Raba Kistner

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Project No. ASR08-059-00
November 10, 2008

Mr. Edward Pape
San Antonio Housing Authority
459 Precious Drive
San Antonio, Texas 78237

RE: Consulting Engineering Services
Residential Study
138 Villa Arboles
San Antonio, Texas

Dear Mr. Pape:

Raba-Kistner Consultants, Inc. (R-K) is pleased to submit this document of our engineering services provided for the above referenced residence. It is our understanding that this work is being performed to assess the general physical condition of the above referenced residence and to specific items that may be influencing the performance of this monolithic concrete foundation and wood frame. To accomplish this objective we conducted visual observations of the foundation along with relative floor elevation measurements and some non-destructive testing of the reinforced concrete beam and slab on ground foundation. This document presents our observations and findings in accordance with our approved scope of work presented in **R-K** proposal No. PSR08-100-00, dated June 16, 2008, as well as the amended agreement, **R-K** Proposal No. PSR08-095-00A, dated August 6, 2008.

INFORMATION REVIEW

Prior to our on-site observation, **R-K** was provided with the following information from construction documents for the San Antonio Housing Authority Mirasol Hope VI Revitalization Program Single Family Housing:

- Architectural Floor Plans and Elevations, Site Plans, Wall Sections, Soffit, Fascia, and Door Details, Door/Window Schedule, Electrical and Roof Plans prepared by Bartholomew & Company of San Antonio, Texas, dated between February 19, 1999 and February 28, 2002, Sheets A100 to A-103; A-200 to A-220; A-300, A-301, A-303, and A-304; A-400, A-401, and ELEC-1, 2, and 3;
- A Foundation Plan prepared by Unitech Consulting Engineers, Inc., of San Antonio, Texas, dated August 23, 2000, marked sheet S-1;
- MEP Drawings prepared by INCE Distributing of San Antonio, Texas, sheets HVAC-1, 2, and 3, (not dated);
- Plumbing Drawings prepared by Ashley Plumbing of San Antonio, Texas, sheets MECH-1, 2, and 3, (not dated); and
- Truss/Wall Panel Design Drawings prepared by Structural Lumber Company of San Antonio, Texas, sheets RF-1 to RF-9 (not dated).
- Geotechnical Report prepared by Nova Consulting Group, Inc. of San Antonio, Texas, dated September 30, 1999, pages 1 through 14 and Appendices A-1 through A-6, Appendix B field program with Boring Logs B-1 through B-30 and Appendix C Laboratory Testing.

- Inspection Report page 2 of 9 prepared by Amerispec Home Inspection Service, (not dated).

LIMITATIONS

The information provided in this document is directed to the Client, San Antonio Housing Authority, and may not contain information for others and/or for other uses. Construction documents were provided to us by our Client prior to our site visit; however, a set of the "as-built" construction drawings was not available. Some of our observations were limited due to building finishes, room contents, etc. Additional conditions may exist or may have existed at the time of our observations. This document includes observation information as obtained by **R-K** and from various other sources. Our comments and opinions are based upon that data. If information provided by others is incorrect, or if additional information becomes available, **R-K** may need to revise the comments and opinions presented in this document. Illustrative photographs were taken by **R-K** marked 1 through 18 of 18 and are presented in Attachment B.

BACKGROUND INFORMATION

During a meeting held at the home on June 18, 2008 between Mr. Matt Michulka with the San Antonio Housing Authority, Mr. Jesse H. Aguilar, P.E., and Mr. Ignacio Vivanco, E.I.T. of **R-K**, it is our understanding that this home serves as a model home for the development. At the time of our site visit, repairs were being performed to this residence to include:

- The hot water heater and the heating, ventilation, and air-conditioning (HVAC) units were being replaced.
- The roof and roof vents were being repaired.
- Replacing the horizontal sliding windows with new windows and flashing and sealing wall penetrations.
- The front and right side exterior doors were replaced.

GENERAL INFORMATION

The front, back, left, and right directions used in this document are determined by standing on the street facing the front door of the home. The home is a single family, one-story wood framed dwelling supported on a reinforced concrete beam and slab-on-ground "floating" foundation. The exterior wood frame of the home is covered with fiber cement board siding on the front, back, left, and right sides of the home. The wall framing is supporting a wood roof manufactured truss framing system with a composition shingle roof covering. The framing of the perimeter walls consists of standard pressure treated 2x4 wood studs spaced about 16-inches on center. The roof framing system has prefabricated wood trusses spaced about 24-inches on center.

