201 North Civic Drive, Suite 115
Walnut Creek, California 94596
Tel: 925-210-2518
Fax: 925-937-9026
www.brownandcaldwell.com

June 30, 2011

Brown AND Caldwell

Confidential

Yitzhak Gilon
California American Water
4701 Beloit Drive
Sacramento, CA 95838

Subject: Letter Proposal for Wild Wings Water Reclamation Facility Odor Survey

Dear Mr. Gilon,

Brown and Caldwell (BC) is pleased to provide you with this letter proposal to complete an odor survey at your Wild Wings Water Reclamation Facility (WWWRF) in Woodland, California. BC is highly experienced at conducting similar projects at wastewater treatment facilities throughout the United States and we are confident that we will provide you with the scientific process of data collection, dispersion modeling, and emissions control that you require.

We are providing you with a recommended scope of services for the work as we understand it and a fee quote for completing that work. Note that our fee quote includes all field sampling and laboratory analysis services.

Proposed Scope of Services

We have divided the scope of services for this work into six tasks. A total fee for each of these tasks is provided in the Fee Quote section of this letter proposal.

Task 1: Odor Emissions Assessment

In this task, BC will complete an odor emissions assessment for the WWWRF, focusing on process areas within the plant and offsite areas that BC determines are potentially contributing to offsite (beyond the plant property line) impacts. For this study, an odor impact is defined as any detectable odor above typical background levels.

Task Elements

The odor emissions assessment contains the following elements:

Initial Field Survey: BC shall conduct a site visit to the WWWRF to review plant operations with WWWRF staff, collect field data and identify locations for sampling (one BC engineer shall conduct the site visit, which is projected to last four hours). Plant and offsite odor sources will be characterized using a hand-held Jerome 631-X hydrogen sulfide (H_2S) analyzer, which measures H_2S concentrations to a resolution of 1 part per billion by volume (ppbv). Ambient concentrations will be measured in the headspace above the emission surface for each source. The Jerome analyzer data will be recorded and used to prioritize odor sources for the bag sampling work.

Furthermore, the initial field survey will include field odor measurements using a Nasal Ranger field olfactometer. The Nasal Ranger provides a field estimate of the "total odor"

of a source when the user is standing downwind of an odorous area (the device utilizes multiple dilution levels of filtered and ambient air to the operator nose piece to establish an approximate odor unit value). The Nasal Ranger will be used to provide numerical measurements for the odor sources at the plant as well as two offsite areas that could also be contributing to odors at complaint locations (nearby pond and agricultural area).

Jerome analyzer and Nasal Ranger readings will be taken at each source in multiple locations to produce a sufficient average characterization of odorous emissions. This data, along with data describing meteorological conditions and any notable treatment plant process conditions, will be compiled into a Field Sampling Plan, which will identify priority odor sources based on the initial field survey and recommend specific plant and offsite locations for air sampling.

During the Initial Field Survey, BC will install OdaLog H_2S data loggers at three odor source locations within the WWWRF. These data loggers measure the ambient H_2S concentration every 5 minutes and record the measured concentration in a data file that can be downloaded onto a personal computer and analyzed. The goal of this data collection is to identify variations in odorous emissions over time. This data will be used in production of the Field Sampling Plan, in particular to set timing of air sampling.

Air Sample Collection: BC shall conduct a second site visit to the WWWRF to collect air samples that will further characterize the odorous emissions from the treatment plant as well as from offsite sources. One BC engineer shall complete this site visit, which is projected to last 8 hours.

During the site visit, BC shall collect air samples in Tedlar bags in the locations identified in the Field Sampling Plan. Samples will be shipped to offsite laboratories for analysis of total odor and odorous compounds. (Note this task includes the sampling effort only; laboratory analysis costs are presented in Task 2.) The following bag samples will be collected during this site visit:

- 10-liter (L) Tedlar bags will be used to collect air samples to be shipped to St. Croix Sensory Laboratory (Lake Elmo, MN) for odor panel analysis.
- 1-L Tedlar bags will be used to collect air samples to be shipped to Columbia Analytical Services (Simi Valley, CA) for reduced sulfur compound analysis.

Air samples will be collected using a vacuum chamber, which consists of a pump within an air-tight Pelican case and Teflon sampling tubing through which the collected air flows. Tedlar bags are placed inside the case and filled using the pump. Odor surfaces will be isolated using a flux chamber, which essentially is an inverted bowl that is placed over the liquid or solid surface, thereby eliminating wind impacts and infiltration of air that is not a part of the odor source headspace.

