February 23, 2018

Robin Merod, Ph.D, P.E
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, #200
Rancho Cordova, CA 95670

Re: City of Newman, Tentative WDR and MRP Revision Requests

Dear Dr. Merod,

The City of Newman requests revisions (as presented in Attachment 1) to the City of Newman Tentative Waste Discharge Requirements, and associated Monitoring and Reporting Program. In Attachment 1, we have listed our requested revisions, starting with the WDRs first, in the order they occur in the subject documents. We have attached additional information, as noted in some requests. Please feel free to contact me (phone number) if you wish to discuss our requests or desire additional information which we may have and/or may be able to develop. Thank you for your efforts in preparing the WDRs and your consideration of the attached requests.

Sincerely,

City of Newman

Michael E. Holland
City Manager

Enclosures:

Attachment 1: Requested Revisions to the Tentative WDRs and MRP
Attachment 2: WWTF Capacity Assessment
Attachment 3: Nitrogen Uptake Efficiency of Various Crops
Attachment 4: 1998-2017 MW-4 Results

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ATTACHMENT 1:

REQUESTED REVISIONS TO THE TENTATIVE WDRS AND MRP

Requested Revisions to Tentative WDRs (TWDRs)

p.1, Finding 4. With the TWDRs recognizing Basin-1 as an anaerobic basin that has been field measured to remove roughly 70 percent of the influent BOD, now, even before the planned improvements to it are made, the ADWF treatment capacity of the WWTF as it exists today is estimated by Stantec to be at least 1.25 MGD using standard wastewater treatment process design criteria. The 270 MG of existing storage is estimated to satisfy ~ 1.6 MGD ADWF needs under 100-year conditions. The 531 acres of irrigation area are estimated to have a capacity of ~ 1.7 MGD based on the need for diluent well water to mitigate salinity impacts. The safe yield of the three City-owned diluent water wells is estimated to be sufficient to meet 1.3 to 1.5 MGD ADWF capacity diluent water needs based on City experience with these wells to date. Treatment appears to be the current limit on overall WWTF ADWF capacity. Stantec's estimate of treatment capacity is provided in Attachment 2. The City requests that the 1.14 MGD limit be changed to 1.25 MGD, here, and globally throughout the TWDRs (e.g., Order C.1).

p.5, Finding 16, d) (typo shows what is supposed to be "d" as "a"). With the TWDRs including new Effluent and Mass Loading Limitations (Order C), the City proposes to meet those effluent limitations over time as discussed later in reference to Order C.1. The City will use lower salinity groundwater for irrigation purposes at times during the growing season to comply with Groundwater Limitations (Order E). From our understanding of our meeting with Ms. Creedon in 2016, we are not required to "blend" water, but rather irrigate with effluent at times and lower salinity water at times to approximate the salinity of water applied to these lands when in agricultural production. We bought these new lands in 2011 and 2014, they have been fallow much of that time. Obviously, we cannot match the salinity of rainfall currently falling on fallow land. The City would prefer if the Finding 16.d) language were modified to read as follows:

> "Blending the relatively saline effluent with lower salinity groundwater by means of irrigating with effluent at times and irrigating with well water at other times during the irrigation season such that the overall salinity load to shallow groundwater is similar to the historical salinity load from historical agricultural irrigation practices, such that the resulting salinity (measured as EC) of the water applied to the use areas is equivalent to (or less than) the salinity of groundwater historically applied to the reclamation areas, and"

p.5, Finding 16, e) (typo shows what is supposed to be "e" as "b"). The "TBD" years are 2011 and 2014.

p.9, Finding 33. MW-1, MW-2, MW-3, and MW-4 have been monitored since 1998. This needs to be reflected, here, and globally within the TWDRs (e.g., in Finding 54). Standardized groundwater monitoring protocols were implemented in 2008.

p.11, Finding 38. We believe water quality and "origin of water" forensic data from the Casey wells down-gradient from the WWTF should be included, here, not just in the Information Sheet to provide site-specific, quantitative data on "ambient" groundwater quality in the area known to not be impacted by the WWTF. The data from the Casey wells were summarized and presented in a letter from Stantec Consulting Services Inc., dated November 17, 2017.

p.11, Finding 39. We request that the reference to MW-4 also note that farming practices (off-site of the WWTF) near MW-4 changed from flood irrigation of fodder crops to micro-sprinkler irrigation of almonds. The high irrigation efficiency of micro-sprinklers naturally increases the leaching fraction water's salinity and possibly the nitrate concentration.

p. 11, Finding 40. The City believes that the "discharge" of effluent is not likely the sole cause of arsenic and manganese concentrations observed in MW-5. Rather, it could be the existence of the effluent storage basins and Oxidation Pond up gradient of MW-5 which creates conditions facilitating the observed concentrations. This is due to low reduction/oxidation potential conditions expected to exist beneath these large water holding facilities. The water (and any liner, natural or synthetic) effectively cuts off the exchange of atmospheric oxygen and aerobic rainfall percolation in the soil below these water bodies resulting in anaerobic conditions beneath the ponds. As shallow groundwater flows beneath these ponds and through these low redox zones, arsenic and manganese (and likely other metals) are much more likely to become dissolved in that water. Additionally, MW-5 is believed to be installed in a former floodplain and marsh (similar to the swamp lands north of the WWTF) where reducing conditions are expected to occur naturally below the root zone of wetland plants. Either way, it is expected (and we believe demonstrated by the Casey well data) that the impact observed in MW-5 is transient in nature as the redox conditions change after the underlying groundwater flows past the WWTF ponds to where atmospheric oxygen and aerobic percolate can once again create more aerobic soil conditions. The City does not object to further evaluation as suggested in this Finding and in Provision H.1.d (page 31 of the TWDR). Further comment is made, herein, relative to Provision H.1.d.

p.11, Finding 41. The statement "MW-7 will be utilized as a compliance well" is premature considering the groundwater compliance studies being required of the City under Order H, Provisions. When a natural salinity gradient exists in the area based on all available data known to the City (e.g., DWR data and City well data vs. Casey well data), any "up-gradient monitoring well" will suggest that all activities down-gradient of said well are degrading groundwater quality. If a natural/ambient salinity gradient does exist in the area, then the compliance well(s) is(are) not up-gradient of the WWTF, but rather side-gradient to even down-gradient of the WWTF. Furthermore, MW-7 is the well closest to a surface water conveyance source that has lower salinity than effluent, and does not experience evapotranspirative concentration of salinity. Any application of effluent at agronomic rates in the vicinity of MW-7 should cause its salinity to increase. Thus, this well should not be used for compliance, if intra-well statistics are to be utilized.

p.13, Finding 52. The City would like to understand more clearly the implications of the phrase "…required to participate in a basin-wide Prioritization and Optimization Study…".

p.13, Finding 54. As noted earlier, some WWTF historical groundwater monitoring data goes back to 1998. Standardized groundwater monitoring protocols were implemented in 2008.

p.15, Finding 55.a. ii. The annual average EC limit, here, is 4,400 µS/cm. It is 4,200 µmho/cm on p. 22 under Order C.1. These two values and their units should be same, we think.

p.15, Finding 55.a. vi. Finding 52 states "Discharger will likely be required to participate". Finding 55.a. vi states " 'best efforts' must include participation". Based on the groundwater studies required of the City (Order H, Provisions) and the results from the Casey wells, the City believes it is premature to require participation ahead of required study results, unless we misunderstand what is being required of the City, and why. It is also important to note that the natural salinity in the Casey wells down-gradient of the WWTF is higher than that at the WWTF, and is free from any known influence by WWTF activities based on water quality forensic analyses.

p.15, Finding 55.b. As noted previously for Finding 39, farming practices near MW-4 have changed. This needs to be noted with any discussion of recent groundwater quality changes in MW-4, in our opinion; otherwise, the language, as written, implies a connection to City activities that have not changed materially over the time span stated.

p.16, Finding 55.c. We agree that the WWTF ponds with their de facto sludge liners (or alternatively with synthetic liners) block the transfer of atmospheric oxygen and aerobic water into shallow groundwater, and therefore may be causing or contributing to reducing conditions different from natural conditions (i.e., the swamp lands to the north). This is to be determined by the Order H, Provisions studies (as we understand them). Our effluent does not have “high strength BOD”, and Basin 1 is more than a mile away from MW-5. Consequently, we believe the statement “such as the high strength BOD in the effluent and operation of Basin-1 as an anaerobic basin” should be revised to “such as by the large area of the Oxidation Pond immediately up-gradient of MW-5”. Further evidence that effluent is not likely causing other wells to contain high arsenic concentrations is provided by MW-3. MW-3 is essentially 100% percolated effluent that has reducing conditions but does not have problematic arsenic concentrations. Similarly, MW-2 (also found to have a high percentage of effluent) does not have high arsenic concentrations. The difference between these wells and MW-5 is that MW-5 is believed to be in former marsh and flood plain soil, and has the permanently inundated Oxidation Pond immediately up-gradient of it.

p.22, Order B.1. As discussed in Attachment 2, the ADWF capacity of the WWTF as it exists today is believed to be at least 1.25 MGD, with treatment (not land, storage, or diluent water) being the limiting factor. The total annual flow limit for the existing WWTF is forecast to be around 490 MG under 1.25 MGD ADWF and 100-year rainfall conditions. The ADWF period should be July through September. October is the beginning of our wet season, and therefore, the start of our water balance year. The City suggests a note be added to indicate the Total Annual Flow represents the maximum forecast influent flow under 100-year precipitation conditions. If precipitation is greater than that predicted by a 100-year statistical return period, then this limitation would not apply.