The main living area of the home is comprised of the living room, kitchen, utility closet, master bedroom and closet, master bathroom, hallway bathroom, right-middle bedroom, right-rear bedroom, and garage. The concrete floor slab is covered with carpet, with the exception of the front entry, kitchen, utility closet, and both bathrooms, which are covered with a vinyl floor system. The garage and covered entry porch are exposed concrete. Views of the outside of the residence as it exists during our on-site visit are shown on Photographs 1 through 4 included in Attachment B of this document.

EXTERIOR OBSERVATIONS

While walking around the exterior of the home during our site visit held on June 18, 2008, we noted the following:

Front

- The surface drainage is considered to be good along the front of the home as shown on Photograph 1.
- A portion of the concrete driveway slab has been replaced as shown on Photograph 5.
- The expansion joint between the front concrete sidewalk and the grade beam along the left side of the garage has been previously resealed.
- There is some drying of the soils along the perimeter beam as shown on Photograph 6.
- There is a slight sag in the gutter where it extends along the right side garage eave as shown on Photograph 7.

Left

- The former temperature/pressure relief drain is located about 4-1/2 feet from the back edge of the stoop as shown on Photograph 8.
- The PVC condensate drain line exits the foundation about 4 feet from the back edge of the concrete stoop and extends about 5-ft into the right yard as shown on Photograph 8.
- There is some drying of the soils along the perimeter beam as shown on Photograph 9.
- The surface drainage is considered to be good along the right side of the home as shown on Photograph 2, with the exception of a low spot between the grade beam and the front edge of the concrete stoop as shown on Photograph 10.
- A drip line has formed on the ground surface below the edge of the roof eave.
- The fiber board between the grade beam and the concrete stoop has collapsed into the joint.

Back

- The surface drainage is considered to be poor with the ground surface sloping toward the foundation as shown on Photograph 11. There is a slight swale that extends from left to right across the yard; however it is not well defined.
- The coil and fan unit is located adjacent to the perimeter grade beam.
- There is some drying of the soils along the perimeter beam as shown on Photographs 12 and 13.
- There is a 2-ft diameter tree stump located about 15-ft to the rear of the right-rear corner of the home as shown on Photograph 14.
- A drip line has formed on the ground surface below the edge of the roof eave.

Right

- The surface drainage is considered to be good along the right side of the home as shown on Photograph 15.
- There are no signs of cracking along the perimeter grade beam.
- There is some drying of the soils along the perimeter beam as shown on Photograph 16.

INTERIOR OBSERVATIONS

While performing visual observations of the interior of the home, the following observations were noted:

Entry

- No signs of cracking or separations were noted.

Living Room

- No signs of cracking or separations were noted.

Kitchen

- No signs of cracking or separations were noted.

Utility Closet

- No signs of cracking or separations were noted.

Garage

- Some hairline cracks were observed along the surface of the garage slab.

Master Bedroom

- No signs of cracking or separations were noted.

Master Bedroom Closet

- No signs of cracking or separations were noted.

Master Bathroom

- No signs of cracking or separations were noted.

Hallway

- No signs of cracking or separations were noted.

Hallway Bathroom

- There is a separation at the top front corner of the doorway trim that varies up to about 0.06-inch in width as shown on Photographs 17 and 18.

Right-Middle Bedroom (Bedroom No. 3)

- No signs of cracking or separations were noted.

Right-Rear Bedroom (Bedroom No. 2)

- No signs of cracking or separations were noted.

RELATIVE FLOOR ELEVATIONS

Relative floor elevations were conducted by **R-K** using elevation measuring equipment placed at various locations on the floor surfaces throughout the home during a site visit on June 23, 2008, after the HVAC and window repairs had been completed. Presented on Figure 2 of Attachment A are the relative floor elevation measurement values to the nearest hundredth of a foot. The relative floor elevation measurements were tied to a temporary reference benchmark located on the concrete covered entry porch slab. To facilitate the relative floor elevation survey and for the purposes of this document an arbitrary value of 4-ft has been assigned to the reference benchmark. All other floor elevation measurements shown on Figure 2 have this assigned value of 4-ft.

