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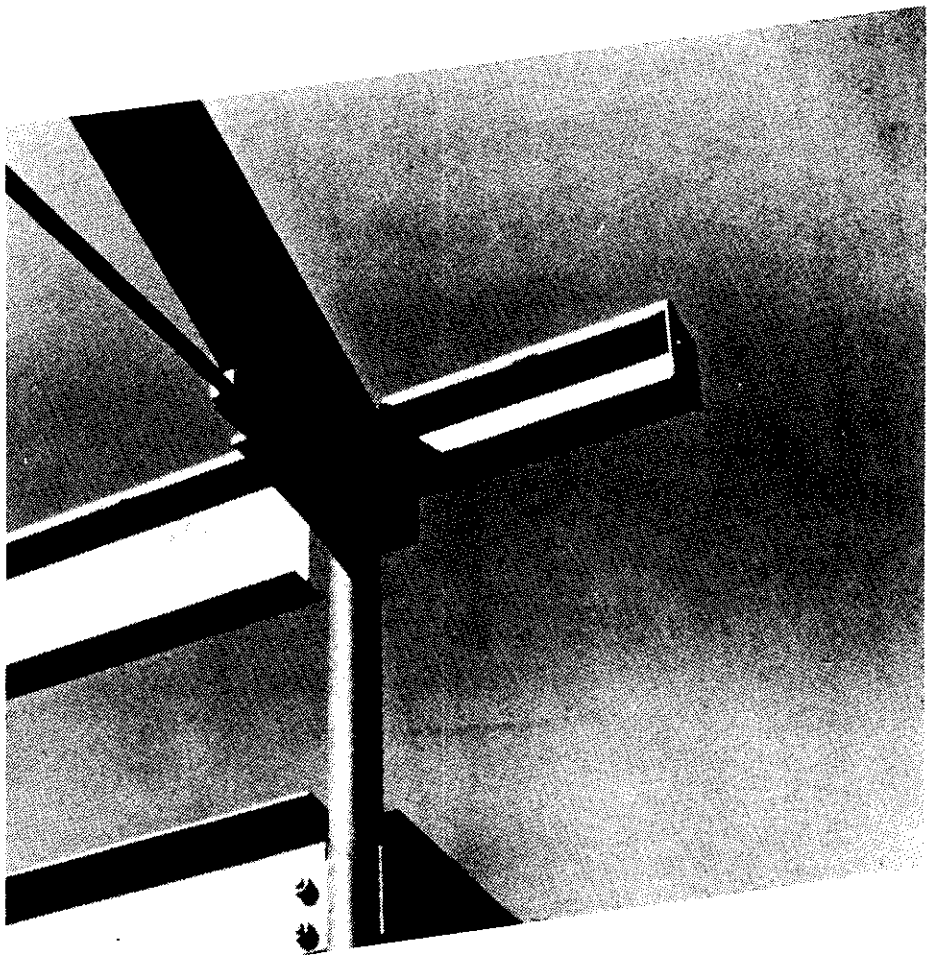
Groundwater Quality Monitoring For Graywater Systems — Part II



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John Zoltek, Jr.

School of Building Construction
University of Florida
1985

Report

to

Florida Department of Education

Groundwater Quality Monitoring

for

Graywater Systems

Harold Holland, Principal Investigator

John Zoltek, Jr., Co-Principal Investigator

School of Building Construction

College of Architecture

University of Florida

1985

EXECUTIVE SUMMARY

PURPOSE: The purpose of this investigation is to provide a standard operating procedure to install test wells in the drain field of Graywater Systems, to provide a bibliography of library research that is pertinent to the study of Graywater Systems, to provide a synopsis of project coordination on the previous Graywater project, and to provide a statement on the need of future research.

FINDINGS: Five test wells are to be installed at each site, one at the center of the Graywater drainfield and four located 50 feet from the drainfield with a central angle of 90° between them. The center well will measure the concentration of contaminants in the drain field. The upstream wells will indicate the contaminants in the natural groundwater while the downstream wells will measure the spread of the contaminants through the groundwater. The test wells are to be 4" PVC pipe with 24" well screens located below the water table. A bibliography pertinent to the study is provided in Appendix B. The previous Graywater Study failed because of lack of support of the homebuilders.

CONCLUSIONS: A fully funded pilot study not depending on promised donations would determine if a full scale study needs to be undertaken. Methods of scientifically determining the quantity and quality of graywater and its effects on groundwater are available.