P.22, Order C.1. The annual average EC limit, here, and in Finding 55.a.ii should be the same, as noted earlier. Additionally, an effluent BOD limit is new for the City, and therefore the City is concerned about how to monitor for this specific parameter from a compliance perspective. When sampling from a storage pond, interferences may come from seasonal algae growth, seasonal wind-induced mixing (particularly in typical early winter months when storage ponds may have shallow water depths over algae decay products), edge effects (if not sampled from the pipe delivering effluent to a reclamation field), etc. The City believes its treatment process is in compliance with the intent of Title 22 §60304 (d) (4), §60301.900, and §60301.650, but worries about BOD compliance monitoring because of possible interferences and high BOD values the City has recorded in the storage ponds in the past, particularly in winter.

Based on Title 22 language, the City requests that BOD compliance monitoring be conducted using the CBOD test which focusses on the organic matter (§60301.650) and eliminates inorganic nitrogenous oxygen demand interference. Because BOD/CBOD is a new requirement for the City, the City requests a time schedule to conduct compliance CBOD monitoring, and to make further improvements to the WWTF treatment processes if found to be necessary. The potential problem based on BOD data collected by the City to date (for informational purposes) centers on the early to mid-winter period. We are suspicious that this may be caused by wind-induced roiling of algae settled matter in shallow storage ponds. If this is the case, then more appropriate CBOD effluent monitoring would be from the Oxidation Pond, which is the last treatment pond, and the first effluent storage pond (i.e., it’s a multi-purpose pond). We need at least one year of specialized CBOD monitoring of the Oxidation Pond, Storage Basin #1, and Storage Basin #2 to determine the appropriate monitoring location. If this new information suggests that the current WWTF is, in fact, not producing an effluent with oxidized wastewater organic matter (in other words, equivalent secondary effluent for pond treatment systems as recognized by EPA) for reasons not clear from conventional wastewater engineering analysis of pond systems, then the City believes it will need at least 2 years to design, finance, and build improvements.

In summary, the City is requesting that BOD monitoring use the CBOD test to remove interference from inorganics, and the CBOD limits come into force 3 years after adoption of the Order. Three years is the absolute minimum time the City needs to study the erratic nature of winter BOD/CBOD values, and make further improvements to the WWTF if found to be necessary.

p.23, Order C.2. We accept the 100 lb/ac/day BOD/CBOD mass loading value as an effective means to prevent surface "leathering" of the soil, which is undesirable for the soil and crop. However, leathering takes time to form. Basically, an organic layer of non-readily biodegradable organics must accumulate. We plan to alternate between effluent irrigation cycles and well water irrigation cycles. Considering our irrigation method and the time it takes for leathering to occur, we request that the 100 lb/ac/day limit be applied as an annual average, not as an irrigation cycle average. We have used the same effluent irrigation practices for decades with only minor amounts of diluent water being used to prevent salinity toxicity to our crops. In that time, we have never experienced leathering or the associated BOD overload problems of field odors or vector (fly) problems. Regarding Footnote 1 to the mass loading table, crops are not 100 percent efficient at taking up applied nitrogen. State Water Board estimates of the nitrogen uptake efficiency of several crops are provided in Attachment 3. In light of this inherent inefficiency of crops, we request that Footnote 1 be revised to read, "…determined using published nitrogen uptake rates and uptake efficiencies for the grown vegetation/crops". Additionally, we think a "Footnote 2" should be added making it clear that the daily BOD/CBOD mass loading rate is to be calculated using the most recent BOD/CBOD monitoring result (as already stated in the MRP).

p.24, Order 14. Photosynthesis by crops as well as algae in the San Joaquin valley can be near optimal. Photosynthesis by algae can cause afternoon pond pH values as high as 10, or more. These elevated pH values are transient, natural, and not of wastewater origins, and cause no known environmental, health, aesthetic, or agricultural problems. We request Order 14 language to be modified (all or in part) as suggested below.

> "Bulk wastewater contained in any unlined pond shall not have a pH less than 6.0 or greater than 10.0 on an average daily basis".

This language prevents "cherry picking" pH sampling along pond levees in the peak of the afternoon when localized, transient pH values may reach 11…here the water may be bubbling from super saturation of oxygen caused by photosynthesis. Permit language regarding pond pH must recognize "bulk wastewater", and should recognize a daily averaging period because elevated pH conditions are transient with sunlight. With "bulk wastewater" and "average daily basis" language, the City believes it can comply with a 9.5 limit, but prefers a 10.0 limit because there is no actual problem, and a 9.5 limit will trigger additional pond pH monitoring on days when values greater than 9.5 are measured, again, for no known beneficial purpose. High pH values are as natural as photosynthesis, itself.

p.24, Order D.16.a. The City does not object to the timing of this requirement, but would like to point out that a very similar study was completed in February 2016 and submitted to the Regional Water Board. Is this necessary given the information presented in the submitted *Commercial Salinity Reduction Study* report?

p.25, Order D.16.d. After consultation with the City Attorney, the City believes it can pass an ordinance banning the installation of self-regenerating water softeners in new construction by December 2019. We believe we can use BMPs to eliminate or significantly reduce the impact of self-regenerating water softeners and avoid banning in-kind replacement of existing self-regenerating units. However, we agree that if this is not evidenced by performance indicators, the ban may be put in place by December 2024.It is the City's desire to keep options open that could take advantage of new technologies, or technologies that could emerge prior to December 2024.

p.27, Order F.6.a. Based on the inefficiency of crops to take up applied nitrogen (see Attachment 3), the phrase "cropping activities shall be sufficient to take up the nitrogen applied" should be revised to read "cropping activities shall maximize the uptake of applied nitrogen".

p.27, Order F.6.b. The Regional Water Board recognizes the need to leach salts from the root zone; therefore, Order F.6.b.iv makes no sense to us as written. We suggest replacing the existing iv language with "Minimize the concentration of waste constituents percolating below the root zone". If controlling salinity is the goal, we want to apply water at a rate that maximizes percolation below the root zone within the limits of the underlying soil, which is known to be poorly drained.

p.27, Order F.8. Flood irrigation cycles of our alfalfa fields occur 24 hours per day for around 4 days. We monitor the progress of the irrigation water across the field during daylight hours. The perimeters of the field(s) in use are not continuously monitored 24 hours per day. Someone is on-call 24 hours a day to respond to alarms. If that is what "on duty" means, then the language is acceptable. If "on duty" means someone is monitoring on-site conditions all night around the perimeters of fields being irrigated, then "on duty" is unnecessary and unacceptable.

p.28, Order F.15. We flood irrigate. We do not spray irrigate, and the Order may be revised to reflect this. Some of our property boundaries abut public road rights-of-way that may include manmade drainage ditches. We request that the minimum setback to rights-of-ways and manmade drainage courses be 25 feet for our contained/bermed flood irrigation practices.

p.30, Order H.1.a. Choosing appropriate statistical methods is often dependent on the nature/distribution of the data being analyzed. From the requirements of the TWDRs, we believe we are going to need several new monitoring devices (ideally wells, but possibly some driven points if the State will not allow wells in the swampy area to the north, which is the only natural/background environment in the area relatively free from the ever-changing influences of human activity). If we can get all new monitoring facilities in by the end of 2018 (which is probably optimistic, even if we start now, considering the easements that may need to be negotiated and the State's previous position on sampling groundwater in the swamp), then we should have 2 years of quarterly data before deciding on a statistical method appropriate to the data we are attempting to evaluate.