Presented on Figure 2, is the highest relative floor elevation measurement on the carpet surface in the master bedroom at elevation 5.00 feet, recorded near the left-rear corner of the bedroom. The lowest measured elevation on carpet surface was recorded in the living room at elevation 4.88 feet. The maximum floor differential between the highest and lowest elevation on carpet was determined to be 0.12 feet or about 1.44 inches over about a 36 foot distance (about 1/4-inch over a 6'-3" distance).

The garage floor slab was to be built with a 2-inch slope from back to front. Our measurements identify about 3/4-inch slope from the overhead garage door to the back partition wall demonstrating some vertical uplift along the front-right side of the garage assuming the slope was from back-to-front following concrete placement.

GENERAL FOUNDATION INFORMATION

Using a Schmidt rebound hammer, **R-K** determined the in-place relative compressive strength of the surface concrete on the garage floor slab and concrete covered porch to be in excess of 3,000 psi. Additionally, **R-K** determined the location and spacing of the slab reinforcing steel using a reinforcing steel detector. The spacing of the reinforcing bars in the garage floor slab varies from about 17 to 18 inches on center each way in front to back and left to right directions. No elevation measurements were made on the monolithic covered entry porch.

SOILS INFORMATION

Information provided in the geotechnical report prepared by Nova Consulting Group, Inc., it is our understanding that the soils conditions encountered within this site consist of a 6-inches to 2-foot thick layer of surficial fill materials overlying highly plastic natural clay soils. Further, we understand that the Potential Vertical Rise (PVR) values calculated for this area range in magnitude of 6-inches. It should be noted that information regarding the site preparation of the foundation footprint was not available at the time of the preparation of this document.

During a subsequent site visit performed on October 27, 2008, we obtained two soil samples from two locations adjacent to the perimeter grade beam for physical characteristic testing (Atterberg Limits testing) using a 3-inch diameter hand auger to collect soils at a depth below the grass from 12 to 27-inches at about the depth the concrete foundation is judged to be bearing upon. Sample S-1 was obtained along the right side of the foundation near the right-front living room window, about 1-1/2 ft from the foundation and can be described as highly plastic dark brown clay with traces of roots and gravel. Sample S-2 was recovered along the left side of the foundation near the Master Bedroom window, about 1-1/2 ft from the foundation and can be described as highly plastic dark brown clay with traces of gravel. The soil samples described above have the following physical characteristics using ASTM D 2216 and D 4318 procedures:

Laboratory Test	S-1	S-2
Moisture Content	30	24
Liquid Limit	70	69
Plastic Limit	20	19
Plasticity Index	50	50

The clay soils that exist beneath the home are considered to be highly expansive soils. Expansive soils are clay soils that can experience volume changes with changes in soil water content. Expansive soils shrink or reduce their volume when they lose water (damp to dry) and swell or increase their volume when they gain water (damp to wet). The foundation design Plasticity Index on the foundation drawing sheet marked S-1 dated August 23, 2000 is 65. The average Plasticity Index determined by our soils testing is 50. The design Plasticity Index is 15 points greater than the site specific soils.

COMMENTS

The floor slab is relatively flat and is performing within the boundaries for floor slab elevation differentials in the San Antonio locale. In general, the random cracking conditions observed in the garage floor slab during the time of our site visits are considered to be normal cracking conditions and is not considered a structural deficiency.

There are several factors that can cause and/or influence cracking of beam and slab-on-ground "floating" foundations including; soil-related movements, initial drying and shrinkage related cracking during the curing of the concrete following placement, thermal expansion and contraction, internal or external restraint to shortening; settlement of the supporting soils; and the applied loading to the foundation system to name a few. Based on our preliminary observations, the performance of the foundation system has not been negatively affected.

With the exception of the gutter and downspout, located along the roof eave at the front of the home, runoff from the rooftop falls onto the ground surface and may pond adjacent to the foundation where the ground surface grading is not sufficient to allow this water to drain away from the perimeter of the foundation in an efficient manner. Rain water that ponds adjacent to the foundation may soak into the soils located along the perimeter grade beam and could possibly wet the soils beneath the home's foundation. Inconsistent watering of the yard near and along the perimeter of the foundation and changes in seasonal moisture content can also contribute to soil-related differential foundation movements. Possible plumbing leaks beneath the foundation may also contribute to differential foundation movements. We recommend that plumbing leak testing be performed to assess if leaks are occurring in the domestic water lines and sanitary sewer lines beneath the concrete foundation.

