Exhibit No.:
Issue: Waste Water Treatment Improvements

Witness: Thomas P. Wells
Sponsoring Party: Jason Becker and Becker Development Company, LLC
Type of Exhibit: Surrebuttal Testimony
Case No.: SC-2007-0044, et al.
Date Testimony Prepared: November 29, 2006

MISSOURI PUBLIC SERVICE COMMISSION

JASON BECKER and BECKER DEVELOPMENT COMPANY, LLC

SURREBUTTAL TESTIMONY

OF

THOMAS P. WELLS

BECKER v. AQUA MISSOURI, INC.

CASE NO. SC-2007-0044

CONSULTING ENGINEERS

TRABUE, HANSEN & HINSHAW, Inc.

1901 Pennsylvania
Columbia, MO 65202

January 26, 2007

Mr. Jason Becker
Becker Development Company
9723 Nine Hills Lane
Centertown, MO 65023

RE: Lake Carmel Subdivision
Wastewater Treatment Improvements
Response to PSC Testimony

Dear Mr. Becker:

We have received and reviewed the package containing the testimony of Robert O. Gaebe, P.E. on behalf of Aqua Missouri. We have the following responses:

General:

The prior report relied on physical and design information concerning the lagoons, water use records, and subsequent lagoon volume checking. The general lagoon geometry and the permit conditions currently in effect are not in question.

In preparation of the original report, water sales records were requested to verify actual user contributions in comparison to permitted maximums. Monitoring for I/I was not performed, but estimates of reasonable I/I values were used.

Effluent flow monitoring:

The existence of lagoon effluent records was not made known to us until this time. The records now provided show flow measurements taken at the discharge of the lagoon during the months of March and June, 2006. The flows shown are very substantially in excess of flows to be reasonably expected, especially in light of confirmed water sales records for connected homes. The data as shown contains only the flow figures. The method of effluent measurement, descriptions of measuring equipment used to measure these flows, and verified calibration data for the equipment is not provided. This is critical, since use of any metering equipment relies on proper setup and calibration for the weir or flume at the site. Given the extremely high flow values, use of proper calibration needs to be confirmed.

573-814-1568
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For quick visual confirmation of flows, assuming a 90 degree V-notch weir is present, the head on the weir (Measured at least 12" upstream of the weir) would have to be in excess of 2.4 inches to meet the March average daily flow of 29,904 gpd or 20.77 gpm. At the June value of 17,836 gpd 12.39 gpm, the head on the weir would be 1.95 inches. For comparison, the average daily domestic flow only would result in a head on the weir of 1.4 inches.

Weir measurement accuracy is fully dependent on proper calibration of the equipment. After equipment setup, verifiable physical measurement of flow (Usually by timed filling of a container of known volume) must be performed and compared to the equipment readings, and adjustments made as needed until the values match. If electronic equipment is used, the routines contained in the software have specific settings for each type of weir or flume, and these must also be properly entered.

If the proper calibration steps were not taken, recorded and verified, the data showing extremely high I/I is suspect. If calibration was properly performed and recorded, then the data may be valid and a high I/I problem may indeed exist.

Domestic flow and I/I flow:

The water sales records that were provided by Aqua Missouri support the daily domestic contribution figure of 170 gpd per residence, as outlined in the past report. It is also understood that 44 homes are currently tributary to the lagoon system, not 49. For 44 homes, the daily domestic flow is 7,480 gpd.

In order to reach the reported total average flow figure of 29,904 gpd measured in March 2006, and to reconcile that figure with the actual water used, I/I would have to average nearly 510 gpd per home. This is a factor of 3.0 over verified domestic flow. If this is indeed accurate, it indicates a major I/I source exists.

Even in the lowest month of measured effluent flow provided (June 2006) I/I would have to be 235 gpd per home to reach the stated figure of 17,836 gallons per day. the I/I factor is still over 1.38, and well in excess of any reasonable amount. A steady dry weather flow of at least 7.2 gpm would need to be present in the lower reaches of the sewer system during overnight periods of little or no domestic flow. The wet weather steady state I/I flow (Example - March 2006) would be 15.6 gpm. The presence of such flows can be readily verified by direct observation during overnight hours, and subsequent observation of manholes progressing upstream in the system can also provide information to help find any severe I/I locations present.