MW-4 is an example of the dilemma we face. Shallow groundwater results from the much referenced MW-4 for the period 1998 through 2017 are presented in Attachment 4. Our farming operation in the area has been relatively stable throughout this period. If that is the case, then how do we explain/model the results/statistics of MW-4 data relative to a stable agricultural operation? Are we to believe nitrate ions are "building up" in shallow groundwater, somehow "staying behind" while the water it's dissolved in separately moves away to terminal drainage? We need some rational understanding of the data in order to propose a statistical method. We will not have that understanding until we have more data, and enough data to understand its trends/characteristics. Ideally, the Compliance Assessment Plan would be addressed as part of the Monitoring Well Installation Workplan…that's where we explain what we are doing and why, including what we are looking for in terms of side-gradient wells and impact zone wells. As noted above, the final method for analyzing the data will be dependent on the data to be analyzed, or at least a reasonable subset of the data to be collected over the expected life of the new WDRs. In closing, we request that the Compliance Assessment Plan be part of the Monitoring Well Installation Workplan.

p.30, Order H.1.b. To avoid changing the Monitoring Well Installation Workplan, we first need to determine what we think is appropriate in light of the TWDRs, and then obtain the necessary easements to install wells off City property, and subsequently have access to monitor those wells quarterly. Even if we start our thinking and easement negotiations, now, we will not have the necessary easements by June 2018 unless all parties are agreeable, which is unlikely. We think 1 February 2019 gives us time to negotiate easements and consider alternatives if easements cannot be obtained. The basis for where we believe we can sample groundwater will be a portion of the basis for how we believe we will use the resulting data. Therefore, by 1 February 2019 we should be able to 1) provide a Monitoring Well Installation Workplan, and 2) propose a preliminary Compliance Assessment Plan…subject to change if actual well results appear irrational.

p.30, Order H.1.c. We agree with the TWDRs that the Monitoring Well Installation Report can follow the Installation Workplan by seven months, particularly if the Monitoring Well Installation Workplan is due 1 February 2019 such that the later part of the seven-month period occurs in the dry season when weather should not hinder well installation. Thus, we request that the Monitoring Well Installation Report be due 1 September 2019.

p.31, Order H.1.d. The Arsenic and Manganese Groundwater Impact Evaluation Report is a subset (i.e., specific ions) of the overall results coming out of the Groundwater Limitations Compliance Assessment Plan and the subsequent installation and monitoring of new monitoring facilities. Therefore, the schedule for completing the Evaluation Report should be part of the Compliance Assessment Plan, and be based on the results coming out of the new side-gradient and impact zone monitoring facilities we believe we need to address Regional Water Board concerns. In summary, regarding Order H.1.a, b, c, and d, we request these four points be consolidated into two: 1) a Groundwater Monitoring Well Installation Workplan (due 1 February 2019) which includes a) a proposed Compliance Assessment Plan and implementation schedule, and b) a proposed Arsenic and Manganese Groundwater Impact Evaluation Plan and implementation schedule; and 2) a Monitoring Well Installation Report (due 1 September 2019).

Requested Revisions to Tentative MRPs (TMRPs)

p.2, Influent Flow Monitoring. The BOD, TSS, TDS, and EC influent samples should all be 24-hour composites. Grab samples are not representative of influent constituent concentrations because of diurnal fluctuations in our wastewater characteristics. We believe “Suspended Solid” is supposed to be “Total Suspended Solids”. We believe the next constituent entitled “Total Suspended Solids” is supposed to be “Total Dissolved Solids” to complement the influent EC data being required.

p.4, Water Supply Monitoring. Sampling the municipal water supply monthly is excessive. We believe quarterly monitoring aligned with our quarterly groundwater monitoring program should be appropriate. We recognize that the Regional Water Board’s typical annual water supply monitoring requirement is not appropriate because the City’s potable water supply quality is a major factor in the concerns of both the City and Regional Water Board.

p.3, Effluent Monitoring. Footnote 3 should specify use of either a 0.45 μ filter or 0.10 μ filter per EPA guidance on the matter as we understand it. A 0.45 μ filter passes particles that are not dissolved. EPA avoided requiring the more accurate 0.10 μ filter because of the added cost of this test. The City should be provided the option of using either filter based on a cost effectiveness evaluation of the two filters relative to the City’s specific situation. This same comment applies to Footnote 2 on MRP page 6 under Groundwater Monitoring; and any other globally found references to “0.45 μ filter”.

p.4, Daily Pre-Application Inspections. Daily monitoring of each field being irrigated starting immediately before an irrigation cycle begins includes 11 items (a through k). Eleven items seem excessive. In general, these are flood irrigation fields we have farmed for many years. Erosion, berm condition, and the condition of infrastructure do not change from day-to-day. We don't check soil saturation daily, we gauge our irrigation cycle length based on when the irrigation water approaches the tail end of our fields. That is how we avoid significant ponding. If we were to measure soil saturation, then where and how is it to be done, and at what depth in the soil? The head end of a flood irrigated field will have saturated top soil conditions before the water reaches the tail end of the field. That's just how flood irrigation works. We do drive the perimeter of each field being irrigated daily. We could fill out a check list covering the items requested (except soil saturation unless we receive guidance on what to do). The check list would have a comment space to record anything out of the ordinary or any corrective action(s) taken. We request clarification of whether a daily check list with room for comments is what is requested. Because we would complete and file/scan the check lists daily, we could submit them electronically with the monthly reports, but we question their value to Regional Water Board staff. Monthly reporting only when anomalies are observed or when corrective actions are taken makes more sense to us. We can include the scanned daily log sheets electronically monthly, quarterly, annually, or as requested.

p.6, Land Application Monitoring. It is premature to specify MW-2, MW-3, MW-5, and MW-7 as compliance wells when the whole point of Order H is to determine how to monitor compliance with Groundwater Limitations (Order E). This section of the TMRP should read "compliance wells will be determined based on the results of the Groundwater Monitoring Installation Workplan, Groundwater Monitoring Well Installation Report, and subsequent data provided by all groundwater monitoring facilities."

p.9, Quarterly Monitoring Reports 6.b. We agree that daily BOD (preferably CBOD) loads to each LAA must be calculated and reported to comply with the 300 lb/ac/day daily maximum BOD/CBOD mass loading limit which is intended to prevent odors and preserve soil conditions. However, per our comments on the TWDRs, we believe the 100 lb/ac/day limit should be an annual average mass loading limit, not an irrigation cycle limit. If the Regional Water Board agrees with our logic on that request, then the irrigation cycle limit equation needs to change to an annual average equation. We are not opposed to calculating and reporting the cumulative average BOD/CBOD mass loading rate quarterly through the calendar year so that all parties are aware of what irrigation practices are needed to comply with the annual loading limit. The Annual Monitoring Report would include the final, end of calendar year result for comparison to the 100 lb/ac/day annual average limit.

ATTACHMENT 2:
WWTF CAPACITY ASSESSMENT

WWTF Capacity Assessment

BACKGROUND

The City of Newman (City) currently owns a total of 825 acres of land at its Wastewater Treatment Facility (WWTF), of which 531 acres are available for effluent reclamation via flood/surface irrigation. The efficiency of flood irrigation on these fields is estimated to be around 0.57 to 0.58. A typical flood irrigation event for a single alfalfa field involves several days of continuous irrigation. Because alfalfa is a rotational crop, current City practice is that roughly 75% of the 531 acres of reclamation land is in alfalfa production, and 25% is dual-cropped with corn and oats at any given time as an overall average.

Currently available storage (upper 4.5 feet of Oxidation Pond, Storage Basin #1, and Storage Basin #2) is 270 Mgal.

Diluent water is provided by three wells ("J Pipe", "50 HP", and "McPike") with an estimated total annual safe yield of 600 to 700 Mgal/yr with a flow-weighted average salinity of 1529 µS/cm (i.e., around 1500 µS/cm)

Typical rainfall (the basis for salinity impact and mitigation analyses) is 11.05 inches (i.e., 11"). 100-year rainfall (the basis for hydraulic capacity assessments) is estimated to be 20.0 inches.

Effluent reclamation involves flood irrigation of fodder crops with milk producing animals not using the fields as pasture. For this use of effluent, Title 22 (California Code of Regulations) § 60304 (d) (4) requires at least undisinfected secondary recycled water. Title 22 requires the effluent to have its organic matter oxidized, without providing further numerical definition of what oxidized organic matter means. EPA recognizes pond treatment (such as provided by the WWTF) as equivalent secondary effluent. The WWTF consists of three treatment processes:

1. Basin-1 is an anaerobic lagoon that is modeled to perform as indicated by past performance data, as made available by the City.
2. Basin-2 is a partially mixed aerobic pond whose BOD reduction performance is estimated via a conventional first-order kinetic model for partially mixed aerobic ponds.
3. The Oxidation Pond is a non-aerated facultative pond whose ability to produce equivalent secondary effluent is based on keeping the BOD load to the pond no more than 30 lb/ac/day as a quarterly average with recirculation facilities to assist with distribution of the BOD load over the pond's surface area, if/when necessary.

The objective of the following ADWF capacity assessment is to determine which aspect(s) of the current WWTF is (are) most limiting:

1. Treatment: the ability to produce undisinfected equivalent secondary recycled water.
2. Storage: the effluent storage volume needed to contain rainy season effluent and storm runoff from the reclamation fields through 100-year rainfall conditions.
3. Reclamation land: the irrigated acreage needed to reclaim effluent, I/I, rainfall (including captured storm runoff), and diluent water required to mitigate salinity impacts.
4. Diluent water: the volume of well water (of a known salinity) needed to prevent the overall annual average salinity of the leaching fraction water from exceeding 5180 µS/cm (the estimated SSGG for area shallow groundwater).

