Clean Water Coalition

September 17, 2010

North Coast Regional Water Quality Control Board
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

Comments Concerning Order No. R1-2010-0034, Waste Discharge Requirements and Master Reclamation Permit for the City of Healdsburg

The following comments concern Order No. R1-2010-0034, draft of August 16, 2010, and are made on behalf of the Clean Water Coalition of Northern Sonoma County (CWC) which was formed September 6, 2007. The Coalition is an organization comprised of local property owner groups and concerned individuals within the agricultural valleys in Northern Sonoma County. The Coalition represents citizens who live in the Alexander Valley, Dry Creek watershed or Middle Reach of the Russian River, and who depend on high-quality groundwater supplies for drinking, domestic uses, agriculture and wineries.

The CWC commented extensively on the March 2010 draft of Order No. R1-2010-0034 (Attached). These comments focused on the potential for groundwater contamination from reclamation projects proposed in the Middle Reach of the Russian River. They were supportive of the Water Reclamation Requirements and Provisions contained in Attachment G but offered some recommendations to make them even stronger. Some of these recommendations were included in the draft considered at the June 10, 2010 public hearing.

The CWC commented at the June 10, 2010 hearing (Attached). These comments strongly supported the Order, especially Attachment G, as written. This support was based largely on the requirement that a rigorous Technical Report including an Irrigation Management Plan be submitted for each proposed reclamation project, that the Technical Report be subject to a public comment period and that the Technical Report be approved by the Board Executive Officer as a necessary condition for project approval.

We understand and are sympathetic to the concerns expressed by the applicant and some members of the Board that the requirement for Technical Report, public comment and Executive Officer approval for each proposed project and for each proposed user of reclaimed water might place an unnecessary burden on applicants for reclamation projects and might inhibit potential user participation. Indeed, we participated with the applicant and Board staff in consideration of a Programmatic Technical Report concept and separation of Technical Report requirements into those specific to urban reclamation and those specific to reclamation on vineyards with drip irrigation.

However, our study of the August 16, 2010 draft of Order No. R1-2010-034 indicates that some of the major additions and changes made to Attachment G in order to implement the programmatic Technical Report concept are inappropriate and, in fact, cause it to no longer provide adequate protection of critical groundwater resources. We have three primary criticisms of the draft of August 16, 2010. The specific requirements for Technical Reports for reclamation on vineyards with drip irrigation were drastically, inappropriately and unnecessarily reduced. A premature, and in our opinion incorrect, conclusion was made that these projects are eligible for steamlined permitting under the State Recycle water policy. And, the conclusions from the Gus Yates report of June 28, 2010 (3) were inserted into the Fact Sheet as absolute with no discussion of the underlying assumptions and resulting ranges of possible results.

First, the division of Water Reclamation Technical Report Requirements, Attachment G, Section C into General Technical Report Requirements, Technical Report Requirements for Reclamation on Vineyards with Drip Irrigation and Technical Report Requirements for Urban Irrigation strangely resulted in reversion to generic, vague and inadequate requirements for Technical Reports for Reclamation on Vineyards with Drip Irrigation.

As previously stated, we have no issue with the concepts nor the language contained in General Technical Report Requirements (C.1) which implement the concept of Programmatic and Site-Specific Technical Reports and Public Notice Requirements. Also, the Technical Report Requirements for Urban Reclamation (C.3) retain very specific descriptions of required contents of an Operations Plan and an Irrigation Management Plan. We believe these requirements will produce a Technical Report which will allow the applicant, the public and the Board to make valid judgments about the potential of the projects to cause contamination of groundwater.

However, the appropriate, very specific descriptions of required contents of an Operations Plan and an Irrigation Management Plan have been removed from Technical Report Requirements for Reclamation on Vineyards with Drip Irrigation (C.2). This section reverts to generic and non specific language. We do not believe that this language will assure Programmatic Technical Reports which will allow the applicant, the public and the Board to make valid judgments about the potential for these projects to cause contamination of groundwater. Furthermore, we see absolutely no reason why requirements for Programmatic Technical Reports for Urban and for Drip Irrigation of Vineyards should be different. It appears that the authors of this draft have made some arbitrary judgment that the latter have less potential to cause harm without benefit of the information to be provided in the Technical Reports. To the contrary, we believe in the specific case of currently proposed Healdsburg projects the reverse is likely the case. The Drip Irrigation of Vineyards projects have greater potential to cause harm than the urban projects.

We strongly recommend that section C2 be rewritten to contain the same very specific descriptions of required contents for an Operation plan and an Irrigation management Plan as those in section C3.

Second, the authors of this draft have for some inexplicable reason now made the judgment (Attachment G, Section A, 3 Streamlined Permitting) that "the irrigation elements of the Discharger's proposed reclamation project meet the criteria for the streamlined permitting (Paragraph 7) of the Recycled Water Policy)". This requires judgment that none of the discharger's proposed projects will be shown to have "unique, site-specific conditions" as described in this document (Attachment G, Section C,1,c,i) and in the Recycled Water Policy (Paragraph 7 b (1)). These judgments are

higher than the value of 7 inches per year reported by Wagner and Bonsignore (1999) and used by Johnson". I could find no such 1999 reference.

The amount of recycled water applied is estimated by Gus to be 4 to 6 inches per year based on 6 gallons/vine/week reported by the grower. However, there is no certainty that this will indeed be the amount of water applied. Gus's analysis provides an initial estimate of irrigation requirement for these vineyards of approximately 9 inches per year and he speculates that "the vines are apparently experiencing deficit irrigation".

We strongly recommend that the permit authors make an effort to understand the many complexities, variables, assumptions, uncertainties, and ranges of possible conclusions that are inherent in an analysis as presented in the Gus Yates Report. We strongly urge that any conclusions included in the permit Fact Sheet reflect these issues and do not appear to be absolute as in the current draft.

We strongly recommend that the Programmatic Technical Report for any project proposed for the Middle Reach is required to provide much more clear and complete analysis of the potential for groundwater contamination than that in the current Yates Report before it receives approval.

Finally, because of the obvious complexities of analysis of the potential for a specific reclamation project to cause groundwater contamination and because of the strong dependence of such an analysis on the amount of recycled water applied, we strongly recommend that any permit place an absolute limit on the amount of water applied and require metering to validate compliance. There appears to be no provision in the current draft for such a limit and its verification.

We thank the applicant, the Board staff and the Board for their willingness to work toward an optimum reclamation requirements structure. We believe this will become an important precedent for future permits. Thank you also for the opportunity to comment.

Respectfully submitted,

Fred Corson

Fred Corson
Chairman

Clean Water Coalition

April 23, 2010

North Coast Regional Water Quality Control Board
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

Comments Concerning Order No. R1-2010-0034, Waste discharge Requirements and Master Reclamation Permit for the City of Healdsburg

The following comments concern Order No. R1-2010-0034 and are made on behalf of the Clean Water Coalition of Northern Sonoma County (CWC) which was formed September 6, 2007. The Coalition is an organization comprised of local property owner groups and concerned individuals within the agricultural valleys in Northern Sonoma County. The Coalition represents citizens who live in the Alexander Valley, Dry Creek watershed or Middle Reach of the Russian River, and who depend on high-quality groundwater supplies for drinking, domestic uses, agriculture and wineries.

The CWC and/or our member organizations including the Soda Rock Neighborhood Association, the Russian Riverkeeper, the Dry Creek Valley Association, and the Westside Association to Save Agriculture have extensively studied and commented on waste discharge and reclamation projects in Northern Sonoma County including the City of Healdsburg Wastewater Treatment Plant Upgrade Project, the Santa Rosa Discharge Compliance Project, the Sonoma County Water Agency Northern Sonoma County Agricultural Reuse Project, and the Syar Property Recycled Wastewater Agricultural Irrigation Project. During these efforts we have commissioned four studies of the geology, hydrology, water balances, and potential for groundwater contamination from reclamation projects in these alluvial valleys (1, 2, 3, and 4). These studies have concluded that the potential for concentration of contaminants in these high quality groundwater aquifers from concentration in the soil and percolation with rainwater is high. We have found CEQA documents on such reclamation projects to be deficient in identifying and mitigating such negative effects.

Our comments on Order No R1-2010-0034 focus on this potential for groundwater contamination from reclamation projects proposed in the Middle Reach of the Russian River. We believe protection from such contamination is especially critical since this large, high quality groundwater aquifer is a source for municipal wells for Healdsburg, Windsor, and the Sonoma County Water Agency as well as many domestic, agricultural irrigation, and winery wells.

We are strongly supportive of the Water Reclamation Requirements and Provisions contained in Attachment G of this order. We believe that they offer the best protection of groundwater from contamination during reclamation of any permit we have evaluated to date. We especially applaud the requirement for submission and approval of a Report of Waste Discharge (ROWD) as defined in

Attachment G, Section C, Water Reclamation Provisions, paragraph 5 prior to approval of any specific reclamation project. The ROWD process includes a 21 day public notice period, requirement that the discharger attempt to resolve any issues raised by public comment, and final authority to the Executive Officer to schedule an action item to be considered at a board meeting. We believe that it is critical that these provisions remain in the final order. They are essential to protecting critical groundwater resources. And, we believe that these provisions should establish a precedent for all future Master Reclamation Permits issued in the North Coast Region.

With our strong support for this order and especially for the Water Reclamation Requirements and Provisions stated, we have three recommendations for improvements which we believe are required to make it stronger: it must be clear and unambiguous that all reclamation projects, irregardless of status of current CEQA documents, must meet all of the requirements of Attachment G in order to be approved; it must be clear and unambiguous that groundwater monitoring may be required depending upon the specific findings in the ROWD; and the requirements for specific studies and groundwater monitoring for a project having unique site specific conditions should be strengthened.

First, concerning clarity of the requirement for all reclamation projects to meet the requirements of Attachment G, the two sections which discuss CEQA (NPDES, pages 8 and 9 and Attachment F, pages F-15 to 19) appear to infer that reclamation projects with certified CEQA documents may already be approved and that only additional projects be may be subject to the provisions of attachment G. These sections state that the board "considered the effects of the Discharger's reclamation plan as identified in the certified Final EIR" and "finds that all potentially significant environmental effects to water quality will be reduced to less-than-significant levels with the incorporation of mitigation measures described in section III B of the Fact Sheet". However, the mitigation measures in the CEQA documents and in Section III B contain essentially zero protections from contamination of groundwater. Then, the two sections state in a final paragraph that for any additions to the reclamation system, the Discharger will be lead agency for CEQA and that the Discharger must ensure that all reclamation activities comply with the provisions of Attachment G. This language leaves it unclear whether the intent is for all reclamation activities, irregardless of status of CEQA documents, to meet the provisions of Attachment G. This ambiguity could be eliminated if the final sentence, in a separate paragraph, stated that "All reclamation activities, irregardless of status of current CEQA documents, must meet the provisions of Attachment G.

NPDES, page 19, footnote 8 reads "Authorized recycled water use sites means sites which have been evaluated for CEQA compliance and addressed in the Discharger's Title 22 Recycled Water Engineering Report and approved by the State Department of Public Health and Regional Water Board. In addition, new recycled water use sites must submit a Report of Waste Discharge for review and approval as required by section C.5 of Attachment G to this Order". This language again infers that reclamation projects evaluated for CEQA compliance and having approved Engineering Reports are approved. Current CEQA documents are clearly inadequate in their address to groundwater contamination and we don't believe that there are any currently approved Title 22 Recycled Water Engineering Reports. This inference is in direct conflict with Attachment G-1, page G-14. Attachment G-1 clearly states that "there are no approved recycled water use sites for this Discharger at this time".

Attachment G, pages G-7 and 8, paragraph 5 states that "Recycled water shall only be used on areas identified in the 2005 EIR and any future certified environmental document and all mitigation

Clean Water Coalition

June 10, 2010

Mr. Geoffrey Hales, Chair and Members
North Coast Regional Water Quality Control Board
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

Comments For Hearing Concerning Order No.R1-2010-0034, Waste Discharge Requirements and Master Reclamation Permit for the City of Healdsburg

I make the following comments on behalf of the Clean Water Coalition of Northern Sonoma County. The Coalition is an organization comprised of local property owner groups and concerned individuals within the agricultural valleys of Northern Sonoma County. The Coalition represents citizens who live in the Alexander Valley, Dry Creek watershed or Middle Reach of the Russian River, and who depend on high-quality groundwater supplies for drinking, domestic uses, agriculture and wineries.

The Clean Water Coalition strongly supports this order as written. We believe the Water Reclamation Requirements and Provisions as defined in Attachment G will meet the objective of minimizing contamination of the large, high quality groundwater aquifer in the alluvial valley of the Middle Reach of the Russian River Valley. We acknowledge the leadership provided by the Regional Board staff in drafting this permit. We also acknowledge the efforts of the City of Healdsburg in building the most effective wastewater treatment plant in the region and in working to understand how the treated water effluent can be appropriately used in reclamation projects.

The CWC and our member organizations have extensively studied and commented on all reclamation projects proposed for Northern Sonoma County. During these efforts we commissioned four studies of the geology, hydrology, water balances, and potential for groundwater contamination from reclamation projects in these alluvial valleys. Our studies as well as multiple studies by others have uniformly concluded that the potential for contamination of our high quality groundwater aquifers from concentration of contaminants in the soil and percolation to groundwater with rainwater is high. These studies were all submitted for the record with our comment letter on the draft order.

Our strong support for this order as written is contingent on several specific provisions which we believe are critical to groundwater quality protection and which have been criticized by the applicant.

First, the order makes it very clear that for any specific reclamation project to be approved, all provisions of Attachment G must be met irregardless of current status of CEQA documentation. This is critical. We have found CEQA documents on many reclamation projects to be deficient in identifying and mitigating impacts on groundwater quality. This unfortunately includes the 2005 EIR

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September 17, 2010

Ms. Cathleen Goodwin
California Regional Water Quality Control Board
North Coast Region
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403

Re: City of Healdsburg Wastewater Treatment Facilities
Draft Waste Discharge Requirements Order No. R1-2010-0034
NPDES Permit No. CA0025135
City of Healdsburg Comments

Dear Ms. Goodwin,

This letter presents the City of Healdsburg's comments on the Regional Water Quality Control Board, North Coast Region's ("Regional Board") Draft Waste Discharge Requirements and Master Reclamation Requirements ("Draft Permit") (NPDES Permit No. CA 0025135) for the City of Healdsburg ("City") dated August 12, 2010.

As with the last draft of the permit, the City sincerely appreciates the Regional Board staff's efforts to address the issues raised by the City during the preparation of the Draft Permit. In our April 23, 2010 comment letter, we expressed concern over the onerous conditions the March 22nd draft Permit would have imposed on the City's proposed recycled water system, and in particular, the documentation requirements for nitrogen loading, the additional rounds of public comment and approval, and the potential requirements for more expensive studies. The Regional Board has made many changes to the permit since the previous draft that have, in our view, made the permit somewhat more workable. We sincerely appreciate the Regional Board staff's attempts to address these issues.

Since the June 2010 hearing on the draft permit, the City has provided to the Regional Board the June 28, 2010 Gus Yates report, described in more detail below in our comments on the related findings on page F-16. This "water balance study" was prepared at the request of Northern Sonoma County Clean Water Coalition (CWC), using the consultant and specific scope of work suggested by CWC, to address CWC's concerns on the City's proposed Syar Irrigation Project. The City prepared the report following a February 10, 2010 meeting between the City and CWC, at which CWC representatives stated that the proposed water balance study, combined with specific groundwater follow-up monitoring, would alleviate their concerns with the Syar Irrigation Project if the water balance study demonstrated no significant impacts. The City moved forward in good faith and spent $15,000 on preparation of the study. The study concluded that none of the potential ground water or surface water quality issues addressed in the study would present significant impacts.

In the current Draft Permit, the additional "General Technical Report Requirements" for agricultural irrigation have been modified so that only Programmatic Technical Reports are subject to public notice and comment, rather than every site-specific report. In our view, this is an improvement over the requirements in the March 22nd draft permit, which would have subjected each new use site to a new Report of Waste Discharge, public noticing and comment, and potentially endless special study requirements. We generally support and appreciate these revisions to the March 22nd draft, many of which the City requested. However, we still do not believe that any new requirements beyond those in the new State Recycled Water Policy, which apply only to landscape irrigation projects, are necessary. Furthermore, we believe that the conclusions in the Gus Yates Report support this approach. To put it simply, the new Attachment G conditions are complicated and burdensome solutions to insignificant or non-existent problems, and are being applied to what is arguably the highest quality recycled water in the North Coast Region. Our greatest concern remains, which is that these requirements will become a significant impediment to attracting new agricultural users.

As stated in our April 23rd comment letter on the March 22nd draft permit, the City remains very concerned with the application of the "tributary statement" to assign to the Basalt Pond all the beneficial uses and accompanying discharge prohibitions applicable to the Russian River. The current Draft Permit appears to recognize the problems associated with determining compliance with receiving water limits in Basalt Pond, requiring two special studies to assess receiving water conditions and to determine appropriate receiving water monitoring requirements and monitoring locations for specific conductance (SC), total dissolved solids (TDS) and other constituents. While we appreciate recognition of the problem, the current Draft Permit does not resolve this issue. We are concerned that the water quality objectives for SC and TDS in the Russian River (which are the basis of the receiving water limits being applied to Basalt Pond) appear to be based solely on ambient water quality data available at the time the objectives were established many years ago, and are likely far more stringent than necessary to protect beneficial uses. We are also concerned that the current Draft Permit would expose the City to citizen lawsuits for alleged violations of TDS and SC water quality objectives that are not tied to any beneficial uses, and which we believe were improperly adopted and applied. For these reasons and the detailed reasons listed in our April 23rd comment letter, we request that the SC and TDS receiving water limits be removed from the permit.

Alternatively, because the Draft Permit acknowledges that the neither Basalt Pond nor the Russian River can currently meet the water quality objectives for TDS and SC, the Regional Board should include a compliance schedule in the City's permit with performance-based interim limits for TDS and SC until the Basin Plan is amended to properly establish water quality objectives tied to beneficial uses. The City is aware that the Regional Board is currently proposing amendments to the Basin Plan to update existing water quality objectives for groundwater. We strongly believe that the Regional Board should revise the TDS and SC limits in Table 3-1 of the Basin Plan in the current amendment process, with special consideration given to the unique circumstances in the Basalt Pond.

The City's other detailed comments are summarized below.

ORDER R1-2009-0034

Permit, Page 18, Table 6 Effluent Limitations

As described in the Fact Sheet on page F-36, the applicable technology-based effluent limitations should be 6.0 to 9.0 (40 C.F.R. § 133.102(c)), rather than 6.5 to 8.5.

Permit, Page 19, Footnote 8

These requirements have been changed and are no longer listed in Section C.5. of Attachment G.

Permit, Page 20, Reclamation Specifications 2.b.

This specification has been revised and now states that "....discharges of treated wastewater shall not exceed the hydraulic or nutrient agronomic requirements of the crops being irrigated." We support this agronomic rate language and similar language now incorporated into the Fact Sheet and Attachment G, As we clearly stated in our April 23rd comment letter, the City would oppose any requirements similar to those included in the March 22nd draft permit, which would make recycled water providers responsible for all nutrients applied on recycled water use sites managed by others.

Permit, Page 23; MRP, Page E-15; Fact Sheet, Page F-73 - Receiving Water Limitations and Monitoring

The references and approaches to the problematic receiving water limitations (temperature, pH, D.O., TDS, conductivity, and ammonia) are inconsistent and confusing throughout the Draft Permit, the MRP and the Fact Sheet. This section of the Draft Permit states that "Compliance with receiving water limitations shall be measured at monitoring locations..." However the Fact Sheet (page F-73) indicates that there is no compliance monitoring for receiving water temperature, pH, D.O., TDS, conductivity, and ammonia, and notes that compliance for these constituents will be based on the outcome of the special study requirement on page 30 of the permit. Yet Table E-8 in Attachment E still specifies monitoring for temperature, pH, D.O., and ammonia without reference to the special study on page 30 of the permit. The following changes should be made to reconcile these conflicts:

> Permit, page 23, V.A. – Insert "With the exception of constituents subject to the special study requirements in provision VI.C.2.c, compliance with receiving water limitations shall be measured..." etc.
>
> MRP, Table E-8: Delete monitoring requirements for temperature, pH, D.O., and ammonia (total and un-ionized), and if necessary add footnotes referencing special study requirements in permit provisions VI.C.2.b. and c.

Permit, Page 25; V.B.1. Groundwater Limitations

We support the proposed change to the "statistically significant degradation" language in the prior draft of the permit.

MONITORING AND REPORTING PLAN (MRP)

Attachment E, page E-4, Table E-4

Effluent flow measurement – Although effluent samples are collected at the EFF-001 site located at the downstream end of the UV disinfection system, effluent flow is monitored by a flow meter downstream of the membrane filters and upstream of the UV disinfection system. It should be noted that effluent flow must be calculated by subtracting pumping to the WWTP non-potable water (NPW) system that occurs downstream of the UV disinfection system. The NPW system is separately metered.

MRP, Table E-4, Acute and Chronic Toxicity sampling

As we noted in our June 23rd email, the City requests that both the chronic and static/acute toxicity requirements be changed from composite to grab. This is similar to requirements adopted in other recent permits, notably Windsor and RRCSD.

MRP, Table E-4 and Table E-6

Monitoring for Title 22 Pollutants is specified 1X/5 yrs for EFF-001 and 1X/5 years for REC-001 (June - September of first year operated). Both of these sample points are at the same location and are only designated differently to distinguish the destination of the effluent (discharge vs. reclamation.) This testing is expensive, costing over $3,000 for each round. We assume that the Regional Board intended that EFF-001 results would be allowed to meet the REC-001 requirements, provided that it is collected during the correct time period. A footnote should be added to Table E-6 to clarify this.

MRP, Page E-6, Footnote 16

Monitoring for chloride, TDS, and fluoride is no longer required and should be removed from the footnote.

MRP, Page E-8

The Chronic Toxicity Test Species requirement should be revised to clarify that the City need only use one of the three species listed for routine testing (see Fact Sheet, page F-51). Also, there is a typo in this paragraph- "shall be" is included twice.

MRP, Page E-13, Footnote 17

The intention of this footnote is unclear, but it would certainly be exceedingly expensive for the City to track and report the number of days recycled water is used at individual recycled water sites, and even more expensive to track and report average and maximum daily flow rates at each site. To our knowledge this has never been required of any other recycled water provider in the North Coast Region. This footnote should be revised as follows: "Each month, the Discharger shall report the number of days

that treated wastewater was used for reclamation at ~~all~~ authorized reclamation sites, as well as the total average and maximum daily flow rates. This is also consistent with the monthly water use reporting contemplated in the Reclamation Operation Reporting requirements on page E-22.

MRP, Table E-6

Footnote reference for flow measurement is incorrect. The footnote number should be "17."

MRP, Table E-7

The requirement to monitor rainfall should be revised to clarify that rainfall will be recorded only at the production site (as the City currently reports), and not at every recycled water use site. Since there is little or no variability within the overall area the City expects to irrigate, monitoring more than one rainfall gauge would not provide any useful information.

MRP, Table E-8, Footnote 28

Footnote 28 is no longer needed because there is no monitoring required for specific conductance.

MRP, Page E-24

New Use Site Reporting, the reference to Water Reclamation Provision C.5. (Attachment G) is incorrect. The correct reference is Provision C.a.iii.

FACT SHEET

Fact Sheet, Page F-15

Engineering Report Requirements, the reference to Water Reclamation Provision C.2 (Attachment G) is incorrect. The correct reference is Provision D.2.

Fact Sheet page F-17, Table F-4

The City's revised Title 22 Recycled Water Engineering Report was received by CDPH on August 24, 2010 and by the Regional Water Quality Control Board on August 25, 2010. Since the report has already been submitted, we suggest that this be removed from Table F-4.

Fact Sheet page F-16

The findings on page F-16 include the conclusions of the report titled "Syar Property Recycled Wastewater Agricultural Irrigation Project—Additional Analysis of Potential Groundwater and Russian River Impacts" dated June 28, 2010 ("Gus Yates Report"), which was submitted to the Regional Board on July 21, 2010. This "water balance study" report was prepared at the request of Northern Sonoma County Clean Water Coalition (CWC), using the consultant and specific scope of work suggested by

CWC, to address CWC's concerns on the City's proposed Syar Irrigation Project. The City prepared the report following a February 10, 2010 meeting between the City and CWC, at which CWC representatives stated that the proposed water balance study, combined with specific groundwater follow-up monitoring, would alleviate their concerns with the Syar Irrigation Project if the water balance study demonstrated no significant impacts. The Gus Yates Report concluded that none of the potential ground water or surface water quality issues addressed in the study would present significant impacts. The City supports the Regional Board's incorporation of the Gus Yates Report conclusions in the Fact Sheet. We believe these conclusions are a worst-case projection of the potential ground water and surface water quality impacts of irrigating vineyards with recycled water.

Fact Sheet page F-17, Table F-4

The City's revised Title 22 Recycled Water Engineering Report was received by CDPH on August 24, 2010 and by the Regional Water Quality Control Board on August 25, 2010.

Fact Sheet, Page F-17

CEQA finding 3 on page F-19 of the Fact Sheet states that "Recycled water will not be used for frost protection of vineyards." While the City has no current plans to contract with recycled water users to use recycled water for frost protection, and such use would generally not help the City comply with the seasonal discharge prohibition, frost control is an allowable use under Title 22 regulations. We believe it would be short-sighted and counterproductive to preclude the use of recycled water for frost protection for the entire permit term, or to imply that it will not be considered in the future. As you are aware, the State Water Resources Control Board (SWRCB), following a workshop on January 19, 2010, is considering changes to Title 23 regulations to address the effects of frost protection water diversion practices in the Russian River watershed on salmonids. The proposed SWRCB regulation would declare diversion of surface water from the Russian River for frost protection an unreasonable use and a violation of Water Code section 100, unless carried out under an SWRCB-approved water demand management program. On page 56 of the Fact Sheet discussing satisfaction of the Antidegradation Policy, the Regional Board has noted that recycled water use "...reduces the diversion of water from Dry Creek, thus reducing the potential for dewatering Dry Creek." The use of recycled water for frost control, when carried out under the requirements in Title 22 requiring robust runoff control measures, would reduce the diversion of surface water during periods when Dry Creek, the Russian River and its tributaries are arguably under the greatest threat of dewatering and the resulting fisheries impacts. As written, the finding implies that frost protection with recycled water will never be considered. If adopted in its present form, the Draft Permit would require submission of technical reports on frost protection for public review and Regional Board approval in accordance with the requirements in Attachment G. For these reasons, we believe this finding should be deleted.

Fact Sheet, Page F-29

The reference to Water Reclamation Requirement B.27 regarding Salt-Nutrient Management Plan compliance, is incorrect. The correct reference is B.26. Also, the reference to "IV.d.2 of this Order" should be "IV.d.2 of this Fact Sheet."

Fact Sheet, Page F-54, Satisfaction of Antidegradation Policy

This revised Fact Sheet discussion has been expanded to include specific findings on recycled water use and consistency with "maximum benefit to the people of the State." With the exception of the City's concerns over Attachment G requirements that we believe are beyond what is necessary to protect water quality, we support these revisions and believe that the new findings are generally well constructed and supported by the evidence, and in particular, the findings based on the conclusions of the June 28, 2010 Gus Yates Study.

Fact Sheet, Page F-56, Implementation of feasible alternative treatment or control methods

The qualifying statement in item ii. "(whichever is lowest)" should be changed to read "(whichever is limiting)."

Fact Sheet, Page F-71

The threshold for reducing acute toxicity monitoring is incorrectly listed as "at least 90% survival" during the first year. The correct threshold is "at least 80% survival" (see Footnote 11 on page E-5).

