure stillage disposal operations do not pollute underlying groundwater.

The decomposition of stillage was described in *Land Application of Stillage Waste: Odor Control and Environmental Effects* (Wine Institute Study) prepared in 1980 for the Wine Institute by Metcalf and Eddy Engineers. The Wine Institute Study, along with its recommended stillage disposal guidelines, forms the basis of the Stillage Guidelines. Below is a brief technical description of the soil treatment processes involved in these disposal operations.

The discharge of stillage to land for treatment and disposal is an inexact science highly dependent upon the constituent, soils, climate, other practices that affect the property, and proper waste management and control. The process depends upon attenuation (decomposition, immobilization, and transformation) in the soil profile and consumption from the root zone by crops to remove waste constituents.

Nitrogen in stillage is predominantly in the organic form, which is not very soluble in water. During the drying period, the upper soil profile should re-aerate, thereby creating conditions conducive to the mineralization of organic nitrogen to ammonia and rapid nitrification of ammonia to nitrate. During the next stillage application, nitrogen that has been converted to nitrate should be converted to nitrogen gas, as the high organic loading associated with stillage induces anaerobic conditions. For denitrification to occur a carbon source must be available for denitrifying bacteria. The Wine Institute Study assumed that most of the carbon from stillage remained in the upper four to six inches of the soil profile. As nitrate by these assumptions must denitrify in the upper six inches of the soil profile, elevated nitrate in the soil profile below this depth is evidence of inadequate treatment and indicates the soil should be cropped to uptake excess nitrogen. Elevated nitrate below the rooting depth of the crop is evidence that nitrogen removal has not been totally effective even with cropping, and has a reasonable potential to leach through the soil and degrade groundwater.

Excessive stillage applications can overload the shallow soil profile, cause anaerobic soil conditions, retard the degradation, stabilization, transformation, and immobilization of waste constituents, and create nuisance odors. Due to its low pH, it can also cause the soil's buffering capacity to be exceeded. When this occurs, soil amendments, such as lime, must be added to restore the soils' buffering capacity. Applications of such amendments may further degrade groundwater for salinity constituents.

Decomposition of organic waste constituents within the soil profile generates carbon dioxide gas, which either vents to the atmosphere or dissolves in soil-pore liquid and increases the concentration of alkalinity in soil-pore liquid. In the absence of oxygen, organic matter will contribute a significant amount of reducing power to flooded soils and sediments, which will cause a decline in oxidation-reduction potential and result in a reduction of oxidizing constituents (e.g., nitrate, iron, manganese, arsenic). Anaerobic soil conditions are associated with the dissolution of soil minerals such as calcium and magnesium. Temporal storage of residual waste constituents within the soil column can misrepresent the effectiveness of the process. Hydraulic overloading flushes waste constituents, their decomposition by-products, and dissolved soil minerals from the upper soil profile. Absent sufficient sustained reliable attenuation of residual waste constituents in the remaining soil profile, the constituents will eventually discharge into groundwater.

Elevated nitrate in affected groundwater compared to background is evidence that a discharge has exceeded a disposal site's treatment capacity for organic nitrogen. Conversely, low or non-detectable concentrations of nitrate in affected groundwater, combined with elevated concentrations of total organic carbon and indicators of organic overloading such as manganese, iron, and arsenic, is evidence that a discharge has exceeded a disposal site's treatment for organic carbon. Additional evidence of organic overloading is elevated concentrations in groundwater compared to background of calcium, magnesium, and bicarbonate alkalinity (i.e., salinity constituents).

Activities Undertaken to Revise the Stillage Guidelines. In August 2002, Central Valley Water Board staff circulated for public comment tentative WDRs for a major stillage disposal operation in Fresno County that is currently regulated by WDRs that implement the Stillage Guidelines. The tentative WDRs questioned the effectiveness of the Stillage Guidelines and

the exemption of this discharge from the designated waste containment requirements of Title 27, California Code of Regulations, § 20005 et seq. (Title 27). While this discharge is located in the Tulare Lake Basin, the water quality issues posed by this discharge are pertinent to stillage disposal operations in the Sacramento River and San Joaquin River Basins.

Designated waste need not be contained if the waste constituents of concern can be demonstrated to be effectively removed by controlled land treatment or, if not removed, subjected to best practicable treatment or control (BPTC) and reduced sufficiently thereby to satisfy the criteria of State Water Resources Control Board Resolution 68-16, *Statement of Policy with Respect to Maintaining High Quality of Waters in California* (Resolution 68-16), which is included in the Basin Plan by reference. Resolution 68-16 requires regional boards to regulate waste discharges in a manner that maintains high quality waters of the State. Degradation of high quality water by a discharge can only occur after full application of BPTC, must be consistent with maximum benefit to the people of the State, not unreasonably affect a beneficial use, and not result in water that exceeds a water quality objective.