Stantec prepared a preliminary assessment of the equivalent ADWF capacity of each of the foregoing components of the WWTF and concluded that treatment capacity appears to be the most limiting component at this time, with an ADWF capacity of at least 1.25 Mgal/d using what are believed to be conservative assumptions and conventional wastewater treatment design criteria, see Memo 2.1. Using 1.25 Mgal/d as the limiting component, Stantec then prepared water and salt mitigation analyses (i.e., water and salt "balances") to estimate storage, land, and diluent water needs under 1.25 Mgal/d ADWF conditions. Table 2.1 estimates 100-year effluent storage needs to be 204 Mgal, which is less than the 270 Mgal storage volume currently existing. Table 2.1 also uses 374 acres of reclamation land, a value derived from Stantec's salinity mitigation analysis (which includes the large amount of dilute water needed in typical rainfall years, which is less than needed in wet years because of the superior salinity mitigation potential of rainfall compared to local well water). This acreage is less than the 531 acres of effluent irrigation land currently owned by the City. The design reclamation land need is believed to occur under typical rainfall conditions where 1500 µS/cm diluent water replaces some of the very low salinity rain water of 100-year seasons such that the additional diluent water volume needed to mitigate salinity impacts is greater than the incremental increase in rainfall volume occurring under 100-year conditions. Table 2.2 estimates reclamation land needs and diluent water needs that mitigate salinity impacts under typical 1.25 Mgal/d conditions. The estimated reclamation land need is 374 acres (as noted above), and the estimated diluent water need is 555 Mgal (less than the estimated 600-700 Mgal/yr safe yield of the City's three WWTF irrigation wells). Based on available data provided by the City, Stantec's preliminary assessment of the ADWF capacity of the key components of the existing WWTF are:

- Treatment: 1.25 Mgal/d
- Storage: ~1.6 Mgal/d
- Irrigation area: ~1.7 Mgal/d
- Diluent water: ~1.3 to 1.5 Mgal/d

As noted, treatment capacity appears to be the overall limit on WWTF capacity, followed by diluent water availability, storage, and irrigation area based on available data.

Stantec

Memo 2.1

To:	Rich Stowell Rocklin, CA	From:	Akram Botrous Rocklin, CA
File:	184030115	Date:	February 21, 2018

REFERENCE: NEWMAN ADWF TREATMENT CAPACITY EVALUATION

The purpose of this memorandum is to present my professional opinion regarding the treatment capacity of the Newman wastewater treatment plant. This capacity will be expressed in terms of average dry weather flow (ADWF).

BACKGROUND

The treatment system consists of three ponds in series: AB#1, AB#2, and the Oxidation Pond. Treated effluent is stored in the Oxidation Pond and two dedicated storage ponds during low irrigation water demand months for subsequent use in high irrigation water demand months (See Figure 1). In December 2016/January 2017, the City conducted special testing to evaluate the effectiveness of BOD removal in the first pond (AB#1). This special testing revealed that AB#1 removes approximately 68% of the BOD (see Table 1). Since the air supplied to AB#1 is not proportional to the amount of BOD removed, we suspect that the BOD is removed anaerobically, which is evidenced by the negative ORP values and the increase in alkalinity presented in Table 1.

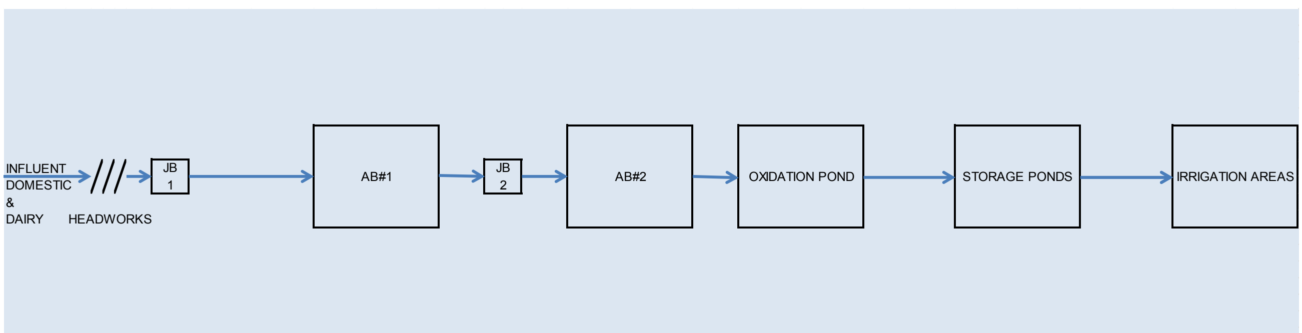

Figure 1. Schematic Diagram of Newman WWTP

Table 1. Results of Special Testing of AB#1

Plant Influent & Aeration Basin #1 (AB1) Test/Monitoring Results																			
	pH	EC (µS/cm)		TDS (ppm)		ORP (mV)		BOD (mg/L)		COD (mg/L)		Total Alkalinity as CaCO3 (mg/L)		FDS (mg/L)		Sulfate (mg/L)		Sulfide (mg/L)	Acetic Acid (mg/L)
Date	AB1	Influent	AB1	Influent	AB1	Mid Depth	AB1	Influent	AB1	Influent	AB1	Influent	AB1	Influent	AB1	Influent	AB1	AB1	AB1
12/7/2016	7.0	2896	3109	2172	2331	-256	-254	1330	482	1710	553	487	684	1220	1130	N/A	15.6	8.50	220
12/14/2016	7.0	2585	2886	1939	2177	-288	-132	1490	359	1710	559	516	714	1110	1160	N/A	33.1	8.70	170
12/21/2016	7.0	2630	2967	1980	2208	-289	-254	1240	478	2120	594	523	760	1330	1160	N/A	20.6	7.70	210
1/4/2017	6.9	2962	3085	2217	2313	-309	-286	1530	511	2580	831	397	760	1400	1190	N/A	26.8	9.40	170
1/11/2017	6.9	2779	2879	2090	2168	-280	-250	1830	461	2680	804	484	670	1260	1970	99.1	14.1	7.60	7.9
1/18/2017	6.8	2544	2913	1904	2178	-317	-296	1530	439	2230	715	413	720	1180	1260	95.0	1.84	10.0	190
1/25/2017	6.8	2747	2665	2086	1996	-326	-303	1310	494	2200	856	445	648	1120	1200	19.2	115	8.80	180

METHODOLOGY AND LEVEL OF CONSERVATISM

A spreadsheet model was developed to model the treatment system. Input model parameters and assumptions are discussed briefly below:

Influent BOD Concentration:

The City's average BOD concentration[1] appears to range from 600 mg/L to about 1,250 mg/L as shown in Figure 2 below. Historically, the industrial discharger (Saputo) has exceeded its permitted BOD load limit of 4,010 lb/d at times as shown in Figure 3. Assuming that Saputo limits its BOD load in the future to its permitted level, the concentration will be reduced from the current maximum of 1,250 down to about 1,140 mg/L. A peak influent BOD concentration of 1,140 mg/L is used in this treatment capacity evaluation.

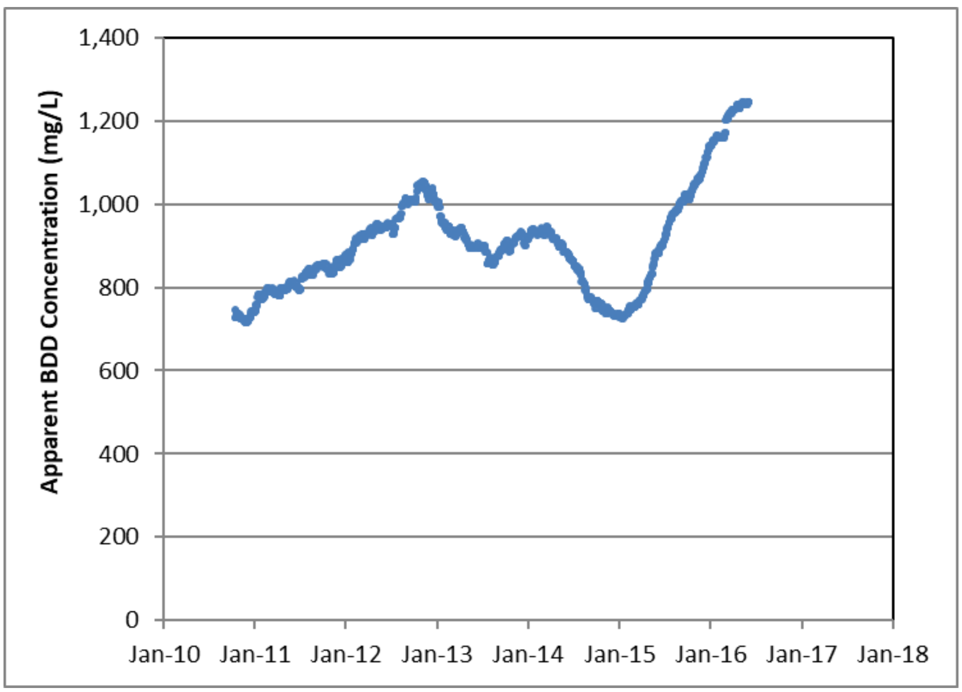

Figure 2. Apparent BOD Concentration

[1] Calculated from annual average flow and BOD load.