Laboratory Coordination: BC shall coordinate with St Croix Sensory Laboratory and Columbia Analytical Services to procure sampling equipment and reserve time for analysis of the air samples. (Note that equipment rental fees are included in Task 2.)

Task Deliverables

The deliverable for Task 1 is the Field Sampling Plan, to be produced following the initial field visit. One draft and one final Plan shall be submitted to California American Water, both in electronic technical memorandum format. The final version of the Plan shall

incorporate California American Water comments on the draft version, with any exceptions to comments identified in writing in a separate electronic transmittal.

The Plan shall be approximately 5 pages in length and shall include the following data compilations:

- A tabular compilation of field-measured H_2S concentrations at odor sources using the Jerome analyzer
- A tabular compilation of field-measured "total odor" data downwind of odor sources using the Nasal Ranger
- Graphical compilations of logged H_2S concentrations, downloaded from the OdaLog devices

Task Assumptions

BC assumes that there will be available one California American Water operator available to allow access to the WWWRF for the two site visits listed in this task. BC also assumes that the plant will be operating under normal conditions during the site visits (no plant upsets) and that the site visits will be conducted at least 1 day after the end of the most recent rain event.

Task 2: Laboratory Analysis

This task includes laboratory analysis costs associated with the Task 1 Air Sample Collection (samples collected during the second site visit). Two laboratories will be used for analytical services: St Croix Sensory and Columbia Analytical Services.

Task Elements

Laboratory analyses included in this task are as follows:

Olfactometry Analysis: St. Croix Sensory Laboratory provides services from a certified "odor panel", which generates numerical quantities to describe the odor of an air sample, a procedure also known as olfactometry (ASTM E679 and EN13725). The advantage of the odor panel is that it provides a "total odor" measurement of an air sample, as opposed to a measurement of one particular compound, such as H_2S. Tests to be conducted by the St Croix Sensory Laboratory are as follows:

- Detection Threshold: Assessment of how detectable the odor is in an air sample, measured as the number of dilutions of odor-free (carbon filtered) air are required for half of the 12-person odor panel to be able to correctly identify the odorous sample when presented three choices: the odor sample and two samples of odor-free (carbon filtered) air. A greater number of required dilutions represents a more detectable odor.
- Hedonic Tone: Assessment of the offensiveness of the odor sample by the odor panel, on a scale of -10 to +10, where -10 represents the most offensive odor the panelist has ever smelled and +10 represents the most pleasant odor the panelist has ever smelled.
- Odor Characterization: The odor panel provides descriptions of the air sample, which includes well-known odors such as "grassy", "floral", "fecal", "garbage", etc. These characterizations help to further describe the subjective nature of the total odor and how offensive the odor in the air sample is.

Analysis of 8 air samples by the odor panel is assumed. Each of the three tests listed above shall be conducted for each of the 8 air samples. Duplicate samples (total of 16) shall be shipped in the event that a Tedlar bag breaks during air transport.

Reduced Sulfur Compound Speciation: Columbia Analytical Services provides analytical measurement of the concentration of 20 reduced sulfur compounds that are commonly found in wastewater conveyance and treatment emissions (ASTM D5504). Compounds consist of 19 organic sulfides and the inorganic hydrogen sulfide. Analysis is conducted using a gas chromatograph / mass spectrometer and concentrations are reported as low as 2.5 ppbv. The purpose of this analysis is to identify specific compounds that are contributing to odors in the vicinity of the WWWRF, which aids in identifying primary contributors to offsite impacts and also is critical in identification of best means of odor emissions control, if needed.

Analysis of 8 air samples by Columbia Analytical Services using ASTM D5504 as described above is assumed. Duplicate samples (total of 16) shall be shipped in the event that a Tedlar bag breaks during air transport.

Task Deliverables

There are no specific deliverables associated with this task. Tabular and graphical laboratory results, chains-of-custody forms, and laboratory correspondence shall be included as an appendix to the Task 4 Odor Survey Report.

Task Assumptions

This task shall be designated as “expenses only”; no BC labor shall be applied to this task. Laboratory coordination labor shall be applied to Task 1 and labor for analysis of laboratory data and findings shall be applied to Tasks 3 and 4.

Task 3: Dispersion Modeling

This task includes producing and running a computer dispersion model that will identify the current projected spread of odors beyond the WWWRF plant boundary and also estimate the contribution of two nearby odor sources not associated with the WWWRF to odor impacts at nearby receptors.