CHAPTER ONE

INTRODUCTION

A Graywater Study Project was initiated in August 1982 by the Florida Home Builders Association and the Department of Health and Rehabilitative Services as a result of the restrictions being put on septic tank installations in certain parts of Florida. Due to the slow expansion of wastewater treatment plants some localities were not issuing building permits because there was no way of treating the resulting wastewater flow. Poor soil conditions or dense land development precluded the use of conventional septic tanks. It was felt that a graywater system providing a separate drainage path for laundry and sink discharge to an onsite septic tank would decrease the load to a wastewater treatment plant without overly stressing the soil treatment capabilities. The toilet and kitchen sink drainage are the largest mass organic loading coming from a house and they would still be treated at the wastewater plant.

At the beginning of the project time was of the essence. The state legislature required the results in order to determine if the use of graywater systems were beneficial and safe so a state law authorizing graywater systems could be implemented. In September 1982 a University of Florida Proposal was submitted to the Building Construction Industry Advisory Committee and subsequently approved. The approximate two year studies consisted of $53,330 to be supplied via the Building Construction Industry Advisory Committee (BCIAC) to the School of Building

Construction, University of Florida, for the University's role in the project. The study also was to have donated, by local homebuilders, $107,514 for field work that consisted of installing graywater systems, drilling monitor wells, and collecting and testing samples. The University's role in this project was to serve as advisor of field work siting, drilling, sampling and testing, as well as evaluating data and writing the final report.

Because the Florida homebuilders were unable to provide any of the donated $107,514 in the project it was impossible to proceed to the actual installation of Graywater Systems and to monitor them. The Principal Investigator and Dr. Zoltek, the Co-Principal Investigator, had, in fact, established procedures and had accomplished a significant milestone by determining what would be required in order that a test would be accepted by all interested parties.

A revised proposal was submitted to the Building Construction Industry Advisory Committee revising the scope of the project which was to document the agreements that had been made and the procedures that would need to be followed in future research and approve funds for the production of a final report. This report is the final report which will conclude DOE Contract Number 083-100 and the revised DOE Contract Number 085-125.

CHAPTER TWO

SITE DEVELOPMENT

During a October 1982 meeting in Tallahassee between the Principal and Co-Investigators and the Florida Home Builders Association the groundwork was laid for the project. During that meeting it was determined that the Department of Health & Rehabilitative Services (HRS) was to develop the methods of installing test wells and sampling. However, in a December 7, 1982 letter the Principal Investigator was notified that due to a shortage of HRS manpower, the University was to handle this aspect of the project. After many phone calls and discussions a "Standard Operating Procedure" was written and is described in Chapter Three.

At this point it became apparent that unless home sites were quickly selected the project would be delayed. A flyer, shown in Appendix A, was prepared by the Florida Home Builders Association (FHBA) and circulated among state home builders asking for volunteers in the graywater project. During this time period University Personnel formulated a tentative sampling technique and were ready to test it on a site. Once the sampling technique was "debugged" it was the intent to make a video tape of the procedure for distribution to the people who would actually do the sampling.

After many phone calls and discussions between University Personnel and the various involved agencies it became apparent that there was a good probability that no sites would be established. During a "Gray-

water Meeting" held at the University on 15 February 1984 it was concluded that the project still could be finished if sites were selected by May 1984. As of this writing no sites have been established.

CHAPTER THREE

GRAYWATER SYSTEMS RESEARCH

PROCEDURE FOR LOCATING AND INSTALLING MONITORING WELLS

LOCATION: Since it is extremely difficult to establish the direction of groundwater flow, a series of four wells will be located at 90° around the drainfield with one well at the center of the drainfield. The four peripheral wells are ideally to be located on quadrant lines (north-south-east-west) spaced 50 feet from the center well (drainfield well) or at the edge of the property line if the property line is less than 50' from the center well. In this manner a clean and a drainfield sample will be assured. Figure 1 is a sketch of the well's location. The Graywater systems for this study should be limited to sewered areas only, eliminating the effects of septic tank effluent on the groundwater.

DEPTH: A very crude approximation of the high water depth can be obtained from the county soil sewery reports. However, it is felt that only actual drilling will give accurate data. Each well will be drilled approximately three feet below the existing groundwater table and have a two foot screen at the bottom. If the groundwater drops or rises significantly, more wells may need to be drilled to collect interface samples. It is important to note that it is virtually impossible to predict with any degree of certainty groundwater and soil conditions at each site, and therefore location and sampling procedures must be adapted to each location as needs arise. Figure 2 is a sketch of the well profiles. At this point it

should be noted that only one well is to be drilled at each sampling location rather than the two initially proposed. This will minimize the drilling expenses at most sites, since it is felt that in the majority of cases there will be no need for further drilling.