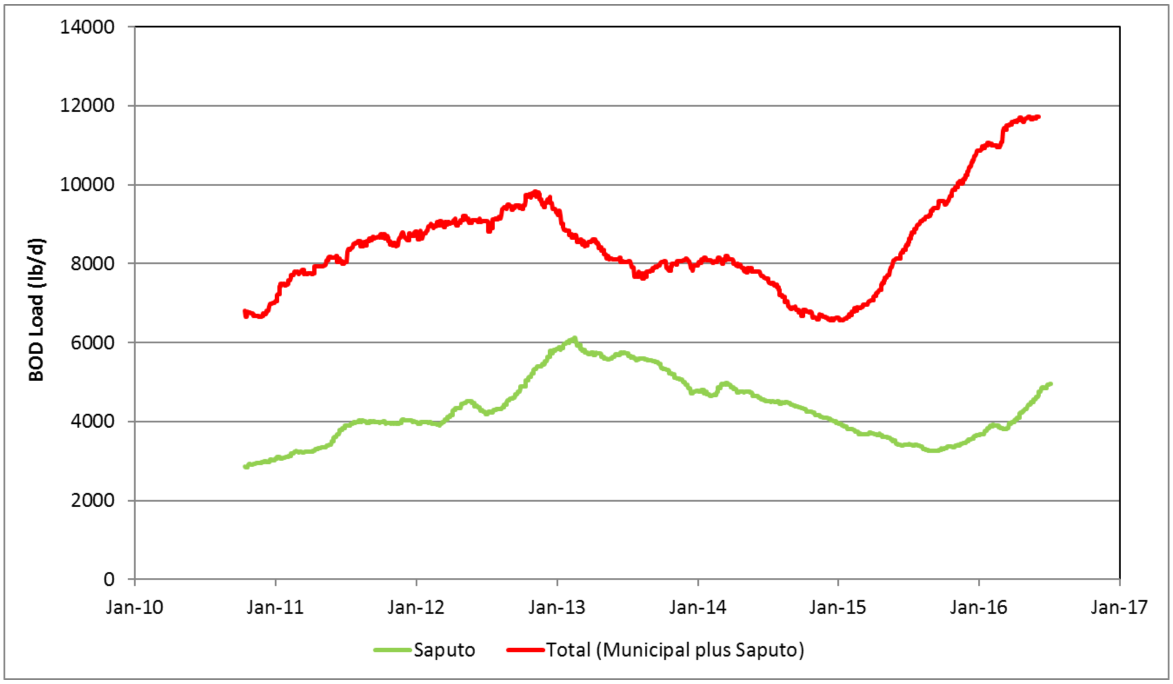

Figure 3. Contribution of Saputo to the BOD Load to the WWTP

Modeling AB#1:

AB#1 is modeled as a "black box" that removes BOD based on field studies under cool (low microbial activity) conditions. Even though the BOD removal in AB#1 was based on a brief study, the BOD removal efficiency in AB#1 of 68% (Table 1) is assumed to be conservative since this study was performed in the winter when the microbial treatment kinetics were low.

Modeling AB#2:

Aerated ponds can be either partially mixed or completely mixed. This depends on the aeration and associated mixing horsepower delivered per unit of pond volume. Theoretically, we call the pond partially mixed when the aeration/mixing power of the pond is about 6 hp/Mgal and completely mixed when the ratio is more than 30 hp/Mgal. The kinetic parameter for partially mixed ponds is low (0.28 d^{-1} at 20 ºC) and high for completely mixed ponds (2.5 d^{-1} at 20 ºC). No vetted information is currently available on how to model a pond that has a mixing power between 6 and 30 hp/Mgal. Linear interpolation is a reasonable means of preliminary assessment of treatment kinetics when the ratio falls between 6 and 30 hp/Mgal, but this involves risk and may not be sufficiently conservative.

Currently, there is 220 horsepower of aeration installed and operational in the 9 Mgal AB#2. Therefore, the mixing power is about 24 hp/Mgal. Though AB#2 appears to be very close to being completely mixed, the mixing power fell short of the 30 hp/Mgal to qualify as the completely mixed pond. To be conservative, AB#2 was modeled as a partially mixed pond with a first order kinetic parameter of 0.28 d^{-1} at 20 °C. It is assumed that the whole AB#2 volume of 9 Mgal is available for treatment (no sludge accumulation)

Oxidation Pond:

The 50 acre Oxidation Pond is not aerated but rather is a facultative pond. Facultative ponds designed to produce equivalent secondary effluent have a BOD surface area loading rate limit of 30 to 50 lb/ac/day, with the lower value being more appropriate when blue green algae are expected to be present and contribute an additional BOD load to the pond from time to time (usually late summer to early autumn). To be conservative, this evaluation is based on keeping the BOD loading rate on the Oxidation Pond at no more than 30 lb/ac/day under peak loading conditions.

RESULTS

Treatment process model input data and calculated results for the 1.25 ADWF condition are presented below.

INPUT DATA	Value	Notes
K20, D^{-1}	0.28	(NOTE: 10 STATES STDS USES 0.28)
LB O2 / LB BOD5 REMVD	2.5	(TYPICAL: 1.5 - 2.0 W/O SAFETY/PEAK FACTOR)
LB O2 / HP HR	1.25	(TYPICAL: 1.4-1.7 HI SPD, 0.8-0.9 DIRECTIONAL)
FLOW, MGD	1.25	
INFL BOD5, MG/L	1140	
TEMP, C	13	
PERCENT OF BOD REMOVED IN AB#1, %	68	
VOLUME OF AB#2 (PARTIALLY AERATED), MGAL	9	
SURFACE AREA OF OXIDATION POND, AC	50	
CALCULATIONS		
AB#1		
INFLUENT BOD LOAD, LB/D	11900	
BOD CONCENTRATION EXITING AB#1, MG/L	364.8	
BOD LOAD EXITING AB#1, LB/D	3808	
AB#2		
FLOW TO AB#2, MGAL/D	1.25	
HRT IN AB#2, DAYS	7.2	
BOD CONCENTRATION ENTERING AB#2, MG/L	364.8	
K @ TEMP., D^{-1}	0.22	
EFFLUENT BOD CONCENTRATION FROM AB#2, MG/L	141	
BOD REDUCTION IN AB#2, LB/D	2330	
OXYGEN REQUIREMENT, LB/D	5830	
AERATOR HORSEPOWER, HP	190	(NEEDED HP)
OXIDATION POND		
ORGANIC LOAD TO OXIDATION POND, LB/AC/DAY	29.3985	(MAX 30 LB/AC/DAY)

EVALUATION

Using what we believe to be conservative wastewater treatment process design criteria, the equivalent secondary effluent wastewater treatment capacity of the existing WWTF appears to be at least 1.25 Mgal/d on an ADWF basis. We do not believe a treatment capacity rating greater than this preliminary estimate is appropriate at this time because of City reports of high BOD concentrations of effluent in Storage Basin #1 at times, particularly in winter. While there may be many reasons why high BOD concentrations are measured at times, we believe the 1.25 Mgal/d estimate developed and reported, herein, is appropriate until the cause of the high Storage Basin #1 BOD concentrations is at least investigated, if not resolved.

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Table 2.1 Estimate of 100-Year Influent Flow Volume and Effluent Storage Need for 1.25 Mgal/d ADWF Conditions

City of Newman WWTRF — **WATER BALANCE - 1-100 YEAR RETURN PERIOD FOR PRECIPITATION** — 22-Feb-18 3:40 PM

FLOWS AND INFILTRATION/INFLOWS (I/I)		OXIDATION POND		STORAGE BASINS (Some storage in Oxidation Pond)		IRRIGATION AREA CHARACTERISTICS	
3-MONTH AVG. DRY WEATHER INFLUENT FLOW (ADWF), MGD	1.25	GROSS STORAGE AREA (AC)	53.0	GROSS STORAGE AREA (AC)	77.0	ACTUAL AREA BEING IRRIGATED (AC) [1]	374
ANNUAL I/I (%)	7	WATER SURFACE (AC)	50.0	WATER SURFACE (AC)	68.0	LEACHING FRACTION	0.4
CLIMATOLOGICAL FACTORS		BOTTOM SURFACE (AC)	49.0	BOTTOM SURFACE (AC)	58.0	OVERALL IRR. EFFICIENCY	0.57
PRECIP/AVG PRECIP RATIO	1.81	WATER DEPTH (FT)	2.5	WATER DEPTH OF STORAGE COMPONENT (FT)	12.0	ALFALFA AREA (% OF LAND IRRIGATED)	75%
OCT-APR EVAP/AVG EVAP RATIO	0.82	STORAGE AVAILABLE (MG)	40	STORAGE AVAILABLE (MG)	230.0	ROTATION CROPS AREA (% OF LAND IRRIGATED)	25%
MAY-SEP EVAP/AVG EVAP RATIO	1.00	INFILTRATION RATE (IN/DAY)	0.069	INFILTRATION RATE (IN/DAY)	0.115	PRECIP IRR. EFFICIENCY	0.85
PAN COEFFICIENT	0.80						
LAND PRECIP COLLECTED (FRAC)	0.9						