WATER RECLAMATION REQUIREMENTS AND PROVISIONS

Attachment G, Page G-2, Streamlined Permitting, provision 3.a.iii. and 3.b

We request that the wording be modified as follows: "This Order includes a requirement that the Discharger must comply with any future salt and nutrient management plan ~~developed~~ adopted by the Regional Board."

Water Reclamation Requirements and Provisions, Pages G-2 and G-3

The permit is incorrectly referred to as Order No. R1-2010-0035. Currently, the Order No. is specified as R1-2010-0034.

Water Reclamation Requirements and Provisions, Page G-5, B.9

We believe that monthly reporting to users on the nutrient levels in the City's recycled water is excessive, since variation in the qualify of the City's effluent is demonstrably minor relative to crop demand (as noted in the Gus Yates report), and the information cannot be used to alter real-time crop management. We suggest that this requirement be replaced with a requirement to make the information available on the City's website and to update it monthly.

Water Reclamation Requirements and Provisions, Page G-5, B.10

See the City's comments above on potential frost control use under Fact Sheet page F-17. We believe this requirement should be changed as follows: "Recycled water shall not be applied on water-saturated

or frozen ground or during periods of precipitation such that runoff cannot be controlled and contained~~is induced~~.

Water Reclamation Requirements and Provisions, Page G-5, B.11

To be consistent with the wording on page G-3, paragraph 8, we request that the incidental runoff statement be changed as follows: "However, incidental runoff of recycled water, such as unintended, minimal overspray from sprinklers that escapes the recycled water use area, or accidental breakage of a sprinkler head on a properly maintained irrigation system, is not a violation of this Order."

Also, many of the "practices and strategies" under this provision will not be either necessary or applicable in some cases. Provision h., for example, requires use of "....repeat start times and multiple water days to increase irrigation efficiency and reduce runoff potential." This may be necessary for a sprinkler irrigation system, but with drip irrigation there is an insignificant potential for runoff. This requirement, if retained in its present form with no flexibility, would present a significant disincentive to voluntary agricultural recycled water use. The wording in the first paragraph should therefore be revised as follows: "Practices and strategies to prevent the occurrence of runoff shall include where appropriate~~, but not be limited to~~:"

Water Reclamation Requirements and Provisions, Page G-5, B.11a

Provision B.11.a still requires new recycled water use sites to include a 100-foot setback from any surface water but since the March 22nd draft the Regional Board has added an alternative that would allow a recycled water use site to provide a written justification as to why a 100-foot setback would be infeasible. This requirement, which has no rationale or justification, could needlessly eliminate wide swaths of use sites. Irrigation systems properly designed and managed in accordance with Title 22 requirements are more than adequate to prevent runoff to surface water, whether they are 50 or 500 feet away from surface water. Such a rigid setback approach was considered and rejected during the stakeholder process leading up to the adoption of the State Recycled Water Policy, and should not now be revived and imposed through this Draft Permit. We strongly urge the Regional Board to eliminate this requirement, and instead rely on the existing provisions in Title 22 to prevent recycled water runoff to surface waters, which we believe are fully protective.

The Engineering Report Provision is incorrectly identified as Provision C.2. The correct reference is Provision D.2.

Water Reclamation Requirements and Provisions, Page G-6

Item j. specifies design of recycled water "transport" facilities to meet 25-year, 24-hour storm event criteria. The State Recycled Water Policy only specifies this design criterion for storage ponds.

Water Reclamation Requirements and Provisions, Page G-11, Training Program Programmatic Technical Report

The City has established training requirements in its Recycled Water Engineering Report which comply with Title 22 requirements. Paragraph (d) in the training program components requires a "Means of ensuring recycled water and other supplemental nutrients (including fertilizers) are used appropriately. This should include a means for accounting for nutrient sources (including recycled water content and fertilizers) to ensure that nutrients are applied at an agronomic rate;" As we described in our comment above on the Reclamation Specifications in the Order, the City supports the new language limiting the City's responsibility to the recycled water applied. This requirement, however, would again put the City in the position of prescribing "appropriate" fertilizer application to potential users, which is not within the City's jurisdiction or area of expertise. As with other Attachment G provisions addressed above, this requirement would present a significant disincentive to voluntary agricultural recycled water use. The training program should instead be designed to identify the City's agronomic rate estimates and to train users on how to calculate the nutrient application from the City's recycled water.

Water Reclamation Requirements and Provisions, Page G-12

Typo in heading for Item d. Approved Recycled Water Use Sites.

Water Reclamation Requirements and Provisions, Page G-12, Technical Report Requirements for Reclamation on Vineyards with Drip Irrigation

As written, this provision would limit vineyard irrigation to drip irrigation only. There are sites within the areas identified in the City's 2005 EIR that are irrigated with mist or spray irrigation plumbing, and at least one site that is pasture. In the case of vineyards, spray or mist irrigation would not be expected to affect the rate of application or the "agronomic" irrigation rate. This wording would unnecessarily limit the areas where recycled water may be used, potentially to the extent that it would affect the City's ability to comply with the seasonal discharge prohibition. The references to "Vineyards with drip irrigation" in these technical report requirements should be simply replaced with "Agricultural Irrigation."

We appreciate the opportunity to comment on the Draft Permit. We will make time available if you would like to meet to discuss any of these comments or potential remedies.

Sincerely,

Jim Flugum
Deputy Public Works Director

cc: Mike Kirn, Marjie Pettus, Mike Gogna, Greg Newmark

RUSSIAN RIVERKEEPER®
"We're On It!"

September 17, 2010

Ms Cathleen Goodwin
California Regional Water Quality Control Board, North Coast Region
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403

RE: Comments on NPDES Order R1-2010-0034 August 16, 2010 revised draft

Dear Ms Goodwin,

I want to Thank You for meeting with us this week to discuss our concerns with the current draft of Order No. R1-2010-0034 for the City of Healdsburg. I am writing to briefly detail our concerns on the August 16, 2010 revised draft Order. As a current member of the Clean Water Coalition of Northern Sonoma County (Coalition), we fully endorse and support the comment letter submitted on behalf of the Coalition by Chairman Fred Corson.

Our concerns focus on additions and changes to the March 2010 draft of the permit, which we had supported in our comment letter submitted in April 2010. These concerns are:

Removal of specific requirements for Technical Reports for Reclamation on Vineyards with Drip Irrigation – as we stated in our April letter Vineyard application requires more stringent controls than other proposed irrigation areas, yet requirements were relaxed compared to Urban Irrigation requirements.

We disagree with the statement that irrigation elements in the proposed reclamation policy meet the criteria for streamlined permitting – in fact we for reasons well cited by the Coalition letter Vineyard Drip Irrigation in the areas proposed are not appropriate for streamlined permitting.

We urge you to change the statements in the Fact Sheet Attachment F to reflect the layers of assumptions the Gus Yates report conclusions are based on – particularly the statements that recycled water irrigation would not result in any long-term degradation of groundwater quality as there are just too many assumptions built in to the current Yates report to reach such a far ranging conclusion.

Lastly we believe that any recycled water permits be conditioned to place numeric limits on the amount of recycled water applied and require metering to ensure compliance because any analysis tied to avoidance of impacts to groundwater quality would be tied to an specific amount of recycled water applied. The current permit offers no prevision to limit and verfify the amount of recycled water applied.

We appreciate Waterboard staff and the City of Healdsburg's helpfulness in answering questions and meeting with us so that we can work toward a permit we can all agree upon. Thank you for your consideration of our comments.

PO Box 1335 Healdsburg, CA 95448 ❖ 707-433-1958 ❖ Fax 707-433-1989 ❖ info@russianriverkeeper.org

Sincerely,

Don McEnhill
Executive Director
Russian Riverkeeper

RUSSIAN RIVER
WATERSHED ASSOCIATION

MEMBER AGENCIES

- City of Cloverdale
- City of Cotati
- City of Healdsburg
- City of Rohnert Park
- City of Santa Rosa
- City of Ukiah
- County of Sonoma
- Sonoma County Water Agency
- Town of Windsor

VIRGINIA PORTER
Executive Director

300 Seminary Avenue
Ukiah, CA 95482
(707) 833-2553

September 16, 2010

Ms. Cathleen Goodwin
California Regional Water Quality Control Board
North Coast Region
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403

City of Healdsburg Wastewater Treatment Facilities
Draft Waste Discharge Requirements Order No. R1-2010-0034
Russian River Watershed Association (RRWA) Comments

Dear Ms. Goodwin:

This letter presents comments from the Russian River Watershed Association (RRWA) on the Regional Water Quality Control Board's ("Regional Board") Draft Waste Discharge Requirements and Master Reclamation Requirements ("Healdsburg permit") (NPDES Permit No. CA 0025135) for the City of Healdsburg dated August 13, 2010. The RRWA includes nine public agencies in the Russian River watershed in Sonoma and Mendocino Counties that have come together to coordinate regional programs for clean water and watershed enhancement. Nearly all our member agencies manage and operate wastewater treatment and disposal systems, and most either have or plan to have recycled water delivery systems for the beneficial reuse of treated and wastewater. We appreciate the opportunity to comment on the Healdsburg permit, which as we explain below will have implications for all of our member agencies.

The draft permit appears to recognize the challenges of determining compliance with receiving water limits in Basalt Pond by requiring two special studies to assess receiving water conditions and to determine appropriate receiving water monitoring requirements and monitoring locations for specific conductance (SC), total dissolved solids (TDS) and other constituents. While we appreciate recognition of the compliance determination challenges in Basalt Pond, we think this only partially addresses the problem. We are concerned that the water quality objectives for SC and TDS in the Russian River (which are the basis of the receiving water limits being applied to Basalt

Pond) are based solely on ambient water quality data available at the time the objectives were established many years ago, and may be more stringent than needed to protect beneficial uses. We urge the Board to formally review SC and TDS objectives for the Russian River.

The March 22, 2010 draft of the Healdsburg permit added several new recycled water requirements in Attachment G, including new approval and public review steps for the addition of new recycled water users to the recycled water system. Since Regional Board staff have made clear that the draft Healdsburg permit will likely be the template for renewed Master Reclamation Permits in Region 1, our member agencies will be directly affected by this permit. Our primary concern has been that many of the Attachment G requirements in the March 22nd draft Healdsburg permit would be inconsistent with the State Water Resources Control Board's ("State Board") Recycled Water Policy (May 2009) because they would discourage, rather than encourage, recycled water use, impeding its specific goal of "substitution of as much recycled water for potable as possible by 2030."

We have limited our comments on the recycled water provisions of the Healdsburg permit to what we believe are the common key concerns of our member agencies. Our concerns are summarized below.

<u>New Requirements for Recycled Water Use Site Approvals</u>

Attachment G to the Healdsburg Permit draft permit includes new provisions for adding recycled water users which would go well beyond what has typically been required of other water recyclers regionally and statewide. In the view of our member agencies this is well beyond what is necessary. RRWA members believe that the existing Title 22 reclamation requirements, such as those issued for Santa Rosa and Windsor, are more than adequate to protect water quality.

Many of the Attachment G provisions in the Healdsburg draft permit; and in particular the additional approval, public input and special study requirements; have the potential to discourage new recycled water use. In the current draft of the Healdsburg permit, the additional "General Technical Report Requirements" for agricultural irrigation have been modified so that only Programmatic Technical Reports are subject to public notice and comment, rather than every site-specific report. In our view this is a significant improvement over the requirements in the March 22nd draft, which would have subjected each new use site to a new Report of Waste Discharge, public noticing and comment, and potentially endless special study requirements. While we generally support and

appreciate these revisions to the March 22nd draft, we remain unconvinced of the need for any new requirements beyond those in the new State Recycled Water Policy, which apply only to landscape irrigation projects. Our greatest concern is that these requirements could become a significant impediment to attracting new agricultural users. If this permit is adopted in its present form, we urge the Regional Board to periodically review the impact of these new requirements to determine whether they impede development of new recycled use sites, and if so, modify the permit accordingly.

We are also concerned with the specific requirement for quarterly reporting while the Statewide General Permit for Landscape Irrigation requires only annual reporting. We believe alignment with the State accepted reporting standards will better position our region to succeed in supporting the statewide goals of utilizing the recycled water resources appropriately.

Nutrient Management

RRWA supports the proposed requirement to inform recycled water users of the nutrient content in recycled water so that irrigation managers can take this into account when they calculate agronomic rates for supplemental fertilization. RRWA would oppose any requirements similar to those included in the March 22nd draft, which would make recycled water providers responsible for *all* nutrients applied on recycled water use sites managed by others. This would require that recycled water providers inappropriately intrude into the crop management practices of private users. The current draft of the Order and Attachment G appear to resolve this by clarifying that compliance will be determined by meeting the reporting requirements. We strongly urge the Regional Board to retain this wording, i.e. where compliance is determined by providing the nutrient information to recycled water users.

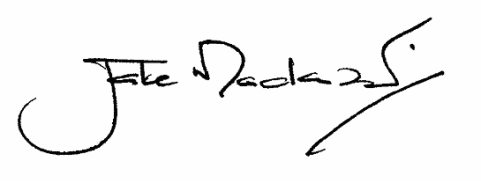
For a number of reasons, we also believe that this should be satisfied by seasonal rather than monthly reporting to users, since effluent quality variation is typically minor relative to crop demand (as noted in the Yates report cited in the Healdsburg permit), and the information cannot be used to alter real-time crop management . In addition, monthly reporting to individual users would be unnecessarily burdensome for providers such as Santa Rosa with large numbers of users. Alternatively, the information could be made available by posting on websites operated by recycled water providers. We suggest that nutrient concentration be reported to users monthly only when more than 65 percent of the agronomic nutrient demand of plants is met with recycled water.

Runoff Control

Provision B.11.a includes a requirement for a 100-foot setback from any surface water, or alternatively, a justification from the provider on why the setback would be infeasible. This requirement, which has no rationale or justification, could needlessly eliminate wide swaths of use sites. Irrigation systems properly designed and managed in accordance with Title 22 requirements are more than adequate to prevent runoff to surface water, whether they are 50 or 500 feet away from surface water. Such a rigid setback approach was considered and rejected during the stakeholder process leading up to the adoption of the State Recycled Water Policy, and should not now be revived and imposed through the Healdsburg permit. RRWA strongly urges the Regional Board to eliminate this requirement, and instead rely on the existing provisions in Title 22 to prevent recycled water runoff to surface waters, which we believe are fully protective.

Again, we greatly appreciate your consideration of these comments.

Sincerely,



Jake Mackenzie, Chair, Board of Directors
Russian River Watershed Association, www.rrwatershed.org

cc: RRWA Board of Directors

Russian River Watershed Protection Committee

2009 Photo Project

Report: June 21, 2010

By Brenda Adelman for RRWPC

Photographic Report on 2009 Water Quality Conditions in Lower Russian River:

Response to proposed 45% cut in summer flows.

By Brenda Adelman for RRWPC

I. INTRODUCTION

In late May, 2009, in anticipation of very low summer flows as measured at the Hacienda Bridge, I started taking photographs from the Hacienda Bridge, the Guerneville (Old) Bridge, and the Monte Rio Bridge and Beach every week until early October, but for one week. Several other photographers assisted, including Laurie Ross, Larry Hanson, Shula Zuckerman, Kim Pistey, Tom Meldau, Shane McColgin, and Community Clean Water Institute volunteers.

Photographs were taken between the end of May and the end of September between Steelhead Beach and Monte Rio Beach. We also received a few photos from supporters and have included one picture from the Duncans Mills area as well. We ended up with thousands of photos and this report offers just a sample of representative scenes we shot.

Our goal was to photograph water quality problems, mostly in the form of nuisance algae and Ludwigia and also to show the water levels as the summer progressed. The two dams at Guerneville and Vacation Beach kept waters consistently high in that area all summer. The area where flow changes were most visible was the Kid's Beach in Monte Rio, which is east of the bridge. That was also the area with some of the worst algae. Over the course of the summer we saw many different kinds of attached and unattached algae and offer a representative sample in the pictures. We don't know the names of what we found, but hope some more knowledgeable than ourselves will be able to identify them.

We also tracked water quality monitoring reports as well as pathogen exceedances and beach postings. Furthermore, we include flow data as measured at Hacienda. There are no other flow gauges for the lower river that we know about. Unfortunately, the nutrient data for the entire year included inappropriate protocols and is very inadequate for scientifically determining the extent of the problem. Hopefully this will be corrected in 2010.

This report is divided into several sections including, algae, Ludwigia, water levels and impact on beaches, both by flow control and opening of mouth. We include two sets of before and after pictures, upstream and downstream of the Monte Rio Bridge showing the impact of opening the mouth of the river. Two of the pictures were taken on October 5th just as the mouth was being opened, and two were taken the very next day. The difference is profound.

After the breaching, when the water went way down, the beaches where the water had been were covered with algae. I talked to Regional Board staff about the algae and was told they would take samples. I was later informed that toxic blue-green algae had been found in the area of the Kids' beach at Monte Rio.

We include Hacienda flow data here, which we obtained from Sonoma County Water Agency. All of the flows through Sept. 30, 2009, had been verified by USGS. The October flows had not yet been verified. Over the course of the summer, of the 130 days total, 57 days the flow was under 85 cfs, and 31 days were under 70 cfs. The lowest flow was 47 cfs on August 17, 2009.

A few of the pictures state "pathogen exceedence". This means that weekly monitoring at Monte Rio Beach for pathogens was out of compliance on that date. The temperature data came from Hacienda or Johnson's Beach monitoring sites and averaged about 20 to 25 Celsius, which is far too high for salmonids. Temperatures diminish considerably in the fall however.

II. MOUTH BREACHING & FLOW IMPACTS

Breaching of Mouth: impacts on Monte Rio Beach: looking west….

Photo 0145 was taken from the Monte Rio Bridge in the afternoon on Oct. 5, 2009 around 4 pm. looking west. Notice signs on mid-right of photo, far into the water. On far left notice accentuated plant on cement structure and plants submerged behind it. The water here was much higher than I had seen all summer at this location.

Hacienda flow: 92 cfs (not yet verified by USGS)

Photo 0228 was taken one day later (Oct. 6, 2009) of the same scene (magnification a bit different however.) In this picture you can see flat rectangular cement structure with plant behind it and beach all exposed behind.

On the right you can see the sand bar jutting way out with signs that had been far into the water on Oct. 5th, now far back on the sand. The line in the sand behind the signs is where the water had been the day before. Also, you can see sand bar jutting way out beyond bushes in upper right of photo. Although you can't see it in this picture, that beach is covered in algae where the water had been.

Hacienda flow: 102 cfs (not verified by USGS)

Breaching of Mouth: impacts on Monte Rio Beach: looking east….

Photo 0165: This picture was taken about 4 pm on Oct. 5th. The water line is right behind white wood platform. Bushes along the bank and Ludwigia go far out beyond water line.

Photo 0239: This was taken around 2:30 pm on Oct. 6th after breaching of the mouth. You can see white platform far back on sand and sand bar juts out beyond Ludwigia.

Low flow impacts on Monte Rio Beach:

Photo 5845: This is another comparison of the same beach scene looking east. This picture was taken earlier in the season on July 11, 2009. Water levels are more than October 6th but less than October 5th when the mouth was closed. The mouth was open when this picture was taken.

Hacienda Flow: 112 cfs

Temperature: (Johnson's Beach) 23 Celsius

Photo 7924: This picture contrasts with 5845 in that you can see that the river level is much lower (mouth open in both pictures). This was the most visible bridge location where we can see the impact of flow levels on the river. It was taken on Aug. 15, 2009

Hacienda Flow: 50 cfs

Temperature: (Johnson's Beach) 25 Celsius

III. ALGAE:

Photo 0329: This is essentially a blow up of photo 0228 on page 3 (upper right of photo) and taken Oct. 6, 2009 at Monte Rio Beach looking west. It shows prevalent algae in water and on beach AFTER opening of the mouth of the river. You can also see water line from prior day in bottom right corner.

Photo 0387: taken by Bill Clark behind his Duncans Mills vacation home on July 31, 2009 in the morning.

Hacienda flow: 76 cfs

Monte Rio Pathogen exceedence

Photo 4752: This photo was taken from the Monte Rio Bridge looking west on June 22, 2009. The whole water column seems to be subject to a large algal bloom. In subsequent visits, it was not nearly so iridescent green.

Hacienda flow: 157 cfs

Temperature:

Photo 0326: This picture was taken on Aug. 22nd from the Monte Rio Bridge looking east towards the Kid's Beach. As I looked down into the water in the middle of the bridge, the floating algae could be seen going by.

Hacienda flow: 64 cfs

Temperature: (Johnson's Beach) 23.63 Celsius

Photo 0407: This was taken at the Monte Rio Kid's Beach while down at the beach, also on Aug. 22nd. I believe that this is a different kind of algae than what was seen in the prior picture.

Hacienda flow: 64 cfs

Temperature: (Johnson's Beach) 23.64 Celsius

Photos 6814 and 7239: These photos were both taken at the Kid's Beach (from the beach) in Monte Rio. 6814 was taken on Aug. 2, 2009 and 7239 was taken on Aug. 8th. They were both from the same area.

Hacienda flow: 71 cfs and 64 cfs

Temperature: (Johnson's Beach) 23.35 Celsius

Temperature: (Johnson's Beach) 23 Celsius

Photo 6980: This picture was taken from Hacienda Bridge on Aug. 2, 2009 Looking west (downstream), the hill on the right is where the pipe is located and the algae is right down below.

Hacienda flow: 71 cfs
Temperature: 22 C

Photo 0369: This was taken at the footings of the Vacation Beach Dam (from the road) soon after it was taken down. The picture was taken on Oct. 6, 2009. The algae are very bright green as you can see, but we don't know what it is. Regional Board staff verified that it is not blue-green algae.

Hacienda flow: 102 cfs

Photo 8100: This picture was taken from the Hacienda Bridge on the North side and looking over to the right. There is a huge outcropping of Ludwigia on this bend and immediately downstream is the large mat of attached algae. This picture was taken on Aug. 16, 2009.

Hacienda flow: 51 cfs
Temperature: 23 C

Johnson's Beach algae photographed by Shula Zuckerman on September 27, 2009. The picture speaks for itself.

Hacienda flow: 69 cfs
Temperature: 21 C

Photo 3542: Picture of floating and submerged algae taken by Laurie Ross in the Steelhead Beach area on August 18, 2009

Hacienda flow: 51 cfs
Temperature: 23 C

Photo 3552: Steelhead Beach algae taken by Laurie Ross on August 16, 2009

Hacienda flow: 51 cfs

Temperature: 23 C

Photo 3311: taken by Laurie Ross in the Steelhead Beach area. This picture shows both Ludwigia and the attached floating and attached tubular algal plant under the water's surface. July 20, 2009 at west Steelhead Beach area, I found the same kind of growth at Hacienda looking south from the bridge on the right bank. **Photo 6327** was taken July 19, 2009.

Hacienda flow: 69 cfs

Temperature: 23 C

IV. LUDWIGIA

This invasive plant has overrun much of the Laguna and is now evident throughout the entire lower Russian River watershed. The Laguna Foundation eradicated it fairly successfully a few years ago in one area (near Stony Point west of Cotati), but it rapidly came back full force when not maintained. It now fills the entire channel.

Ludwigia is found in outgrowths from the bank along the whole lower river. We photographed downstream of SCWA facilities, but we know it occurs upstream as well, although not as prevalent as the lower section of the river. We include representative photos here going down the river from Mirabel (Steelhead Beach) to Monte Rio.

Steelhead Beach: Photo 7-31c looking downstream on July 31, 2009. You can see seven outcroppings in this picture along the bank. Hacienda flow on that date was 76 cfs. Picture taken by Tom Meldau and Shane McColgin.

Sunset Sunset Beach Ludwigia pictures taken by Larry Hanson (Photos 0098, 0024, 0026).

Photos 0024 and 0026 were taken west of the main Sunset Beach on July 25, 2009

Hacienda flow: 71 cfs

Photo 0098 was taken on July 4, 2009 in about the same location

Hacienda flow: 128 cfs

Hacienda Beach:

Photo 8091 was taken on August 16, 2009 (**Hacienda flow:** 51 cfs) and shows a large outcropping just north of the Hacienda Bridge looking down to the right.

Photo 8384 was taken looking south on the Hacienda Bridge towards the right bank on August 22, 2009.

Hacienda flow: 64 cfs

Photo 6684: Hacienda Bridge looking downstream at the left bank. Picture taken July 26, 2009 This is an outcropping of Ludwigia right next to outcropping of submerged attached algae.

Hacienda flow: 74 cfs.

Oddfellow's Bridge:

Photo 30002 taken by Kim Pistey, I believe at the Oddfellow's Bridge. (I was unable to contact her to verify.) The picture was taken in late August.

Old Guerneville Bridge: (looking east):

Photo 6246: taken July 18, 2009.

Hacienda Flow: 81 cfs.

Dubrava Beach:

Photo (#8) taken September 5, 2009 by Shula Zuckerman.

North bank between Russian River County Sanitation District and Monte Rio Beach:

Photo 3200: taken by CCWI volunteer. Not sure of date, but I had noticed area and it had been pretty consistently the same all summer.

Monte Rio Kid's Beach:

Photo 6591 taken July 25, 2009.

Hacienda Flow: 71 cfs

Researched and prepared by volunteers for:
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RRWPC Comments on Healdsburg Reclamation Permit Changes

Submitted by Brenda Adelman for RRWPC (by email)
September 17, 2010

RRWPC has read the underlined portions of Healdsburg's Reclamation Permit. If any of our comments are already answered in the original text, we apologize. We offer the following comments.

First, we noted an inconsistency that we would like to call to your attention. On page E-5 in the Monitoring and Reporting Program in footnote #11, it states, "*Monitoring for acute toxicity shall be conducted monthly during the first year of the permit. If all sample results show at least 80% survival during that time period, the Discharger may reduce monitoring frequency to quarterly*." Then on page F-71 of the Fact Sheet it states, "*The monitoring frequency for acute toxicity may be reduced from monthly to quarterly if, during the first year of the Order, monthly monitoring shows at least 90% survival during that time period*." We certainly hope the standard is 90% and not 80%. We believe that 90% has been Santa Rosa's standard for acute toxicity reporting.

RRWPC skimmed the entire document (Waste Discharge Requirements and Master Reclamation Permit) and took notes on the various changes proposed. We provide questions and comments here and then subsequently also comment on the letter written in support of Healdsburg by the Russian River Watershed Association (RRWA). We attended the meeting at which this letter was discussed and offered comments then that we include here.

Waste Discharge Requirements:

Monitoring and Reporting Program:

In general, we support the initial monthly monitoring for many constituents, with the idea that after a year, monitoring may be reduced or eliminated for TDS, chloride, boron, and sodium if constituents are present in an amount that does not threaten ground water quality. While we would not mind less frequent monitoring in such circumstances, we have concerns about eliminating it completely. We would suggest annual monitoring instead.

Comment (p. E-14): We wonder why only ground water quality is mentioned here, since the Reclamation Permit admits that occasional run off of irrigated

wastewater will occur? If sampling is eliminated, how will anyone know if the problem resurfaces after that occurs? What is monitoring frequency of Title 22 Pollutants at REC 002 if any are determined to be out of compliance?

Fact Sheet:

Comment (p. F-15): The Cease and Desist Order places great pressure on Healdsburg to get Reclamation Project up and running, since discharges to Basalt will no longer be allowed in the summer time. While we agree with this requirement, it is also problematic, since it gives Healdsburg justification to demand a loosening of restrictions with the Reclamation Program in order to comply in a timely manner. Healdsburg ultimately has five years to get the program up and running. Regional Board staff have already given numerous concessions as a result of this concern. We urge you not to grant further allowances as proposed in the RRWA letter supporting Healdsburg.