Self-monitoring data in Central Valley Water Board files for this discharger (E. & J. Gallo Winery Fresno Winery) indicate that groundwater underlying the stillage disposal operation contains nitrate in concentrations exceeding the water quality objective, as well as elevated salinity. The type and degree of groundwater salinity degradation caused by this discharge is not unique, but typical of many stillage disposal operations. I base this technical opinion on my extensive familiarity with the water quality impacts from these disposal operations.

In preparing the tentative WDRs, staff could not recommend the Central Valley Water Board find that the existing discharge was consistent with Resolution 68-16 and qualified for exemption from the containment requirements of Title 27. Consequently, the tentative WDRs characterized stillage as a designated waste subject to the land treatment requirements of Title 27 § 20250(b)(5), which requires waste constituents in the discharge to be consistently and completely degraded, transformed, or immobilized in a treatment zone of less than five feet from the initial soil surface. The tentative WDRs would have required the discharger to identify the practices and control, and any pretreatment, to assure waste constituent attenuation within the upper five feet. If removal, containment, or uptake of a waste constituent cannot be guaranteed by the discharger to occur completely within the treatment and root zones, the tentative WDRs would have required the discharger to complete a BPTC evaluation for the waste constituent, and identify the concentration and mass of the constituent that will be released to groundwater and its consequent impact on concentrations of the constituent in groundwater. The tentative WDRs would have also required the discharger to submit all available documentation as to why degradation is or will be of maximum public benefit if the discharger wishes the authorization for continued degradation.

The discharger responded to the tentative WDRs by requesting staff delay presenting the tentative WDRs to the Central Valley Water Board to allow industry time to conduct research and field studies on stillage and non-stillage waste disposal practices. This work was funded by the Wine Institute and performed by Kennedy/Jenks Consultants. Briefly, the work involved two summers of pilot testing of existing and revised operational procedures at the E. & J. Gallo Winery Fresno Winery and at the Bronco Winery near Ceres. The field testing involved the

monitoring of hydraulic and waste constituent loading rates and the volume and quality of soil-pore liquid obtained from lysimeters installed at various depths below ground surface.

The State Water Resources Control Board arranged for the report documenting the work to be peer reviewed for the Central Valley Water Board by a panel of three professors.[1] The peer review was generally negative. Essentially, the reviewers questioned the applicability of the work to other stillage and non-stillage disposal operations:

> **Study design.** The study design was simple and scientifically lacking, making the results site specific at best. These concerns were raised in a letter to Kennedy/Jenks Consultants from Jo Anne Kipps of the [Central Valley Water Board] prior to the initiation of the study. The major concern in this regard is the use of a non-replicated experimental design without a proper control that makes it impossible to analyze the results statistically. Because of this the study results cannot be used to develop a scientific basis for modifying the existing guidelines or to develop general loading rates based on soil type or quality of winery wastewater.
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> Because sampling was done temporally to include a number of wastewater discharge cycles these samples could have been used as pseudo-replicates to provide an estimate of "within site" variability. Even so, since only one soil type was used, the results would still be site specific and it would be extremely difficult to extrapolate them from the sandy, high permeability, low buffer capacity soils used in the study to soils in other wine growing areas such as the Napa/Sonoma Valleys and the Central Coast. It is likely the results produced on coarse-textured soils will overestimate wastewater application on fine textured soils.
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> The small soil plots used make it likely that sampling was influenced by boundary effects. The plots were too small for the conduct of a valid percolation study. Different soil plots were used in the two years' of study for the stillage wastewater application study. Therefore, the results cannot be used to assess the residual effect of repeated applications.
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> The soil plots were cropped but no indication of this practice was given in the study plan and no reasons were given for the deviation from the study plan.
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> The lysimeter design is unpublished and does not appear to have been peer reviewed for suitability to this study.

My point in presenting the above quote is to show that the work sponsored by the Wine Institute, while laudable, did little to justify the Stillage Guidelines (as well as proposed revisions to the guidelines) as reflective of BPTC. Many years have past since the Wine Institute sponsored the work and technical staff who had been involved in reviewing the work's research design and execution, including me, have been reassigned to other work and are no longer involved in industry efforts to improve waste disposal practices. Meanwhile, stillage and non-stillage disposal operations continue to pollute groundwater under the authorization of outdated and ineffective WDRs. And, the groundwater pollution caused by these authorized discharges are generally viewed internally as evidence of defective WDRs and not pollution subject to State Water Resources Control Board Resolution 92-49, *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304.*

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[1] Technical and Scientific Review Report of: "Land Application of Winery Stillage and Non-stillage Process Water", Kennedy/Jenks Consultants. By V. Dean Adams, Associate Dean of Engineering, University of Nevada, Reno; William R. Horwath, Professor of Soil Biogeochemistry, University of California at Davis; David Jenkins, Professor in the Graduate School, University of California at Berkeley.