CONSTRUCTION OF MONITORING WELLS: Monitoring wells constructed for this research project will be designed to sample groundwater in unconsolidated formations less than 10 feet beneath the ground surface. Also, since the test parameters in this study are not particularly sensitive to the materials used in constructing the wells, well casings can be constructed of PVC or plastic pipe without jeopardizing sample quality.

The diameter of the casing should be just sufficient to allow the sampling tool (bailer or pump) to be lowered into the well to the desired depth. A 4" diameter casing is standard for this project. The diameter of the hole into which the casing is placed must be at least sufficiently large for the casing to fit and in many cases must be at least 2 inches larger to permit placement of grout seal around the outside of the casing. A water tight seal (grout or clay) from the ground surface to the water table is a must to prevent direct surface water contamination of the sampling point. See Figure 2. The wells must remain capped when not being sampled. Method of installation (posthole diggers, auger, jetting, etc.) is to be determined at each site.

The intake portion of monitoring wells must be properly constructed and developed to allow easy flow of water into the well while at the same time preventing natural soil formation material from entering the well. Commercially made well screens attached to the bottom of the casing or

narrow sawed slots (in the lower 24" of the casing) may be used to allow water to flow into the casing.

DEVELOPMENT OF WELLS: Wells are to be constructed to sample the upper 36" of the saturated zone of the ground water table (see Figure 2). The need for additional wells will be determined by examining the monthly water table fluctuations.