Comment (p. F-16): We wonder if the consultant's assessments are correct regarding net dilution, and whether cumulative impact potential has been fully assessed? Also, if ground water contaminants can move from the groundwater to the river, shouldn't impacts to the ground water also be considered impacts to the river (surface water) and be regulated accordingly? (That raises a question I never thought of before: to what extent can salt and nutrients in groundwater leech into surface water in summer time, especially with low flow?) Does the regulator agree with the consultant's analysis here?

Comment (p. F-22): There are two #9's on this page. One is crossed out and the other is normal (not underlined). There does not seem to provide any replacement language for the one that is crossed out regarding the detailed engineering report. The two #9's seem to cover different topics. Is this an error? If not, please explain.

Comment (p. F-28): This section refers to the need for Salt & Nutrient plans to assure ground water quality when irrigation with wastewater occurs. There is reference to the circumstances under which groundwater can be impaired by salt and nutrients in the last paragraph (underlined) on page F-28. There is one possible impact that is not mentioned. We ask that the salt and nutrient management also consider the impact of concentrated constituents resulting from the drawdown of the aquifer. If the extent of the aquifer is not known, how can it be determined at what point salt intrusion is becoming a water quality problem? Will there be any studies to quantify the aquifer and determine how much salt intrusion is allowed to avoid harm?

The underlined portion of the bottom of page F-28 and the top of page F-29 refers extensively to the need to develop a Salt and Nutrient Management Plan and that Healdsburg must abide by the conditions of the Plan. Yet it says

nothing about when the Plan will be adopted, nor any kind of time line for getting it done, nor what will be addressed in the plan.

Does the timeline appear in some other section? I know the City of Santa Rosa has hired consultants to begin the project, which they have, but I have heard that there have been hang-ups in expediting it's development. What/when can we expect this document? What will the public review include? How much time will be given to the public to respond to its contents? How does regional Salt/Nutrient Management differ from a TMDL?

It is problematic that, presuming that the need for such a Plan presupposes that a problem exists, this permit can then turn around and determine that the project can move forward because beneficial uses are being protected. It doesn't make sense. There is so much nutrient pollution in the lower river, that any additional contributions can have serious impacts. The ecological balance is very disturbed now and getting worse all the time, so it is reasonable to conclude that this project, even with a minimal incremental contribution, could have serious effects.

Comments (page F-54-57): Antidegradation Policy:
There is a great deal of language on page F-54 guaranteeing that water quality objectives will be met for this project and they will provide maximum benefit to the people of the State (due to offset of water supply). None of this language is really enforceable. We only need to look at the narrative standards for nutrients. No matter how much algae is present or how much biomass is apparent, the standards are almost never enforced on dischargers. While Regional Board staff used such conditions to list the Laguna on the 303(d) list for nutrients, I don't believe a Cease and Desist Order based on the current Basin Plan standard has ever been issued.

The terms and conditions on page F-55 do make an effort to address the issue, although the biggest problem we have is the lack of definition of "incidental runoff". The same verbal gymnastics used for "narrative" regulations holds true for the term "incidental". By itself it has very little specific and enforceable meaning. The conditions placed on its interpretation are themselves open to interpretation, and an attorney's dream. It's especially problematic when the signs of nutrient pollution are everywhere for which no cause has been formally identified. (RRWPC wrote extensive comments in support of listing the lower Russian River for nutrients. We have also submitted extensive photos and we include our 2009 Photo Report as an attachment here. Regional Board has received copies of our recent comments to the State and we incorporate them here by reference. They were submitted on August 30th.)

It is stated that nutrient removal will occur through Healdsburg's treatment process. Does this include phosphorus removal as well as well as nitrogen? It was my understanding that Santa Rosa wouldn't do phosphorus removal

because of its great expense. Did Healdsburg make such removal a part of their system?

There are two other issues that seem to go unaddressed. The Biological Opinion will require lower flows in Dry Creek and the Russian River. Predictions of lower flow would also result from hot dry summers caused by global warming. Have these issues been addressed in prior documents? How would the expected impacts of these two issues affect this project?

On page F-56 at the very top of the page it states, "*The use of recycled water reduces the diversion of water from Dry Creek, thus reducing the potential for dewatering Dry Creek*." Since the Biological Opinion limits SCWA releases at a time when water availability from Lake Mendocino is becoming more problematic, we would expect that SCWA would simply release more water from the dam. There seems to be plenty of water available in Lake Sonoma, even during draught years.

Comment (page F-63: d): Healdsburg is required to monitor for chemicals in the CCR. This section says nothing about what will be the follow up if CCR chemicals are found in the wastewater. Also, the statement on TDS and chloride was not clear to us. It said that increases occurred in downstream wells over upstream ones, but the following statement concluded that because discharge will be to Basalt Pond, "….*land discharge specifications for these parameters are not required by this Order*." Doesn't the water discharged to Basalt Pond get the same treatment as the Recycled Water Pond?

The paragraph on pages F-67 and F-68 partially addresses this question, stating that, *"….in light of past monitoring results and due to the higher quality of effluent that is now discharged to Basalt Pond, and specific groundwater limitations and monitoring for these parameters are not required by this Order*." Yet the monitoring program calls for monitoring of chloride and TDS for at least the first year of the permit (see Table E-6 on page E-14). Then on page F-74 in c. it states that the monitoring program does not include monitoring requirements for TDS. Please explain the apparent contradiction.

Perhaps there is something we don't understand here since the RRWA letter (page 1) refers to two special studies that will be required and states, "*The draft permit….to determine appropriate receiving water monitoring requirements and monitoring locations for specific conductance (SC), total dissolved solids (TDS) and other constituents*." They go on to challenge TDS and SC Russian River water quality objectives for these constituents.

Comment (page G-2): Again, while Healdsburg must comply with Salt & Nutrient Plan findings, apparently the lack of a Plan will not hold up this project. Neither is any timeline offered for the completion of such a plan. It is our understanding that while consultants have been hired, the plan is currently in limbo. What is the

status of the Plan? When in the anticipated completion date? What approvals must be granted before it can go into effect? The paragraph in the middle of this page is very vague as to what kind of monitoring may be required to prepare for the plan, and how long it might go on. Our concern is that problems may develop before the Plan is approved and implemented. What if there are legal impediments to the Plan that stalls it for years? What role does the Regional Board play in assuring that the Plan is appropriately developed?

Also item iv. on this page states that users will determine nutrient needs based on nutrients in wastewater and needs of plant. Are there any standards for this? When will this be determined? How often will it be checked? What is the range of nutrients in the wastewater? If wastewater nutrient levels are considered monthly, do adjustments have to be made monthly? What are the variables in the calculation? Will the soils get tested for nutrients or just the nutrients in the wastewater and the topical fertilizers? Will there be any reporting to anyone about these adjustments as they are made? What oversight will occur to make sure it is being done correctly?

Comment (page G-5): The statement is made in b. that if nutrient levels are consistent and low month to month, they can reduce notification frequency. What is considered "low"? For instance, 0.l mg/L is high for phosphorus and .01 mg/L is low. There is a wide range in between. What numbers will you be looking for in this case?

Item 11 on this page discusses incidental runoff. Item a. requires a 100' set back from waterways. We agree with this requirement and believe it would be better to make it 200'. Yet the Permit states that some exclusions may be given where this standard is infeasible. What kinds of situations are envisioned here and what kinds of remedies would be acceptable? This is especially important because the RRWA letter challenges this requirement altogether. They believe the standard has no rationale or justification. We totally disagree.

Comment (page G-6): Why is #15 eliminated on this page?

Comment (page G-8): Why is #25 eliminated from this page? Also, what will be required in the way of a programmatic technical report if a new property is added after the General Permit is approved? Will there be any public notice and/or review of new properties after the permit is issued?

Comment (page G-10): We are very concerned about the adequacy of the public notice which is simply to put a 30 day notice on the website. In order for the public to take advantage of the full 30 days for comments, it would require checking the site daily. This is impracticable for most concerned citizens. We would request that concerned parties and involved environmental water groups receive a simple email notice alerting them to the posting of the document.

We would like to finalize our comments on the Draft Permit by saying that we believe that, but for our noted comments, it makes a worthy attempt to cover the issues of concern for all parties. We hope you will be able to respond to our comments, many of which are informational in nature.

RRWPC COMMENTS ON RRWA LETTER SUPPORTING HEALDSBURG AND CHALLENGING THE DRAFT PERMIT

RRWPC would like to comment on the RRWA draft comments on Healdsburg's Draft Permit presented to the RRWA technical group at their September 16th meeting. We have no reason to believe that any significant changes have been made to this letter.

RRWA consists of seven cities (dischargers), the County of Sonoma and the Sonoma County Water Agency (also dischargers). All of these are direct or indirect permit holders and have a stake in the development of this permit. It is believed, although we have heard staff state differently, that this permit is a template for similar permits to come. We agree with that assessment and therefore think the permit is not stringent enough in some areas. Nevertheless, we acknowledge that it is a work in process, and other than a few concerns, do not want to see it downgraded in any way. The reduction and/or elimination of certain requirements are the purpose of the letter. Obviously we don't agree.

Comment (page 2): The comment is made that water quality objectives for SC and TDS in the Russian River is based solely on ambient water quality data available many years ago. While we are unfamiliar with the facts behind this assertion, we would like to suggest that circumstances might very well be worse now and not better, as this letter suggests, at least for TDS. RRWPC has established that recently nutrients are a real topic of concern, especially with the prospect of lowered flows resulting from new Biological Opinion requirements.

Also, the letter claims that this Permit goes against the State's Recycled Water Policy because it discourages recycled water use. Nowhere does the Policy state that recycled water use should be encouraged at the cost of water quality. In fact, the Policy allows Regional Boards to determine specific necessary requirements to assure water quality goals are met. This comment is completely erroneous. Reuse of wastewater should in no case occur at the expense of water quality.

On the same page, the statement is made that Title 22 requirements are sufficient for water quality protection. This is completely untrue. Title 22 protects human health, but does nothing to protect the health of the ecosystem and the total environment, which includes wildlife, aquatic life, flora and fauna, and a whole range of invertebrates that are essential to the functioning of the total food

chain. (I'm sure that I'm leaving many things out here.) Many of the Basin Plan goals and limits are based on the needs of all beneficial uses.

Comment (page 3): The letter complains that "new requirements" will inhibit potential ag irrigation participants. They seem to be referring to the requirements in the "Programmatic Technical Reports", although they are not specific. They then go on to address requirements related to application of nutrients. They are glad the Regional Board eliminated their responsibility for nutrient management of individual users and that compliance will be met by simply meeting reporting requirements. This seems problematic to us. We did raise concerns about meeting Salt and Nutrient Plan requirements when that is complete. Yet we will remind you that it is unclear when that will occur.

Frankly, we are deeply concerned about the prospect of this lack of nutrient control at a time when nutrients are becoming a severe problem in the Russian River, temperatures, bacteria, and sediment pollution are a serious concern, and the prospect of lowered flows will be exacerbating the problem. While we understand your attempts to find a middle ground, we believe that you should put in a clause to revisit this issue should specific problems be revealed in this regard. We do not believe that enough is being done to address the nutrient issue and the allowance of incidental runoff, even with constraints, may exacerbate this serious problem.

Comment (page 3):
Finally, the letter seems to indirectly complain about public review of the Programmatic Technical Report, even though public review opportunities have been greatly reduced. Again, the concern is expressed that they don't want any regulations to inhibit the use of wastewater on "designer" wines. They might consider that consumers paying premium dollars for wine may not want it irrigated with any wastewater at all. By having more stringent oversight, it may guarantee consumers that all possible care is being taken to protect the vines from unwanted contaminants.

They also complain about quarterly reporting rather than yearly reporting called for in the State Landscape Permit. First, as we stated previously, the Regional Board is allowed to make more stringent requirements. We live in a very special area with many beneficial uses, not the least of which is very high recreational use and a major drinking water supply immediately downstream of the irrigation areas. The lack of sensitivity of these circumstances by RRWA, who claims to have come together to "….coordinate regional programs for clean water and watershed enhancement." is surprising. We are particularly concerned about the large cutback in public involvement, especially since similar considerations will be sought by recycled water users in the urban areas. We think this is a poor precedent to establish in light of all the impairments in our sensitive streams. In fact, it is precisely because other dischargers want similar looseness in their requirements that this letter is being considered.

We totally disagree with the suggestion at the bottom of page 3, that the nutrient concentration be reported to users monthly only when more than 65% of the agronomic nutrient demand of plants is met with recycled water. Since Healdsburg has a policy of non-interference with agricultural irrigators, they would simply rely on the user's statement that this is indeed the case (with a wink and a nod?)

They refer to the problem Santa Rosa will have of notifying large numbers of users of the nutrients in the wastewater. They apparently are not familiar with Santa Rosa's plan to just irrigate large commercial and multi-unit parcels where a responsible party will be on site managing the operation. I have been informed that individual private property owners will not be involved (unless Healdsburg knows something we don't).

Comment (page 4): The last paragraph contains a request that is the most problematic for us. They strenuously appeal for the elimination of the 100' set back from surface water. As we mentioned before, they claim this is against the State Water Policy and has no rationale or justification. For reasons already stated, we strongly disagree. Furthermore, we disagree with their assertion that they only have to meet Title 22 requirements and see no need to do anything further.

No where in this letter do they establish how they will protect the environment for all beneficial uses if their requests are all met. We urge staff to ignore all of their recommendations. RRWPC believes that enough concessions have been made that already cause us great concern. Please do not all any more.

Sincerely,

Brenda Adelman for RRWPC

PS: For the record, we are attaching our 2009 Photographic Report showing nutrient and invasive plant problems in the lower Russian River.

SONOMA COUNTY WATER AGENCY

FILE:CF/70-6-9 AIRPORT-LARKFIELD-WIKIUP SZ – NPDES PERMIT

September 20, 2010

Ms. Cathleen Goodwin
California Regional Water Quality Control Board
North Coast Region
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403

RE: City of Healdsburg Wastewater Treatment Facilities
Draft Waste Discharge Requirements Order No. R1-2010-0034
Sonoma County Water Agency Comments

Dear Ms. Goodwin:

This letter presents comments from the Sonoma County Water Agency (Water Agency) on the Regional Water Quality Control Board's ("Regional Board") Draft Waste Discharge Requirements and Master Reclamation Requirements ("Healdsburg permit") (NPDES Permit No. CA 0025135) for the City of Healdsburg dated August 13, 2010. The Water Agency operates either by agreement or ownership eight sanitation districts or zones, of which five operate with NPDES permits issued by the Regional Board. We appreciate the opportunity to comment on the Healdsburg permit, which as we explain below will have implications for all of our operations.

The March 22, 2010 draft of the Healdsburg permit added several new recycled water requirements in Attachment G, including new approval and public review steps for the addition of new recycled water users to the recycled water system. Since Regional Board staff has made clear that the draft Healdsburg permit will likely be the template for renewed Master Reclamation Permits in Region 1, our operations will be directly affected by this permit. Our primary concern has been that many of the Attachment G requirements in the March 22nd draft Healdsburg permit would be inconsistent with the State Water Resources Control Board's ("State Board") Recycled Water Policy (May 2009) because they would discourage, rather than encourage, recycled water use, impeding its specific goal of "substitution of as much recycled water for potable as possible by 2030." The new Attachment G conditions are complicated and burdensome solutions to insignificant or non-existent problems, and are being applied to some of the highest quality recycled water in the North Coast Region. Our concern is that these requirements will become a significant impediment to attracting new agricultural users. We urge the Regional Board to consider our comments and those of the City of Healdsburg to move forward as guided by the State Board Recycled Water Policy.

The Water Agencies specific comments follow.

404 Aviation Boulevard - Santa Rosa, CA 95403-9019 • (707) 526-5370 - Fax (707) 544-6123 - www.sonomacountywater.org/

Monitoring and Reporting Plan (MRP)

MRP, Page E-13, Footnote 17

The intention of this footnote is unclear, but it would certainly be operationally intensive to track and report the number of days recycled water is used at individual recycled water sites, and even more so to track and report average and maximum daily flow rates at each site. This footnote should be revised as follows: "Each month, the Discharger shall report the number of days that treated wastewater was used for reclamation at all authorized reclamation sites, as well as the total average and maximum daily flow rates.

MRP, Table E-7

The requirement to monitor rainfall should be revised to clarify that rainfall will be recorded only at a single location and not at every recycled water use site. Since there is little or no variability within an overall area where one would expects to irrigate, monitoring more than one rainfall gauge would not provide any useful information.

FACT SHEET

Fact Sheet, Page F-17

CEQA finding 3 on page F-19 of the Fact Sheet states that "Recycled water will not be used for frost protection of vineyards." We believe it would be short-sighted and counterproductive to preclude the use of recycled water for frost protection when it is already allowed under Title 22 regulations. As you are aware, the State Water Resources Control Board (SWRCB), following a workshop on January 19, 2010, is considering changes to Title 23 regulations to address the effects of frost protection water diversion practices in the Russian River watershed on salmonids. The proposed SWRCB regulation would declare diversion of surface water from the Russian River for frost protection an unreasonable use and a violation of Water Code section 100, unless carried out under an SWRCB-approved water demand management program. On page 56 of the Fact Sheet discussing satisfaction of the Antidegradation Policy, the Regional Board has noted that recycled water use "...reduces the diversion of water from Dry Creek, thus reducing the potential for dewatering Dry Creek." The use of recycled water for frost control, when carried out under the requirements in Title 22 requiring robust runoff control measures, would reduce the diversion of surface water during periods when Dry Creek, the Russian River and its tributaries are arguably under the greatest threat of dewatering and the resulting fisheries impacts. As written, the finding implies that frost protection with recycled water will never be considered. If adopted in its present form, the Draft Permit would require submission of technical reports on frost protection for public review and Regional Board approval in accordance with the requirements in Attachment G. For these reasons, we believe this finding should be deleted.

WATER RECLAMATION REQUIREMENTS AND PROVISIONS

Water Reclamation Requirements and Provisions, Page G-5, B.9

We believe that monthly reporting to users on the nutrient levels in recycled water is excessive, since variation in the quality of a tertiary plant effluent is demonstrably minor relative to crop demand and the information cannot be used to alter real-time crop management. We suggest that this requirement be replaced with a requirement to make the information available on a publicly available website and to update it monthly.

Water Reclamation Requirements and Provisions, Page G-5, B.11a

Provision B.11.a still requires new recycled water use sites to include a 100-foot setback from any surface water but since the March 22nd draft the Regional Board has added an alternative that would allow a recycled water use site to provide a written justification as to why a 100-foot setback would be infeasible. This requirement, which has no rationale or justification, could needlessly eliminate wide swaths of use sites. Irrigation systems properly designed and managed in accordance with Title 22 requirements are more than adequate to prevent runoff to surface water. Such a rigid setback approach was considered and rejected during the stakeholder process leading up to the adoption of the State Recycled Water Policy, and should not now be revived and imposed through the Draft Permit. We strongly urge the Regional Board to eliminate this requirement, and instead rely on the existing provisions in Title 22 to prevent recycled water runoff to surface waters.

We appreciate the opportunity to comment on the Draft Permit. If you have any questions or comments, please contact me directly.

Sincerely,

for:
Kevin Booker
Water Agency Principal Engineer

c Pamela Jeane, Randy Cullen, Wendy Gjestland, George Lincoln

April 23, 2010

North Coast Regional Water Quality Control Board
5550 Skyline Boulevard, Suite A
Santa Rosa, CA 95403

RE: Healdsburg NPDES Permit No CA0025135 – Order No. R1-2010-0034

The Westside Association to Save Agriculture (WASA) is a community organization formed to promote stewardship of the land and to protect both agricultural uses and natural resources of the Middle Reach of the Russian River. For nearly a decade, WASA has actively supported the Water Quality Control Board's objectives relative to Healdsburg's wastewater permits and disposal plans. We've participated in every public process, and appreciate the opportunity to provide input on the NPDES permit process.

Many WASA members are landowners in the vicinity of Healdsburg's treatment plant and are concerned about the lack of adequate studies on the impacts to domestic drinking water wells from Healdsburg's disposal plans. Of concern is both what we know about the small number of metals and chemical compounds that are regulated, and what we don't know about the thousands of chemicals that are not monitored. Current regulations require the California Department of Health to set mitigations to meet "drinking water" standards; however, there is general agreement that Title 22 standards are woefully out of date with regards to protecting groundwater wells from chemical contamination.

Of primary concern is the fact that the Middle Reach is the drinking water aquifer for over 700,000 people. WASA has consistently challenged projects in the Middle Reach that have the potential to impact the quantity of water and quality of the Middle Reach aquifer. Our position is that agricultural land re-use projects must be outside the drinking water aquifer. WASA has consistently supported urban re-use projects that provide potable water offsets.

As a member of the Clean Water Coalition (CWC), our mutual objectives are to protect both surface and groundwater quality. WASA supports CWC comments, and provides additional perspective below.

Should Healdsburg propose an agricultural-reuse project in the aquifer, WASA's perspective is that the NPDES/ Master Reclamation Permit must require an extensive studies, including but not limited to Water Balance and fate and transport studies, to ensure no irreparable damage to surface or groundwater. If the land area is around the Syar terrace pits, the studies must account for the unique hydrology in this area. WASA agrees that the Water Quality Control Board water reclamation requirements should be the controlling documents that define or aggregate the required surface and groundwater mitigations before any reuse project is approved. And, WASA supports groundwater monitoring in alluvial soils to assure the public that any reuse project will not degrade groundwater and domestic well water quality.

1. Regardless of the status of a re-use project's environmental documentation, the permit language should be clear that Attachment G provisions apply to ALL reuse projects. For an effective public and agency review process, the Master Reclamation Permit (wastewater reclamation requirements) should be definitive and contain the full set of studies and protective measures. The public should not have to find an out of date EIR or the Title 22 Engineering Report to piece together required mitigations.

Attachment G-1 clearly states there are no approved recycled water use sites. Most provisions in the document state that new sites are to be approved through the process in Attachment G, which includes completion of the required studies, a Report of Waste Discharge, an Operation and Management Plan, and an Irrigation Management Plan. We recommend that Appendix G be the controlling document for any project.

2. Remove or clarify the intent of the confusing and circular references for the Syar agricultural reuse project: The majority of references are clear and unequivocal that all Appendix G provisions and Water Reclamation Requirements (WRR) apply to all reuse projects. The Order is clear that there are no approved recycled water use sites.

Of concern are the circular references associated with the potential agricultural reuse project on Syar's lands: Attachment G (C) (5) states environmental review is required, and that all mitigation measures are to be implemented, but then refers to the 2005 Wastewater Treatment Plant Upgrade EIR and the uncertified 2009 Mitigated Negative Declaration.

Significant analysis and public comment on both of Healdsburg's environmental documents, including the Water Quality Control Board's September 22, 2009 letter, reveals that the current environmental documents have virtually no analysis and relatively few mitigations to protect surface water or prevent groundwater contamination.

In fact, the only mitigation measure in the hydrology and water quality section of Healdsburg's Mitigated Negative Declaration clearly states that the NPDES Permit Water Reclamation Requirements (WRR's) will include all mitigations. Thus, the WRR's appear to be controlling, and there is no need for the circular reference.

> "The project shall comply with all permit requirements as set forth by the Regional Water Quality Control Board (RWQCB) as set for in water reclamation requirements (WRRs) by this agency. Permit requirements are expected to include requirements for recycled water established in Title 22 of the California Code of Regulations, including requirements for treatment and use area restrictions, together with any other recommendations by the California Department of Public Health." (Mitigation Measure: Hydrology and Water Quality, 2009 Draft MND Page 31)
>
> The 2005 WWTP EIR page 3.2-35 also states that regardless of disposal options, the effluent will comply with the NPDES permit.

Neither the 2005 EIR nor the 2009 Negative Declaration included any site specific studies, and the 2009 Negative Declaration ignored the 2007 Middle Reach studies completed by Kennedy-Jenks Engineers. Of concern is that these environmental documents – in the absence of scientific analysis - make broad findings of no significance and do not include specific mitigations.

3. Assuming the appropriate studies have been completed that demonstrate that there will be no impacts to groundwater and surface water by an ag-reuse project, WASA recommends that, at a minimum, the required 100 foot Buffer between wastewater application and surface water (Russian River and two intermittent streams) also apply to the terrace pits.

Attachment G (B) (11a) protections should apply to all lands along the River, along seasonal creeks and land surrounding the terrace pits. **Note Attachment 1** to this letter: there are two intermittent creeks in the Syar lands area: 1) straitened creek to the west of terrace Pits V and VI, with adjacent wells supplying a large number of parcels; and 2) the creek running southeast between Pits IV and III.

WASA supports the recommendation for a buffer zone around all water bodies, including the terrace pits which represent a "direct discharge to groundwater." The Water Quality Control Board's September 22, 2009 letter clearly states:

> "**The MND should identify the shortest distances from the proposed recycled water irrigation system to the Russian River, seasonal creek and ponds. In addition, buffer zones must be established** to ensure that recycled water does not discharge into these water bodies. ... Setbacks between the irrigation system and water bodies are necessary in the event of a system malfunction (line break or failure of system to shut down)."

All areas in the drinking water aquifer meet the "special site study" criteria due to high transmissivity soils; however, the areas in the vicinity of the terrace pits have even more unique site specific conditions given the groundwater mounding effects of terrace pits Phase V and VI. (Order Attachment G, pages 10-11). Unlike Basalt, the new terrace pits have not silted in, thus, the application of wastewater in and around the terrace pits could have a significant cumulative effect on groundwater levels and water quality -- impacts have not been addressed in the current environmental documents.

> "...highly porous sand and gravel in these valleys does not effectively attenuate metals, nutrients or organic compounds." (Kennedy – Jenks 2007 Technical Memoranda)

> "There is higher and more prolonged springtime ground water levels on the adjacent vineyards to the north and west of the pits." (Todd Engineers, December 2006 report Phase VI SEIR).

In 2002, the Water Quality Control Board commissioned the GeoTrans study, in part due to concerns about the accuracy of previous hydrologic models of terrace pit impacts. Conditions have changed since Healdsburg's 2005 EIR; the excavation of the Phase VI gravel pit immediately south of Phase V has totally changed the assumptions in the wastewater flow models used in the 2005 EIR. In fact, numerous subsequent studies, conducted by Luhdorff & Scalmanini Engineers, Dr. Curry and Todd Engineers raise the concern of higher groundwater levels and the potential for cumulative impacts in the areas around the terrace pits.

The Phase VI Conditions of Approval put the "restricted area" that separates Phase V and VI from the intermittent creek shown on Attachment 1 in an agricultural easement. These conditions are still in effect, and place both Phase V and VI in a protective open space easement that prohibits discharge of treated effluent.

> " In addition to the 28.06 acre open space easement to offset land removed from agriculture due to the terrace mining operation, the operator shall place the Phase V and VI mining areas under open space easements that protect the wildlife habitat created by site reclamation and prohibit the discharge of treated effluent to either pond." (Phase VI Conditions of Approval PLP03-0046 Provision 42)

1994 ARM Plan Section 4.4 "Groundwater" identifies both an aquifer – River interaction and an aquifer - terrace pit interaction. The ARM Plan and subsequent studies reveal that the pits capture water from the surrounding aquifer in summer and then release water to the downstream aquifer.

The hydrology report, substantiated by more recent studies, shows that the Middle Reach aquifer is unconfined with recharge from the north and west. The aquifer flows to the south/southeast and is hydraulically connected to the River, recharging the River for most of the year.

Likewise, monitoring well data show that the gravel pits act as a recharge pond in the winter with flow leaving the pits and recharging the aquifer and ultimately the River. This trend reverses in the summer when evaporation of the exposed groundwater results in the terrace pits becoming a sink, capturing water from the aquifer.