PARAMETERS	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
DAYS IN MONTH	31	30	31	31	28	31	30	31	30	31	31	30	365
AVG PAN EVAP (IN)	4.40	2.10	1.00	1.30	2.30	4.20	5.90	8.30	9.60	10.00	8.50	6.30	63.90
AVG PRECIP (IN)	0.46	1.29	1.73	2.42	2.04	1.62	0.86	0.35	0.04	0.01	0.02	0.21	11.05
Eto [2]	4.02	2.05	1.39	1.30	2.20	4.07	5.40	7.78	8.36	8.14	7.16	5.70	57.57
Kc (Rotation Crops)	0.00	0.33	1.10	1.10	1.10	1.10	0.39	0.56	1.00	1.00	0.50	0.00	
BARE SOIL ET (IN)	0.70	0.70						0.35			0.35	0.70	
Kc1 (Alfalfa)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
PERCENT OF ANNUAL I/I OCCURRING IN MONTH	0.0	0.0	5	15	25	25	20	10	0.0	0.0	0.0	0.0	100.0
INFLUENT- EXCLUDING I/I (MGD)	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	

CALCULATIONS	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
MONTHLY AVERAGE WASTEWATER FLOW RATE (MGD)	1.25	1.25	1.30	1.40	1.54	1.51	1.46	1.35	1.25	1.25	1.25	1.25	
WASTEWATER VOLUME (MG)	39	38	40	44	43	47	44	42	38	39	39	38	488
APPLIED EFFLUENT (MG)	25	0	0	0	0	30	42	62	60	50	45	32	346
SUPPLEMENTAL IRRIGATION WATER (MG) [3]	22	0	0	0	0	13	33	76	101	98	74	47	464
DESIGN EVAPORATION (IN)	2.9	1.4	0.7	0.9	1.5	2.8	3.9	6.6	7.7	8.0	6.8	5.0	48
DESIGN PRECIPITATION (IN)	0.8	2.3	3.1	4.4	3.7	2.9	1.6	0.6	0.1	0.0	0.0	0.4	20
PRECIPITATION VOLUME (MG) [5]	8	24	32	45	38	30	16	6	1	0	0	4	203
OXIDATION POND													
PERCOLATION (IN)	2.1	2.1	2.1	2.1	1.9	2.1	2.1	2.1	2.1	2.1	2.1	2.1	25
PERC VOLUME (MG)	3	3	3	3	3	3	3	3	3	3	3	3	34
EVAP. VOLUME (MG)	4	2	1	1	2	4	5	9	10	11	9	7	64
PRECIP. VOLUME (MG)	1	3	4	6	5	4	2	1	0	0	0	1	29
NET DISPOSAL POTENTIAL (MG)	5	1	-1	-2	-1	2	6	11	13	13	12	9	69
STORAGE BASINS													
PERCOLATION (IN)	3.6	3.5	3.6	3.6	3.2	3.6	3.5	3.6	3.5	3.6	3.6	3.5	42
PERC VOLUME (MG)	6	5	6	6	5	6	5	6	5	6	6	5	66
EVAP. VOLUME (MG)	5	2	1	1	2	4	6	10	12	13	11	8	76
PRECIP. VOLUME (MG)	2	5	6	9	8	6	3	1	0	0	0	1	41
NET DISPOSAL POTENTIAL (MG)	8	3	0	-2	0	4	8	15	17	18	16	13	101
IRRIGATION													
EVAPOTRANSPIRATION (IN)	3.2	1.9	1.4	1.3	2.3	4.2	4.6	7.0	8.4	8.1	6.4	4.5	53
TOTAL IRRIG DEMAND (IN)	4.4	0.0	0.0	0.0	0.0	3.0	5.7	11.4	14.6	14.3	11.1	7.3	72
IRRIGATION DEMAND (MG)	44	0	0	0	0	30	58	116	149	145	113	74	730
IRRIGATION APPLIED (MG)	47	0	0	0	0	43	75	138	161	148	119	79	810
SITE STORMWATER RUNOFF (IN)	0	0.4	0.5	0.7	0.6	0	0	0	0	0	0	0	2
SITE STORMWATER RUNOFF (MG)	0	5	6	9	7	0	0	0	0	0	0	0	27
COMBINED STORAGE													
BEGINNING STORAGE (MG)	0	0	38	85	142	193	204	192	146	93	50	16	
STORAGE GAIN (MG) [4]	0	38	47	57	51	11	-12	-46	-53	-43	-34	-16	
FINAL STORAGE (MG)	0	38	85	142	193	204	192	146	93	50	16	0	

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		STORAGE (MG)		DISPOSAL (MG)	
WASTEWATER	456	EVAP. FROM PONDS/BASINS	140	STORAGE AVAILABLE	270	DISPOSAL AVAILABLE	969
INFLOW AND INFILTRATION	32	PERC. FROM PONDS/BASINS	100	STORAGE REQUIRED	204	DISPOSAL REQUIRED	558
PRECIP. INTO PONDS/BASINS	70	IRRIGATION DEMAND	730				
				SURPLUS STORAGE CAPACITY	**66**	**SURPLUS DISPOSAL CAPACITY (MG)**	**411**
TOTAL	**558**	**TOTAL**	**969**	**(NEGATIVE INDICATES STORAGE REQUIRED)**		**(NEGATIVE INDICATES ADDITIONAL LAND IS REQUIRED)**	

Notes:

Manual Input (highlighted)

1 Includes irrigated portions of City Owned Land

2 Evapotranspiration from CIMIS 161 Patterson, intermediary between zone 14 and 15

3 Additional supplemental water required to meet salinity requirements in a typical year less vloume of additional rainwater falling on fields during a wet year

4 Storage volume increases with rainfall runoff and excess effluent not used for irrigation; storage decreases as efflunet is withdrawn for use as irrigation water

5 Volume of precipitaion falling on City owned land where effluent is applied

Table 2.2 - Estimate of Diluent Water Needs and Resulting Reclamation land Needs to Mitigate Salinity Impacts for 1.25 Mgal/d ADWF Conditions

City of Newman WWTRF — **SALINITY BALANCE - 1.25 MGD INFLUENT FLOW - TYPICAL ANNUAL PRECIPITATION - SUPPLEMENTAL BLENDING W/ GROUNDWATER** — 22-Feb-18 3:40 PM

INPUT DATA

FLOWS AND INFILTRATION/INFLOWS (I/I)	
3-MONTH AVG. DRY WEATHER INFLUENT FLOW (ADWF), MGD	1.25
ANNUAL I/I (%)	3
CLIMATOLOGICAL FACTORS	
PRECIP/AVG PRECIP RATIO	1.00
OCT-APR EVAP/AVG EVAP RATIO	1.00
MAY-SEP EVAP/AVG EVAP RATIO	1.00
PAN COEFFICIENT	1.00
LAND PRECIP COLLECTED (FRAC)	0.9

OXIDATION POND	
GROSS STORAGE AREA (AC)	53.0
WATER SURFACE (AC)	50.0
BOTTOM SURFACE (AC)	49.0
WATER DEPTH (FT)	2.5
STORAGE AVAILABLE (MG)	40
INFILTRATION RATE (IN/DAY)	0.069

STORAGE BASINS	
GROSS STORAGE AREA (AC)	77.0
WATER SURFACE (AC)	68.0
BOTTOM SURFACE (AC)	58.0
WATER DEPTH (FT)	12.0
STORAGE AVAILABLE (MG)	230.0
INFILTRATION RATE (IN/DAY)	0.115

IRRIGATION AREA CHARACTERISTICS	
AVAILABLE AGRICULTURAL LAND AREA (AC) [1]	531
ACTUAL AREA BEING IRRIGATED (AC) [2]	374
LEACHING FRACTION	0.37
OVERALL IRR. EFFICIENCY (ACCOUNTING FOR EVAPORATION)	0.58
ALFALFA AREA (% OF LAND IRRIGATED)	75%
ROTATION CROPS AREA (% OF LAND IRRIGATED)	25%
PRECIP IRR. EFFICIENCY	0.85

IRRIGATION WATER SALINITY (μS/cm)	
J PIPE	2000
50 HP	1560
McPike	1340
WELLS VOLUME WEIGHTED AVG.	1529
APPLIED EFFLUENT	3800
RAINWATER	10

PARAMETERS	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
DAYS IN MONTH	31	30	31	31	28	31	30	31	30	31	31	30	365
AVG PAN EVAP (IN)	4.40	2.10	1.00	1.30	2.30	4.20	5.90	8.30	9.60	10.00	8.50	6.30	63.90
AVG PRECIP (IN)	0.46	1.29	1.73	2.42	2.04	1.62	0.86	0.35	0.04	0.01	0.02	0.21	11.05
Eto [3]	4.02	2.05	1.39	1.30	2.20	4.07	5.40	7.78	8.36	8.14	7.16	5.70	57.57
Kc (Rotation Crops)	0.00	0.33	1.10	1.10	1.10	1.10	0.39	0.56	1.00	1.00	0.50	0.00	
BARE SOIL ET (IN)	0.70	0.70						0.35			0.35	0.70	2.80
Kc1 (Alfalfa)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
PERCENT OF ANNUAL I/I OCCURRING IN MONTH	0.0	0.0	5.0	15.0	25.0	25.0	20.0	10.0	0.0	0.0	0.0	0.0	100.0
INFLUENT- EXCLUDING I/I (MGD)	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	

