Exhibit No.:	_____
Issue:	Systems features and capacity Compliance with regulatory and engineering standards
Witness:	David G. Krehbiel
Sponsoring Party:	Folsom Ridge LLC and Big Island Homeowners Water and Sewer Association, Inc.
Case No.:	Case No. WO-2007-0277 **Joined for hearing with Case No. WC-2006-0082**

FOLSOM RIDGE LLC
AND BIG ISLAND HOMEOWNERS WATER AND SEWER ASSOCIATION, INC.

Case No. WO-2007-0277
Joined for hearing with
Case No. WC-2006-0082

DIRECT TESTIMONY

OF

DAVID G. KREHBIEL

Camdenton, Missouri
February, 2007

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the matter of the Application of Folsom Ridge LLC and Big Island Homeowners Water and Sewer Association, Inc. for an order authorizing the transfer and Assignment of Certain Water and Sewer Assets to Big Island Water Company and Big Island Sewer Company, and in connection therewith certain other related transactions.	)	Case No. WO-2007-0277

AFFIDAVIT OF DAVID KREHBIEL

STATE OF MISSOURI)
) ss.
COUNTY OF CAMDEN)

I, David Krehbiel, of lawful age, and being duly sworn, do hereby depose and state:

1. My name is David Krehbiel. I am a consulting engineer for Krehbiel Engineering, Inc.

2. Attached hereto and made a part hereof for all purposes is my direct testimony.

3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct to the best of my personal knowledge, information and belief.

David Krehbiel

Subscribed and sworn to before me, a Notary Public, this 13th day of February, 2007.

Notary Public

CAROLYN A. BRISCOE
Notary Public - Notary Seal
STATE OF MISSOURI
Camden County – Comm.#06425703
My Commission Expires Dec. 21, 2010

DAVID KREHBIEL DIRECT

BACKGROUND

Q. **Please state you name and your business address.**

A. My name is David G. Krehbiel and my business address is 63 Blair Ave., Camdenton, MO 65020.

Q. **By whom are you employed and what is your position?**

A. I am employed by Krehbiel Engineering, Inc. as a Consulting Engineer.

Q. **Please describe your education, professional credentials and previous work experience.**

A. I obtained a Bachelor of Science Degree in Civil Engineering from the University of Missouri, Columbia in 1961, and returned to that institution to earn my Masters of Science in the same field in 1964. From 1961 to 1964 I worked for Krehbiel Construction Company, Inc. as an Engineer and Corporate Secretary. From 1965 to 1969 I acted as President of the Missouri Engineering Corporation. From 1969 to the present I have been employed by Krehbiel Engineering, Inc. of Camdenton either in management capacities or as an engineer with the group. I am licensed by the State of Missouri as a Professional Engineer and Professional Land Surveyor.

Q. **For whom are you testifying in this proceeding?**

A. Folsom Ridge LLC and the Big Island Homeowners Water and Sewer Association, Inc. (the Association)

Q. **What is the purpose of your testimony?**

A. I will be covering several topics in my testimony. First, I will describe for the Commission the role of my engineering firm in the design of the water and sewer systems serving Big Island at the Lake of the Ozarks. I will explain the features of each system and the layout of each at this time. I will also advise the Commission of the expected additions and improvements to the system that are either planned or underway at this time.

DESIGN AND FEATURES OF THE WATER AND SEWER SYSTEMS.

Q. **Mr. Krehbiel, when was your firm retained by Folsom Ridge LLC in connection with the water and sewer systems for the Island.**

A. We submitted a letter of engagement for our services to Folsom Ridge on February 19, 2004 to provide consulting engineering services regarding the separation of the water distribution lines and sewer collection lines. Ms. Barb Brunk is expected to testify about the circumstances involving this event but basically, Folsom Ridge was required to abandon an existing water line that had been installed too closely to a wastewater collection line. Our firm was hired at the time the replacement line was under consideration. Krehbiel Engineering has

also been involved in the design and construction of extensions and improvements to the systems.

Q. **Please explain the design and components of the water system.**

A. The water system is comprised of the following components: a water supply well, three (3) ground storage tanks, a booster pumping system and distribution system. The well has an estimated capacity of 140 gpm. This is adequate to serve 320 residential customers. The pumping equipment delivers a flow of approximately 100 gpm, and will have to be upgraded to supply 140 gpm. The ground storage tanks were designed to serve 80 residential customers. They are in the process of being replaced with a standpipe designed to serve 320 residential customers. The distribution system is adequately sized to serve 320 residential customers.

Q. **Please explain the design and components of the sewer system.**

A. The sewer system is comprised of a septic tank effluent pumping (STEP) collection system and a recirculating sand filter treatment facility. Wastewater from each home is treated at each individual home with a septic tank. The gray water is pumped from the septic tanks through small diameter pipes to the recirculating sand filter where the water is treated to meet Missouri Department of Natural Resources (DNR) discharge limits. The original treatment facility was designed to treat 22,525 gallons per day. The addition currently under construction will provide for treatment of an additional flow of 41,625 gallons per day.