Brief Statement of reasons for the addition or deletion of an issue. The Basin Plan should be amended to delete its incorporation of the Stillage Guidelines. This deletion will announce to the regulated community that the guidelines are not consistent with Resolution 68-16. Any proposals by industry to revise the Stillage Guidelines must be demonstrated at various field locations over several years on lands that have never received applications of waste such as stillage, food processing waste, dairy wastewater, etc. Use of existing land application sites for such demonstrations risks obfuscating water quality impacts caused by past discharges conducted in accordance with the Stillage Guidelines from impacts caused by discharges conducted in accordance with proposed revised guidelines.

In the meantime, the Basin Plan should also be amended to clarify the responsibility of dischargers of stillage and other high-strength food processing waste to demonstrate their land disposal operations are consistent with Resolution 68-16.

Recommendation on the priority that should be given to that particular issue. Without an amendment to the Basin Plan to delete the Stillage Guidelines and to add specific requirements for dischargers of stillage (and non-stillage winery waste) to evaluate their disposal operations for consistency with Resolution 68-16, many more years will pass before these dischargers are required to improve waste management operations, as limited staff resources preclude the timely updating of WDRs. Meanwhile, the groundwater pollution caused by these disposal operations will only worsen. Limited staff resources also mean limited efforts to process formal enforcement orders to require dischargers to cleanup and abate pollution caused by their disposal operations.

The changes necessary to effectively regulate discharges to land of stillage, as well as food processing waste, should ideally be made at the same time through a Basin Plan amendment that provides a reasonable amount of time for dischargers to fully implement improved waste treatment and disposal practices. This ensures affected dischargers have a "level playing field" and prevents the situation in which each year only a handful of dischargers are required to improve waste treatment and disposal practices because their time had come up in the WDRs update schedule.

The Basin Plan amendment should encourage staff to develop General WDRs for existing land discharges of stillage and non-stillage winery waste, as well as General WDRs for existing land discharges of food processing waste. These General WDRs should establish a time schedule for dischargers to design and construct wastewater treatment units to provide a 90% reduction in 5-day biochemical oxygen demand (BOD). These General WDRs should also require application of waste at rates not exceeding reasonable agronomic demand, and monitoring of crop yield and tissue to confirm agronomic uptake of applied nitrogen, as well as monitoring of soil, soil-pore liquid, and groundwater.

The 90% BOD reduction requirement in these General WDRs would encourage dischargers to install anaerobic digesters that convert organic matter to methane, which could be captured and converted into electricity. Converting the organic carbon in the waste to methane will substantially reduce the amount of carbon dioxide generated by the soil treatment of these wastes. Surface impoundments serving as anaerobic digesters should ideally be regulated by separate Title 27 WDRs, while the discharge of digester effluent to land for additional

treatment and disposal/reuse should be regulated by separate Non15 Program WDRs, provided waste constituent loadings are protective of beneficial uses. Alternatively, one WDRs Order may serve to regulate both the digester surface impoundment and land disposal operation provided the Order requires the digester surface impoundment to comply with Title 27 containment requirements.

To demonstrate that the Non15 Program discharge is consistent with the Basin Plan, the General WDRs should require dischargers to monitor soil-pore liquid percolating from the bottom of the active soil treatment zone (i.e., the root zone) in representative disposal fields via linear pan lysimeters. The design of these linear lysimeters should be developed in a collaborative process involving technical staff, industry, engineering consultants, and university researchers, and presented at a Central Valley Water Board meeting as an information item.

The General WDRs should require lysimeter samples be collected at regular intervals and analyzed for decomposable waste constituents (nitrogen compounds and total organic carbon); total dissolved solids (both volatile and fixed dissolved solids); iron, manganese, and arsenic (indicators of organic overloading); and salt constituents such as sodium, potassium, and chloride. Simply put, if the soil-pore liquid collected from these lysimeters contain excessive concentrations of decomposable waste constituents (nitrate and total organic carbon) or detectable concentrations of waste constituents indicative of organic overloading (iron, manganese, arsenic), then the waste constituent loadings must be reduced (via pretreatment and/or expansion in disposal area) to levels that result in lysimeter samples containing low concentrations of decomposable waste constituents and no detectable concentrations of waste constituents indicative of organic overloading. The General WDRs should impose an effluent limitation of 40 mg/L BOD within three years should lysimeter monitoring show chronically elevated concentrations of decomposable waste constituents.

To evaluate the contribution of greenhouse gases by dischargers operating under WDRs issued by the Central Valley Water Board, staff should be directed to estimate the amount of carbon dioxide currently generated yearly by Central Valley discharges of winery and food processing wastes. I recommend that staff also be directed to estimate the yearly reduction in carbon dioxide emissions that could be realized if the Central Valley Water Board imposed an across-the-board 90% BOD reduction requirement on winery and food processing waste discharges. This information should be presented to the Central Valley Water Board in a staff information item.

I appreciate this opportunity to provide comments on the Basin Plan's triennial review.

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