Lagoon Volume:

A separate assessment of lagoon volume was performed in the fall of 2006, a copy of which is attached. That assessment also found the volume to be lower than anticipated, due to probable sludge accumulation. The assessment recommended lagoon modifications to restore the volume needed for a design flow of 12,600 gpd.

Recommendations:

Based on a review of the further data provided from PSC hearing proceedings, the following actions are needed:

1. Obtain the measurement method, type of equipment and calibration data to assure that the flows as measured represent an accurate record of lagoon discharge. If the equipment can be shown to be accurate, the exceptionally high I/I figures are justified. If there is any discrepancy or if no calibration can be verified, further monitoring and new calculations of I/I need to be accomplished.
2. If effluent monitoring records show that accurate calibration was done and that equipment settings were proper for the weir in place, perform on-site observations to identify and isolate the sources of the excessive I/I flow. The amounts calculated from the provided effluent flow are extreme, but if accurate, they indicate the probable presence of problems other than minor joint leaks or other normal I/I sources. If such sources are found, they should be corrected in a timely manner.
3. Lagoon volume has been verified to be low, based on two independent on-site evaluations. Lagoon modifications to restore a 120 day detention time at design domestic flow of 12,600 gpd should be performed.
4. Correction of any major unusual I/I sources and restoration of lagoon volume would certainly allow consideration of the addition of 4 homes as discussed in the original report.

Please let me know what you find out concerning the monitoring done. If you need further assistance we can provide it as required.

Sincerely,

TRABUE, HANSEN & HINSHAW, INC.

Thomas P. Wells, PE
Senior Project Engineer

Lake Carmel Lagoon Volume Confirmation
For
Jason Becker

From available data, the lagoon configuration was assumed to be as follows:

- First cell: 0.70 acre cell, with operating depth of 5 feet.
- Second cell: 0.33 acre cell, with operating depth of 4 to 5 feet.
- Third cell: 0.12 acre cell, with operating depth of 4 feet.
- The total volume in system: approximately 1,779,000 gallons
- Permitted flow: 12,600 gallons per day

Since none of the above figures had been confirmed by actual measurement, it was necessary to visit the site and take accurate soundings and area measurements . Volume was confirmed by soundings across each cell, along with perimeter measurements. Positions of all soundings and points were established using GPS equipment. Soundings were done using a flat-bottom probe to prevent penetration of any seal layer. Some sludge presence beneath the probe base is possible, and the depths noted may be slightly conservative.

The calculated volume, based on confirmed areas and average depths, is 1,108,468 gallons at present. This translates to a maximum flow at 120 days detention time of 9,237 gallons, which is below the permitted figure of 12,600 gallons per day. A total of 1.24 Acre-Feet or 404,027 Gallons in additional volume is needed to provide for 12,600 gpd.

The surface area of the system totals 1.123 Acres. Addition of 1.1 feet of depth can provide the capacity needed. In order to do this, it will be necessary to modify the outlet pipes from each cell, and to raise freeboard accordingly. The length and slope of the entering line should be sufficient to allow this amount of increase.

The freeboard currently available at the cells is as follows:

(Assumed datum: Top of effluent pipe from cell #1 to cell #2 = 100.00)

Cell #1: Water surface elevation = 99.63
Lowest berm elevation = 101.00
Current freeboard = 1.37 feet

Cell #2: Water surface elevation = 99.23
Lowest berm elevation = 100.83
Current freeboard = 1.60 feet

Cell #3: Water surface elevation = 99.16
Lowest berm elevation = 100.75
Current freeboard = 1.59 feet

10 CSR 20-8 requires a 2 foot freeboard. Some earthwork is needed to bring the cells into compliance even without volume increase. However, raising the water surface by 1.1 feet to provide increased volume will result in the following:

Cell #1: Current water surface elevation = 99.63
Desired water surface elevation = 100.73
Lowest Current berm elevation = 101.00
Fill for 2' freeboard = 1.73 feet

Cell #2: Current water surface elevation = 99.23
Desired water surface elevation = 100.33
Lowest current berm elevation = 100.83
Fill for 2' freeboard = 1.50 feet

Cell #3: Current water surface elevation = 99.16
Desired water surface elevation = 100.26
Lowest current berm elevation = 100.75
Fill for 2' freeboard = 1.51 feet

Summary: Verified cell volumes are low, probably due to sludge accumulation and siltation. Modification of the cells to raise level and provide proper volume and freeboard can be done by adjusting the outlet pipe elevations and raising the berm elevations. Placement of new compacted clay fill should be done by first stripping the vegetation from the berm surfaces and then laying up new compacted clay fill in lifts not exceeding 6 inches.