OPINIONS

On the basis of our observations/measurements, measured relative floor elevations, our on-site specific soils testing information and soil information provided by others, non-destructive testing information, and our knowledge of beam and slab-on-ground "floating" foundations founded on expansive clay soils, it is our opinion that:

- The separation at the wood trim along the hallway bathroom doorway may be a result of some soil-related movements; however, it can be corrected by filling the opening with standard color matching caulking material.
- The cracks in the garage floor slab are plastic shrinkage and dry shrinkage cracking and crack widths are related to normal soil movements supporting the foundation and are not a structural deficiency.
- The monolithic beam and slab on ground reinforced concrete foundation supporting the home and the wood frame is considered to be structurally adequate.

RECOMMENDATIONS

To the extent possible, all sources of water around and beneath the foundation should be controlled and regulated; therefore:

- The domestic and sanitary plumbing lines beneath the foundation should be tested for leaks. If the system leaks, the exact leak locations should be determined and repairs made by a licensed plumbing contractor.
- Irrigation should be controlled within a 10-foot zone around the perimeter of the home. The moisture content of the surface clay soils should be maintained at a uniform condition year round. The ground within this area should not be allowed to become dry to the point where the ground cracks and pulls away from the foundation. These conditions were noted along the back, left, and right sides of the foundation. Water should also not be allowed to pond in these areas or near the foundation.
- The soils in the yard need to be maintained adjacent to the foundation year round. This can be managed by watering along the perimeter of the foundation with soaker hoses connected to 12-foot long garden hoses that are attached to the hose bibbs along the exterior of the home. The soaker hoses can be laid out

in an "S" pattern extending a minimum of five feet, if property lines allow, away from the foundation as shown on Figure 3 of Attachment A of this document. Generally, slow soaking watering for a maximum of about 4 hours per week will provide a uniform water content in the yards surface soils during dry weather conditions. The flow rate of the water through the soaker hoses should be maintained at a 3/4 valve turn at the hose bibbs. Watering should be controlled so that there is no trapped or ponded water near the foundation.

- In order to help control the effects of surface water around the home, all water draining off the roof eaves should be collected in gutters and redirected in downspouts to drain to the street located along the front of the residence.
- Correct the sagging condition in the gutter attached to the entry porch eave, and install a splashblock at the downspout discharge opening.

We appreciate the opportunity to be of service to you on this project. Should you have any questions about the information presented in this report, or if we may be of additional service, please call.

Very truly yours,

RABA-KISTNER CONSULTANTS, INC.