Q. **Have there been any improvements or additions to the systems since they were first constructed and installed. Please describe them for the Commission and the reasons for each.**

A. For reference purposes, the water system projects for Big Island have been categorized in the following Phases:

Phase I – Original system – supply – storage – distribution system – East side

Phase II – Completion of distribution system loop – West side

Phase III – Off island extension

Phase IV – First section of duplexes and triplexes

Phase V – Storage upgrade

Between Phases II and III the project to relocate the waterline to establish a 10 feet separation between the water and sewer line intervened. As I said earlier, Krehbiel Engineering was the engineer for the separation project and also for Phases IV and V.

Krehbiel Engineering was the consultant for the off island sewer line extension, the upgrade of the wastewater treatment facility and the sewer line extension to serve the first section of duplexes and triplexes.

The water and sewer line extensions were to serve additional customers.

The wastewater treatment facility and water storage upgrade are to provide for additional capacity for each system.

Q. **Did you coordinate the design and permitting of these improvements with DNR.**

A. Yes, I did.

Q. **Did your firm inspect the installation of the improvements to the systems?**

A. Our firm provided observation services for the relocation of the waterline in accordance with a settlement agreement reached between Folsom Ridge and DNR, and the extension of water and sewer lines and the upgrade to the wastewater treatment facility.

Q. **Have the improvements been inspected by DNR and have any improvements been rejected by DNR.**

A. To the best of my knowledge, the improvements have been inspected by DNR and no improvements have been rejected by DNR.

Q. **Mr. Ben Pugh has raised in his complaint concerns about the relocated water main and its position below a sewer main on an incline. Does the location of the sewer main pose a risk of contamination of the water supply?**

A. No, there is no risk to public health because of the location of these lines. The relocation of the water main is in full compliance with the regulations of DNR and otherwise in accord with applicable engineering standards. The required separation of the water line and the sewer line has been achieved. To accept what seems to be Mr. Pugh's logic, that no water line should be installed below a sewer line, is simply not practical in the field, --where topography, soil or rock conditions must be considered--and both DNR and professional engineers understand this.

Q. **Mr. Pugh has also raised a concern that the minimum required distance between the public water supply and the wastewater treatment plant for these two systems has not been met. He claims that the Big Island facilities are not in compliance with applicable regulations. Were the Big Island well and the wastewater treatment plant designed, constructed and separated in accordance with regulation?**

A. Yes. Although I was not the engineer when the well was drilled and the first phase of the treatment plant was constructed, at the time of the design, construction, and permitting of the Big Island water and wastewater systems, the applicable DNR regulation 10 CSR 20-8.020 (11) (A) 3 provided:

> Wastewater treatment facilities shall not be located within one hundred feet (100'), and preferably three hundred feet (300') of any well or water supply structure.

To the best of my knowledge, this regulation is still in effect. I have attached a copy to my testimony as Krehbiel Schedule 1. The well and the wastewater treatment system on Big Island are separated by more than 100 feet. In fact, the well structure and the discharge point for the treatment plant effluent are separated by more than 300 feet. The facilities are in compliance with the DNR Design Guide and again, are otherwise compliant with applicable engineering standards.

Q. **Have the water and sewer systems subject to transfer in this case been inspected by Big Island Water Company, Inc. and Big Island Sewer Company, Inc. (the 393 Companies)?**

A. Yes, a walk through and inspection of the wastewater treatment plant, the well and pumping facilities, and the mains, valves and other equipment for each system was conducted on January 10, 2007. I joined Ms. Pam Holstead and Mr. Gail Snyder representing the 393 Companies, Mr. Jim Crowder who works with Folsom Ridge, Mr. Chad Stout and Mr. Jim Heppler of LOWS, who is the current operator of the systems, and Kenny Carroll, the installation contractor for these systems for the walk through and inspection.

Q. **As a result of that walk through and inspection were any actions taken with respect to preparing the systems for transfer.**

A. There were none that required my services. I understand that LOWS may have performed some minor repairs or improvements that were requested by Ms.

Holstead and the others from the 393 Companies. Mr. McDuffey will address this in his separate testimony.

Q. **Does this conclude your direct testimony?**

A. Yes.

basin. The basin must be designed to drain back into the wet well or collection system as the influent flow recedes;

B. A portable pump capable of being connected to the pumping station or a portable generator; or

C. Storage of excess flow in trunk line sewers provided sufficient capacity for twenty-four (24)-hour storage of peak flows is available and flooding of basements will not occur; and

.10. Alarm systems. Alarm systems shall be provided for all pumping stations. The alarm shall be activated in cases of power failure, pump failure or any cause of high water in the wet well. If possible, the alarm should be telemetered to a location that is manned twenty-four (24) hours per day. Audio-visual alarms with self-contained power supply shall be provided as a minimum. A sign shall be posted at each pump station in a clearly visible location, listing a telephone number to be called if the alarm is seen or heard; and

11. Instructions and equipment. Sewage pumping stations and their operators should be supplied with a complete set of operational instructions including emergency procedures, maintenance schedules, tools and spare parts as may be necessary.