CALCULATIONS	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
MONTHLY AVERAGE WASTEWATER FLOW RATE (MGD)	1.25	1.25	1.27	1.32	1.37	1.36	1.34	1.29	1.25	1.25	1.25	1.25	
WASTEWATER VOLUME (MG)	39	38	39	41	38	42	40	40	38	39	39	38	470
APPLIED EFFLUENT (MG)	15	14	0	0	9	25	23	30	34	33	26	16	223
SUPPLEMENTAL IRRIGATION WATER (MG) [4]	34	0	0	0	0	24	44	88	112	109	85	59	555
DESIGN EVAPORATION (IN)	4.4	2.1	1.0	1.3	2.3	4.2	5.9	8.3	9.6	10.0	8.5	6.3	63.9
DESIGN PRECIPITATION (IN)	0.5	1.3	1.7	2.4	2.0	1.6	0.9	0.4	0.0	0.0	0.0	0.2	11.1
PRECIPITATION VOLUME (MG) [5]	5	13	18	25	21	16	9	4	0	0	0	2	112
TOTAL WATER APPLIED (MG)	54	27	18	25	30	65	76	121	146	142	111	77	890
AVERAGE FLOW WEIGHTED EC (μS/cm)	2037	1948	10	10	1167	2014	2033	2045	2048	2048	2048	1956	1906
OXIDATION POND													
PERCOLATION (IN)	2.14	2.07	2.14	2.14	1.93	2.14	2.07	2.14	2.07	2.14	2.14	2.07	25.2
PERC VOLUME (MG)	2.85	2.76	2.85	2.85	2.57	2.85	2.76	2.85	2.76	2.85	2.85	2.76	33.5
EVAP. VOLUME (MG)	5.86	2.80	1.33	1.73	3.06	5.59	7.86	11.05	12.78	13.32	11.32	8.39	85.1
PRECIP. VOLUME (MG)	0.66	1.85	2.48	3.47	2.92	2.32	1.23	0.50	0.06	0.01	0.03	0.30	15.8
NET DISPOSAL POTENTIAL (MG)	8.05	3.71	1.70	1.11	2.71	6.12	9.38	13.40	15.48	16.15	14.14	10.84	102.8
STORAGE BASINS													
PERCOLATION (IN)	3.57	3.45	3.57	3.57	3.22	3.57	3.45	3.57	3.45	3.57	3.57	3.45	42.0
PERC VOLUME (MG)	5.62	5.44	5.62	5.62	5.08	5.62	5.44	5.62	5.44	5.62	5.62	5.44	66.2
EVAP. VOLUME (MG)	6.93	3.31	1.58	2.05	3.63	6.62	9.30	13.08	15.13	15.76	13.40	9.93	100.7
PRECIP. VOLUME (MG)	0.95	2.67	3.58	5.00	4.22	3.35	1.78	0.72	0.08	0.02	0.04	0.43	22.9
NET DISPOSAL POTENTIAL (MG)	11.60	6.08	3.62	2.66	4.48	8.89	12.96	17.98	20.49	21.36	18.97	14.93	144.0
IRRIGATION													
EVAPOTRANSPIRATION (IN)	3.19	1.88	1.42	1.33	2.26	4.17	4.57	7.01	8.36	8.13	6.35	4.45	53.1
TOTAL IRRIG DEMAND (IN)	4.81	1.35	0.00	0.00	0.90	4.81	6.61	11.55	14.32	13.97	10.90	7.35	76.6
IRRIGATION DEMAND (MG)	48.9	13.7	0.0	0.0	9.1	48.9	67.2	117.4	145.6	142.0	110.8	74.7	778.2
IRRIGATION APPLIED (MG)	48.9	13.7	0.0	0.0	9.1	48.9	67.2	117.4	145.6	142.0	110.8	74.7	778.2
SITE STORMWATER RUNOFF (IN)	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
SITE STORMWATER RUNOFF (MG)	0.0	0.0	2.6	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3
COMBINED STORAGE													
BEGINNING STORAGE (MG)	0	4	18	52	89	111	113	109	88	55	24	4	
STORAGE GAIN (MG) [6]	4	14	34	37	22	2	-5	-21	-32	-31	-20	-4	
FINAL STORAGE (MG)	4	18	52	89	111	113	109	88	55	24	4	0	

SUMMARY

ANNUAL INFLOW (MG)		ANNUAL OUTFLOW POTENTIAL (MG)		STORAGE (MG)		SALINITY	
WASTEWATER	456	EVAP. FROM PONDS/BASINS	186	STORAGE AVAILABLE	270	ANNUAL FLOW WEIGHTED AVERAGE (μS/cm)	1906
INFLOW AND INFILTRATION	14	PERC. FROM PONDS/BASINS	100	STORAGE REQUIRED	113	SALINITY TARGET [7]	2100
PRECIP. INTO PONDS/BASINS	39	IRRIGATION DEMAND	778			TOTAL VOLUME OF WATER APPLIED TO LAND	890
SUPPLEMENTAL BLEND WATER	555					EC OF APPLIED WATER REACHING SHALLOW GROUNDWATER	5178
						EC OF WATER REACHING SHALLOW GROUNDWATER	4857
TOTAL	**1064**	**TOTAL**	**1064**	**SURPLUS STORAGE**	**157**	SSGG	5180

Notes:

(yellow) Manual Input

1 Acres of City owned land available for farming
2 Acres of land receiving effluent
3 Evapotranspiration from CIMIS 161 Patterson, intermediary between zone 14 and 15
4 Additional water applied to satisfy irrigation demand and salinity requirements
5 Volume of precipitaion falling on City owned land where effluent is applied
6 Storage volume increases with rainfall runoff and excess effluent not used for irrigation; storage decreases as effulnet is withdrawn for use as irrigation water
7 Salinity compliance target for applied irrigation water to meet the site specific groundwater goal of 5200 uS/cm identified in the Antidegradation Analysis

ATTACHMENT 3:
NITROGEN UPTAKE EFFICIENCY OF VARIOUS CROPS

IRRIGATION WITH RECLAIMED MUNICIPAL WASTEWATER
A Guidance Manual

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July 1984

Report Number 84-1 wr

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Sopper [4] reported that application of sewage effluent to forest and cropland at the rate of 1 inch/week over a period of 6 years did not increase the nitrate-N concentration of soil solution samples above the 10 mg/L Public Health Service standard, but this limit was exceeded when the application rate was 2 inches/week.

A crop does not utilize all of the inorganic N present in the root zone. The fraction of the total amount assimilated depends on the plant, depth and distribution of roots, stage of growth, rate of water movement through the root zone, and other factors. In general, the efficiency of uptake of applied N is seldom much in excess of 50% and is often less. Table 12-1 lists values for N uptake efficiency for a few important crops in California in conventional fertilizer practice, but these values may be somewhat higher than would be obtained with a diffuse and dilute source of N such as wastewater.

Table 12-1. Nitrogen utilization efficiency for some crops in California.