CHAPTER FOUR

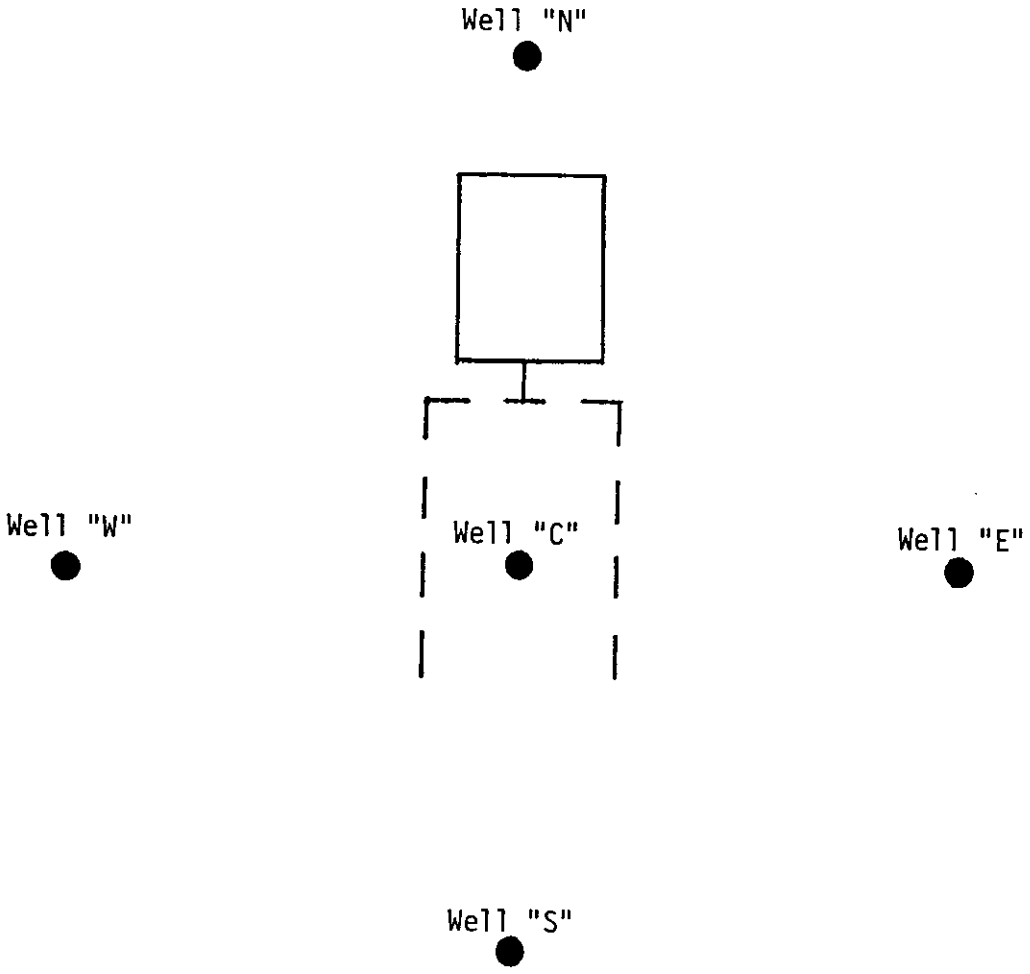
CONCLUSIONS AND FUTURE WORK

After reviewing the existing literature it is clear there exists the need for more work in Florida on the usefulness of a graywater system for private homes. The main problem appears to be to get private homebuilders to absorb the cost and to bother with the installation of these systems for experimentation. Dual piping, careful installation of test sites and sampling would be the biggest stumbling blocks for contractors. It is unrealistic to expect private contractors to be enthusiastically involved with these experimental systems at their own expense. It is painfully clear the reason the original project did not succeed in its goals was nonexistent contractor participation.

Future work in this area must first establish the best way to install a graywater system. Only after the use of a thoroughly tested system can a good design be establisned. This necessitates the construction of a pilot project close to the contracting researchers for monitoring and study. Once a system that works well is designed, operated and tested, then private contractor interest can be expected, probably with a need for financial assistance to the contractor. It is recommended a pilot project be funded that establishes prototype installations for its first phase. Once the problems associated with this new system are defined and solved, the second phase consisting of substantial field work at different sites can be initiated.

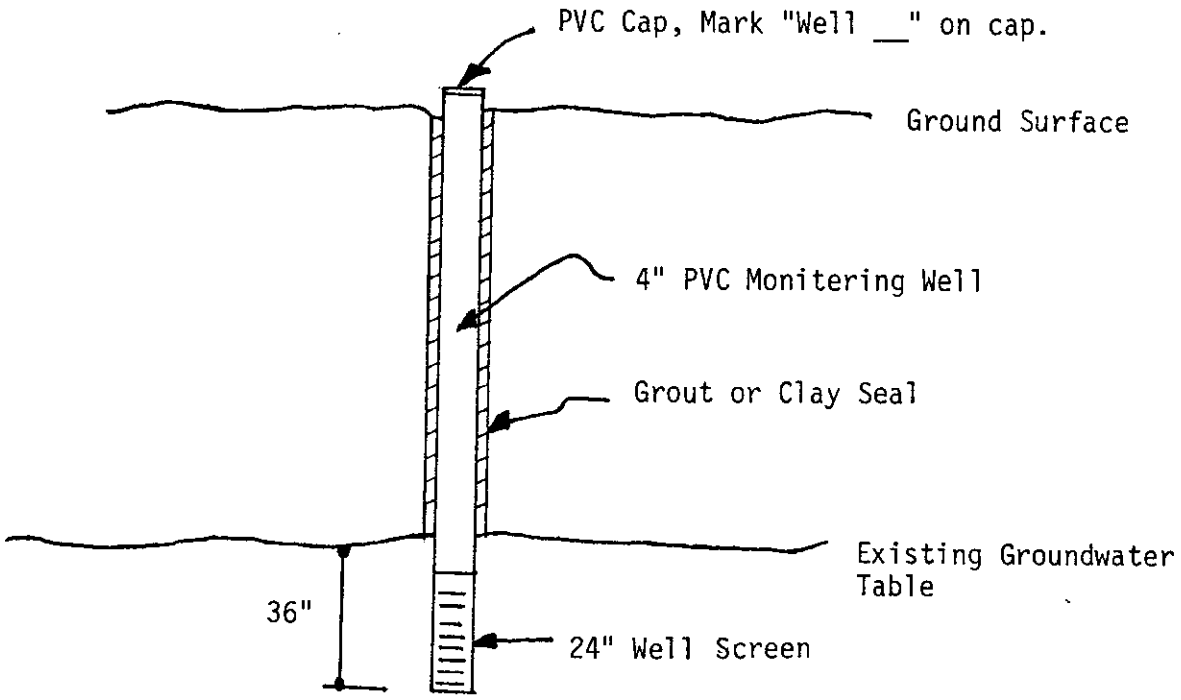
A bibliography is provided as Appendix B of this report.

Figure 1



Note: Well "N" will be the north well, etc. Well "C" to well "N", "E", "S", and "W" 50'. It is not necessary that tank and drainfield be oriented in any direction.

Figure 2


PVC Cap, Mark "Well __" on cap.
Ground Surface
4" PVC Monitering Well
Grout or Clay Seal
Existing Groundwater Table
36"
24" Well Screen

APPENDICES

APPENDIX A

FLORIDA HOMEBUILDERS FLYER

We're Looking for at Least 27 Volunteers for . . .

