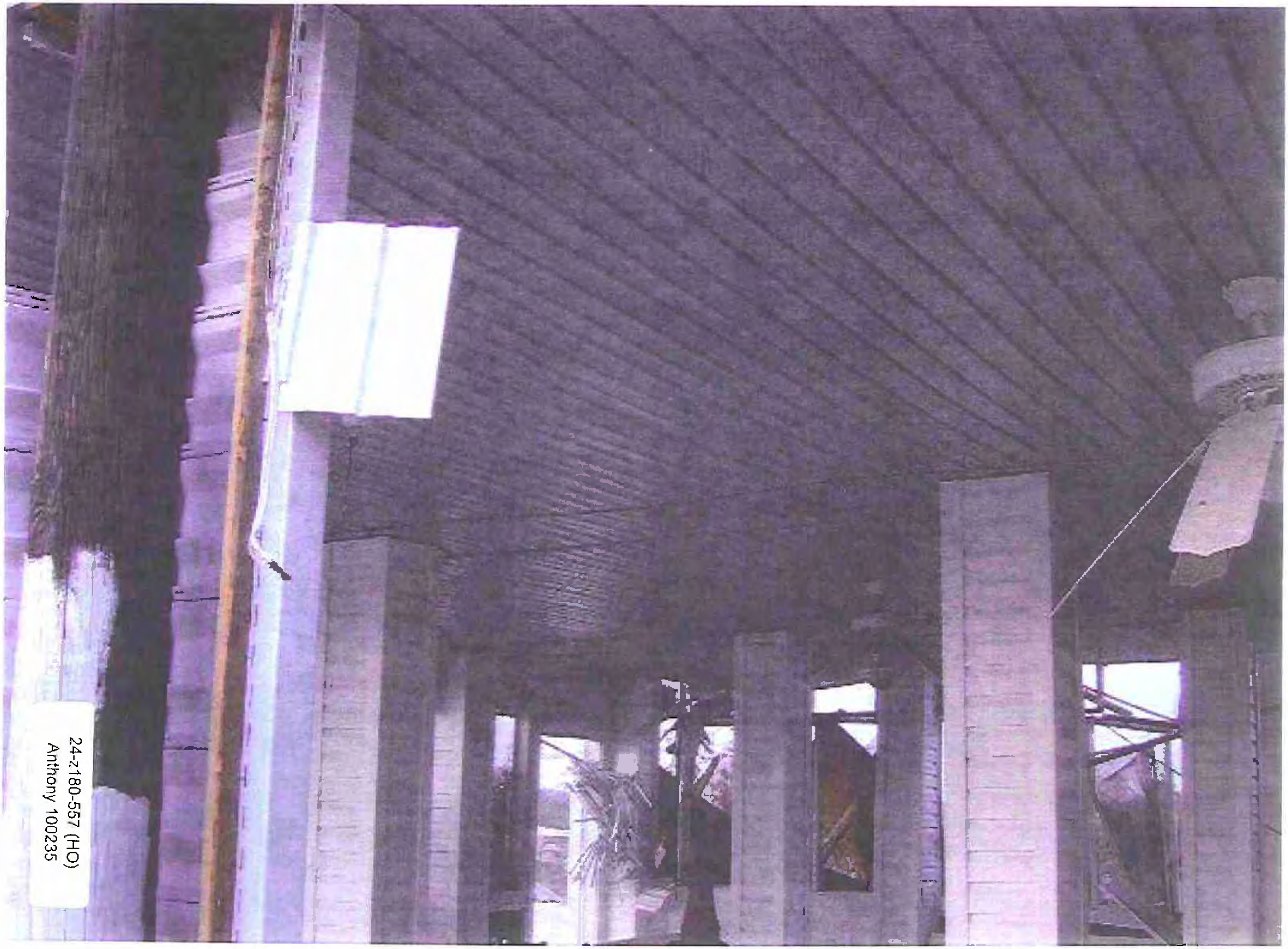
IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
SOUTHERN DIVISION