Task Elements

The dispersion modeling task includes the following elements:

Data Analysis and Model Calibration: BC will analyze odor and odor-related data collected in Tasks 1 and 2 along with other pertinent plant data (influent and process water quality parameters provided to BC by California American Water) to identify appropriate emission rates for odor sources listed in the Field Sampling Plan produced in Task 1. Emission rates selected shall be projected by BC to correspond to conditions that are most likely to contribute to offsite impacts (i.e., “worst-case” conditions).

BC assumes that emission rates will be identified in units of “Odor Units per cubic meter per second”, which will capture the contribution of all compounds being emitted by each source. This will result in projections of “total odor” given various meteorological conditions in offsite areas.

BC shall use the Industrial Source Complex Short-Term 3 (ISCST3) dispersion model, an Environmental Protection Agency-approved computer model that is widely used to model

offsite odor concentrations emitted by processes within wastewater treatment facilities. The ISCST3 model is a straight-line Gaussian plume model which uses mathematically and statistically averaged approximations of plume rise and wind-driven dispersion behavior to estimate downwind impacts to concentrations of odorous compounds, or total odor levels.

The model will predicts odor levels at various receptor locations adjacent to the plant given the range of meteorological conditions typically experienced in the area of the WWWRF. Results are presented as predicted offsite odor levels or as the number of hours a specified odor threshold is exceeded over the course of a year. Model output is plotted on top of an aerial photograph of the plant and surrounding area, with "odor contours" representing areas of either equal odor levels or equivalent number of hours exceeding the established threshold. A typical dispersion model output plot for a wastewater treatment facility is shown in Figure 1, for reference.

Figure 1. Typical dispersion model output plot.
Contours are areas of predicted equal odor levels (values are in "odor units")

Alternative Scenario Dispersion Modeling: BC will analyze the results of the dispersion model and determine, based on model output, if significant offsite odor impacts that could produce odor complaints can be attributed to sources within the WWWRF. BC will use judgment based on past experience and typical odor thresholds that tend to trigger complaints to make this determination. Following completion of this analysis, BC will identify technological means to reduce odor emissions such that impacts do not pass beyond the WWWRF property line. The following technological improvements or modifications will be considered in this analysis:

- Chemical injection to reduce the concentration of odorous compounds in the liquid phase, and therefore decrease the volatilization of odors into the air.
- Capture of foul air from key contributing odor sources and venting the foul air to an air treatment system. Small (less than 500 cubic feet per minute) activated carbon adsorption and biological treatment systems will be considered.
- Changes in operations, such as treatment modifications, storage modifications, changes to cover systems, etc

BC will use typical emissions reduction percentages to adjust the input of impacted odor sources to the dispersion model (reduce the odor emission rates of sources that would need to be better controlled) and rerun the dispersion model assuming these improvements are incorporated. Similar output plots shall be generated following the model run. BC assumes that the model will be modified and rerun three times to demonstrate the impact of various solutions.

Task Deliverables

There are no specific deliverables associated with this task. Dispersion model input tables, plots, and results tables shall be included in the Task 4 Odor Survey Report.

Task Assumptions

The following assumptions apply to Task 3 Dispersion Modeling:

- Two consecutive years of meteorological data providing hourly wind speed, wind direction, and stability class data are available from a weather station less than 5 miles from the WWWRF are available for free download and use.
- Emission rates for up to 10 area odor sources will be input into the dispersion model; no point sources (sources with a stack and forced air velocity component to the emission) will be included in the dispersion model.
- BC shall complete 1 dispersion model run to characterize the impact of existing odor emissions from the WWWRF. Model output shall not be adjusted to attempt to match areas of recent odor complaints.
- One offsite odor source (natural pond located approximately 300 ft northeast of the plant liquid-phase treatment basins) shall be incorporated into the dispersion model to assess its relative contribution to offsite odors and complaints.
- Due to size limitations, the agricultural area west of the WWWRF will not be incorporated into the dispersion model. However, its relative contribution to offsite odor impacts will be evaluated in the field using the Nasal Ranger and assessed in the Task 4 Odor Survey Report.
- BC shall complete three additional dispersion model runs for the alternative scenario task element in an effort to identify means by which odors can be controlled to within the WWWRF property line.

Task 4 Odor Survey Report

This task includes production of the Odor Survey Report, which compiles data, observations, model results, and recommendations made in Tasks 1-3.

Task Elements

Following are the task elements associated with completion of the Odor Survey Report:

Project Summary Preparation: BC shall summarize the findings of Tasks 1-3 in a report that includes the odor data collected in the field and analyzed in the laboratory, emissions calculations, data analysis, a dispersion modeling summary, and odor control recommendations. The following main sections are assumed for the body of the report:

- Section 1: Background
- Section 2: Odor Assessment
- Section 3: Dispersion Modeling
- Section 4: Odor Control Recommendations

Appendices shall be included that provide raw field and laboratory odor data and plant data as is pertinent to the project.