The Water Quality section then goes on to say that domestic water supply may be impacted by terrace mining activities which extract gravel. "**Groundwater moving through the terrace gravel benefits from the filtering effect while groundwater moving through an open body of water in a terrace pit receives no filtering.**" (ARM Plan page 4.4:11-19). Any studies regarding the suitability of Healdsburg's ag-reuse project in the Middle Reach must take into account these hydrologic conditions resulting from these pits.

4. A spill or over-irrigation in the drinking water aquifer could have irreparable impacts. WASA recommends the Operation and Maintenance and Irrigation Plans

are based on accurate and site-specific agronomic studies, with adequate requirements for Discharger Monitoring and non-compliance fines.

Again, the 2009 Mitigated Negative Declaration proposed wastewater application rates, but provided no analysis. Dennis Hill, WASA past-President with extensive experience in the wine industry, prepared an analysis for light, medium and heavy irrigation regimens based on experience in growing grapes in the Middle Reach aquifer area. This study showed the vineyards may only need 30-40% of the Mitigated Negative Declaration's proposed 35-50 million gallon discharge on Syar lands.

Like the Water Quality Control Board's September 22, 2009 letter, the September 30, 2009 comments on the Mitigated Negative Declaration have not been answered. In Attachment 2, the agronomic rate analysis is covered on pages 7-10.

Recent studies, such as the December 21, 2009 Science Daily article "Lost Water of the Napa Valley Vineyards," show that – even at agronomic rates – a percentage of applied irrigation water is not absorbed and percolates below the root zone. And, certain metals of concern, such as copper, remain in the soil.

5. Recommend more protective requirements for domestic wells, including groundwater monitoring: Attachment G (B) (22) states that "The use of recycled water shall not cause degradation of any water supply." This is of special concern in the drinking water aquifer because the Kennedy – Jenks fate and transport studies in the Middle Reach clearly show that the high transmissivity soils do not attenuate metals, nutrients and chemicals. Thus, a 50-foot buffer between wastewater application and a well is clearly inadequate.

Attachment G (5) (a) states that wells within 200 feet of the wastewater irrigation boundary must be identified. WASA recommends that Healdsburg complete more extensive Water Balance and fate and transport studies, not only to determine the suitability of applying treated wastewater over the aquifer, but also to determine the adequate buffer between wastewater application and domestic wells.

It is WASA's belief that results of these studies would require any proposed project in the drinking water aquifer to have, at a minimum, a dual irrigation system and groundwater monitoring. Monitoring is required to ensure the theoretical models were correct, and to protect well owners from abnormal effluent discharges, such as the October 2008 event.

Sincerely,

Marc Bommersbach President, Westside Association to Save Agriculture

Attachment 1: Map with intermittent streams and additional wells identified
Attachment 2: September 30, 2009 Comment Letter

Attachment 1

Syar Properties Proposed for Seasonal Irrigation with Treated Wastewater

NORTH

Exhibit 1

September 17, 2010

North Coast Regional Water Quality Control Board
5550 Skylane Boulevard, Suite A
Santa Rosa, California 95403

RE Comments Concerning Order No. R1-2010-0034, Waste Discharge Requirements and Master Reclamation Permit for the City of Healdsburg

The following comments concern the August 16, 2010 draft of Order No. R1-2010-0034 and are made on behalf of the Westside Association to Save Agriculture, a member of the Clean Water Coalition that has participated in the administrative process for the Healdsburg Wastewater Treatment, Reclamation and Disposal Facility since the turn of the century. The Westside Association to Save Agriculture (WASA) is a community organization formed to promote stewardship of the land and to protect both agricultural uses and natural resources of the Middle Reach of the Russian River.

For nearly a decade, WASA has actively supported the North Coast Regional Water Quality Control Board's (WQCB) objectives relative to protection of our high quality groundwater resource, and even joined in the WQCB's suit over Healdsburg's wastewater permits and disposal plans, and its inadequate Draft EIR. We've spoken at virtually every public hearing, submitted comments on the 2005 EIR, and then submitted over 26 pages of substantive comments on the 2008/09 Draft Mitigated Negative Declaration (Draft MND). To date, very few of our concerns have been addressed, and we have been offered only one last chance for a definitive Technical Study.

WASA would like to thank the WQCB staff for meeting with us to review drafts of this permit; however, we have a number of concerns with the most recent draft. We are discouraged that much of the public's input was omitted from Healdsburg's NPDES permit, and have attached the April 23rd WASA comments to this letter.

As all of the previous environmental documents (see Attachment 1) point to the NPDES/Master Reclamation Permit as the controlling document, the required Technical Report must be in sufficient detail to support the conclusion of no unmitigated impacts to surface or groundwater. This will require specific studies to address the unique hydrology around the gravel pits and studies that differentiate the study area into properties with different soil types and depths, different run-off and deep percolation rates, and different hydrologic conditions.

Based on substantive facts in the record for the Healdsburg Draft MND, the NSCARP project and the Santa Rosa Indirect Discharge project, wastewater irrigation in the alluvial soils of the Middle Reach may have a significant impact on the environment. And, at a minimum, the proposed agricultural discharge project should require a *Special Study* to determine the appropriateness of recycled water use in various portions of the Study Area before investment in full Technical Studies

and before any conclusions are drawn.

We ask that Healdsburg's NPDES Permit be clarified to:

- **Eliminate the premature assumption that the study area meets the requirements for Streamlined Permitting,**
- **Require groundwater monitoring to validate the theoretical assumptions and models used and to assure no harm is being done to the drinking water aquifer,**
- **Set more specific Program level study criteria, including but not limited to, required analyses of the differences in soil profiles throughout the study area, and the hydro-geologic conditions created by the gravel pits,**
- **Require "fate and transport" studies to ensure mitigations and best management practices address hot spots and potential contamination of residential wells,**
- **Require the Discharger to meter the flow to each Ag User based on the calculated Agronomic Rate for the characteristics of that user's lands, and**
- **Reinstate the requirements for O&M and Irrigation Management Plans to the Drip Irrigation Technical Study.**

Point 1: Site-Specific Study Needed:

The Streamlined Permitting and minimized requirements for the program level Ag Irrigation Technical Study appear to be based on reports that are not complete or certified (Engineering Report and Draft Mitigated Negative Declaration). Regardless, these reports do not contain the necessary data or analyses to support such assumptions or conclusions.

WASA and the Clean Water Coalition (CWC) have provided substantial evidence that Healdsburg's proposed irrigation sites located in the alluvial valley soils north and south of Healdsburg's wastewater treatment plant **meet the high transmissivity soil and shallow, high quality groundwater criteria for unique, site specific conditions.**

These facts, reasonable assumptions predicated upon fact and expert opinion supported by fact are included in the Healdsburg Draft MND record, including references to, links and attachments of technical studies completed for the North Sonoma County Agricultural Reuse Project (NSCARP) and Santa Rosa's Indirect Discharge project.

WASA and the CWC point to multiple reports prepared by authors who are experts holding advanced degrees which provide detailed, lengthy scientific explanation of the potential for impacts from another agricultural re-use project proposed for this exact same area. These studies demonstrate that wastewater irrigation on alluvial soils with high groundwater may cause a significant water quality impact.

Point 2: WASA is concerned that assumptions in the NPDES Permit are based on unsubstantiated evidence – current data and analyses that have not been provided to the public and mitigations defined in future studies.

The Middle Reach alluvial valley is the drinking water aquifer for over 600,000 people.

1. The (Attachment G (A) (3) assumption that Healdsburg's proposed agricultural reuse program meets the criteria for Streamlined Permitting per Paragraph 7(c) of the Recycled Water Policy is premature – **there has been no specific study, the Engineering Report is not complete, the program-level Technical Study is slated for the future, and there is no "Salt and Nutrient Management Plan" for the Middle Reach.**

   This conclusion, and the potential release of the obligation to do groundwater monitoring, is based on the assumption that drip irrigation will be applied at Agronomic Rates and that there will be no deep percolation of wastewater below the root zone. Yet, these conclusions are not based on substantiated evidence, data or field analyses.

   The Streamlined Permitting assumption appears to undo the protections provided by **Attachment G (C) (1) (a) and (c).** The conclusions are based on theoretical analyses with assumptions toward the average – not actual field data. These theoretical models assume homogeneity in application of wastewater throughout a vineyard, and do not address the issue of "hot spots" where concentration of contaminants may be greater than the averages predicted in theoretical analyses.

CEQA discourages reliance on evidence that is not provided to the public or in the record.

2. The Fact Sheet and other assumptions in the NPDES Permit appear to rely on the June 28, 2010 report by Gus Yates, Consulting Hydrologist titled "Syar Property Recycled Wastewater Agricultural Irrigation Project – Additional Analysis of Potential Groundwater and Russian River Impacts." This is a draft study that has not been released to the public.

   This report is based on a theoretical simulator model, driven by assumptions, with two of the key assumptions not substantiated by evidence or field data.
   - The calculation of deep percolation rates is reliant on assumptions relative to runoff – yet there are no readily available data sets for runoff on flat agricultural land.
   - The assumption as to the amount of irrigation water applied is based on a phone call with Syar's vineyard manager, and is not backed up by data.
   - Likewise, the soil depth assumption of 6 feet is generalized and not based on actual, available field data for the Middle Reach which shows that many places in the aquifer only have 2-3 feet of silt and loam over the gravel layer.

This technical report underlying the assumption that groundwater degradation will not exceed drinking water standards present conclusions that are not substantiated by full disclosure of methodology or data.

Other studies entered into the record for NSCARP and Healdsburg's environmental review include Nick Johnson's reports for the Alexander Valley and the Dry Creek valleys that warn of the concentration of contaminants stored in the soil from drip irrigation with wastewater being flushed into the groundwater with the advent of winter rains. And, there are other studies, such as the Kennedy-Jenks Technical Memoranda that analyzed surface water impacts from indirect discharge in the alluvial soils of the Middle Reach that arrived at a far different conclusion.

WASA recommends that the NCRWQCB require the calculation of different scenarios or a sensitivity analysis using various assumptions relative to irrigation rates (4 - 6 - 8 -10 -12 -14 16 inches) and deep percolation rate variability (6 – 8- 10- 12 -14-16 inches) on different soil depths and types. In the alluvial valley this could be 3 feet of sandy loam over gravel and 6 feet of sandy loam over gravel. A separate set of assumptions as to soil type and depth are required for the hillside locations.

The objective of this analysis is to define what parameters lead to the cross-over in conclusion from net dilution of contaminants in groundwater with 6 inches of irrigation and 15 inches of deep percolation (Yates, 2010) to net concentration of contaminants in groundwater with assumptions of 15 inches of irrigation and 7 inches of deep percolation (Johnson and Yates, 2008).

Addressing spatial variability in irrigation application rates relative to soil depths and slope will also help identify potential "hot spots" where concentrations of contaminants may be higher than the theoretical averages.

3. **The Yates study does not define or determine the Agronomic Rates.**
   Agronomic Rates for irrigation require analyses of such factors as:
   - Soil Profile – both the soil type and its water holding capacity and the soil depth throughout the application area;
   - Soil – Root distribution;
   - Temperatures throughout the irrigation season;
   - Rainfall levels, run-off and percolation rates,
   - Specific hydrogeology and groundwater levels, and
   - Evapo-transpiration rates of the specific plant type.

The need to address "hot spots," especially in relation to drinking water wells, is substantiated by research being conducted at Stanford University and by new evidence of nitrate intrusion in drinking water supplies. (Links provided below)

The study done by Stanford's Department of Geological and Environmental Sciences, published in the December 21, 2009 *Science Daily* (Attachment 2) concluded:

> "We found that about 10 percent of the water that is applied is lost below the vine rooting zone and does not have contact with the soil and vine roots… This is a conservative estimate."
>
> " In addition to enabling her to calculate that at least 10 percent of the irrigation water was zipping past the root zone without reacting (through animal burrows and cracks in the soil), she discovered that during the winter rain storms, all the sulphur applied to the vines during the previous growing season was getting washed below the rooting zone of the vines, and potentially out of the vineyard."
>
> "The next stage of the research is to look at what the implications of that sulphur input are for aquatic systems down gradient of the vineyards. There, sulphur may interact with other elements, such as heavy metals, which cold have ecological consequences."

CEQA requires review before a permit approval, and cautions against approving a project that will require best management practices without engaging in any study of these practices before permit approval.

Point 3: Attachment G (C) requires future program-level Technical Report for agricultural reuse. However, Attachment G (C) (2) technical report requirements for Vineyards with Drip Irrigation have been striped of the requirements for Irrigation Management and Operations Plans, as required for Urban Reuse projects.

The requirements for an Operations and Management Plan (O&M Plan) and Irrigation Management Plan – including the essential requirements for calculation of agronomic rates and protections to the degradation of groundwater – are omitted from the Vineyards with Drip Irrigation Requirements. These essential management and monitoring requirements included in the draft and now only present in Attachment G (C) (3) (a,b,c) must be added back in to the C.2.

The risk to groundwater from vineyard irrigation is compounded by the fact that the enforcement mechanism is User self-management and self reporting. The Permit must require the Discharger to meter the flow to each Ag User based on the calculated Agronomic Rate for the soil profile and characteristics of that user's lands.

Absent an Ag User-specific Irrigation Management Plan, there is no assurance that individual users will apply wastewater irrigation at the required agronomic rates, adjust fertilizer applications appropriately, or install the equipment necessary to prevent surface and groundwater contamination from broken pipes or emitters.

Best practices are not defined in the NPDES Permit – even though many best management practices exist to ensure that wastewater is not over-applied on any one block of vineyard land. In fact, a number of demonstration projects are currently using available technologies to measure irrigation rates and soil retention in Sonoma County.

- Ag Recycled Water Users should be required to install pressurized systems with pressure sustaining valves to ensure even distribution and to avoid hot spots. And, flow regulators that notify the vineyard manager in the case of a pipe crack or breakage.
- Filtration, including Media Tanks that take out organic and inorganic contaminants, may be required to avoid clogged emitters.

In conclusion: WASA has submitted multiple letters, citations to technical reports and letters from technical experts into the record. Given the substantial evidence in the record, WASA questions whether a Mitigated Negative Declaration is the right environmental documentation for a wastewater irrigation project of this magnitude and in this sensitive location. Analyses and issues relative to groundwater impacts and well impacts are not answered in the Draft Mitigated Negative Declaration, then the MND states that groundwater impacts will be addressed and mitigated in the NPDES Permit.

We are concerned that the required Engineering Report is not final or approved. And, that the NPDES Technical Study requirement is a program level analysis that may have critical specific analyses missing. Absent sensitivity analyses, or scenarios documenting different assumption ranges, it is risky to rely purely on theoretical analyses not backed by field data. It is absolutely critical the future Technical study clearly gather and present the public with the underlying assumptions and data to support its conclusions. And, that defined mitigation measures are enforceable.

Sincerely,

Judith Olney
Westside Association to Save Agriculture

Attachments and Links below

Attached: April 23, 2010 Comment letter from WASA
May 3, 2009 Comment letter on NSCARP from Richard A. Kagel, PhD

December 21, 2009 *Science Daily Article*

Lost Water of the Napa Valley Vineyards

Link to ScienceDaily (Dec. 16, 2009) —But Stanford researchers have found that a significant portion of the water applied to the vines zips right by the plants, hardly even pausing...
http://www.sciencedaily.com/releases/2009/12/091216103605.htm

Links to "Nitrates in our Drinking Water" Articles and Video

Part 1: The Present Threat
Part 2: Charting a Cleaner Future and Part 3: Cleaning up the Past
http://californiawatch.org/video-how-nitrates-enter-drinking-water

http://www.californiareport.org/archive/R201005140850/a

Citations - Expert Analyses submitted or provided via links in previous comment letters:
References from April 2010 CWC Comment Letter:

1. Johnson, N.M. Potential Water Quality Impacts of NSCARP in the Alexander Valley funded by the SRNA and AVA, May 2007.

2. Johnson, N.M. Potential Water supply Impacts to Dry Creek Valley from NSCARP funded by the DCVA, December 2008.

3. Yates, G. NSCARP: Revised Versions of Nick Johnson's Water and Salt Balance Tables for Dry Creek Basin, funded by the Coalition, March 2009.

4. Yates, G. NSCARP FEIR, Technical Review of Hydrology and Water Quality Issues, funded by the CWC, April 2009.

5. Santa Rosa Discharge Compliance Project FEIR, Volume 6, TM I-3, March 2008.

6. Santa Rosa Discharge Compliance Project FEIR, Volume 6, TM I-5, March 2008.

References 5 and 6 are available for download at http://www.recycledwaterprogram.com/doclib/Documents/ut_irwp_DCP_DEIR_TM_I-3.pdf and http://www.recycledwaterprogram.com/doclib/Documents/ut_irwp_DCP_DEIR_TM_I-5.pdf.

7. Impacts of Proposed Healdsburg Wastewater Discharges on the Russian River, Prepared for the Town of Windsor, Timothy Durbin, March 18, 2005.

References 1 through 4 are in the NCRWQCB files delivered to John Short on CD with cover letter dated April 30, 2009.

Reference 7 is available in the NCRWQCB files as attachment to letter L-4 from the City of Windsor in the Healdsburg Wastewater Treatment Plant Upgrade Project FEIR

Attachment 1: Excerpts from April 2010 Comment Letters

2005 Final EIR and a draft Mitigated Negative Declaration: Significant analysis and public comment on both of Healdsburg's environmental documents, including the Water Quality Control Board's September 22, 2009 letter, reveals that the current environmental documents have virtually no analysis and relatively few mitigations to protect surface water or prevent groundwater contamination. In fact, these documents defer to the NPDES Permit technical studies:

Attachment G Requirement C.1.d (i) (page G-12) states: "The Discharger's certified FEIR identifies the high quality of treatment provided by its upgraded wastewater treatment plant and the use of agronomic rates for application of recycled water as two key mitigation measures to protect water quality."

- The 2005 Wastewater Treatment Plant Upgrade FEIR was completed before the plant was operational, and does not include any data on Healdsburg's wastewater quality nor analyses of appropriate agronomic rates in alluvial soils;

- The draft Mitigated Negative Declaration (December 2008 Initial Study and August 2009 draft also received substantial un-answered comments. This document specifically defers the identification of mitigation measures to the NPDES permit process.

In fact, the only mitigation measure in the hydrology and water quality section of Healdsburg's Mitigated Negative Declaration clearly states that the NPDES Permit Water Reclamation Requirements (WRR's) will include all mitigations.

These circular references confuse the public's ability to understand the required mitigation measures or to assess which document is controlling.

"The project shall comply with all permit requirements as set forth by the Regional Water Quality Control Board (RWQCB) as set for in water reclamation requirements (WRRs) by this agency. Permit requirements are expected to include requirements for recycled water established in Title 22 of the California Code of Regulations, including requirements for treatment and use area restrictions, together with any other recommendations by the California Department of Public Health." (Mitigation Measure: Hydrology and Water Quality, 2009 Draft MND Page 31)

The 2005 WWTP EIR page 3.2-35 also states that regardless of disposal options, the effluent will comply with the NPDES permit.

May 3, 2009

Mr. David Cuneo, Senior Environmental Specialist
Sonoma County Water Agency
404 Aviation Boulevard
Santa Rosa, CA 95403

Dear Mr. Cuneo,

I respectfully submit the following comment letter concerning the North Sonoma County Agricultural Reuse Project (NSCARP) and the recently released Final Environmental Impact Report (FEIR). I submit this letter on behalf of the Clean Water Coalition of Northern Sonoma County (CWC) and it can best be considered in combination with other expert analyses and comments submitted also on behalf of the CWC (Corson, Johnson, Yates, McEnhill, Wilshire, and Teh). In particular, this letter references information contained in the expert hydrology reports prepared and submitted by Nicholas Johnson and Gus Yates.

I will begin with a brief description of my credentials as an expert in the areas of groundwater and wastewater analysis and water quality, especially as it pertains to hazardous chemicals. I hold a Ph.D. in analytical chemistry and have, for over 20 years, worked as Laboratory Director of a California-Certified environmental testing laboratory. Prior experience includes 6 years in industry serving as a research chemist for various firms including Rockwell International's Space Transportation Division and 2 years as a Post-Doctoral Fellow for the National Oceanic and Atmospheric Administration and Hewlett Packard Corporation. I have been qualified in both the State of California and Federal Courts as an expert in the field of analytical chemistry as it pertains to chemicals contained in environmental samples including groundwater and wastewater. I have also served on the faculty at the University of California, Berkeley and Sonoma State University where I taught courses in Environmental Chemistry and Analytical Chemistry.

My comments in this letter focus on significant potential groundwater and surface water contamination, impacting drinking water resources, due to the NSCARP, which is not adequately assessed in the FEIR. I base my opinions, expressed in this letter, on my expertise with regard to the composition of the tertiary treated wastewater to be used for this project, the concentration and nature of the chemicals remaining in the wastewater after treatment and my over 30 years of diverse experience working in the field of environmental chemistry. I have also reviewed two, independent expert hydrology studies that evaluate the basic water balance in the areas that are potentially affected by the NSCARP as well as reviewing the DEIR and the FEIR, including comment letters and responses. Working in a commercial environmental testing laboratory for the past 20 years, I have had the unique opportunity to see the often-untold stories behind the mistakes that have led to serious environmental contamination and the costs associated with attempting to undo these mistakes. I offer this letter in hopes to help avoid serious and permanent detriment of our drinking water resources due to inadequately assessed impacts of the NSCARP.

It is my expert opinion that the NSCARP poses a direct threat to groundwater and surface water quality and has a significant potential to cause the Alexander Valley and Dry Creek Valley aquifers to become largely unusable as future, direct drinking water sources as a result of groundwater quality degradation due to chemical contamination. It is also my opinion that the NSCARP FEIR is totally inadequate because it fails to identify the unique aspects of this project that will result in this significant degradation of groundwater and surface water quality and dismisses, with a near complete lack of meaningful substantiation, key issues identified in comment letters submitted during the Draft EIR (DEIR) process.

This letter is organized in three main sections. The first section describes the unique aspects of the NSCARP that should qualify this project to be regulated as a Direct Waste Discharge or, at best, a poorly planned Groundwater Recharge Project and not an Agricultural Reuse Project. These aspects of the project were identified in comments to the DEIR and are not adequately addressed in the FEIR. The second section provides information regarding key regulated chemicals of concern that have been either completely un-addressed in the FEIR or inadequately considered in responses to comments submitted during the DEIR process. Finally, in the third section, I will address unregulated chemicals and other water quality parameters of concern that, also, have been either completely un-addressed in the FEIR or inadequately considered in responses to comments submitted during the DEIR process.

1. The likelihood that groundwater quality will be degraded by chemical contamination due to NSCARP should force this project to be regulated as a Waste Discharge or a Groundwater Recharge Project.

No one, even the strongest proponents of this project would consider the tertiary treated wastewater adequate for direct use as a drinking water source. The reasons for this are largely due to what we do not know about the wastewater rather than what we do know. Each year we learn more about the potential hazards contained in treated wastewater. The now disconnected drinking water fountain at the Santa Rosa Wastewater Treatment Facility stands as a monument to this learning curve. When first completed, this State-of-the-Art facility proudly constructed in its design a drinking water fountain to allow visitors to drink the highly purified wastewater. As the operators of this facility grew in their awareness, this fountain was disabled and since then no one is allowed to drink this water due to the potential hazards it presents. This disconnected drinking water fountain provides evidence that the treated wastewater is hazardous for drinking.

It is well established that a wide variety of chemicals pose serious health threats when present in drinking water at the part-per-billion (ppb) or even part-per-trillion (ppt) concentration level. For some of the most common of these chemicals, those that one might expect to find in a drinking water source, test methods have been developed and regulatory action levels, Maximum Contaminant Levels or MCL's, have been established. The MCL's for organic chemicals of concern, that might be expected to get

into the drinking water source, are typically in the low ppb to low ppt range (C22 CCR 64444).

The treated wastewater was never designed for drinking; however, the testing methods used to evaluate its potential hazard are largely the same test methods used to monitor drinking water. We do, however, have a less specific test that allows us to evaluate the total quantity of organic chemicals remaining in the wastewater and this test can be used as a general guide to its overall purity. This test measures the Total Organic Carbon or TOC in the water without having to "name" and measure each individual chemical, a task that is not presently technologically possible. Based on this test, we know that the wastewater planned for this project contains a complex mixture of unknown organic chemicals that is at least several million times more concentrated than those on the relatively short list of chemicals that have specifically been tested for. It is, in part, this massive amount of unknown organic chemicals that keeps us from using this water for direct drinking water purposes. A good example to consider is that of dioxin, for which we have a very sensitive and specific testing method. Due to its toxicity, the MCL for dioxin is 0.03 ppt. As seen in Table 3.8-2 in the FEIR, the wastewater averages over 5 billion times this level in unknown organic chemicals, according to Santa Rosa's wastewater facility testing laboratory results. Clearly, it is this untested portion of the wastewater that makes it most unsuitable and why we would never give this water to our children, to our pregnant mothers, or to anyone else, for drinking. Of this, there seems to be little argument.

Safe, beneficial wastewater recycling is based on the idea that filtration of unknown hazards by the soil along with dilution by fresh water recharge (rain) will protect the underlying groundwater where the wastewater is used. In many cases this is in fact the situation. Many soil types have powerful characteristics to both adsorb chemicals and, over time, degrade these chemicals as wastewater is used in controlled quantities for landscape or agricultural irrigation purposes. When these soils are adequately adsorptive, adequately bioactive and the depth to groundwater is adequately large, appropriate amounts of wastewater can be applied for irrigation purposes in a safe and beneficial manner with little or no degradation of the underlying groundwater. The key parameters of adequately adsorptive soils, adequately deep soils and appropriate quantities of wastewater relative to groundwater recharge rates are necessary requirements for beneficial reuse. Unfortunately, none of these three conditions exist in the areas planned for disposal of the wastewater via the NSCARP. These unique conditions associated with this project are largely not identified by the FEIR making it significantly inadequate. I will briefly explain them in this letter.

The first of these conditions is the nature of the soils in the potentially effected areas and their ability to adsorb and degrade the chemicals in the wastewater. Unlike many successful wastewater irrigation projects, the soils involved with the NSCARP are known to be shallow, low in organic material and largely sandy-gravelly alluvial soils typical of our North County river valleys. These soils do not have the potential to adsorb and degrade wastewater contaminants unlike organic rich, deep soils present in successful reuse projects. This fact is substantiated by expert studies conducted by the firm

Kennedy/Jenks Consultants that are referenced in the comment letter by Yates and entitled "Santa Rosa IRWP – Discharge Compliance Project Subregional Soil Column Study" and "Santa Rosa IRWP – Discharge Compliance Project Indirect Discharge Water Quality Constituent Attenuation Summary". These reports support the fact that these soils have uniquely inadequate capacity to adsorb certain wastewater constituents compared to what would be expected of more organic-rich soils.

The second condition I will discuss is the depth to groundwater. In addition to the nature of the soil, i.e., organic-rich versus sandy-gravel, the amount of soil, or in other words, the depth of soil to groundwater is key. Our valley floors, the location of most of the planned vineyard irrigation, cover one of Sonoma County's most precious resources, the source of all of our drinking water, our North County aquifers. However, this covering is extremely thin. I live in the Dry Creek Valley and in August, at the driest point of the year, I can look down into my well and see the groundwater level just a few feet below the ground surface level. This is the case for much of the valley as described in the hydrology reports by both Johnson and by Yates. While there is enough of this sandy-gravelly soil to grow vines there is pitifully little to provide filtration, adsorption or biodegradation of wastewater contaminants.