FRANK ANTHONY and CLARE ANTHONY, Plaintiffs, v. STATE FARM FIRE AND CASUALTY COMPANY, et al., Defendants.	No.: 1:08-CV-300-LTS-RHW

STATE FARM FIRE AND CASUALTY COMPANY'S
MOTION FOR PARTIAL SUMMARY JUDGMENT

Additional Exhibits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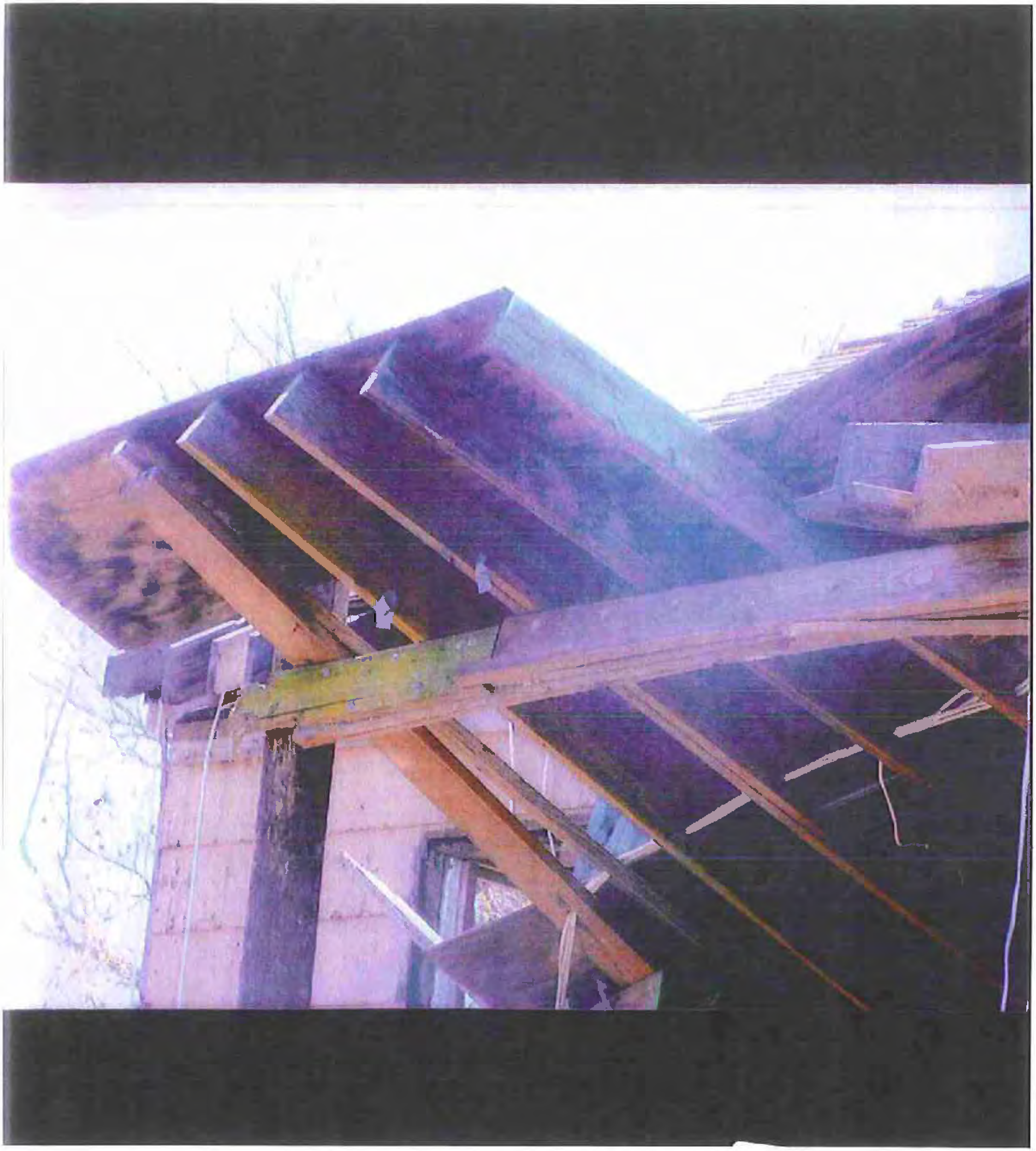