OPERATION GRAYWATER:

Last year, the Florida Home Builders Association was instrumental in passing statewide legislation allowing for the experimental use of graywater disposal systems. Such systems treat non-pollutant waters (from tubs, showers, laundries and sinks) onsite and free up needed capacity in central sewer plants.

Now, the Legislature is asking the building industry to prove that graywater systems do not pollute groundwater.

That's why we need your help . . .and we need it now.

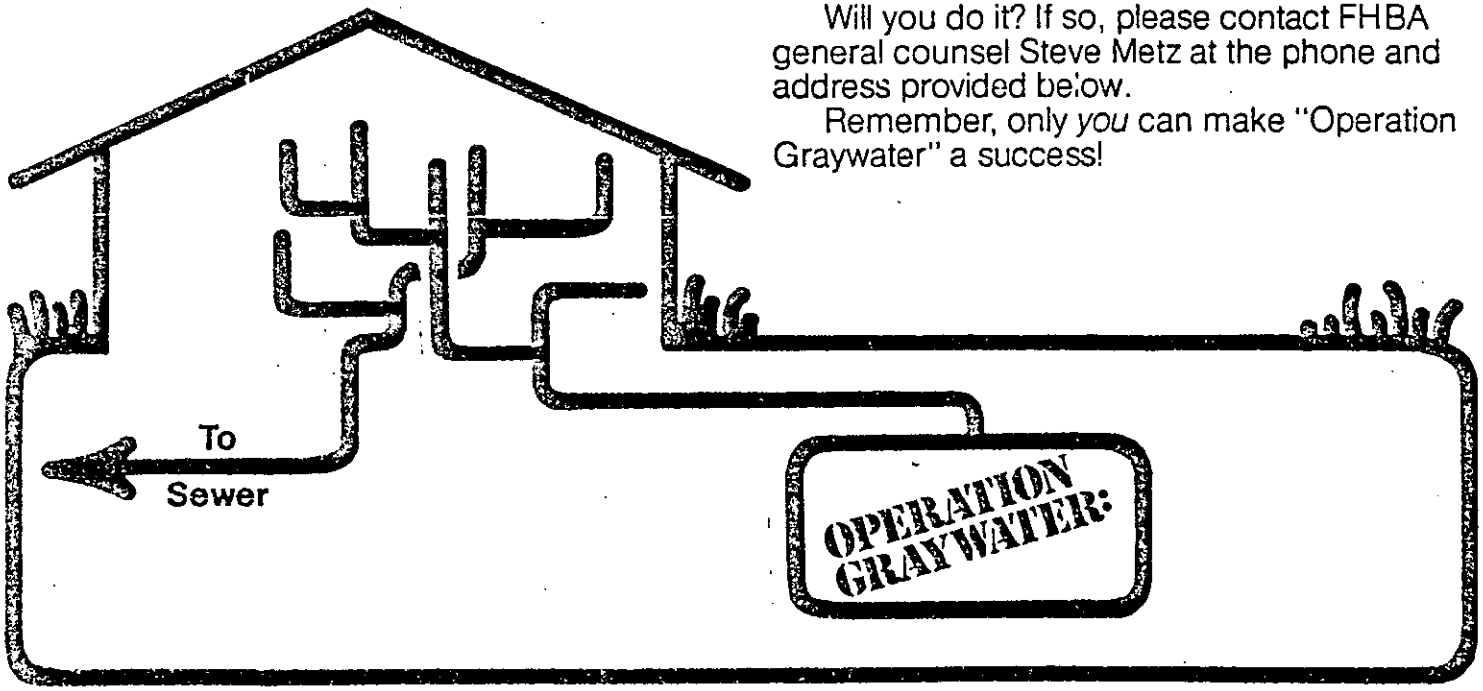
We need at least one builder in each of our 27 local Home Builder Associations to volunteer to install a graywater system and four monitor wells that can be checked periodically for about six months. You will need to make sure your housing consumer agrees to these checks.

The total cost of installing the system and the graywater wells will be $350 to $500 but you'll get plenty of help from FHBA, technical experts and members of the Florida Septic Tank Association . . .and you'll be helping the industry.

Also, each participant will receive widespread industry recognition, including a commemorative plaque at a special ceremony with state and local officials.

Will you do it? If so, please contact FHBA general counsel Steve Metz at the phone and address provided below.

Remember, only *you* can make "Operation Graywater" a success!



Contact Steve Metz, *FHBA General Counsel*
Florida Home Builders Association
Call collect 904-224-4316 or write P.O. Box 1259, Tallahassee, Florida 32302

APPENDIX B

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