Finally, I will discuss the condition related to the amount of wastewater planned for disposal versus the amount of fresh aquifer recharge that occurs. Most of this wastewater will be dripped onto vineyards during the summer months. Drip irrigation will not saturate the soils down to groundwater but instead nearly all of the water that enters the soil will be either taken up into the plants or will slowly evaporate into the air. Each irrigation event will consist of dripping the wastewater into the relatively shallow soils and will be then repeated as soon as most of this water is gone. Virtually all of the soluble organic compounds contained in the wastewater will be concentrated in the soils during these irrigation cycles over the summer months. The quantity of wastewater planned for application to the soils is certainly enormous and the total quantity of dissolved organic chemicals, "the solutes", will be concentrated into this shallow layer of sandy-gravelly soils that overlie the groundwater aquifer. This is made clear in the expert hydrologist reports by both Johnson and by Yates.

After the irrigation season, our winter rains come. Because of the relatively heavy rains we experience, most of the rain water runs off. We see this vividly as our streams and rivers quickly rise during our rain events. As described in the hydrologist reports by Johnson and by Yates, a smaller portion does, however, saturate the soils and percolate down into our groundwater aquifers as groundwater recharge. The soluble compounds that were concentrated in the soil due to summer irrigation with wastewater will then be re-solubilized and carried into the aquifer with the recharge water.

The concentration of these chemicals will be based on two main factors. These factors are simply the amount of wastewater that was applied during the summer compared to the amount of winter recharge water. If the amount of recharge water experienced during the winter is vastly greater than the amount of wastewater applied during the summer then the concentration of these chemicals in the groundwater recharge water will be far less

than that of the wastewater. For example, if the winter recharge is 100 times greater than the summer wastewater application then the recharge water will be at least 100 times less concentrated in these chemicals than the original wastewater. Even with little adsorption and/or biodegradation, this dilution effect would help protect our precious aquifers. But this is not the case.

Unfortunately, the actual situation is far less comforting. Two, independent, hydrology reports, prepared by expert hydrologists show that the amount of wastewater planned for irrigation in the NSCARP is equal to or exceeds the quantity of recharge water. In fact, one scenario shows that the quantity of wastewater will be nearly double the typical quantity of fresh water recharge. The result of this is that the recharge water will not be diluted to a factor of 100 times or 10 times or even 2 times. Instead, the recharge water is likely to be at the same concentration, or up to twice the concentration, as the wastewater itself in these contaminants that are concentrated in the soils during summer irrigation.

This combination of poor absorptivity and low bioactivity of the sandy-gravelly alluvial soil, the shallow depth to groundwater and, especially, the amount of wastewater compared to recharge water may cause, over time, these aquifers to become more contaminated than the wastewater itself. Clearly under these conditions, since all are in agreement that the wastewater is unfit to directly drink, our groundwater aquifers will, over time, also become unfit to drink. This is a mistake we can and need to avoid making. This FEIR fails to address this issue and hence is significantly inadequate.

2. Key regulated chemicals of concern have been either completely un-addressed in the FEIR or inadequately considered in responses to comments submitted during the DEIR process.

Over the past 20 years, I have worked on a daily basis with clients to establish groundwater and wastewater monitoring projects at the direction of State and County regulators. The test methods for these programs are selected based on the history of each site and the potential chemical contaminants that might be expected in each different location. For example, a gasoline station will be tested for the chemicals typically found at gasoline sites while an abandoned plating shop will be tested for a different set of potential contaminants typical of plating operations. Over the years I have become quite familiar with the various lists that include chemicals regulated under California's Title 22 as well as many other chemicals that are regulated under various State policies that address chemicals of concern that have not yet made it through the regulatory process that would list them in Title 22, often referred to as "chemicals of emerging concern". In my experience, it is a misnomer to refer to these chemicals of emerging concern as "unregulated". My clients that routinely spend thousands or millions of dollars each year monitoring for these chemicals at the requirement of State regulators would certainly agree with the idea that these chemicals are, in fact, regulated. They are just not regulated under Title 22.

I will begin with a look at the wastewater-monitoring program that is in place and how it relates to overall wastewater quality. Again, I have become quite familiar with the list of

chemicals that our clients are required to test for in a wide array of regulated activities. One list is contained in California's Proposition 65. These are the "Chemicals Known to the State to Cause Cancer or Reproductive Toxicity", a growing list of approximately 737 chemicals or classes of chemicals. The typical list of chemicals required of our clients to test for in their groundwater and wastewater samples comes directly from California's Title 22. Appendix 10 provides a list of those chemicals considered by the State to be "hazardous". It is a list of approximately 791 chemicals. A sub-set of this list appears in Appendix 9 of Title 22. We routinely test for this list of chemicals in both groundwater and wastewater as a requirement placed on our clients. This list is divided into sub-categories according to the analytical testing methods used for each of these chemicals of concern. The major divisions include: Volatile Organic Compounds (a list of 71 different chemicals), Semi-Volatile Organic Compounds (a list of 118 different chemicals), Chlorophenoxy Herbicides (a list of 4 different chemicals), Organophosphorus Compounds (a list of 11 different chemicals) and Dissolved Inorganics (a list of 22 different chemicals or elements).

Recently, I spent a morning at the North Coast Regional Water Quality Control Board reviewing the City of Santa Rosa's, Santa Rosa Subregional Water Reclamation Facility's Discharge Monitoring Reports. I very surprised to see just how few of the Title 22 chemicals are actually monitored for in the discharged wastewater. I was amazed to find that one sample per month is tested for a list of chemicals that includes only 3 Volatile Organic Compounds, 11 Semi-Volatile Organic Compounds. And once each quarter, in other words only four times per year, one sample is tested for a somewhat longer list that includes only 36 Volatile Organic Compounds, 54 Semi-Volatile Organic Compounds and 12 Inorganics (metals).

Considering the requirements typical of many of our clients' projects that involve very specific sites with extremely limited potential "spheres of influence" when compared to that of NSCARP, it is simply amazing to me just how minimal the monitoring requirements are on the wastewater coming from the Santa Rosa facility. Due to these minimal requirements, we really know very little about the wastewater quality.

The above discussion focuses on chemicals that are, in fact, regulated under Title 22 and chemicals for which the laboratory at the wastewater facility has the ability to measure. Yet, there appears to be no requirement for monitoring these compounds and therefore there is no data available on these chemicals, with respect to the historical and ongoing wastewater quality, to be considered in this FEIR. There are discussions within the FEIR on wastewater quality, yet there are no monitoring requirements that would have allowed the actual quality to be assessed. This is clearly a significant deficiency within this FEIR and certainly unjustifiable when one considers the level of monitoring requirements placed, by State regulators, on projects that have so much less potential to do harm.

Beyond the list of chemicals within Title 22, there are many more that our clients are required to test for due to their established toxicity and the potential that they may be present in groundwater or wastewater at any particular site. These "chemicals of emerging concern" would also have a similar potential to be present in the wastewater

planned for NSCARP. Action levels, similar to the MCLs, have been established for these chemicals of emerging concern by the State of California Department of Public Health (CDPH) as Notification Levels (NLs), Preliminary Health Goals (PHGs), or draft MCLs. These action levels have been established based on the known toxicity of these chemicals. According to Health and Safety Code §116455, a drinking water system must notify the governing body of the local agency in which the users of the drinking water reside when a chemical in excess of a notification level is discovered in a drinking water source.

Regulatory testing methods have been developed and established for these chemicals with the capability of accurately measuring these chemicals in water down to levels below the NLs , PHGs or draft MCLs. Most of these testing methods have been promulgated into Federal law as approved Environmental Protection Agency (EPA) test methods. In many cases, these chemicals have been added to existing methods as new "target compounds". It has been an interesting and challenging experience to see this continually updated, growing list of chemicals be added to the requirements of our laboratory. It is also interesting to see that each time we add a new target chemical to our test methods we begin to find it in more places that we might have expected. Since we are still learning about these newly listed chemicals, it is not always clear why they might occur at sites where we would otherwise not expect to find them. A short list would include gasoline station sites that are contaminated with 1,4-Dioxane, machine shops that are contaminated with N-nitrosodimethylamine (NDMA), rural agricultural sites contaminated with perchlorate, sites where diesel fuel has been cleaned from the groundwater that now show high levels of the carcinogens hexavalent chromium and bromate.

Due to the large quantities of these chemicals that are used, many of them would be expected to occur in the Santa Rosa wastewater from a variety of potential sources including industrial and residential. One often-overlooked source is that of contaminated sites that are undergoing investigation and/or cleanup. Five or ten years ago, many of our clients would apply for an NPDES permit to discharge water into rivers or streams as a result of their investigations and clean up efforts. As discharge requirements became more and more stringent, it has become far more cost effective to bring these contaminated waters to the treatment facility for disposal. Acceptance criteria for the wastewater treatment facility are far less stringent than the requirements for an NPDES discharge permit. This is just one example of the new and varied sources of contamination that effect wastewater composition. Having personal knowledge of the wide and sometimes unexpected composition of these waters has provided me with specific insight regarding the potential for wastewater to contain a wide array of chemicals regulated and not regulated under Title 22 and hence not tested for, or monitored for, in the wastewater.

Many of the chemicals listed in Title 22 have long since been banned from manufacture or use in the United States and for this reason detections of these compounds in our laboratory become less and less over time. However, we do see the chemicals that are manufactured and used in the US, in thousand ton quantities, with increasing frequency,

irrespective of whether they are listed in Title 22 or not. The few chemicals mentioned above present good examples.

Production quantity of 1,4 dioxane is in excess of 10,000 metric tons per year and there are nearly 400 facilities that produce 1,4 dioxane in the US. 1,4 dioxane is used in cleaning products, including laundry detergent, it is used in some shampoos, it is used as a solvent in the production of pharmaceuticals, adhesives, magnetic media and has hundreds of other common uses in industry as well as in household products. It has a relatively high water solubility and, due to its common use, 1,4 dioxane is expected to be found in wastewater. Due to its toxicity, the drinking water notification level for 1,4 dioxane is 3 ppb. Yet, 1,4 dioxane is not addressed in the FEIR and is not monitored for in the Santa Rosa wastewater.

Similar conditions exist for a number of these chemicals of emerging concern. These are chemicals used in massive quantities that would be expected to appear in wastewater. These include: perchlorate, NMDA and other nitrosamines, hexavalent chromium, bromate, polybrominated diphenyl ethers, bis phenol A, perfluorooctane sulfonates, hexabromocyclododecane, ethoxylates, pentachloronitrobenzene, fuel oxygenates, formaldehyde and acetaldehyde. These are chemicals that have been shown to exist in municipal wastewater yet there are no data presented in the FEIR with regard to their presence in the Santa Rosa wastewater, a clear deficiency in this document.

Another class of chemicals of significant concern and inadequately addressed in the FEIR is that of pesticides. Most of the pesticides listed in Title 22 are no longer in use. What we see in the environment are, naturally, predominantly the pesticides that are presently in use. For many of these chemicals, there are adequate testing methods, they are known to be highly toxic but are not regulated under Title 22 or the California Toxics Rule. Examples of these test methods and associated chemicals of concern include: EPA Method 527 for the pesticides dimethoate and Terbufos sulfone, EPA Method 525.2 for the herbicides Acetochlor, Alachlor, and Metolachlor, EPA Method 535 for the herbicide metabolites Acetochlor ethane sulfonic acid, Acetochlor oxanilic acid, Alachlor ethane sulfonic acid, Alachlor oxanilic acid, Metolachlor ethane sulfonic acid, and Metolachlor oxanilic acid.

The FEIR for NSCARP does not address the reality that hundreds of chemical contaminants that are regulated due to their extreme toxicity, many of which are listed in Title 22 and many that are not, are potentially contaminating the wastewater. For many of these chemicals, adequate test methods exist and even regulatory action levels have been issued. Yet, these chemicals are not monitored for in the wastewater.

3. Unregulated chemicals of concern and other wastewater quality parameters have been either completely un-addressed in the FEIR or inadequately considered in responses to comments submitted during the DEIR process.

I have described above that as each new test method is developed and applied to environmental samples including groundwater and wastewater, it becomes clear that these chemicals are often more prevalent than one might hope. It also becomes clear that there is a much larger list of chemicals present that we do not have test methods for. As laboratory director, I also help numerous industrial clients in their product development efforts and raw materials quality control measurements. This experience provides a unique perspective into the wide array of chemicals that are used in Sonoma County, nearly all of which are not listed in Title 22 and do not appear on any lists of chemicals of emerging concern. Sonoma County's Office of Emergency Services can provide a list of chemicals used in the County along with the associated quantities. This is important information and it should be contained in the FEIR. Most of these chemicals are not regulated under Title 22 or under any other State policy regulations with regard to potential water contamination. Without specific regulations, it is likely that many, if not most, of these chemicals can be disposed of legally by putting them into the sewer system. For these reasons these chemicals may eventually end up in the Santa Rosa treatment facility.

Recently, the US Geological Survey (USGS) established the Toxic Substances Hydrology Program and developed testing methods capable of measuring a list of approximately 95 chemicals to be used as indicators of wastewater contamination. These chemicals include human and veterinary drugs (including antibiotics), hormones, detergents, disinfectants, plasticizers, fire retardants, insecticides and antioxidants. A recent report by the USGS reveals that one or more of these indicator chemicals were detected in 80 percent of the streams sampled and 82 of the 95 chemicals were detected at least once. Mixtures of these chemicals were common; 75 percent of the streams had more than one, 50 percent had 7 or more and 34 percent had 10 or more. The most frequently detected chemicals included N,N-diethyltoluamide (insect repellent), triclosan (antimicrobial disinfectant), tri (2-chloroethyl) phosphate (fire retardant) and 4-nonylphenol (nonionic detergent metabolite). Steroids, nonprescription drugs and insect repellent were the chemical groups most frequently detected. Detergent metabolites, steroids, and plasticizers generally were measured at the highest concentrations, reported to be in the ppm concentration range. These chemicals are found in streams as a direct result of municipal wastewater discharge.

One emerging result of this type of contamination is the growing occurrence of, what is called, intersex in fish populations. A recent study of intersex abnormalities in fish conducted and reported by the US Fish and Wildlife Service and the USGS in the Potomac River watershed found that at least 82 percent of male smallmouth bass and 23 percent of the largemouth bass had immature female germ cells (oocytes) in their reproductive organs. The study indicates that intersex is more widespread than previously known and is not related to a single chemical but is, instead, likely due to the synergistic effects of several endocrine disrupting chemicals found in water as a result of municipal wastewater discharge.

The list and various classes of unregulated, toxic chemicals one might expect to find in the wastewater planned for use under NSCARP is large and growing and largely unknown. Pharmaceuticals, personal care products, various industrial chemicals including those used in high technology manufacturing and research including nano-technologies, represent a growing and continually changing array of inputs to our wastewater treatment facilities. These facilities are not necessarily designed to treat these wastes and provide little or no monitoring of them in their effluents or discharges.

What we do know is that the chemicals that do make it through the treatment process are particularly resistant to biodegradation, adsorption and filtration. In order for these chemicals to pass through all of the various stages of treatment they will be highly selected in their nature; highly soluble, highly resistant to further decomposition or filtration by the sandy-gravelly soils of our North County valleys. This idea is strongly supported by the White Paper Report on Trace Contaminants, prepared by Padre Associates and included in the FEIR as Attachment 1 in Appendix I. This paper states "Municipal WWTPs effectively remove particles present in sewage. As a result, trace constituents that exhibit an affinity for particles usually are removed during primary and secondary treatment. This means that most compounds that are discharged in wastewater effluent are polar (i.e., highly soluble) and will not be removed to an appreciable degree from surface water by sorption on suspended particles or sediments in a reservoir environment." This White Paper correctly explains the inherent nature of the contaminants in the treated wastewater as being highly soluble and resistant to adsorption onto particles or sediment. The same situation exists for biodegradation. Biodegradation is one of the main processes used in wastewater treatment to reduce the concentration of various chemicals. Therefore, those chemicals that remain must be considered to be recalcitrant to biodegradation. It is for these reasons that deep, organic rich soils are an absolute requirement for relatively small amounts of wastewater to be adequately purified in reuse projects in order to protect the underlying aquifers. The fact that the soils involved in NSCARP are very shallow, are not organic rich and very large volumes of wastewater are planned for use is not addressed in this FEIR.

This White Paper, it was prepared to address concerns brought out in certain comments to the DEIR. It is my opinion that it does a very poor job of it and instead argues with itself on many points, argues with logic on other points and otherwise supports the concept that the wastewater poses a significant threat. This paper acknowledges the existence of various unknown chemicals in wastewater that have significant human and animal toxicity. In its introduction, the author claims that our ability to measure an increasing number of chemicals in the environment is due to "ongoing improvements in analytical sensitivity over the past decade". As an expert in analytical chemistry, I can say that this is not true. There have been very few significant improvements in analytical sensitivity over the past decade. Our ability to measure an increasing number of different chemicals in the environment is simply due to the fact that we are now interested in looking for these chemicals and have begun the process of developing methods that target this larger list of chemicals. The introduction does correctly cite that "One of the significant routes for these "trace constituents" into (the) environment is through the resulting discharges from wastewater conveyances and treated systems."

This White Paper makes the unsubstantiated claim that the "concentration of trace constituents in the reclaimed water will likely decrease during both of these steps (storage in reservoirs and land application) due to natural attenuation mechanisms such as phototransformation, sorption, and biotransformation. This idea is in direct opposition to the concept presented in this same paper that the chemicals remaining in the wastewater are unlikely to adsorb to particles since they passed through a treatment system largely based on adsorption to particles. This same logic applies to phototransformation and biotransformation. The Santa Rosa wastewater treatment facility exposes the wastewater to extreme UV light radiation as its method of disinfection. Those chemicals that are easily phototransformed would already have undergone this process. The treatment system also subjects the wastewater to powerful levels of microbial degradation causing most biotransformations that are possible to have already occurred. For these reasons, the remaining chemicals are highly selected to be resistant to further degradation by sorption onto soils, or degradation by light or microbes. This White Paper also fails to discuss the well known fact that transformation by either light or microbial activity can render chemicals to be more toxic than they were prior to transformation, rather than less toxic.

The position taken by the author of this White Paper is clearly biased in defense of the complete safety of wastewater and makes many poorly substantiated claims to this concept. Several examples follow. In section 3.3 "Land Application of Reclaimed Water" the blanket statement is made that "A compound that has sorbed to a soil surface will not easily leach to the groundwater and is less available for uptake into plant roots". As a professional chemist I find this statement to be, frankly, silly and simply argumentative. The likelihood of leaching of a sorbed molecule into the groundwater is dependent on many factors. Specifically, it depends on how strong the attraction is between the soil surface and chemical and the water solubility of the chemical. The White Paper correctly identified the chemicals remaining in the treated wastewater as being "highly soluble" and that "most compounds that are discharged in wastewater effluent are highly soluble and will not be removed to an appreciable degree from surface water by sorption". Although the statement is made that chemicals sorbed to soil are less available to plant roots, this same paper states, in Section 4.0 on Potential Impacts that "the veterinary pharmaceuticals diazinon, enrofloxacin, florfenicol, and trimethoprim have been shown to be taken up into carrot roots, and florfenicol, levamisole and trimethoprim are taken up into lettuce leaves". This paper contains one contradiction after another.

This paper cites references to biotransformation soil column studies to address concerns over hormones, certain surfactants and acidic pharmaceuticals. However, the paper cites studies that have not used soils similar to those in the Alexander or Dry Creek Valleys. The Kennedy-Jenks soil column studies that used soils from the Alexander Valley and Santa Rosa wastewater show that little or no depletion in measured wastewater chemicals was observed during their tests.

In section 4.0 "Potential Impacts" of this White Paper, the author states that "Overall, while there are currently many unknowns about possible synergistic effects, and of long-term chronic exposure to low levels of complex mixtures of compounds, the risk assessments that have be (been) performed have not indicated an unacceptable risk to humans." However, the references cited for the argumentative position deal solely with pharmaceuticals in surface waters and do not at all address the "complex mixtures of compounds" in treated wastewater and it makes little sense that if there are "many unknowns about possible synergistic effects, and of long-term chronic exposure" it is possible to establish a meaningful risk assessment.

Interestingly, in this same section on potential impacts, this paper states that "Very little is known about the effects of trace constituents in water used to irrigate domestic animal feed. It has been suggested that endocrine disruptors in domestic animal feed and water may be responsible for fertility problems in ruminants". The FEIR is clearly deficient in addressing this link, proposed in the White Paper, between mammalian fertility problems and the presence of trace constituents in wastewater used to irrigate food crops. The following section of this paper cites that "Removal (of wastewater chemicals) can be enhanced by applying advanced treatment technologies such as advanced oxidation, activated carbon adsorption or membrane filtration." The FEIR is deficient in its lack of assessing this alternate approach to further purifying the wastewater making it far safer for a variety of uses including agricultural reuse and groundwater recharge.

One additional parameter that poses significant risk to the North County aquifers and surface waters due to NSCARP is that of biological contaminants. Most of the data that exists for wastewater reuse projects deals with water that has been chemically disinfected and contains a residual level of chemical disinfectant. The Santa Rosa wastewater is extremely unique in its lack of chemical disinfectant. This wastewater is disinfected using UV radiation instead. Similar to the situation that exists for unknown chemicals that remain in the wastewater, unknown bacteria, viruses, protozoan and other parasites also exist in the wastewater. The completely inadequate approach of testing for only one form of biological contaminant, coliform, is the standard by which disinfection of the wastewater is monitored. Unlike chemical contaminants, biological entities that remain in the wastewater can, upon leaving the treatment facility begin to multiply in pipelines, distribution systems and storage reservoirs. Some examples of the threat these biological contaminants can pose are provided below.

Cryptosporidiosis is a parasitic disease caused by the protozoan, cryptosporidium. Many are familiar with this, often fatal, disease due to the fact that it is one of the most common water-borne diseases worldwide. It is spread through water that has been contaminated with feces (such is the case with wastewater). The parasite is transmitted to humans when they drink water that has been contaminated with the environmentally hardy cysts. The UV disinfection system at the Santa Rosa wastewater treatment facility is not monitored for its effectiveness for destroying these hardy cysts. Other water borne diseases caused by drinking feces contaminated water include the protozoa caused diseases Amebiasis and Giardiasis, the bacteria caused diseases Campylobacteriosis, Cholera, Salmonellosis, Shigellosis, Typhoid fever, Legionnaire's disease, Pontiac fever,

and the viral diseases Hepatitis, and Viral gastroenteritis. These pathogens are not monitored for in the wastewater and would be expected to pass through the waste treatment system to some, unknown, small degree. Once these pathogens leave the treatment facility they can begin to populate in the wastewater. These pathogens could then infect pipelines and storage reservoirs and ultimately infect groundwater aquifers and drinking water wells of the North County. The FEIR does not address this serious concern or take into account the unique aspect of how the Santa Rosa wastewater is disinfected. Also not addressed in the FEIR is the potential effect of failures with the UV disinfection system. My short review of monitoring reports for this year, 2009, held at the Regional Water Quality Control Board show that this system can fail from time to time allowing non-disinfected waters to be released from the facility. For example, on March 3, 2009, the UV treatment system did not function properly for approximately 2 minutes allowing 17,130 gallons of non-disinfected water to be discharged from the facility. The FEIR is inadequate because it does not address the impact that these types of system failures could have on infectious pathogen concentrations in the wastewater distribution system including storage reservoirs. The reports also indicate that Total Coliform requirements were not met on March 5th, March 6th and again on March 8th of this year (2009). The FEIR does not address how these types of failures might impact pathogen levels in the wastewater. This is critical because, once again, unlike chemicals, these pathogens can multiply in the wastewater over time.

Recently, there is growing concern over what are being called "Super Bacteria". Microbiologists at the University of Michigan have conducted studies that suggest that wastewater treatment facilities are a significant source of antibiotic resistance bacteria. The resistant bacteria used in the study were found to be as much as ten times more resistant once they had been through the wastewater treatment process.

In addition to its use in drip irrigation of vineyards, according to NSCARP, the wastewater is also planned for use in overhead spraying as a means of frost protection. When frost protection is required, it is required by nearly every vineyard in the Valley floor. I live in the Dry Creek Valley and on cold spring mornings I often see the rather impressive sight of the entire valley floor in full spray. The FEIR does not address the potential health effects of the aerosol created during these frost protection events. Several of the pathogens discussed above can be transmitted via inhalation and the widespread aerosol created during frost protection in narrow valleys would have the potential of bringing a serious health threat to our local populations if infected waters are being used.

Conclusion

I have been an expert in environmental chemistry, working as a professional in this field, for over 30 years. During this time I have gained significant experience and insight into issues concerning groundwater contamination. The FEIR, repeatedly, relies on the comment that "wastewater reuse in California is regulated by Title 22". I have pointed out in this letter two key facts related to this concept. Firstly, most of the large, yet limited, list of chemicals regulated under Title 22 are not monitored for in the NSCARP

wastewater. Secondly, most of the chemicals of real concern that are likely to remain in the treated wastewater are not currently listed in Title 22.

I believe it is critical to recall that the chemicals that so tragically contaminated Love Canal, New York and Times Beach, Missouri were disposed of completely legally! Regulations at the time were clearly inadequate to address these situations in advance of the disasters that rendered these towns still uninhabitable some 20 years later. In the hypothetical situation where an EIR was required for the burying of chemicals at Love Canal or the spraying of contaminated dust control oil at Times Beach, they might have claimed the lack of regulations limiting these practices as providing adequate support of the lack of significant environmental impact. However, a truly adequate EIR would clearly have identified the nature of these pending disasters allowing concerned individual to properly evaluate these projects in terms of their overall environmental impacts.

Such is the case here. The NSCARP FEIR is inadequate, as explained in some detail in this comment letter, because it fails to identify the unique aspects of the wastewater and its planned disposal locations and the resulting environmental impacts it is likely to cause. An understanding that, due to these unique conditions, this project is essentially a project that involves direct discharge to the groundwater aquifers is not identified in this FEIR. The State of California does have newly constructed regulations governing these types of projects such as the California Department of Health's Draft Regulations on Groundwater Reuse Projects. These regulations require a far greater degree of testing and monitoring and, in turn, require a far greater degree of water quality than is present in this tertiary treated wastewater. For example, the total amount of unknown organic chemicals, referred to earlier as "TOC" must be 100 times less than is often present in Santa Rosa wastewater. Areas of the State that are following these guidelines are using advance treatment procedures, similar to those suggested in the FEIR White Paper, namely advanced oxidation, micro filtration and reverse osmosis. These processes not only remove most of the chemicals of concern they also remove most biological agents of concern. This highly purified water has been found suitable for reuse, not only for irrigation purposes but also for later drinking water uses once it has been re-injected deep into groundwater aquifers.

This FEIR is inadequate because it does not recognize the unique conditions involving drip irrigation during the summer that concentrates into the shallow soils all of the chemicals that are dissolved in the wastewater that are then leached into the groundwater with less volume of winter recharge water. The FEIR is inadequate because it fails to recognize the fact that groundwater recharge from this project can be as concentrated or even more concentrated in certain chemicals than the wastewater itself. This FEIR is also inadequate since it also does not address the impact of surface waters due to run off from both frost protection and over irrigation. These issues are discussed in the Yates report. It is interesting that my short review of monitoring reports that I made one recent morning at the Regional Water Quality Control Board revealed that discharges to surface waters via this route are apparently common. For example, on June 10, 2008, 4,500

gallons of recycled water was discharged into the Laguna de Santa Rosa from the Todd Road irrigation system caused by "over irrigation by two users plus one leak".

The White Paper on Trace Constituents concludes with the assurances that "As more data become available regarding trace constituents levels, discharge and treatment standards will be revised as necessary at the treatment facilities prior to discharge or reuse." It goes on to state: "Such a mechanism will provide ongoing protection to both the environment and public health." This statement, in the context of wastewater that has never been tested for, and will not be monitored for, all of the constituents that we do have test methods for and standards for falls short of making any sense. Beyond this, one might imagine that the, before mentioned, hypothetical EIR for Love Canal or Times Beach might have contained a similar statement. However, it is my experience that once contaminants have caused significant degradation of an aquifer, the approach suggested in this White Paper and in the FEIR, are like closing the barn door after the horse has already gone out. The costs and lack of adequate cleanup technologies prohibits its restoration and, prior to any possible restoration, that water source can cause serious health effects in those that drink from it. This fact is not addressed in the FEIR.