Field activity was conducted by Terry Thurman of Trabue, Hansen & Hinshaw, Inc.

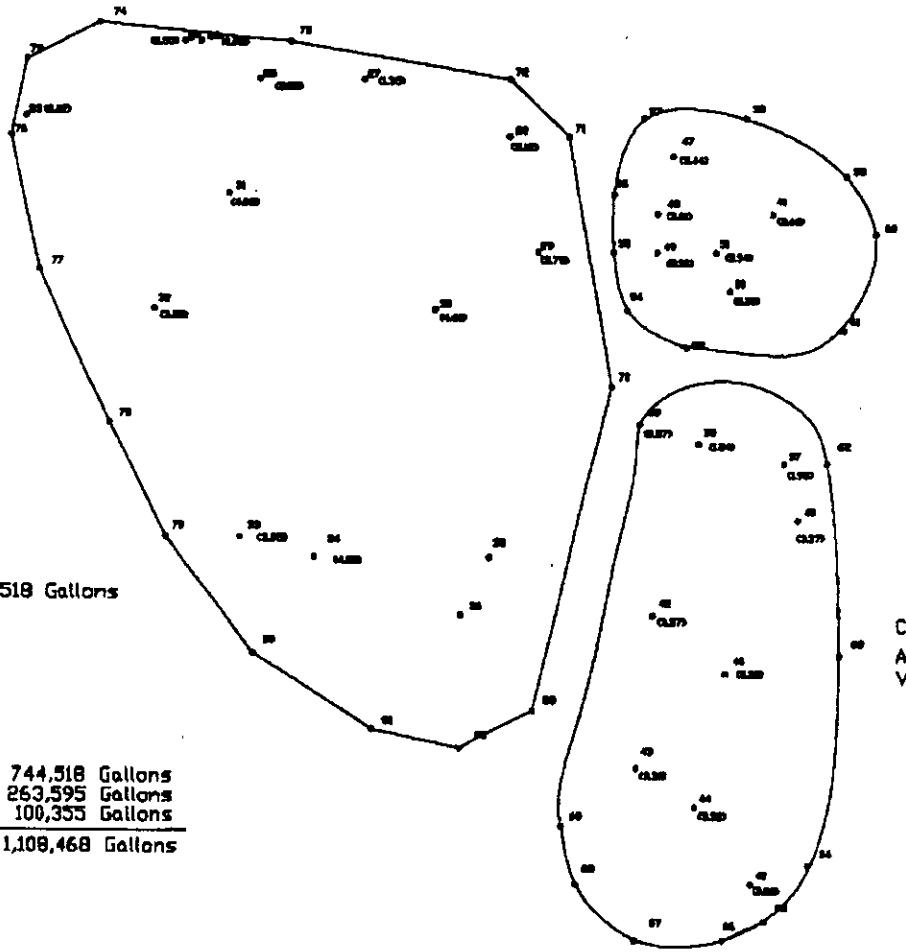
Attached location and depth data and plots were prepared from the field data provided by Mr. Thurman.

I certify that this calculation and report were prepared by me or under my direct supervision, and that I am a duly registered Professional Engineer under the law of the State of Missouri.

STATE OF MISSOURI
THOMAS R. WELLS
E-19964
REGISTERED PROFESSIONAL ENGINEER

Thomas R. Wells, P.E. #19964

11/29/06
Date



CELL #1 Area = 0.726 Acres
Average Depth = 3.147 feet
Volume = 2.285 Acre-Feet = 744,518 Gallons

CELL #3 Area = 0.115 Acres
Average Depth = 2.675 feet
Volume = 0.308 Acre-Feet = 100,355 Gallons

CELL #2 Area = 0.282 Acres
Average Depth = 2.869 feet
Volume = 0.809 Acre-Feet = 263,595 Gallons

744,518 Gallons
263,595 Gallons
100,355 Gallons
1,108,468 Gallons