Jesse H. Aguilar, P.E.
Project Engineer

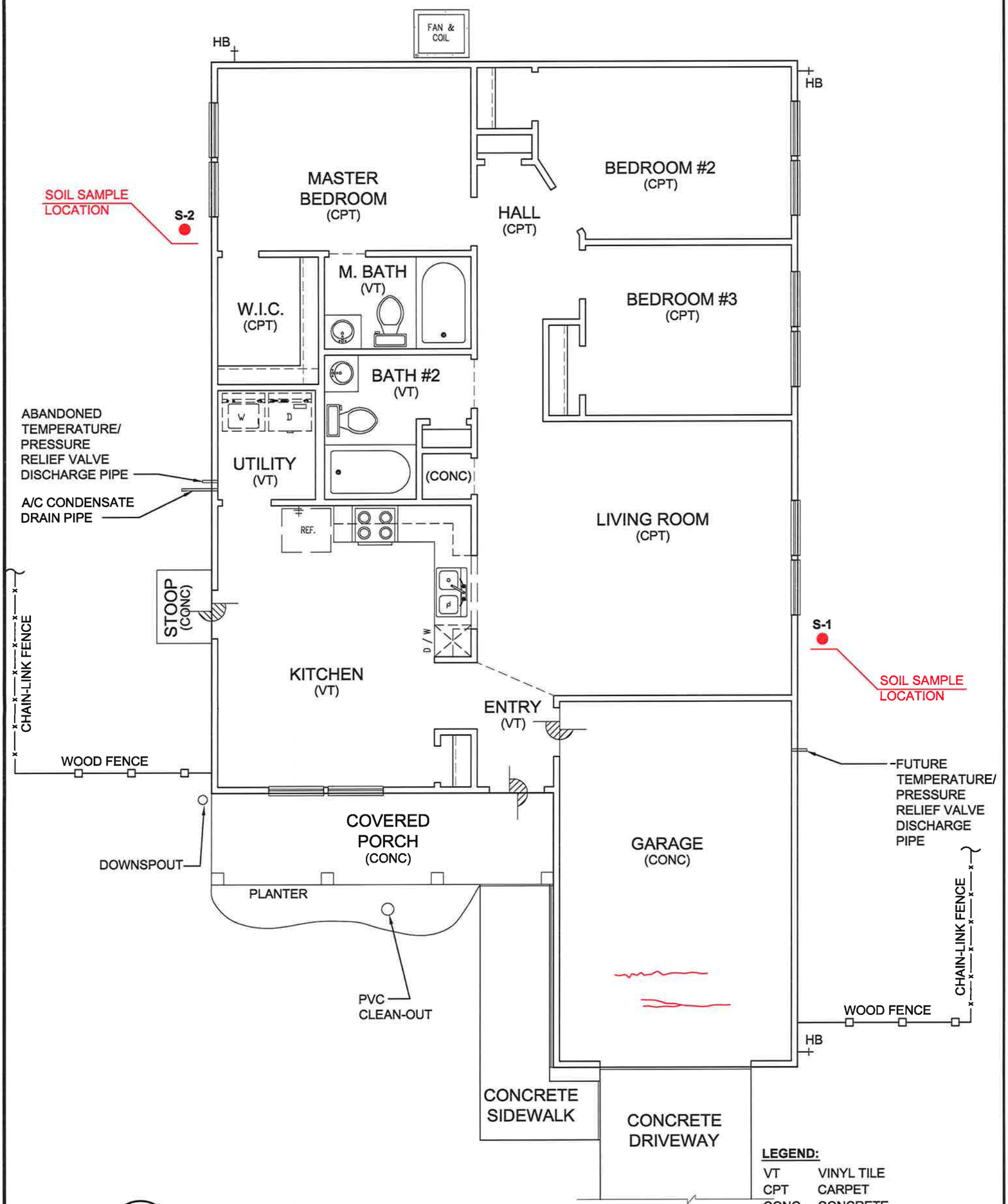
Richard W. Kistner, P.E.
Vice Chairman

JHA/RWK/jg

Attachments: (A) Figures 1 through 3
(B) Photographs 1 through 18

Copies Submitted: Above (3 Originals and 1 Electronic Copy)

ATTACHMENT A



1 FIG. 1 GENERAL SITE LAYOUT

SCALE: 3/16"=1'-0"

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GENERAL SITE LAYOUT

REVISIONS:

No.	DATE	DESCRIPTION

PROJECT No.: ASR08-059-00

DRAWN BY:

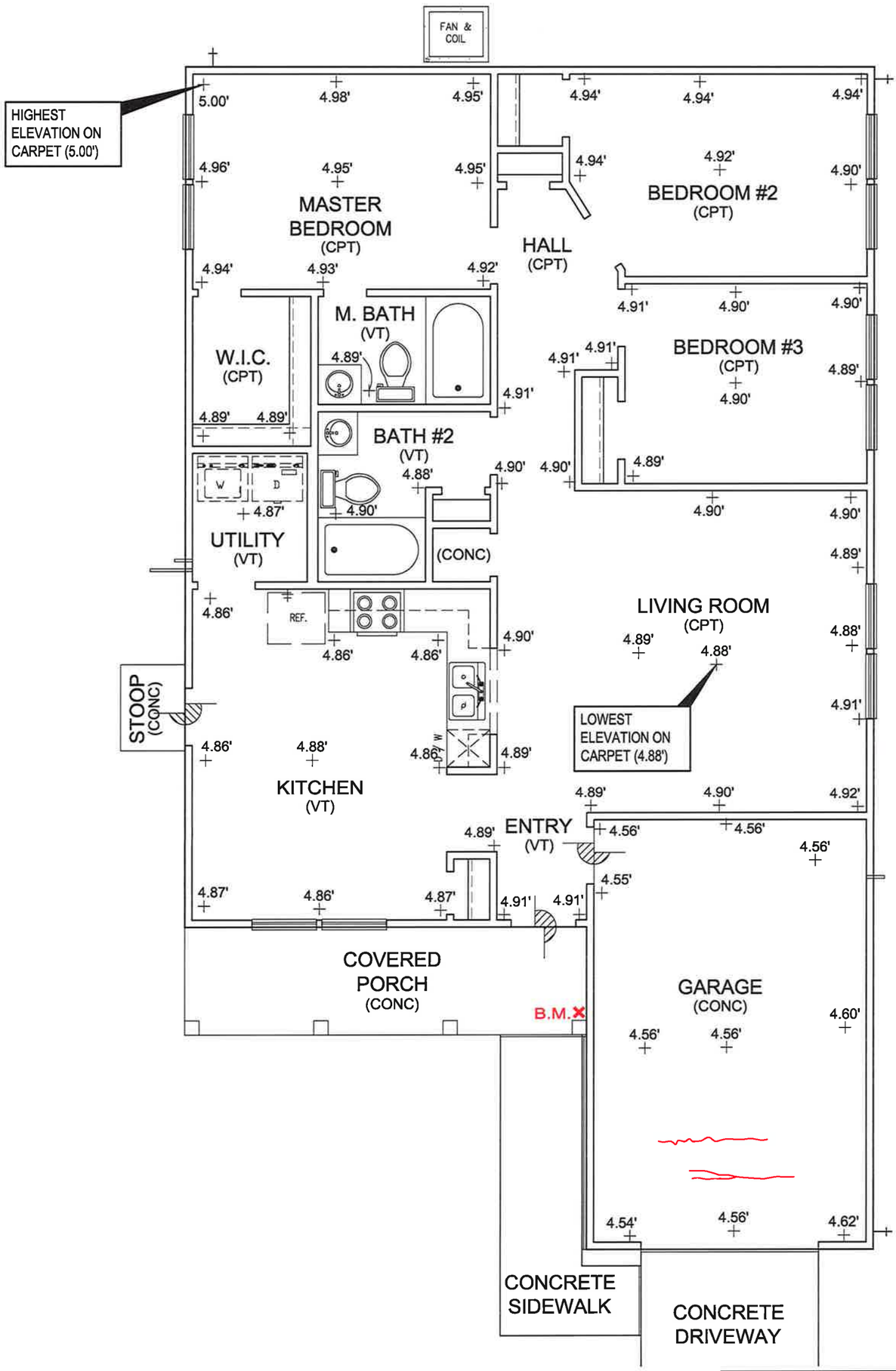
CHECKED BY:

REVIEWED BY:

GENERAL SITE LAYOUT

138 VILLA ARBOLES
SAN ANTONIO, TEXAS

FIGURE 1



1
FIG. 2

RELATIVE FLOOR ELEVATIONS

SCALE: 3/16"=1'-0"

LEGEND:

VT	VINYL TILE
CPT	CARPET
CONC	CONCRETE

NOTE:
ELEVATIONS MEASURED IN HUNDREDTHS OF A FOOT ON JUNE 23, 2008 USING STANDARD ELEVATION EQUIPMENT PLACED ON THE FLOOR SLAB COVERING OR THE EXPOSED CONCRETE SLAB.