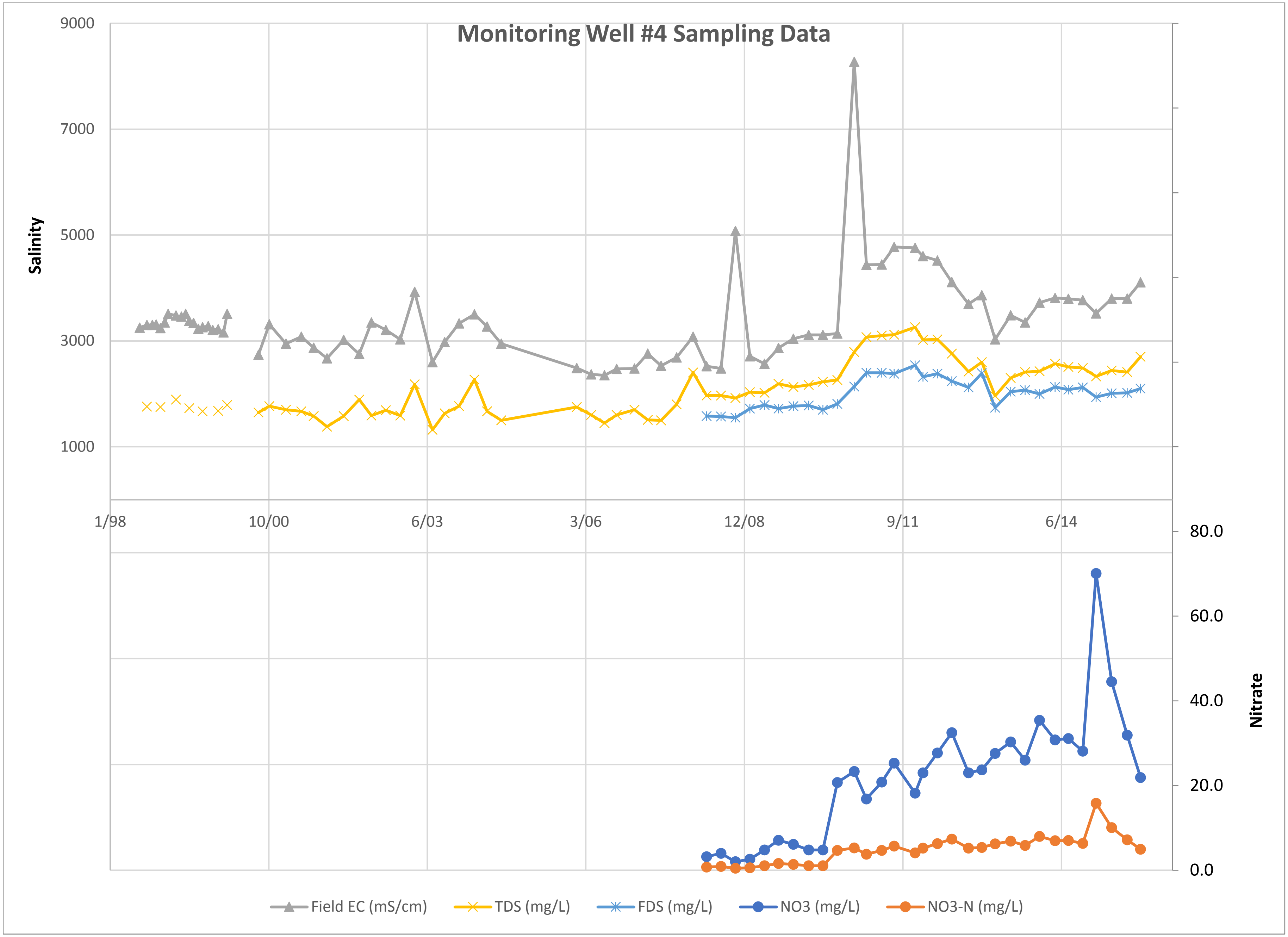
Crop	N application rate (kg/ha)	Uptake of applied N (%)
Corn	180	56
Sugarbeet	135	47
Tomato	112	64
Potato	270	39
Rice	90	34

Another consideration is that a certain minimum concentration of nitrate in the soil solution is required to meet the needs of crops. Broadbent and Rauschkolb [5] reported 10-13 mg/L NO_3-N in the soil solution below the root zone of unfertilized corn plants suffering from nitrogen deficiency. Grasses, especially perennials, tend to be more efficient in N uptake than are row crops. For most crops, part

ATTACHMENT 4:
1998-2017 MW-4 RESULTS

Date/Time	Field pH (std. units)	Field EC (µS/cm)	TDS (mg/L)	FDS (mg/L)	NO3 (mg/L)	NO3-N (mg/L)	NO2-N (mg/L)	TOC (mg/L)
	6.5-8.4(a)	**700(a)**	**450(a)**	**NA**	**45(p)**	**10(p)**	**1(p)**	**NA**
7/10/1998		**3250**						
8/24/1998	7.7	**3300**	**1760**					
9/28/1998		**3300**						
10/21/1998		**3310**						
11/17/1998	7.2	**3240**	**1750**					
12/14/1998		**3350**						
1/5/1999		**3510**						
2/24/1999	7.2	**3480**	**1890**					
3/29/1999		**3460**						
4/26/1999		**3510**						
5/18/1999	7.5	**3380**	**1730**					
6/15/1999		**3340**						
7/14/1999		**3230**						
8/11/1999	7.7	**3260**	**1670**					
9/15/1999		**3280**						
10/13/1999		**3210**						
11/16/1999	8.3	**3220**	**1680**					
12/20/1999		**3160**						
1/13/2000	7.7	**3510**	**1790**					
4/25/2000								
7/28/2000	7.4	**2740**	**1650**					
10/4/2000	7.1	**3315**	**1770**					
1/18/2001	7.1	**2950**	**1700**					
4/24/2001	7.2	**3080**	**1670**					
7/11/2001	7.1	**2870**	**1580**					
10/3/2001	6.9	**2670**	**1380**					
1/16/2002	6.9	**3020**	**1580**					
4/24/2002	7.8	**2750**	**1890**					
7/10/2002	7.2	**3350**	**1590**					
10/9/2002	6.6	**3210**	**1690**					
1/8/2003	7.4	**3030**	**1590**					
4/9/2003	7.6	**3930**	**2180**					
7/30/2003	7.5	**2600**	**1320**					
10/16/2003	7.2	**2980**	**1630**					
1/14/2004	7.2	**3330**	**1770**					
4/20/2004	7.4	**3500**	**2270**					
7/8/2004	7.6	**3270**	**1670**					
10/6/2004	7.3	**2950**	**1500**					
1/25/2006	7.2	**2490**	**1750**					
4/26/2006	7.3	**2370**	**1600**					
7/19/2006	7.9	**2350**	**1450**					
10/4/2006	7.6	**2470**	**1600**					
1/24/2007	7.7	**2480**	**1700**					

Date/Time	Field pH (std. units)	Field EC (µS/cm)	TDS (mg/L)	FDS (mg/L)	NO3 (mg/L)	NO3-N (mg/L)	NO2-N (mg/L)	TOC (mg/L)
	6.5-8.4(a)	**700(a)**	**450(a)**	**NA**	**45(p)**	**10(p)**	**1(p)**	**NA**
4/18/2007	7.5	**2760**	**1510**					
7/11/2007	7.5	**2530**	**1500**					
10/17/2007	7.1	**2690**	**1800**					
1/29/2008	7.4	**3080**	**2401**					
4/23/2008	7.6	**2520**	**1970**	1580	3.2	0.7	<0.1	3.1
7/23/2008	7.3	**2481**	**1970**	1570	4.0	0.9	<0.1	2.2
10/22/2008	7.4	**5077**	**1920**	1550	2.0	0.5	<0.1	1.8
1/21/2009	7.3	**2709**	**2030**	1720	2.6	0.6	<0.1	1.9
4/23/2009	7.3	**2570**	**2020**	1790	4.8	1.1	<0.1	2.4
7/21/2009	7.4	**2866**	**2190**	1720	7.1	1.6	<0.1	1.8
10/22/2009	7.3	**3040**	**2130**	1770	6.1	1.4	<0.1	1.5
1/27/2010	7.3	**3115**	**2170**	1780	4.8	1.1	<0.1	1.4
4/27/2010	7.3	**3116**	**2230**	1700	4.8	1.1		
7/27/2010	7.1	**3141**	**2260**	1810	20.7	4.7		
11/10/2010	8.0	**8275**	**2790**	2140	23.3	5.3	<0.1	
1/26/2011	7.1	**4440**	**3070**	2400	16.8	3.8		
5/3/2011	7.2	**4445**	**3100**	2400	20.8	4.7		
7/20/2011	7.0	**4774**	**3120**	2380	25.3	5.7		
11/30/2011	7.0	**4759**	**3260**	2540	18.2	4.1	<0.1	
1/18/2012	7.0	**4602**	**3020**	2320	23.0	5.2		
4/18/2012	7.1	**4520**	**3030**	2380	27.7	6.3		
7/18/2012	7.2	**4113**	**2760**	2240	32.5	7.3		
10/31/2012	7.1	**3699**	**2420**	2120	23.0	5.2	<0.1	
1/23/2013	7.1	**3865**	**2600**	2390	23.7	5.4		
4/17/2013	7.3	**3027**	**1960**	1740	27.6	6.2		
7/24/2013	7.2	**3486**	**2300**	2040	30.3	6.8		
10/23/2013	7.3	**3350**	**2410**	2070	26.0	5.9	<0.1	
1/22/2014	7.4	**3722**	**2430**	2000	35.4	8.0		
4/30/2014	7.1	**3813**	**2570**	2130	30.8	7.0		
7/23/2014	6.9	**3794**	**2510**	2080	31.1	7.0		
10/22/2014	7.1	**3769**	**2490**	2120	28.1	6.3	<0.2	
1/14/2015	7.0	**3520**	**2330**	1940	**70.1**	**15.8**		
4/22/2015	6.9	**3800**	**2440**	2010	44.5	**10.1**		
7/29/2015	7.0	**3799**	**2410**	2020	31.9	7.2		
10/22/2015	7.2	**4106**	**2700**	2100	21.9	4.9	<0.2	
1/28/2016	IVS							
4/27/2016	IVS							
7/27/2016	IVS							
10/26/2016	Dry							
1/31/2017	7.2	**2859**	**2000**	1580	51.5	11.6		
4/26/2017	7.2	**3587**	**2430**	2010	43.4	9.8		
7/26/2017	7.0	**3440**	**2230**	1880	**56.5**	12.8		
10/25/2017	7.4	**3639**	**2470**	1950	**39.7**	9.0	<0.2	



Monitoring Well #4 Sampling Data
Salinity
9000
7000
5000
3000
1000
1/98
10/00
6/03
3/06
12/08
9/11
6/14
Nitrate
80.0
60.0
40.0
20.0
0.0
Field EC (mS/cm)
TDS (mg/L)
FDS (mg/L)
NO3 (mg/L)
NO3-N (mg/L)