The recycling of waste oil in an attempt to address the ever-present dust problem in Times Beach Missouri while disposing of an otherwise nuisance waste seemed, on the surface, to be a good idea at the time. Upon closer examination, unfortunately in hindsight, this idea turned out to result in an ecological disaster. The recycling of Santa Rosa's waste water to address the ever-present limited water supplies in Sonoma County while disposing of an otherwise nuisance waste may also seem like a good idea. However, it is the role of an adequate EIR to insightfully provide the information needed to avoid an ecological disaster. This FEIR, in my opinion is inadequate because it fails to do just that.

Sincerely,

Richard A. Kagel, Ph.D.

TOWN OF
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September 15, 2010

Ms. Cathleen Goodwin
California Regional Water Quality Control Board
North Coast Region
5550 Skylane Boulevard, Suite A
Santa Rosa, CA 95403

City of Healdsburg Wastewater Treatment Facilities
Draft Waste Discharge Requirements Order No. R1-2010-0034
Comments from the Town of Windsor

Dear Ms. Goodwin:

The Town of Windsor is interested in this Draft WDR order for several reasons—(1) we are an active recycler of treated wastewater in the Russian River watershed, and the provisions in this WDR could have implications for all recyclers in the region, (2) we have our drinking water wells downstream of the City of Healdsburg, adjacent to the Russian River, and (3)the recycled water not irrigated or sent to the Geysers for reuse is discharged to Mark West Creek, a tributary of the Russian River. Our concern is that the Regional Board has established standards in NPDES that are based upon current data and information, and not on outdated data.

Comment (1) – Future Water Reclamation requirements - The March 22, 2010 draft of the Healdsburg permit added several new recycled water requirements in Attachment G, including new approval and public review steps for the addition of new recycled water users to the recycled water system. Since Regional Board staff have made clear that the draft Healdsburg permit will likely be the template for renewed Master Reclamation Permits in Region 1, including the Town, we may be directly affected by this permit. Our primary concern has been that many of the Attachment G requirements in the March 22nd draft Healdsburg permit would be inconsistent with the State Water Resources Control Board's ("State Board") Recycled Water Policy (May 2009) because they would discourage, rather than encourage, recycled water use, impeding its specific goal of "substitution of as much recycled water for potable as possible by 2030."

We have limited our comments on the recycled water provisions of the Healdsburg permit to what we believe are of greatest concern to the Town. These concerns are as follows below.

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New Requirements for Recycled Water Use Site Approvals

Attachment G to the Healdsburg Permit draft permit includes new provisions for adding recycled water users which would go well beyond what has typically been required of other water recyclers regionally and statewide. It is Windsor's view that the existing Title 22 reclamation requirements, such as those issued for Santa Rosa and our Town of Windsor, are more than adequate to protect water quality.

Many of the Attachment G provisions in the Healdsburg draft permit; and in particular the additional approval, public input and special study requirements; have the potential to discourage new recycled water use. In the current draft of the Healdsburg permit, the additional "General Technical Report Requirements" for agricultural irrigation have been modified so that only Programmatic Technical Reports are subject to public notice and comment, rather than every site-specific report. In our view this is a significant improvement over the requirements in the March 22nd draft, which would have subjected each new use site to a new Report of Waste Discharge, public noticing and comment, and potentially endless special study requirements. While we generally support and appreciate these revisions to the March 22nd draft, we remain unconvinced of the need for any new requirements beyond those in the new State Recycled Water Policy, which apply only to landscape irrigation projects. Our greatest concern is that these requirements could become a significant impediment to attracting new agricultural users. If this permit is adopted in its present form, we urge the Regional Board to periodically review the impact of these new requirements to determine whether they impede development of new recycled use sites, and if so, modify the permit accordingly.

We are also concerned with the specific requirement for quarterly reporting while the Statewide General Permit for Landscape Irrigation requires only annual reporting. We believe alignment with the State accepted reporting standards will better position our region to succeed in supporting the statewide goals of utilizing the recycled water resources appropriately.

Nutrient Management

The Town of Windsor supports the proposed requirement to inform recycled water users of the nutrient content in recycled water so that irrigation managers can take this into account when they calculate agronomic rates for supplemental fertilization. We would oppose any requirements similar to those included in the March 22nd draft, which would make recycled water providers responsible for *all* nutrients applied on recycled water use sites managed by others. This would require that recycled water providers inappropriately intrude into the crop management practices of private users. The current draft of the Order and Attachment G appear to resolve this by clarifying that compliance will be

determined by meeting the reporting requirements. We strongly urge the Regional Board to retain this wording, i.e. where compliance is determined by providing the nutrient information to recycled water users.

For a number of reasons, we also believe that this should be satisfied by seasonal rather than monthly reporting to users, since effluent quality variation is typically minor relative to crop demand (as noted in the Yates report cited in the Healdsburg permit), and the information cannot be used to alter real-time crop management . In addition, monthly reporting to individual users would be unnecessarily burdensome for providers such as the Town of Windsor and the City of Santa Rosa due to the large numbers of users. Alternatively, the information could be made available by posting on websites operated by recycled water providers. We suggest that nutrient concentration be reported to users monthly only when more than 65 percent of the agronomic nutrient demand of plants is met with recycled water.

Runoff Control

Provision B.11.a includes a requirement for a 100-foot setback from any surface water, or alternatively, a justification from the provider on why the setback would be infeasible. This requirement, which has no rationale or justification based upon the Town's experience managing recycled water, could needlessly eliminate wide swaths of use sites. Irrigation systems properly designed and managed in accordance with Title 22 requirements are more than adequate to prevent runoff to surface water, whether they are 50 or 500 feet away from surface water. Such a rigid setback approach was considered and rejected during the stakeholder process leading up to the adoption of the State Recycled Water Policy, and should not now be revived and imposed through the Healdsburg permit. The Town of Windsor strongly urges the Regional Board to eliminate this requirement, and instead rely on the existing provisions in Title 22 to prevent recycled water runoff to surface waters, which we believe are fully protective, including protecting the Russian River water quality, our primary drinking water source.

Comment (2) – As an agency using water drawn from the Russian River well field in Windsor, we find that the Draft permit is protective of Russian River water quality both in the surface water discharge provisions of the NPDES permit and the provisions of the Reclamation requirements.

Comment (3) – Future NPDES permit objectives for salinity: The draft permit appears to recognize the challenges of determining compliance with receiving water limits in Basalt Pond by requiring two special studies to assess receiving water conditions and to determine appropriate receiving water monitoring requirements and monitoring locations for specific conductance (SC), total dissolved solids (TDS) and other constituents. While we appreciate recognition of the compliance determination challenges in Basalt Pond, we think this only

partially addresses the problem. We are concerned that the water quality objectives for SC and TDS in the Russian River (which are the basis of the receiving water limits being applied to Basalt Pond) are based solely on ambient water quality data available at the time the objectives were established many years ago, and may be more stringent than needed to protect beneficial uses. We urge the Board to formally review SC and TDS objectives for the Russian River.

Again, we greatly appreciate your consideration of these comments.

Sincerely,

Richard Burtt, Public Works Director

c: Matt Mullan
Richard Bartlett

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Gus Yates, Consulting Hydrologist
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September 21, 2010

Mr. Jim Flugum, Deputy Director
Department of Public Works
City of Healdsburg
401 Grove Street
Healdsburg, CA 95448

Subject: **Impacts of Recycled Water Irrigation on Groundwater and Surface Water Flow and Quality near Healdsburg: a Generalized Approach**

Dear Mr. Flugum:

At your request, I have expanded upon my earlier analysis (Yates, 2010) of potential groundwater and surface water impacts of the Syar Property Recycled Wastewater Agricultural Irrigation Project (Syar vineyard project) to address potential impacts of irrigation at other nearby sites. This report addresses the same types of impacts but converts the previous analysis into a more generalized methodology that could be applied to a variety of recycled water irrigation sites. This approach offers two additional benefits: it explicitly addresses the ranges of uncertainty in the impact evaluations, and those ranges establish limits below which no significant impacts are expected.

Introduction

My recent evaluation of the Syar vineyard project considered only conditions at that site (Yates, 2010). The types of impacts evaluated were the same ones covered in a prior evaluation (Yates, 2009) of the Northern Sonoma County Agricultural Reuse Project (NSCARP), but the conclusions were different for all of the impacts. Recognizing that the conclusions depend on details of the project, the present memorandum identifies key variables that influence the conclusions and identifies ranges of values for those variables that are associated with less-than-significant impacts. Specifically, the potential for adverse impacts depends on numerous factors, including:

- Recycled water quality
- Type of use (irrigation, frost control)
- The ratio of irrigation to deep percolation
- Soil type and slope
- Crop ET, root depth, deficit irrigation
- Groundwater-surface water interactions

- Subsurface dispersion and attenuation

For projects that fall within the specified ranges, this report may be sufficient to conclude that adverse impacts would be less than significant. Otherwise, additional analysis may be needed.

Scope of Analysis

The generalized method addresses five types of potential impacts:

- Surface water and groundwater contamination from irrigation for frost protection
- Excessive nitrogen load on vineyards
- Long-term increases in groundwater salinity
- Reversal of water exchange between surface water and groundwater
- Contamination of groundwater and surface water with metals

All of the impacts are influenced by the quality of the recycled water. Water quality data from the recently upgraded Healdsburg wastewater treatment plant was used in assessing the impacts at the proposed recycled water irrigation areas, but the method is applicable to other sources with different water quality characteristics.

The proposed irrigation sites are shown in **Figure 1**. In this report, the impact evaluation method is applied specifically to the valley floor vineyard areas. Impact conclusions were not drawn for the upland vineyard or the urban turf areas, both of which would likely require more detailed analysis for certain impacts because of differences in soils, slopes, crop types, irrigation rates and irrigation methods.

The remainder of this report explores each of the five types of impacts. For each impact, the method of analysis used in the previous studies is summarized, the key variables affecting the magnitude of the impact are identified, and the ranges of those variables associated with less-than-significant impacts are estimated. Finally, the impact is specifically evaluated for the valley floor vineyard areas.

Impact: Surface Water and Groundwater Contamination from Irrigation for Frost Protection

Method of Analysis

Frost protection is assumed to be by sprinkler during clear, cold nights in spring (no concurrent rainfall). If the sprinkling generates runoff, recycled water can flow directly into creeks and the Russian River. For the Syar vineyard analysis, recycled water was assumed not to be used for frost control, therefore no impact could occur. In contrast, frost control was included as a planned use of recycled water for the NSCARP project. Although

Healdsburg has no near-term plans to use recycled water for frost protection, potential impacts are discussed here in case it comes under consideration at some future date.

Key Variables and Ranges

Frost control consists of a large application of water at a time when soils are typically relatively saturated (at the end of winter) and crop evapotranspiration is small. If the applied water runs off, the nitrogen and metals it contains pose a water quality threat to nearby streams. If it infiltrates, it can raise soil moisture to field capacity and initiate deep percolation, allowing rapid movement of recycled water to the water table. Runoff and deep percolation are therefore key variables in determining the potential for adverse impacts.

Occurrence of Runoff

Uncertainty

Runoff from vineyards is rarely gauged, if ever. The occurrence and amount of runoff depend on the application rate, soil texture, slope, presence of a cover crop and cultivation practices. Anecdotal reports by local residents indicate that runoff occurs on some vineyards for at least some frost control events. Because numerous vineyards will be controlling frost simultaneously, the cumulative volume of runoff into nearby waterways can be substantial. For example, frost control irrigation at a rate of 0.12 in/hr on the 21,000 acres of vineyard proposed for the NSCARP project could have generated 760 cfs of runoff, assuming 30% of the applied water runs off (Yates 2009).

Range that Avoids Impacts

The quality of Healdsburg recycled water is sufficiently high that the existing waste discharge permit for the wastewater treatment plant already allows discharge of recycled water to surface waterways during the frost control season.[1] Therefore, frost protection using Healdsburg recycled water would presumably not have a significant adverse impact on surface water quality. If the recycled water were of lesser quality, the runoff could adversely impact nearby surface water quality unless the grower demonstrates through field data that runoff does not occur or commits to management practices that prevent runoff. Such practices could include tailwater retention ponds constructed at the downslope corner(s) of each irrigation block sized to retain approximately one-half of the maximum anticipated frost control application.

Occurrence and Dilution of Deep Percolation

Uncertainty

[1] Discharge to surface water is prohibited during the low-flow season beginning May 15 each year. Sprinkling for frost protection usually occurs in March and April.

If the root zone were at field capacity at the start of a frost control event, then essentially all of the infiltrated recycled water would become deep percolation. The infiltrated water would pass rapidly through the root zone through relatively large pores, cracks and root tubes in the soil, with little mixing, dilution or attenuation of dissolved constituents. The short-term risk to nearby domestic wells posed by this pulse of recycled water recharge is small primarily because of the high quality of the Healdsburg effluent. Laboratory analyses of 141 constituents in Healdsburg effluent in 2008 (after the treatment plant upgrade) detected no pesticides and only one organic compound, which was two orders of magnitude below the drinking water maximum contaminant level (MCL). The only regulated trace element detected (zinc) was similarly far below the MCL. Major ion concentrations—including total dissolved solids (TDS) and nitrate—were also below their respective MCLs. The only remaining potential concern would be very low concentrations of constituents of emerging concern (for example, pharmaceuticals and personal care products) that are unregulated.

Range that Avoids Impacts

Deep percolation of Healdsburg effluent during frost protection application appears unlikely to impact the potability of groundwater at nearby domestic wells. Under conditions of net annual evaporative concentration of applied recycled water, the total annual load of the constituents could be a concern. This issue is discussed more fully in the section on groundwater salinity, below.

Evaluation of Valley Floor Vineyards

Application of recycled water by sprinkler for irrigation or frost control was explicitly excluded as a proposed use in the project description for the Syar property irrigation project (Jones and Flugum, 2009), and that exclusion is also assumed to apply to the other valley floor vineyards.

If frost protection is requested as a use of recycled water, additional studies and management measures are necessary to prevent runoff and to ensure net annual dilution of recycled water by rainwater when they infiltrate and comingle to become groundwater recharge.

Impact: Excessive Nitrogen Load on Vineyards

The nitrogen contained in recycled water could potentially have two adverse impacts. One is an impact on viticulture (promoting excessive canopy growth on the vines), and the other is an impact on groundwater quality (if the annual nitrogen load exceeds the amount that vines will readily take up).

Method of Analysis

The NSCARP impact evaluation noted that the nitrogen content of recycled water could be excessive for optimal vineyard management in some seasons or on an annual basis. Within the typical range of application rates and recycled water nitrogen concentrations, this constitutes an impact on viticulture, not on groundwater or surface water quality. Up to a point, the vines will take up whatever nitrogen is available and use it to grow additional leaf area. The impact on viticulture is less than significant if the annual nitrogen load from recycled water is well below the normal range of fertilization. Heavier nitrogen loading—beyond the amounts the vines can use—create a risk of leaching from the root zone and contaminating groundwater.

Key Variables and Ranges

Annual Nitrogen Load

The annual nitrogen load equals the nitrogen concentration in the recycled water multiplied by the annual application of recycled water, with appropriate unit conversions to obtain pounds per acre per year. The average nitrogen concentration in treated Healdsburg wastewater is approximately 4 mg/L. The proposed irrigation rate for the Syar vineyards is 4-6 in/yr (depending on vine spacing), which corresponds to 3.8-4.7 lb/ac/yr (Yates 2010).

Uncertainty

The nitrogen concentration in recycled water and the irrigation application rate are both known with considerable accuracy. The range of acceptable nitrogen loading is variable, depending partly on grower preference.

Range that Avoids Impacts

The normal range of annual nitrogen application for table grapes is 22-44 pounds per acre (Peacock, 1998), and a University of California/Napa Sanitation District study found that 14-21 pounds of nitrogen per acre per season is “not exceptionally high, but it may be enough to be of concern to some growers” (University of California Agriculture and Natural Resources, 2006). Allowing for some margin of uncertainty, the nitrogen load from recycled water irrigation of wine grapes would not impact viticulture if it is less than 9 lb/ac/yr (half of the midpoint of the range noted in the U.C./Napa study). This threshold is double the loading that would occur with Healdsburg recycled water at the proposed irrigation rates.

A conservative estimate of the threshold for groundwater quality impacts is the low end of the range of typical table grape fertilization, or 22 lb/ac/yr. Additional analysis should be required for any vineyard irrigation projects with annual loading rates in excess of this threshold, to prevent excessive leaching of nitrogen to the water table. The loading for the proposed Healdsburg projects would be less than one-fourth of this threshold and would create no risk of adverse impact.

Evaluation of Valley Floor Vineyards

Assuming that irrigation rates for other valley floor vineyards are similar to those proposed for the Syar vineyards, the nitrogen load on the vineyards would be well below levels that could cause an adverse impact on vine growth or water quality.

Impact: Long-term Increases in Groundwater Salinity

Many of the constituents in recycled water are not taken up by plant roots and remain in the soil until they are leached out by winter rains. The concentrations of the constituents in this deep percolation—and the corresponding impacts on groundwater quality—depend largely on whether there is net dilution or net concentration of recycled water in the root zone on an annual basis. Use of soil moisture by plants concentrates the dissolved constituents in the soil, whereas infiltration of rainfall dilutes them.

Method of Analysis

The amount of deep percolation beneath a site irrigated with recycled water was calculated for the evaluations of the NSCARP and Syar vineyard projects using a soil-moisture budget approach (Yates 2009, 2010). This mass-balance approach tracks the amount of water stored in the root zone on a daily basis, with inflows from rainfall and irrigation and outflows to evapotranspiration and deep percolation. Deep percolation is difficult to measure directly, and data are not available for vineyards under the horticultural conditions found at the proposed recycled water irrigation sites. Consequently, the soil-moisture-budget (SMB) model of deep percolation is uncalibrated. Numerous variables in the model affect the amount of simulated deep percolation and the determination of whether there is net dilution or concentration of solutes as the recycled water moves through the root zone to become deep percolation. The following analysis addresses this uncertainty.

Key Variables and Ranges

Some of the variables in the SMB model can be estimated relatively accurately. These include rainfall, irrigation rates and reference ET. Root depths and crop coefficients for wine grapes are also reasonably well known. This leaves rainfall runoff as one of the most uncertain terms in the annual water balance. Deep percolation is essentially estimated as the residual of the water balance. Its uncertainty is therefore at least as large as the uncertainty in rainfall runoff. These two key variables are discussed more fully below.

Soil texture also affects deep percolation through its influences on root depth and permeability. Soil texture is relatively easy to measure, so uncertainty is not as big an issue as spatial variability. Floodplain soils commonly include stringers of relatively sandy deposits with lower available water capacity. Vines growing in those areas would not need more water on an annual basis, but could need smaller, more frequent applications of

irrigation water. If those areas are irrigated at the same rate as adjacent heavier soils, some of the irrigation water is likely to percolate directly through the root zone to become deep percolation. This rapid pass-through of irrigation water neither concentrates nor dilutes its dissolved constituents. On an annual basis, however, those constituents would have been leached from the root zone by winter rains anyway, so the long-term impact on groundwater quality is essentially the same.

Rainfall Runoff

Uncertainty

Gaging stations operated by the U.S. Geological Survey, California Department of Water Resources and local agencies almost invariably measure runoff from upland watersheds. Runoff data for flat, agricultural areas are available only for research studies, most of which have been in the central United States. It is clear that runoff from valley floor agricultural areas is less than from upland areas because of flatter terrain, different vegetation, cultivation, and typically deeper and loamier soils. The challenge is to quantify the difference.

Some previous studies that included the Healdsburg area estimated average annual runoff from gaging station data and incorrectly implied that those rainfall-runoff relations apply to valley floor areas. For example, a U.S. Geological Survey map of mean annual runoff in the San Francisco Bay region indicated about 20 in/yr of runoff from the valley floor areas along Dry Creek and the middle reach of the Russian River (Rantz, 1974). Similarly, Johnson (2007) plotted rainfall versus runoff for a number of gages in the region, which showed 14-19 in/yr of runoff for watersheds receiving an average of 41 in/yr of rainfall (which is the average for Healdsburg).

In contrast, hydrological studies focused on agricultural areas typically assume or estimate very little runoff. For example, Blaney's benchmark studies in the Oxnard Plain assumed zero runoff from cropland, although annual rainfall in his study area was only 18 inches (Blaney, 1933). A much more recent and comprehensive modeling study of the Central Valley aquifer in California included detailed recharge estimates for 21 subareas (Faunt and others, 2009). The four northernmost subareas (near Redding and Red Bluff) receive almost as much rainfall as Healdsburg, and estimated annual runoff for those subareas was a nearly linear function of annual rainfall (r-squared = 0.97). Projecting that relationship to the amount of rainfall in Healdsburg (41 in/yr) yielded an estimate of 4.8 in/yr of runoff, or about 12% of annual rainfall. The corresponding estimate of deep percolation was 15.9 in/yr.

The uncertainty of runoff estimates is clearly large, given the range of 0-20 in/yr produced by the aforementioned previous studies. Of those, the 5 in/yr estimate from the Central Valley study is probably the most accurate for Healdsburg, given the similarity of rainfall, terrain, soil types and land use, and also the level of effort, data sets and analytical methods

used for the study. The uncertainty of that estimate cannot be quantified, but for this investigation a range of 3-10 in/yr is probably reasonable.

Range that Avoids Impacts

Rainfall runoff is only indirectly related to groundwater salinity, through its effect on the estimate of deep percolation. Uncertainty in estimated runoff is included in the discussion of the Range that Avoids Impacts for deep percolation, below.

Deep Percolation

The ratio of annual irrigation to annual deep percolation determines whether solutes in recycled water will be diluted or concentrated by the time they percolate out of the root zone. If annual deep percolation exceeds annual irrigation, concentrations of solutes in the deep percolation will be lower than in the recycled water, and vice versa.

In the SMB model, deep percolation has two components: excess applied irrigation water in summer and excess rainfall infiltration in winter. Excess irrigation can occur due to nonuniformity of application or nonuniformity of soil texture and root depth. Assuming the grower irrigates to provide adequate water to the driest part of a field, other parts receive more than enough water. For most crops, irrigation is managed to bring soil moisture back to field capacity, which means that excess irrigation in the wetter parts of a field causes deep percolation. The situation is different for drip-irrigated vineyards under a regime of regulated deficit irrigation. First, drip emitters have a relatively high uniformity of flow rate (0.92). Second, any slight excess irrigation in a wet part of the field or at an above-average emitter would simply be absorbed by the soil and transpired by the vine. Irrigation efficiency would still be 100 percent for practical purposes, and deep percolation would not occur.

Simulated deep percolation beneath valley floor vineyards near Healdsburg is not sensitive to the assumed irrigation efficiency because rainfall is relatively high and irrigation rates are low to begin with. For example, decreasing the assumed irrigation efficiency from 100% to 92% in the SMB model increased average annual deep percolation by only 0.3 in/yr (1.4%).

The second component of deep percolation occurs in winter, when the seasonal cumulative infiltration of rainfall raises soil moisture in the root zone to field capacity. Additional infiltration passes rapidly through the root zone and becomes deep percolation. The SMB model for the Syar vineyard evaluation estimated that average annual deep percolation was 15 in/yr, or three times larger than the proposed recycled water irrigation rate.

Uncertainty

Uncertainty in the estimate of deep percolation can be assessed by comparing the SMB result with estimates reported in other studies of similar areas, and also by testing the sensitivity of the SMB result to uncertainty in the input variables.

Johnson (2008) evaluated potential impacts of the NSCARP project, for which he used an estimate of 7 in/yr of average annual groundwater recharge. Neither calculations nor a reference were presented to support that number, however. The water balances presented in the Central Valley groundwater study indicated that recharge beneath agricultural land near Healdsburg would be approximately 16 in/yr, which is similar to the SMB model result for the Syar vineyard study.

In the SMB model, uncertainty in the deep percolation estimate derives mostly from uncertainty in the rainfall runoff estimate, because mass balance is preserved for the system as a whole. This relationship is illustrated by the following average-annual mass balance summary of the simulations for the Syar vineyard investigation[2]:

Deep percolation	=	Rainfall	–	Runoff	+	Irrigation	–	Evapotranspiration
15 in/yr	=	41	–	7	+	5	–	24 in/yr

As discussed earlier, rainfall and irrigation are known relatively accurately. Annual evapotranspiration can be estimated without wading into details of monthly crop coefficients or the effects of water stress on transpiration. During November-March, ET equals reference ET (8.6 inches), because the soil surface has a grass cover crop. During April-October, ET is limited to the amount of applied irrigation water (4.7 inches) plus the amount of soil moisture depletion. A 72-inch root depth with an available water capacity of 0.16 could potentially supply up to 12 inches of soil moisture depletion. These components produce a maximum of 25 in/yr of evapotranspiration. The daily SMB simulations over a 19-year hydrologic period similarly produced an average of 24 in/yr of evapotranspiration, which means the vines used essentially all of the available moisture during the growing season.

Because of the narrow ranges of uncertainty in rainfall, irrigation and evapotranspiration, the range of uncertainty in runoff is the primary source of uncertainty in the estimate of deep percolation. In the previous section, the estimate of average annual runoff was 5 in/yr with a range of uncertainty of 3-10 in/yr. In the SMB model for the Syar vineyards, the runoff parameters were adjusted to obtain a slightly more conservative average of 7 in/yr of runoff and 15 in/yr of deep percolation. Substituting 3 in/yr and 10 in/yr of runoff into the above mass balance equation produces a range of 12-19 in/yr for deep percolation. The other variables contribute additional uncertainty, although it is probably smaller. Allowing for some additional uncertainty, it is unlikely that average annual recharge is less than 9 in/yr. This minimum estimate of recharge is important because it represents the greatest potential for concentrating solutes in recycled water.

[2] This equation does not include frost protection. Frost protection would be equivalent to an additional rainfall event of perhaps 0.7 inches. Given the season for frost protection (March-April) and the typically moist condition in that season, most of the applied water would probably end up as runoff, with slightly smaller amounts becoming deep percolation and additional soil moisture (later lost to ET).

Range that Avoids Impacts

The impact of recycled water irrigation on groundwater salinity is less than significant if the recycled water salinity is acceptable and there is no net annual evaporative concentration of irrigation water by the time it percolates below the root zone. For both potable and irrigation purposes, TDS concentrations less than 500 mg/L are acceptable because they do not impair beneficial uses. The average TDS of Healdsburg recycled water is 330 mg/L, so the key issue is whether there is net dilution or net concentration in the root zone. Rainfall recharge almost certainly averages more than 9 in/yr. Therefore, net dilution would occur for irrigation rates of up to 9 in/yr. If irrigation rates exceed 9 in/yr, additional analysis is warranted to ensure that groundwater salinity is not adversely impacted.

Evaluation of Valley Floor Vineyards

Assuming the irrigation rate for the valley floor vineyards is the same as for the Syar vineyards (4-6 in/yr on a per-acre basis), there would be no adverse impact on groundwater salinity. Vineyard irrigation should not exceed 9 in/yr on any irrigation block, with appropriate metering and monitoring of irrigation operations on a monthly and annual basis to confirm the actual amounts applied.