(C) Force Mains. Design considerations for force mains are as follows:

1. Velocity. At design average flow, a cleansing velocity of at least two feet (2') per second shall be maintained;

2. Size. In general, three-inch (3") diameter pipe shall be the smallest used for raw sewage force mains. However, use of grinder pumps or similar equipment may allow use of smaller pipe. These instances will be reviewed on an individual basis. Piping materials may be pressure pipe normally used for conveying potable water, however the effects of surges and pressures within the system should be considered in the selection of the piping material. As a minimum SDR 21 PVC pressure pipe or its equivalent should be used. The force main and fittings including reaction blocking shall be designed to withstand normal pressure and pressure surges (water hammer);

3. Air relief valves. An automatic air relief valve shall be placed at high points in the force main to prevent air locking. However, consideration will be given to alternate proposals with proper substantiation;

4. Termination. Force mains should enter the gravity sewer system at a point no more than two feet (2') above the flow line of the receiving manhole; and

5. Water line and sewage force main separation. There shall be at least a ten-foot (10') horizontal separation between water lines and sewage force mains. There shall be an eighteen-inch (18") vertical separation at crossings as required in paragraph (9)(A)4. of this rule. Only in extenuating circumstances will deviations be allowed to these minimum separation distances.

(11) Small Wastewater Treatment Works. Treatment the extent of which will depend on 10 CSR 20-7.015 Effluent Regulations and 10 CSR 20-7.031 Water Quality Standards shall be provided in connection with all installations. Secondary treatment shall be the minimum acceptable degree of treatment. Wastewater treatment plants should be designed to provide for the estimated population and flows to be fifteen (15) or twenty (20) years hence. The following items shall be taken into consideration in planning sewage treatment works:

(A) Plant Location. In general to avoid local objections, the wastewater treatment facilities should be located as far as is practical from any present built-up area or any area which will develop within a reasonable future period. No sewage treatment facility shall be located closer than fifty feet (50') to any dwelling or establishment.

1. The treatment facility shall be located above the twenty-five (25)-year flood level.

2. An all-weather access road shall be provided from a public right-of-way to every treatment facility. Sufficient room shall be provided at the site to permit turning vehicles around. In determining the type of roadway and method of construction, consideration shall be given to the types of vehicles and equipment necessary to maintain and operate the facility. If access is required for heavy sludge trucks, the road must be of more substantial construction than one (1) used only for access of mowing equipment or other light vehicles. Gravel roads to be used by heavy vehicles shall have a minimum depth of six inches (6") of crushed rock material with a bottom layer of four inches (4") of two to three inch (2–3") size material and a top layer two inches (2") thick of three-fourths inch (3/4") size material. In general, the grade of the access road shall not exceed twelve percent (12%).

3. Wastewater treatment facilities shall not be located within one hundred feet (100'), and preferably three hundred feet (300') of any well or water supply structure;

(B) Design.

1. Type of treatment. Careful consideration should be given to the type of treatment before making a final decision. A few of the important factors to consider are the location and topography of the plant site; character and quantity of the wastes to be treated; operating costs and the probable type of supervision and maintenance the plant will receive. Particular care must be used in choosing methods of treatment for seasonal use developments, such as parks and campgrounds, and for developments which produce waste loads which fluctuate between wide extremes from day-to-day. The use of activated sludge type plants is generally not recommended for these developments because a high degree of operating efficiency for these plants is dependent in part upon a relatively stable loading condition. Where all use of the development is confined to a specific season, consideration should be given to designing lagoon systems on the draw-and-fill concept, retaining all wastewaters generated during the season of use and discharging them after an appropriate period during the off season or utilizing the stored water for irrigation.

2. New processes, methods and equipment. The policy of the department is to encourage rather than obstruct the development of new methods and equipment for the treatment of sewage wastes. The lack of inclusion in these standards of some types of wastewater treatment processes or equipment should not be construed as precluding their use. The department may approve other types of wastewater treatment processes or equipment under the following conditions:

A. The operational reliability and effectiveness of the process or device shall have been demonstrated with a suitably sized prototype unit operating at its design load conditions to the extent required by the department; and

B. The department may require test results and engineering evaluations demonstrating the efficiency of the processes or equipment. The department may also require that appropriate testing be conducted and evaluations, other than those employed by the manufacturer or developer, be made under the supervision of a competent process engineer.

3. Sewage flow and strength. Minimum design loadings for all treatment processes shall be calculated using the following table unless the engineer can document the validity of lower per capita figures based on actual waste strength and/or flow data from the development to be served or from similar developments.

Table 1

Type of Establishment	Pounds BOD per person (unless otherwise noted)	Gallons per day per person*
Employee Sanitary Waste	.05	15