Odor Monitoring Plan Preparation: BC shall incorporate the findings and recommendations of Tasks 1-3 into a separate Odor Monitoring Plan that will be used by California American Water to proactively minimize odor emissions and keep odor impacts to within the plant property. The Odor Monitoring Plan shall be a stand-alone document that will be included as an appendix to the Odor Survey Report.

The Odor Monitoring Plan will provide guidance to WWWRF operations staff for daily, weekly, and monthly monitoring of the plant for odorous emissions. The Plan shall focus on the sources that the odor assessment and dispersion modeling has identified as primary contributors to offsite impacts. Depending upon the severity of current impacts, the Plan could include purchase of odor monitoring equipment or modifications to existing plant processes.

The goal of the Odor Monitoring Plan production shall be that the Plan demonstrates that California American Water has an understanding of odor emissions from the WWRF and is being proactive in keeping odors within the plant property.

Task Deliverables

A draft and final version of the Odor Survey Report shall be submitted electronically to California American Water. The Odor Survey Report shall include the Odor Monitoring Plan as an appendix. The final version of the Report shall incorporate California American Water comments on the draft version, with any exceptions to comments identified in writing in a separate electronic transmittal.

Task Assumptions

The following assumptions apply to Task 4 Odor Survey Report:

- The report shall adhere to typical BC report format and shall be submitted electronically to California American Water
- The body of the report shall be approximately 20 pages and shall contain approximately 8 figures and 8 tables.
- The Odor Monitoring Plan in the appendix shall be approximately 3 pages and shall contain approximately 1 figure and 2 tables

Task 5: County Coordination and Meetings

This task includes coordination efforts and meetings to inform Yolo County and the Wild Wings County Service Area (CSA) of project progress, conclusions and recommendations. Regina Espinosa shall be the primary point of contact for this coordination. Two meetings are assumed for this task:

- At the beginning of the project to present goals, methods, and means of data analysis
- At the conclusion of the project to review project findings and recommendations, and to present the Odor Monitoring Plan.

Task Deliverables

BC shall supply California American Water with a copy of the slides to be used in meetings with the CSA and shall incorporate recommended improvements.

Task Assumptions

BC shall participate in two meetings with the CSA. For each presentation, the presentation shall be approximately 20 slides in length.

Task 6: Project Management

BC shall produce a project management plan (PMP) that includes the identification and scheduling of labor resources and reporting procedures. The PMP shall be used as an internal document to guide production of internal and external deadlines and deliverables. BC shall prepare an internal quality assurance / quality control (QA/QC) plan that shall identify the review process for each design submittal, including staff requirements, labor hour projections, and projected review schedules

BC shall monitor progress of the work contained within this scope of services and coordinate completion of work products with the District. BC shall monitor task budgets and project schedule and communicate with California American Water when either is not consistent with projections.

Task Deliverables

Invoices shall be submitted on a monthly basis to the California American Water project manager and shall include a summary of all charges accumulated since the prior invoice.

Task Assumptions

Invoices shall include a monthly summary of work completed in the invoice cycle if requested by California American Water.

Fee Quote

BC has calculated the total fee for the scope of services detailed in this letter proposal to be $42,700. This fee shall not be exceeded by BC without written agreement of an amendment to our agreement.

Table 1 provides a task breakdown of the fee into the 6 tasks described in the Scope of Services section.

Table 1. Odor Survey Fee Quote Breakdown				
Task No.	Task Name	Labor	Expenses	Total Fee
1	Odor Emissions Assessment	$5,501	$1,047	$6,548
2	Laboratory Analysis	-	$6,642	$6,642
3	Dispersion Modeling	$11,183	$512	$11,695
4	Odor Survey Report	$9,791	$416	$10,207
5	County Coordination and Meetings	$3,733	$310	$4,043
6	Project Management	$3,340	$192	$3,532
			Total BC Fee Quote	$42,700

Labor rates, terms, and conditions shall adhere to the BC standard agreement terms and conditions (attached to this letter).

Schedule

BC projects that a draft version of the Odor Survey Report will be produced three months following notice to proceed.

Please let me know if you need further information regarding this letter proposal. Brown and Caldwell looks forward to continuing its excellent working relationship with California American Water in completing this important work.

Very truly yours,

Brown and Caldwell

David McEwen, Project Manager
Walnut Creek

Attachments (1)

1. Attachment A: Brown and Caldwell Standard Engineering Services Agreement Terms and Conditions