Impact: Reversal of Water Exchange Between Surface Water and Groundwater

Irrigation with recycled water decreases the amount of groundwater used for irrigation. If recycled water displaces a substantial percentage of existing groundwater pumping, the local water balance of the groundwater system can be fundamentally altered. Along Dry Creek and the Russian River, groundwater is hydraulically coupled to surface water, and changes in pumping are balanced by a change in the amount of seepage to or from the river. A large decrease in pumping can change the prevailing direction of seepage, with consequences for groundwater quality. For example, the NSCARP project could have decreased June-October pumping along Dry Creek by approximately 5,100 AFY (Yates, 2009). Seepage losses along Dry Creek during those months average about 3,000 AF (Johnson, 2008), so the decrease in pumping would have eliminated creek seepage and probably converted the creek from a losing to a gaining stream in summer. The creek water is relatively low in dissolved solids, and eliminating creek seepage would have adversely impacted groundwater quality.

The opposite condition exists along the middle reach of the Russian River, where the river is consistently gaining in all seasons under existing conditions. Irrigating with recycled water instead of groundwater on the adjacent floodplain would increase the rate of groundwater seepage into the river but not reverse the direction of flow (Yates 2010).

Method of Analysis

The evaluations of the NSCARP and Syar vineyard projects considered water levels and water balances in determining whether the projects would substantially alter stream-aquifer interactions. Those key variables are discussed below. In addition, the evaluations included the following assumptions:

- Existing irrigation is by groundwater using local wells
- Surface water has a lower dissolved solids concentration than groundwater
- The stream and aquifer are hydraulically coupled
- Recycled water substitutes 1:1 for groundwater

If any of these assumptions do not apply to a specific situation, additional analysis may be needed.

Key Variables and Ranges

Groundwater and Surface Water Levels

If existing groundwater levels are higher than adjacent surface water levels during the irrigation season, then groundwater seeps into the creek or river. Decreasing groundwater pumping will elevate groundwater levels and increase the rate of groundwater seepage into the surface waterway. Over the course of a year, the increase in seepage will usually balance the change in pumping. This condition would not impact groundwater quality. However, the increased rate of groundwater flow to the surface waterway could potentially affect surface water quality because flow paths from recharge areas to the stream would be on average shallower and faster.

If existing groundwater levels are lower than adjacent surface water levels during the irrigation season, then surface water seeps into the aquifer. A decrease in pumping will raise groundwater levels and decrease the rate of stream percolation. If groundwater levels rise to an elevation higher than the stream surface, the direction of seepage will reverse. A reversal in seepage direction is potentially significant because it would eliminate the water quality benefits of stream recharge, which tends to dilute groundwater salinity.

Uncertainty

Uncertainty in evaluating groundwater-surface water interactions stems primarily from insufficient local data. Stream gages are typically far apart, and monitoring well networks are typically sparse. Spatial interpolation of both data sets can easily incur errors of several feet at any particular location. However, relative elevations between groundwater and surface water at several points along a reach of creek or river often reveal a consistent pattern that can be generalized for the entire reach.

Range that Avoids Impacts

If existing groundwater levels are consistently higher than adjacent surface water levels during April-October, it is reasonable to assume no reversal of seepage direction and no impact on groundwater quality. If existing groundwater levels are consistently lower than adjacent stream levels, then the amount of water level rise associated with recycled water substitution needs to be estimated. This can be done using historical hydrographs and an estimated local water balance.

Local Groundwater Balance

If groundwater levels are consistently lower than the creek or river elevation during the irrigation season, then some of the irrigation pumping probably derives from induced seepage. It may be possible to estimate the magnitude of induced seepage as the difference in surface flow between two stream gauges. This approach was used for an evaluation of Dry Creek, for example (Johnson, 2008; Yates, 2009). Alternatively, induced seepage can be estimated as the difference between pumping and storage depletion using independent estimates of those variables during the summer months.

Uncertainty

Both methods of estimating induced seepage are subject to considerable uncertainty. The amount of uncertainty depends partly on local site conditions that cannot be generalized. It would be prudent to assume an uncertainty of +/- 50%.

Range that Avoids Impacts

The amount of recycled water substitution can be compared with the amount of existing induced seepage to determine the potential impact. If substitution exceeds existing seepage, then it would probably reverse the direction of seepage during all or part of the irrigation season and would probably impact groundwater quality. In this case, additional analysis may be needed. If substitution is less than half of the amount of existing induced seepage, then impacts on groundwater quality are probably less than significant.

Evaluation of Valley Floor Vineyards

The valley floor vineyards proposed for irrigation with recycled water are near the confluence of Dry Creek and the Russian River. The groundwater system is continuous from the Dry Creek valley into the Russian River valley. However, those two waterways have opposite groundwater-surface water relations in summer. Dry Creek is a losing stream during the summer months, whereas the middle reach of the Russian River just below Dry Creek is a gaining stream (Johnson, 2008; Yates, 2010). Two wells in the valley floor vineyard area with long-term water-level records confirm that stream-aquifer relations are transitional and locally variable (Johnson, 2008, Figure 23a). Well 9N/9W-20E2 near the northwest corner of the valley floor vineyard areas shows summer water levels approximately equal to the surface elevation of Dry Creek at that location (within the

uncertainty of the estimated surface elevation). Well 9N/9W-28N1,2 near the confluence of Dry Creek and the Russian River has summer water levels 2-3 feet below the estimated surface elevation of Dry Creek, indicating losing streamflow conditions. It appears that Dry Creek is neutral to losing, which indicates that a water balance evaluation is needed.

The groundwater balance near the valley floor vineyards is heavily influenced by municipal pumping at the City's Dry Creek and Fitch well fields. The maximum substitution of recycled water for groundwater pumping on the Syar and valley floor vineyards would be about two-thirds of the recycled water produced during the irrigation season, or approximately 280 AF. The remaining one-third will be used for turf irrigation at parks and schools in Healdsburg. By comparison, production at the Dry Creek and Fitch well fields is approximately 2,100 AFY, most of which is during May-October (Winzler & Kelly Consulting Engineers, 2006). This means that irrigation with recycled water would not decrease local groundwater pumping by more than 25 percent.

Groundwater flow and induced seepage are spatially complex in the valley floor vineyard area. The well fields are located adjacent to Dry Creek and the Russian River on the west and east sides of valley floor vineyard areas, respectively (**Figure 1**). Locally, the capture zones of those well fields probably induce and intercept most of the surface water seepage from the creek and river. Groundwater in the intervening area probably flows south under Dry Creek following the regional down-valley gradient. Raising water levels between the two well fields would probably not alter the average rate or direction of regional flow, but would locally accelerate or retard it. More detailed analysis of groundwater flow and stream-aquifer interaction using a groundwater model would be needed to delineate potential flow impacts in detail.

In this case, the quality of the recycled water is sufficiently high and the proposed application rates sufficiently low that impacts on groundwater quality would not be significant in spite of the localized changes in groundwater flow patterns beneath the valley floor vineyards.

Impact: Contamination of Groundwater and Surface Water with Metals

Previous studies evaluated the potential for six metals regulated under the California Toxics Rule (CTR) to discharge into surface waters at concentrations high enough to impact aquatic life (Yates, 2009; Yates, 2010). The metals were cadmium, chromium, copper, lead, nickel and zinc. For all of the metals except chromium, the CTR limits to protect aquatic life are lower than the corresponding limits for drinking water. The maximum contaminant levels allowed for CTR metals are a function of the hardness of the receiving water.

Method of Analysis

The method of analysis used for evaluating impacts of the Syar vineyard project was to apply a sequence of three dilution steps along the flow path from an irrigation site to a

nearby stream via groundwater: dilution during recharge, dilution and attenuation during subsurface transport, and dilution within the receiving water.

Key Variables and Ranges

Dilution Factors

The three dilution factors and maximum allowable concentration in the receiving water are complicated to calculate. However, a simplified approach using conservative assumptions can be used as a screening method to determine whether in-depth analysis is needed. The conservative assumptions are that there is no adsorption or attenuation of metals during recharge or subsurface transport and that there is also no dilution during subsurface transport (equivalent to assuming that seepage into the stream occurs at the same location as the recharge). The simplified approach divides the concentration of each metal by two dilution factors. The first is dilution during recharge, which equals average annual deep percolation divided by average annual irrigation. For the Syar vineyard project, recharge was estimated to be 15 in/yr and irrigation was up to 6 in/yr, for a dilution factor of 2.5 (Yates ,2010). The second dilution factor represents the receiving water and equals the volumetric recharge rate divided by the amount of baseflow in the stream. A recharge rate of 15 in/yr on one acre of vineyard is equivalent to 0.00173 cubic feet per second (cfs). That rate is multiplied by the number of acres of vineyard, and the result is divided into the baseflow in the creek to obtain the dilution factor. For example, recharge from a 100-acre vineyard seeping into a creek with 50 cfs of baseflow would have a dilution factor of 289. Overall dilution is the product of the two factors, or 723 in this case.

After dividing the effluent concentrations by the overall dilution factor, the results are compared with the following maximum concentrations, which are based on average low-flow hardness in the Russian River:

Constituent	Cadmium	Copper	Chromium	Nickel	Lead	Zinc
Constituent Chronic Concentration (μg/L)	3	11	221	65	4	148

Flow in the middle reach of the Russian River is regulated by upstream reservoirs and is subject to minimum flow requirements under State Water Resources Control Board decision D-1610. As a result, minimum baseflow is fairly constant from year to year at 150-200 cfs, although it is sometimes as low as 120 cfs. Baseflow in Dry Creek is similarly regulated and averages about 80 cfs.

If the simplified dilution calculations result in a predicted receiving water concentration greater than 50 percent of the constituent chronic concentration, more complete analysis is needed.

For potential drinking water impacts of chromium, the effluent concentration should be multiplied by the recharge dilution factor only, then compared with the drinking water standard of 50 μg/L.

Uncertainty

Uncertainty in the two dilution factors is compensated for by the conservative assumption that adsorption and the third dilution factor are both zero. Additional insurance against uncertainty is provided by the factor of two margin of safety used when determining whether detailed analysis is necessary.

Range that Avoids Impacts

The concentrations of CTR metals in the receiving stream would not have a significant adverse impact on aquatic life if they are less than their respective CTR constituent chronic concentrations. Impacts of chromium on human health are considered less than significant if the estimated concentration is less than the drinking water standard.

Evaluation of Valley Floor Vineyards

Assuming a recharge rate of 15 in/yr and an irrigation rate of 6 in/yr, the recharge dilution factor for the valley floor vineyards is 2.5. Total recharge flow for the 980 acres of valley floor vineyard averages 1.7 cfs. Conservatively assuming all of the recharge seeps into Dry Creek (which has less baseflow than the Russian River), the stream dilution factor is 47. The overall dilution factor is 118. The concentrations in Healdsburg effluent are all less than the CTR limits to begin with. After dividing the concentrations by 118, they are all less than 1% of the CTR limits for local receiving waters. The average concentration of chromium in Healdsburg recycled water is 48 μg/L. Dividing by the recharge dilution factor (2.5) yields a concentration of 19 μg/L, which is less than half of the drinking water standard. Therefore, potential impacts on aquatic life and drinking water are less than significant.

If a more conservative recharge rate of 9 in/yr is assumed, the recharge dilution factor would be 1.5 and the overall dilution factor would be 71. and the concentrations of CTR metals and chromium would still be below the respective standards for aquatic life and drinking water.

Summary and Conclusions

Previous studies of potential impacts of recycled water irrigation on groundwater and surface water quality near Healdsburg were generalized to apply to similar nearby areas. For each of the potential impacts, a range of values of key variables was identified for which impacts would be less than significant.

Areas proposed for irrigation with recycled water from the Healdsburg WWTP were grouped into four categories: Syar vineyards, other valley floor vineyards, upland vineyards

and turf areas at schools and parks. The generalized approach was based primarily on an earlier analysis of the Syar vineyards and could theoretically be applied to all of the areas. However, the focus of the present report is the valley floor vineyard areas. Application of the method to the upland vineyard and urban turf areas could require additional analysis. Major findings for each type of potential impact are as follows:

- If recycled water is used for frost protection, runoff is possible unless retention or other runoff control measures are implemented. With current Healdsburg recycled water quality, impacts of runoff on surface water quality would probably be less than significant.
- If the TDS concentration of recycled water is less than 500 mg/L and there is net dilution of solutes in irrigation water when they are leached downward in deep percolation, the impact on groundwater salinity is less than significant.
- Deep percolation of recycled water applied for frost protection will not significantly impact groundwater salinity if the TDS concentration is less than 500 mg/L and there is net dilution of deep percolation on an annual basis.
- The annual nitrogen load in the irrigation water—which equals the concentration multiplied by the annual irrigation rate—poses a negligible concern for viticulture if it is less than 8 lb/ac and a negligible risk of groundwater quality impacts if it is less than about 25 lb/ac.
- It is impractical to measure deep percolation directly, and the uncertainty in estimating deep percolation beneath vineyards stems primarily from uncertainty in rainfall runoff.
- For rainfall, soil and irrigation practices typical of valley floor vineyards, average annual deep percolation is estimated to be 15 in/yr. The low end of the reasonable range of uncertainty is 9 in/yr.
- For irrigation rates less than 9 in/yr (and possibly as high as 15 in/yr), solutes in recycled water will be diluted by the time they reach the water table. The proposed irrigation rate for the Syar vineyards (4-6 in/yr) is thus in the range of net dilution.
- Irrigation with recycled water decreases groundwater pumping, which elevates groundwater levels. The potential to reverse the direction of stream-aquifer seepage and impact groundwater quality depends on site-specific water levels and groundwater balances. If the adjacent stream reach is gaining under existing conditions, the decrease in pumping would not reverse the direction of seepage. If the reach is losing, the mass balance of the stream and aquifer system must be evaluated to estimate whether a seepage reversal is likely.
- Recycled water contains dissolved metals regulated under the California Toxics Rule. The metals can reach surface waterways via groundwater recharge and subsurface transport. A conservative estimate of potential concentrations in the receiving waterway can be obtained by multiplying the concentrations in recycled water by the dilution factor during recharge and the dilution factor when groundwater seepage mixes into the stream. If those concentrations are less than half of the maximum permissible concentrations, then the impact can be considered less than significant and additional analysis is unnecessary.

- Irrigation of the identified valley floor vineyard areas with recycled water would be less than significant with respect to all of the impacts considered in this report provided the following assumptions are true:
  - The quality of recycled water remains essentially unchanged
  - Irrigation does not exceed 9 in/yr on any irrigation block
- It is recommended that the foregoing assumptions be used as thresholds for requiring additional analysis.

I hope that this effort to expand on the Syar vineyard analysis to address potential impacts of the valley floor vineyards and other recycled water use areas facilitates the design and permitting of those projects and others in the future. Please do not hesitate to contact me if you have any questions.

Sincerely,

Gus Yates, PG, CHg

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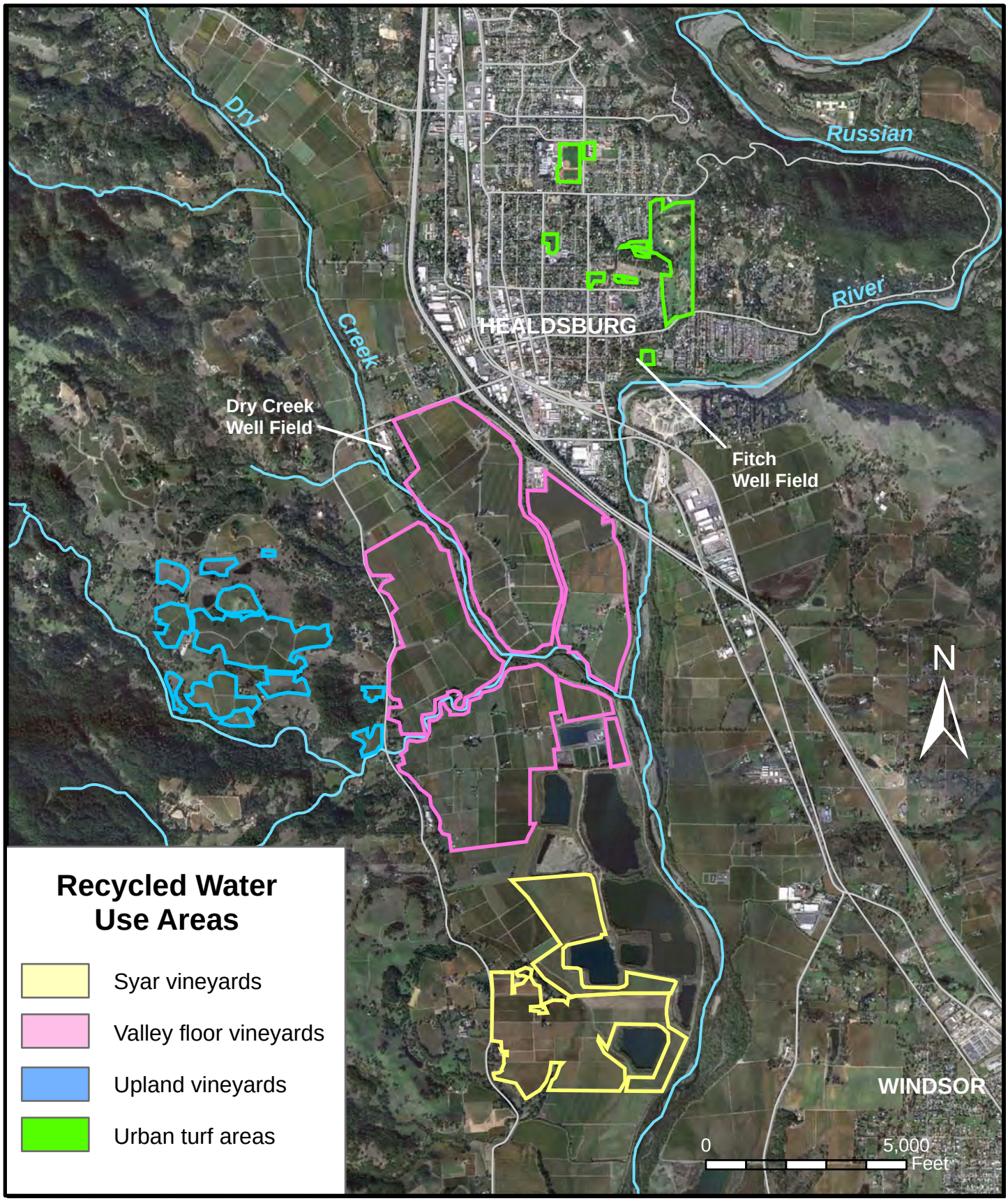

Figure 1. Locations of Proposed Recycled Water Irrigation Areas

Gus Yates, Consulting Hydrologist
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June 28, 2010

Mr. Jim Flugum, Deputy Director
Department of Public Works
City of Healdsburg
401 Grove Street
Healdsburg, CA 95448

Subject: Syar Property Recycled Wastewater Agricultural Irrigation Project—Additional Analysis of Potential Groundwater and Russian River Impacts

Dear Mr. Flugum:

Use of treated municipal wastewater for vineyard irrigation in Sonoma County can potentially contaminate groundwater and surface water with elevated concentrations of nitrate, total dissolved solids (TDS) or metals. The risk of adverse impact depends on various factors including level of treatment, application rates and methods, and local hydrogeologic conditions. In some cases, the interactions of those factors are not obvious. For example, the subsurface mobility of metals is greatly increased by the presence of dissolved organic carbon, which is commonly abundant in wastewater (Kennedy/Jenks Consultants, 2007a and 2007b). Or in the case of a proposal to irrigate all vineyards along Dry Creek with recycled water, the associated decrease in well pumping would have reversed the direction of stream-aquifer exchange and greatly diminished dilution of local groundwater with high-quality stream recharge (Yates, 2009).

My analysis of potential groundwater impacts of the Northern Sonoma County Agricultural Reuse Project (NSCARP) in 2009 demonstrated that details of project operation and local hydrogeology matter. That analysis identified the following potentially significant impacts that had not previously been identified:

- Surface water and groundwater contamination from frost protection
- Excessive nitrogen load on vineyards
- Long-term increases in groundwater salinity
- Reversal of water exchange between surface water and groundwater
- Contamination of groundwater and surface water with metals

This memorandum evaluates the potential for the Syar property recycled wastewater agricultural irrigation project (Syar irrigation project) to cause the last four of those impacts. Impacts from frost protection would not occur because the project description states that

recycled water would not be used for that purpose. The remaining impacts are evaluated below.

Impact: Excessive Nitrogen Load on Vineyards

Recycled wastewater contains nitrogen, and the nitrogen load that accompanies recycled water irrigation could exceed crop requirements during certain parts of the growing season. Scientific and commercial studies have confirmed the seasonality of nitrogen uptake by grape vines and the impact of incorrect fertilizer timing and quantities on the grape crop and subsequent winemaking (for example, Peacock and others 1998; Keller 2005). Nitrogen uptake increases steadily from bud break to veraison, then declines. Excessive nitrogen applications lead to luxuriant canopy growth which must be pruned back to prevent mildew on the berries. Inadequate nitrogen status can reduce the amount of yeast available nitrogen in the berries, which interferes with fermentation. Nitrogen applications outside the season of uptake have a higher tendency to contaminate groundwater. All of these considerations call for flexibility in choosing the amount and timing of nitrogen applications, but irrigating with recycled water precludes the ability of growers to manage irrigation and fertilization separately.

The Syar Family Vineyards presently receive no nitrogen fertilization because canopy growth is adequate, according to the vineyard foreman (Rand Dericco, personal communication, June 7, 2010). This practice is not uncommon among north coast winegrape growers (http://www.lakecountywinegrape.org/ growers/suswine.php accessed 3/31/2009).

Small amounts of nitrogen application may not be deleterious, however. For example, the normal range of annual nitrogen application for table grapes is 22-44 pounds per acre (Peacock, 1998), and a University of California/Napa Sanitation District study found that 14-21 pounds of nitrogen per acre per season is “not exceptionally high, but it may be enough to be of concern to some growers” (University of California Agriculture and Natural Resources, 2006).

The nitrogen loading rate associated with the Syar irrigation project would be much lower than those crop uptake rates because of nitrogen removal during the treatment process and low irrigation rates. Quarterly samples of nitrate plus total Kjeldahl nitrogen (which together represent total nitrogen) from the Healdsburg wastewater treatment plant during 2008-2009 averaged 3.8 mg/L as nitrogen. The median concentration was 4.2 mg/L. These concentrations are less than one-half of the nitrate MCL for drinking water and are achieved through an anaerobic denitrification step in the treatment process. The ambient nitrate concentration in groundwater on the west side of the middle reach of the Russian River is 0.5-1.5 mg/L based on data from five wells in the U.S. Geological Survey NWIS database. Thus, the net increase in nitrogen concentration of irrigation water if recycled water is substituted for well water would be approximately 3 mg/L.

The irrigation rate stated in the project description is 35-52 million gallons over the growing season. The lower and upper ends of this range are equivalent to applying 6 gallons per vine per week during mid-May through September on 319 acres planted with 6 ft x 8 ft and 6 ft x 4 ft vine spacing, respectively. These spacings and irrigation rates were confirmed by the vineyard foreman (Rand Dericco, personal communication, June 7, 2010). The associated nitrogen load on the vineyards ranges from 3.8 pounds per acre to 5.7 pounds per acre, for the two vine spacings. This range of loading is substantially below the aforementioned levels of concern, and the Syar foreman confirmed that those loading rates would not pose any problems.

The potential impact of excessive nitrogen fertilization associated with recycled water irrigation is less than significant because the low nitrogen concentrations in the recycled water and the low irrigation rates result in a small nitrogen loading rate.

Impact: Long-Term Increases in Groundwater Salinity

When irrigation water is applied to soil, most of the water is removed by evapotranspiration, while almost all of the dissolved minerals remain behind. These dissolved minerals are flushed from the soil by infiltration of winter rains and excess applied irrigation water. The salinity, or TDS concentration, of deep percolation beneath the root zone equals the salt mass applied in the irrigation water divided by the volume of deep percolation. Deep percolation becomes groundwater recharge when it reaches the water table.

A soil-moisture-budget model was developed to simulate deep percolation, and that flow rate was combined with TDS data for irrigation water, shallow and deep groundwater, and recycled water to estimate the increase in recharge salinity that would result from substituting recycled water for groundwater as the source of irrigation supply.

The one-dimensional soil-moisture-budget model simulated the water balance in the vineyard root zone on a daily basis during calendar years 1991-2009. Rainfall averaged 41.1 in/yr during that period, or 106% of the long-term average[1]. Rainfall was partitioned into infiltration and runoff using a nonlinear function that accounts for antecedent soil moisture. The root zone soil moisture storage capacity equaled the available water capacity of Yolo sandy loam (0.16) multiplied by the winegrape root depth (6 feet). Reference evapotranspiration (ETo) was obtained from the CIMIS meteorological station in Windsor and averaged 45.89 in/yr. The crop coefficient (Kc) for winegrapes is affected by various factors, but especially by the percent of total vineyard area that is shaded by the canopy at midday. The row spacing in the Syar vineyards is 8 feet. Assuming a canopy width of 2.4 feet, 30 percent of the vineyard area is shaded at midday (Smith, 2010). Applying a linear function developed by Williams (2001) relating Kc to percent shaded area obtained a Kc

[1] Rainfall and ETo data were obtained from the CIMIS station in Windsor. Rainfall was adjusted upward by a constant factor to conform more closely to data from the NOAA gage in Healdsburg and a regional isohyetal map (Rantz, 1969).

value of 0.51 during the period of full canopy development. From December-April, a ground cover of annual grasses was assumed to be present, with a Kc of 1.0.

The initial estimate of average annual irrigation (approximately 9 in/yr) was higher than the estimate of applied water provided by the vineyard foreman. The soil-moisture-budget model assumes irrigation occurs when soil moisture falls below a specified percentage of soil moisture capacity. The amount of applied water equals the deficit divided by the irrigation efficiency. For drip-irrigated vineyards, irrigation efficiency equals the emission uniformity of the drippers and can approach 92% in a well-managed system (Smith, 2010). Although regulated deficit irrigation is not commonly practiced on chardonnay grapes (the principal variety at the Syar vineyards), the low reported irrigation rate of 6 gallons/vine/week could only be duplicated in the soil moisture budget calculations by assuming that soil moisture stored during the preceding winter was consumed almost entirely by the end of the irrigation season. This means that the vines are apparently experiencing deficit irrigation. Nevertheless, it was assumed that the irrigation rate reported by the grower is correct. By allowing gradual soil moisture depletion during the irrigation season, simulated average annual irrigation was 4.7 in/yr, which is consistent with the 4-6 in/yr reported by the grower (obtained by multiplying 6 gallons/vine/week by the number of vines per acre).

The simulation produced an estimate of average annual deep percolation of 15.1 in/yr, almost all of which derives from rainwater during the winter months. This estimate is considerably higher than the value of 7 in/yr reported by Wagner & Bonsignore (1999) and used by Johnson (2008). Available documentation for the latter estimate is not sufficiently detailed to allow a thorough comparison of assumptions and data. Both estimates are larger than the simulated irrigation rate, which means that the TDS concentration in deep percolation would be less than in the irrigation water. However, the TDS concentration of deep percolation is greater than the TDS concentration of recharge under predevelopment conditions (i.e. conditions not influenced by irrigation with either groundwater or recycled water), so irrigation with either source of water will tend to increase ambient groundwater salinity until a new equilibrium is reached reflecting the flows and concentrations of all items in the water balance.