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RELATIVE FLOOR ELEVATIONS

RELATIVE FLOOR ELEVATIONS
138 VILLA ARBOLES
SAN ANTONIO, TEXAS

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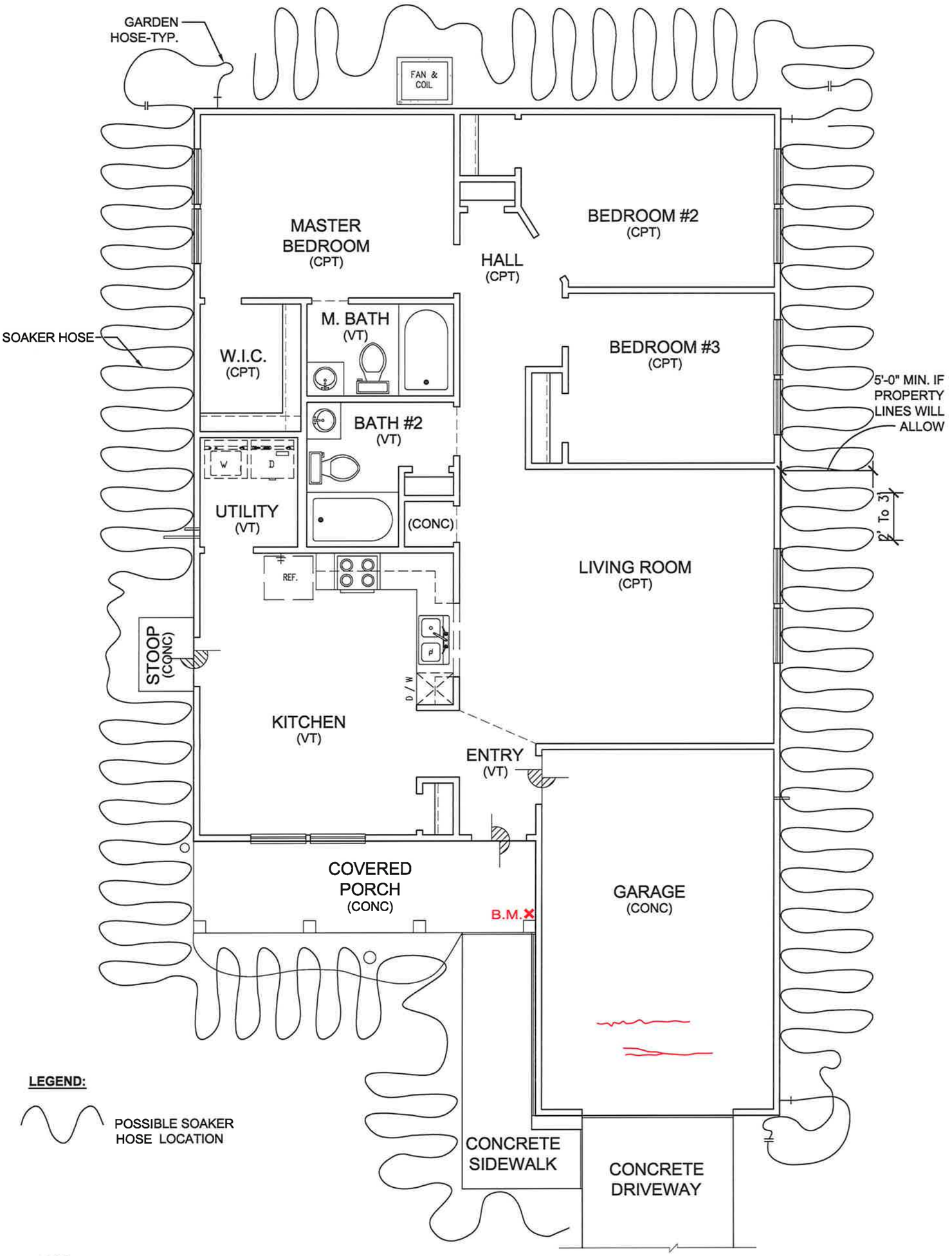
FIGURE 2



1
FIG. 3

SOAKER HOSE LAYOUT

SCALE: 3/16"=1'-0"