The effect of recycled water irrigation on groundwater salinity was estimated by comparing predevelopment groundwater salinity with salinity under existing conditions, and extrapolating to irrigation with recycled water. Predevelopment TDS was assumed to equal the average measured value in Healdsburg and Windsor municipal wells, which were both around 130 mg/L in the most recent consumer confidence reports. Municipal wells typically pump from relatively deep within a basin to minimize the risk of contamination from surface activities, and this water is likely to represent predevelopment conditions. The TDS concentration of current vineyard deep percolation was assumed to equal the TDS concentration measured in Syar monitoring wells MW-4, MW-5 and MW-6, which are located near the vineyards that would be irrigated with recycled water. These relatively shallow monitoring wells sample the water table, where groundwater TDS was assumed to be equal the concentration of deep percolation when groundwater is used as the irrigation

supply. The average TDS concentration in quarterly samples from those wells during 2008-2009 was 170 mg/L, or 40 mg/L greater than predevelopment TDS. This increment was assumed to result from salt loading due to evaporation of applied irrigation water from groundwater wells. The average TDS of Healdsburg wastewater effluent during 2008-2010 was 330 mg/L, or 2.5 times greater than groundwater used for irrigation. Assuming the increase in recharge TDS is proportional to the increase in irrigation salinity, the increase in recharge TDS would be approximately 100 mg/L greater than under predevelopment conditions (or 60 mg/L greater than for groundwater irrigation), for a final recharge salinity of 230 mg/L.[2]

Although the foregoing data and assumptions are rough, it is clear that recycled water irrigation would not elevate groundwater TDS above the long-term secondary drinking water MCL of 500 mg/L because the recycled water (TDS = 330 mg/L) experiences net dilution from infiltrated rainfall as it percolates to the water table. This impact is therefore considered less than significant.

This same dilution process would apply to other pollutants of concern in recycled water, including nitrate and metals. Even with zero crop uptake, the nitrate concentration would remain below the primary drinking water MCL of 10 mg/L. The fate of metals is discussed below.

Impact: Excessive Salt Load on Vineyards

Above some threshold, excessive salinity of soil water adversely impacts the growth and yield of crops. The threshold varies widely among crops and even among grapevine rootstock varieties (Mass and Hoffman, 1977). The commonly accepted specific conductance thresholds for yield impacts are 1,000 µS/cm in the irrigation water and 1,500 µS/cm in a saturated paste extract of soil water (Maas and Grattan, 1999; Grattan, 2002). The irrigation water threshold corresponds to a total dissolved solids concentration of 500 mg/L for wastewater and 600 mg/L for groundwater.[3] The average specific conductance of Healdsburg wastewater is 640 µS/cm, which is well below the threshold for adverse impacts. However, the threshold values reported in the literature assumed a 15-20% leaching fraction during the irrigation season, which does not occur in drip-irrigated vineyards, particularly at low irrigation rates that allow depletion of stored soil moisture. In vineyards, salts accumulate in the soil during the irrigation season.

A mixing model approach was applied to estimate the salinity of the residual soil moisture at the end of the growing season. The calculations assumed: 1) the soil profile began the

[2] The increase in recharge salinity using recycled water is 2.5 x 40 = 100 mg/L. The final recharge salinity equals predevelopment salinity plus the increase due to irrigation: 130 + 100 = 230 mg/L.

[3] The relationship between specific conductance and TDS is typically linear, but the slope and intercept depend on the composition of the water. Linear regression of 18 recent Healdsburg wastewater samples obtained the following equation: TDS = 0.462 x Sp. Cond. + 35.2 (R^2 = 0.65), with TDS in mg/L and specific conductance in µS/cm. For 41 samples of middle reach groundwater, the equation was TDS = 0.596 x Sp. Cond. + 7.6 (R^2 = 0.92).

irrigation season at field capacity (11.5 inches of stored moisture), 2) the initial soil moisture salinity was 130 mg/L of TDS, and 3) soil moisture at the end of the growing season was 10% of field capacity. Under existing conditions in which 6 inches of irrigation water with an estimated salinity of 130 mg/L is applied during the growing season, the ending soil moisture salinity would be 1,980 mg/L, corresponding to a specific conductance of approximately 3,300 µS/cm. If recycled water is used for irrigation, with a TDS concentration of 330 mg/L, the ending soil moisture salinity would be 3,020 mg/L, corresponding to 5,050 µS/cm.

Although the simulated soil moisture salinity with recycled water irrigation is five times greater than the threshold at which adverse impacts would be expected, there are several reasons to suspect the impact would be small or manageable:

- In grapevines, the principal impact of elevated salinity is to reduce leaf and shoot growth, not berry yield (Maas and Hoffman, 1977). A small decrease in canopy leaf area would not pose a problem, given that growers sometimes need to prune foliage to avoid excessive shading anyway.
- Soil moisture salinity would gradually increase during the growing season, reaching high levels at a time when the canopy is already fully developed and growers typically allow some soil moisture depletion (drought stress) to occur.
- The simulation of existing conditions results in salinity three times greater than the threshold, yet no problems have been reported by the grower. This suggests that the estimates of residual soil moisture storage or irrigation efficiency might have been unrealistically conservative, or that a moderate impact of salinity on canopy growth was not considered a problem.
- Recycled municipal wastewater is being used for vineyard irrigation in at least seven other locations in California, including Santa Rosa, Sonoma, Windsor, Napa and St. Helena (Sonoma County Water Agency, 2007). While details of water quality, soil conditions, application rates, irrigation efficiencies, etc. may differ among those sites, excessive salt accumulation in the root zone does not appear to be a widespread problem.
- Salinity and soil desiccation both create drought stress for the grapevines. Given that winegrape growers carefully monitor plant water status during the growing season to ensure optimal quality and yield of berries, they would simply be monitoring the combined impacts of salinity and desiccation, instead of desiccation alone.
- If plant water status is too low, the grower can simply supply additional irrigation water—groundwater or recycled water—to restore optimal growing conditions. A small increase in the current irrigation rates (3-6 in/yr) would still be within the range of agronomically reasonable irrigation rates of 6-10 in/yr published in standard references (California Department of Water Resources, 1975; UNFAO, 2006).
- Deep percolation of winter rain (about 15 in/yr) is 2.5 times greater than the amount of applied irrigation water, whereas a leaching fraction of only 0.30 is needed to prevent salt accumulation (Grattan, 2002). Thus, on an annual basis, salts

are reliably flushed from the soil by infiltration and deep percolation of rainfall. Adequate flushing might not occur during drought years, however, possibly necessitating pre-season irrigation with groundwater. Syar Family Vineyards already plans to implement a post-harvest sprinkler irrigation with groundwater to stimulate sprouting of annual grasses in the vineyards (Rand Dericco, personal communication, June 7, 2010), so the vineyards will have two sources and methods of irrigation available to support salinity management.

A study of the long-term effects on vineyard soils of irrigation with recycled water was completed for Napa Sanitation District by the University of California Division of Agriculture and Natural Resources (2006). Soil samples were collected in mid-September from a vineyard that had been irrigated with recycled water for 8 seasons. Conditions for that project differed somewhat from those for the Syar project, but in most cases the differences would have tended to exacerbate salt accmulation at the Napa site. A hardpan layer was present in the soil at a depth of 18-24 inches. This layer appeared to restrict root depth and leaching. The application rate of 4-5 gallons/vine/week was slightly less than proposed for the Syar irrigation project (6 gallons/vine/week), and the specific conductance of the recycled water was 60% greater than Healdsburg effluent (950 µS/cm versus 597 µS/cm). Annual rainfall at the Napa site averaged 23 in/yr, versus about 38 in/yr at the Syar site.

Soil salinity at the Napa site measured as the specific conductance of a saturated paste extract averaged 467 µS/cm and ranged from 250-780 µS/cm. All of these values are below the threshold of impact, which is 1,500 µS/cm (Ayers and Westcott, 1985). Thus, under conditions more likely to generate salt accumulation in the root zone, none was found.

In summary, the potential impact of seasonal salinity increases in the root zone is considered less than significant because that has not occurred in other areas where conditions tend to favor salt accumulation, the salinity of Healdsburg recycled water is relatively low, salinity tends to affect canopy growth more than berry growth, and the Syar vineyard will have the ability to manage soil salinity by occasional irrigation with groundwater, if needed.

Impact: Potential Reversal of Stream-Aquifer Gradients and Flow

When recycled water is used for irrigation, groundwater pumping decreases by an equal amount. In the Dry Creek Valley, the decrease in groundwater pumping associated with the NSCARP project would have raised groundwater levels to the point that Dry Creek would convert from a consistently losing stream to a consistently gaining stream. This would have largely eliminated stream recharge, which is low in TDS and dilutes the saltier recharge from deep percolation.

Along the middle reach of the Russian River where the Syar irrigation project is located, groundwater consistently flows into the river under existing conditions (Luhdorff and

Scalmanini Consulting Engineers, 1996; Todd Engineers and Yates, 2005; Brunsing Associates, Inc., 2010). **Figure 1** shows hydrographs of water elevations in Syar monitoring wells MW-1, MW-4 and the Russian River adjacent to MW-1. The river stage at that location was estimated by projecting the measured stage hydrograph at the Healdsburg gage downstream using the gradient of the low-flow water surface between the Healdsburg gage and the Basalt Pond (Cluer and others, 2009), which was 20 feet in 3.54 miles. The water levels in MW-1 (300 feet from the river) are approximately equal to the river elevation, while water levels in MW-4 (1,800 feet from the river) are consistently higher (by an average of 1.6 feet), indicating groundwater flow toward MW-1 and the river. The river elevation is higher than adjacent groundwater elevations only briefly during storm events, which is not long enough to introduce a significant amount of river recharge into the groundwater system.

A decrease in groundwater pumping for irrigation would increase water level gradients from the aquifer toward the river. The rate of groundwater seepage into the river would increase, which could affect movement of contaminants from groundwater to the river (see discussion below). However, the direction of flow between the river and aquifer would remain the same. Consequently, this potential impact is considered less than significant.

Impact: Potential Contamination of Russian River with California Toxics Rule (CTR) Metals

Metals are positively charged ions that typically have low mobility in the subsurface because they tend to adsorb to the negatively charged surfaces of clay particles. The presence of dissolved organic carbon—such as occurs in wastewater—greatly increases the mobility of the metals. This phenomenon was demonstrated locally in field and laboratory experiments completed for the City of Santa Rosa's Discharge Compliance Project (Kennedy/Jenks Consultants 2007a and 2007b). The laboratory test involved percolation of recycled water through columns of soils collected from the Russian River floodplain. The field study examined groundwater quality in monitoring wells downgradient of the "Basalt Pond", which receives effluent from the City of Healdsburg's municipal wastewater treatment plant. In both studies, transport of copper, nickel and total organic carbon (TOC) was much greater than expected. For example, 38% of the nickel concentration was still present at a monitoring well 5,300 feet from the Basalt Pond. Attenuation of the metals by adsorption was not considered sufficient to meet the City of Santa Rosa's anticipated effluent limits under the California Toxics Rule (CTR), which sets numerical standards for those and other pollutants. It should be noted that CTR limits are dependent on hardness at the site of a specific discharge, and the limits assumed for Santa Rosa's surface water discharge might differ from the ones that would apply to Healdsburg. The tests also found an "unexpectedly low" average TOC attenuation of only 26%.

Additional tests gave support to the hypothesis that the metals failed to adsorb to sediments because they chelated with organic compounds also present in the recycled water. These interactive effects were not considered in prior modeling studies that had

indicated low subsurface mobility. The only hypothesis offered for low TOC attenuation was that the concentrations were lower than in typical wastewater to begin with.

The results of the Santa Rosa experiments can be translated to the Syar irrigation project by adjusting the concentrations, flow rates, flow path distances and dilution factors. The flow path for potential contamination of the Russian River begins with application of recycled water for vineyard irrigation. Deep percolation beneath the vineyard moves downward through the unsaturated zone until it reaches the water table, at which point it flows laterally to the river. Each step of this flow path is evaluated below for dilution and attenuation that could affect the concentration in the river downstream of the Syar vineyards.

The concentrations of six CTR metals have been measured in the discharge from the upgraded Healdsburg WWTP during the past two years. Routine sampling by WWTP staff includes analysis for copper, for which 24 measurements are available. Groundwater monitoring for the Syar Industries, Inc. gravel mining operation has included three samples of WWTP discharge analyzed for cadmium, chromium, nickel, lead and zinc (Brunsing Associates, Inc., 2010). The maximum and average concentrations of the metals are shown in **Table 1** along with the maximum concentrations allowed in receiving waters downstream of the discharge point under the California Toxics Rule. The Constituent Maximum Concentration (CMC) is for acute exposure and the Constituent Chronic Concentration (CCC) is for chronic exposure. A Reasonable Potential analysis conducted by the Regional Water Quality Control Board did not find reasonable potential for lead[4]. Both are calculated from formulas that take into account the hardness of the receiving water.

The constituent that comes closest to exceeding the anticipated CTR standard for subsurface seepage into the Russian River is copper. The maximum measured effluent concentration was 16 µg/L, which nearly equaled the acute limit of 17 µg/L (based on historical measurements of hardness in the Russian River near Healdsburg). The average copper concentration was 7.7 µg/L, or 70% of the chronic limit of 11 µg/L. The average copper concentration in the river during 2002-2006 was 1.6 µg/L. Given the large dilution factor (see discussion below), the ambient concentration downstream of the Syar vineyards would be much closer to the existing ambient concentration than the effluent concentration. The maximum concentrations of all of the remaining metals were less than one-third of the acute exposure limits, and in most cases average concentrations were similarly far below the chronic exposure limits. However, the average nickel concentration was 72% of its CCC, and the detection limit for lead was larger than its CCC.

When the effluent is used for irrigation, there would be some evaporative concentration of metals in soil water during the irrigation season. However, there would be net dilution by the time the metals mix into deep percolation water. On an average annual basis, only 6 in/yr of effluent is applied as irrigation water, but there is approximately 15 in/yr of deep percolation. This amounts to a dilution factor of 2.5. Using copper as an example, the average concentration in deep percolation assuming no retention in the soil zone would be

[4] North Coast Regional Water Quality Control Board, Draft Order No. R1-2009-0034, Table F-7, June 10, 2010

3.1 µg/L. If some of the metals adsorbed to soil materials, the concentration in deep percolation would be lower.

Attenuation of metals concentrations during transit through the unsaturated zone to the water table and along the water table to the river would result from dilution and adsorption. Both of these factors were measured in the field study for the Santa Rosa wastewater Discharge Compliance Project. Using chloride as a conservative tracer, the investigators tabulated dilution at several monitoring wells downgradient of the Basalt Pond, which was the starting point of the subsurface flow path (Kennedy/Jenks Consultants, 2007b). The relative concentration as a function of distance is shown in **Figure 2**. After correcting for dilution, the field study found that nickel concentrations at a well 5,300 feet downgradient of the Basalt Pond were 38% as large as the initial concentration in the Basalt Pond. Copper attenuation appeared to be greater than nickel attenuation in the Santa Rosa study, although the copper concentrations were too close to the detection limit to track concentrations over long distances.

Dilution and attentuation would likely be greater for the Syar irrigation project, because discharge rates would be smaller and there would be approximately 6 months of residence time in the soil zone. This is the approximate lag time between the irrigation season and the initiation of deep percolation from winter rains. During that time, soil microbes would have an opportunity to metabolize organic carbon in the wastewater, which is the co-constituent that enhances metal mobility. The relatively low rate of deep percolation beneath the soil zone would allow greater dilution upon mixing with regional groundwater flow at the water table than occured with percolation from the Basalt Pond, which contributed a substantial percentage of flow along the downgradient flow path. However, the dilution and attenuation data from the Santa Rosa study are conservatively assumed to apply to deep percolation for the Syar irrigation project. Given an average horizontal distance of 1,500 feet between the point of irrigation and the river for the Syar irrigation project, dilution would reduce concentrations to 38% of the concentration at the point where the water first reached the water table (**Figure 2**). The attenuation due to adsorption can be estimated from the relative concentration of nickel in the Santa Rosa study, which decreased by 1.17×10^{-4} per foot of subsurface travel distance. At an average distance of 1,500 feet, this corresponds to a relative concentration of 82%. Multiplying the dilution and attenuation factors together results in an overall relative concentration of 31%. Multiplying this factor times the estimated copper concentration in deep percolation (3.1 µg/L) results in an average concentration entering the river of 0.96 µg/L.

The volume of flow containing the copper upon reaching the river equals the average deep percolation rate (15 in/yr) adjusted for dilution during subsurface transport (factor of 1.0/0.38 = 2.63). The deep percolation from 319 acres is equivalent to a constant rate of 0.55 cfs. Multiplying this rate by the subsurface transport dilution factor yields a total inflow to the river of 1.4 cfs. Although deep percolation is seasonal, fluctuations in flow and concentration are smoothed out as deep percolation moves through the unsaturated zone and along the water table. This process of attenuation is probably great enough to result in

a fairly steady year-round flow and concentration by the time the deep percolation reaches the river.

Flow in the middle reach of the Russian River is regulated by upstream reservoirs and is subject to minimum flow requirements under State Water Resources Control Board decision D-1610. As a result, minimum flow is fairly constant from year to year at 150-200 cfs, although it is sometimes as low as 120 cfs. Mixing 1.4 cfs of groundwater seepage into 120 cfs gives a minimum dilution factor of 86:1, which would decrease the copper concentration in the river downstream of the Syar vineyards to 0.011 µg/L. This is three orders of magnitude smaller than the chronic exposure limit under the California Toxics Rule. Thus, even with reduced summertime river flows that may be mandated in the future, recycled water irrigation is not expected to measurably increase copper levels in the River.

This analysis demonstrates that the risk of adverse impacts to aquatic life in the Russian River due to subsurface discharge of CTR metals from the Syar irrigation project is less than significant. In spite of applying numerous conservative assumptions, the anticipated concentration of copper would be less than the regulatory limit by a factor of 1000. Even allowing for uncertainty in some of the flow and dilution terms and for variations in concentrations and mobility among the other CTR metals, it is clear that none of them would exceed their respective limits.

I hope this analysis proves useful to you and other involved parties as the Syar irrigation project progresses through the permitting and implementation process. Please do not hesitate to contact me if you have any questions or desire any additional analysis.

Sincerely,

Gus Yates PG, CHg

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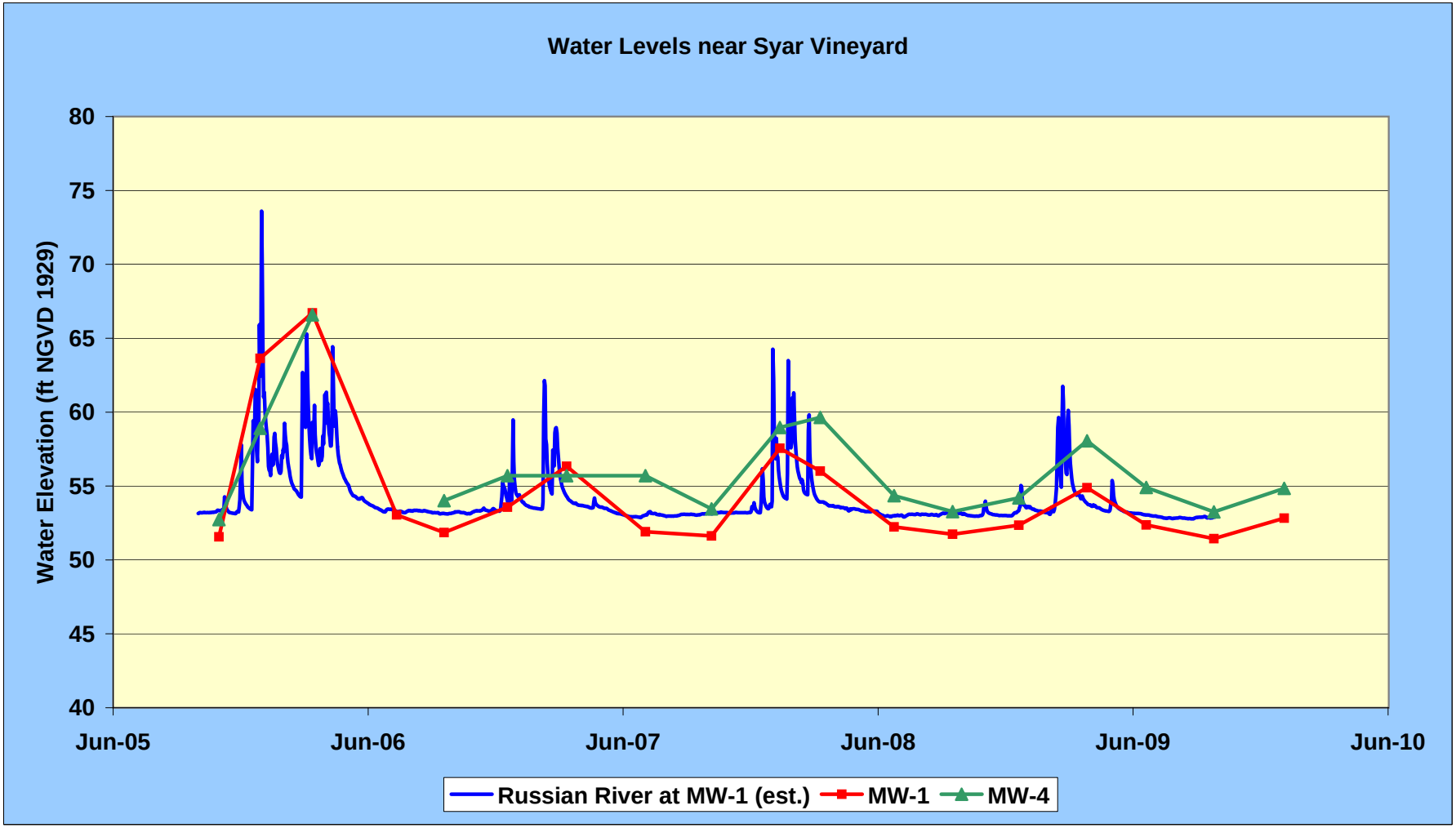
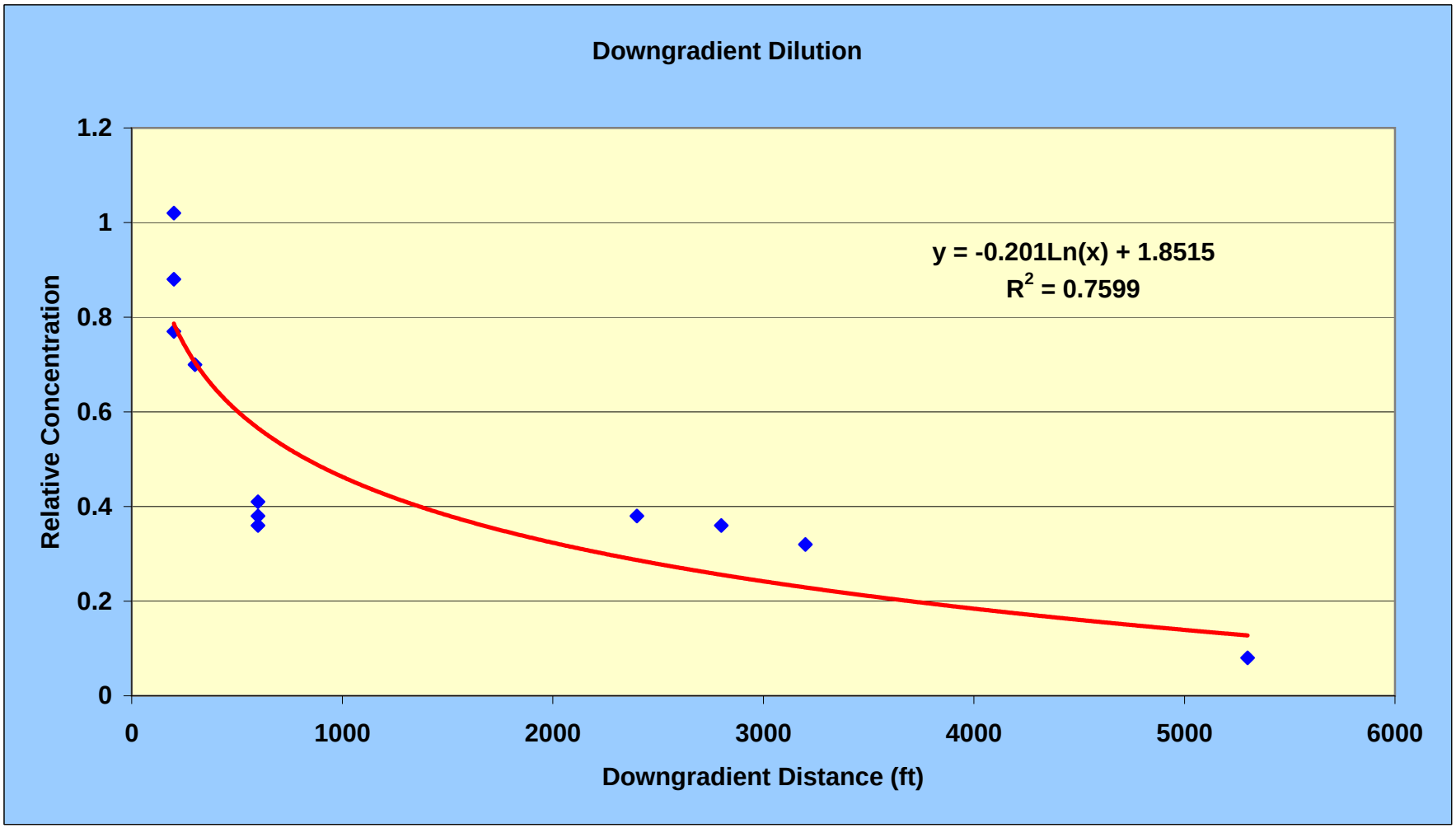


Figure 1. Elevation of Groundwater in wells MW-1 and MW-1 and the Russian River near the Syar Vineyards, 2005-2010



Data source: Kennedy/Jenks Consultants (2007b)

Figure 2. Decrease in Relative Concentration of Chloride Downgradient of the Basalt Pond due to Mixing with Ambient Groundwater

Table 1. California Toxic Rule Concentrations for Metals

Metal	Effluent 2008-2010 (ug/L) # samples	Detection Limit	Max	Avg	Constituent Maximum Concentration: Acute Conversion Factor	Coefficient m_A	Coefficient b_A	Constituent Maximum Concentration (ug/L)	Constituent Chronic Concentration: Chronic Conversion Factor	Coefficient m_C	Coefficient b_C	Constituent Chronic Concentration (ug/L)
Cadmium	3	1	<1	<1	0.944	1.128	-3.6867	6	0.909	0.7852	-2.715	3
Copper	24	1	16	7.7	0.96	0.9422	-1.7	17	0.96	0.8545	-1.702	11
Chromium	3	10	89	48	0.316	0.819	3.688	680	0.86	0.819	1.561	221
Nickel	3	10	130	47	0.998	0.846	2.255	585	0.997	0.846	0.0584	65
Lead	3	5	<5	<5	0.791	1.273	-1.46	90	0.791	1.273	-4.705	4
Zinc	3	50	<50	<50	0.978	0.8473	0.884	146	0.986	0.8473	0.884	148

Notes:

1 The equation used to determine constituent maximum concentration is CMC = (WEF) x (Acute Conversion Factor) x (exp{m_A[ln(hardness)] + b_A} as described in the Federal Register 65(97):31717 (May 18, 2000). A similar equation for consituent chronic concentration (CCC) uses the conversion factor and coefficients for chronic concentrations.

2 The water effect ratio (WEF) was assumed to equal 1.0 in these calculations. WEF can be greater than 1.0 in waters with a hardness greater than 100 mg/L as $CaCO_3$, which increases the permissable concentrations downstream of the discharge. Determination of WEF requires multiple toxicity assays using laboratory dilution water and stream dilution water (USEPA 1994, 1997). Because dilution appears to be clearly adequate in this case, WEF was conservatively assumed to equal 1.0.

3 The hardness of Russian River water averages 130 mg/L as $CaCO_3$ for flows less than 2,000 cfs. It decreases to 46-60 mg/L for flows greater than 7,000 cfs.

4 Effluent copper concentrations were reported to the nearest 0.1 ug/L, but all measured values exceeded 1 ug/L.