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SOAKER HOSE LAYOUT

SOAKER HOSE LAYOUT

138 VILLA ARBOLES
SAN ANTONIO, TEXAS

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FIGURE 3

ATTACHMENT B

PHOTOGRAPH 1

PHOTOGRAPH 2

PHOTOGRAPH 3

PHOTOGRAPH 4

PHOTOGRAPH 5

PHOTOGRAPH 6

PHOTOGRAPH 7

PHOTOGRAPH 8

PHOTOGRAPH 9

PHOTOGRAPH 10

PHOTOGRAPH 11

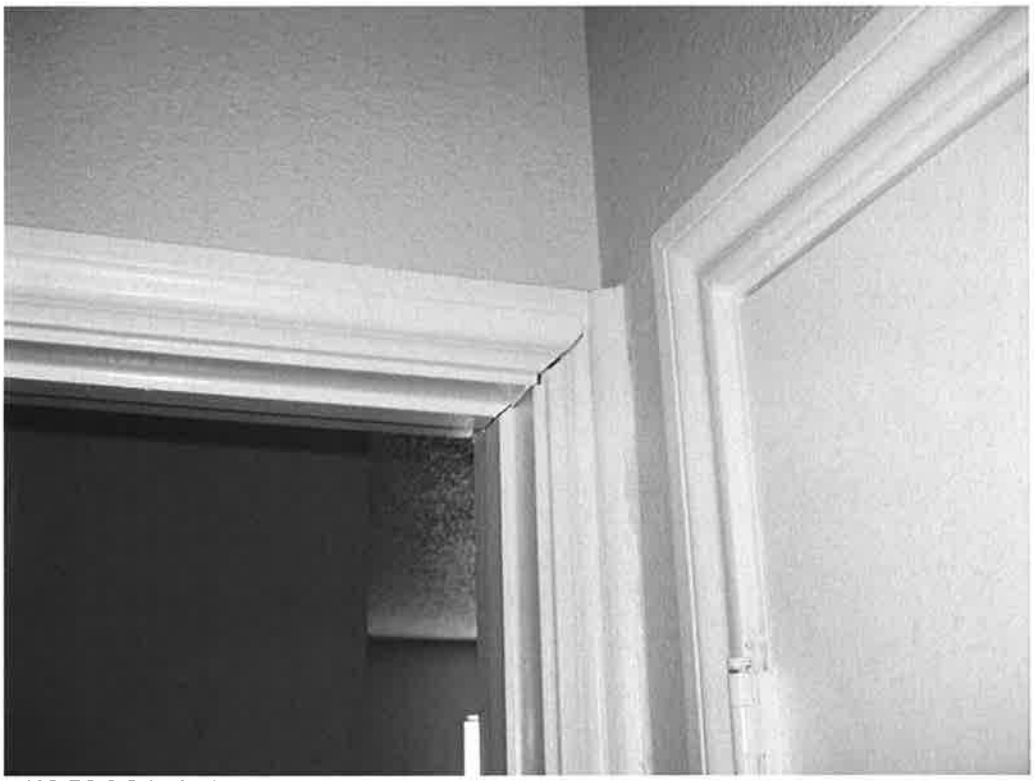
PHOTOGRAPH 12

PHOTOGRAPH 13

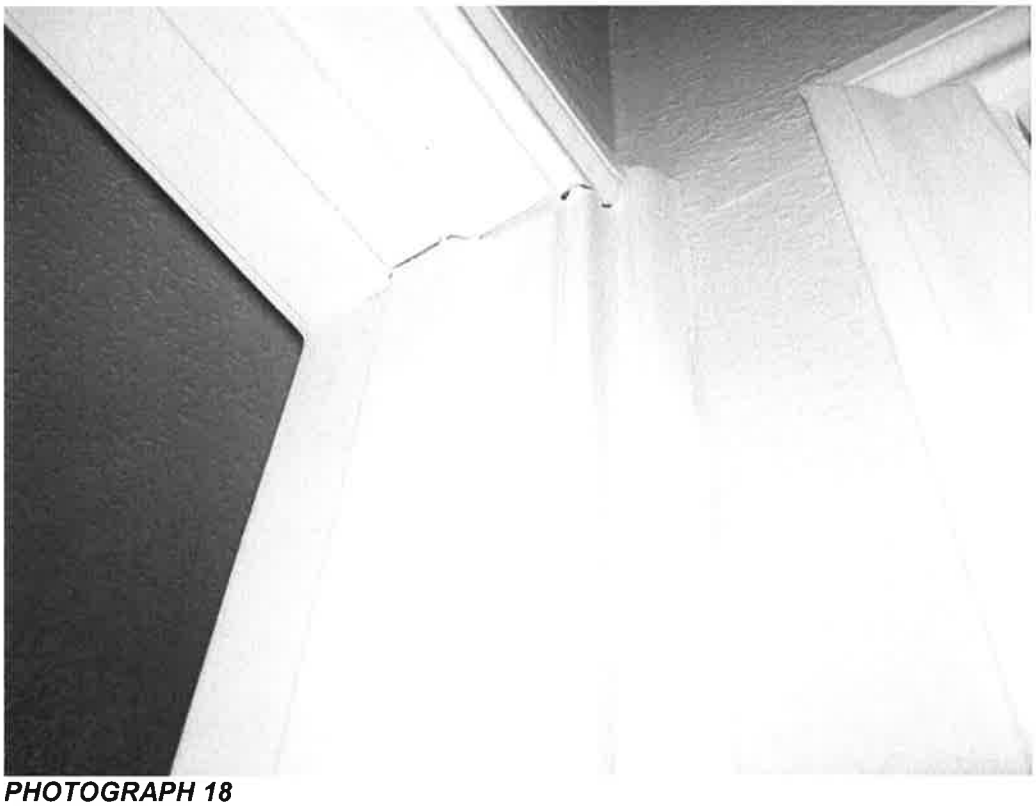
PHOTOGRAPH 14

PHOTOGRAPH 15

PHOTOGRAPH 16



PHOTOGRAPH 17



PHOTOGRAPH 18