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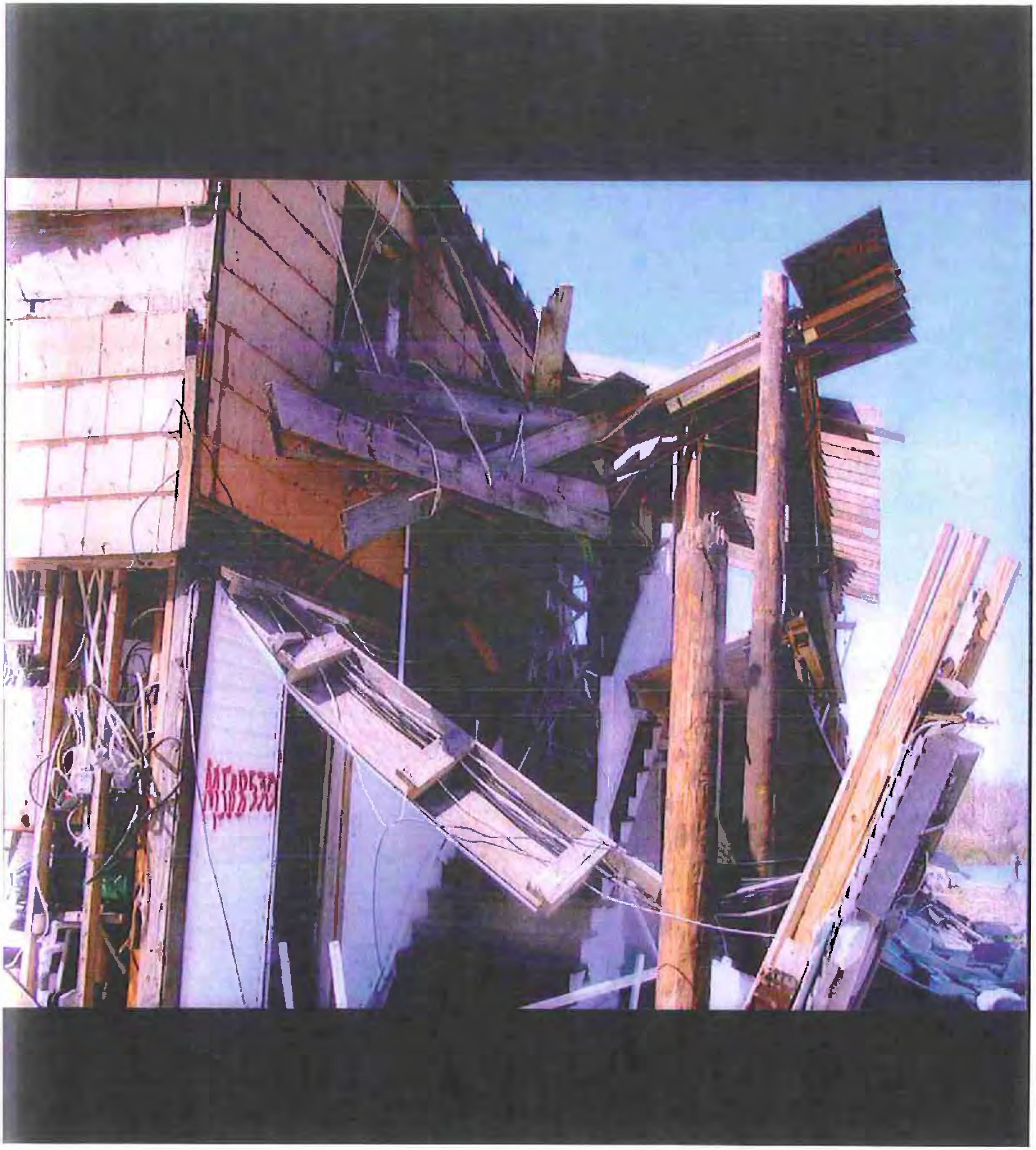

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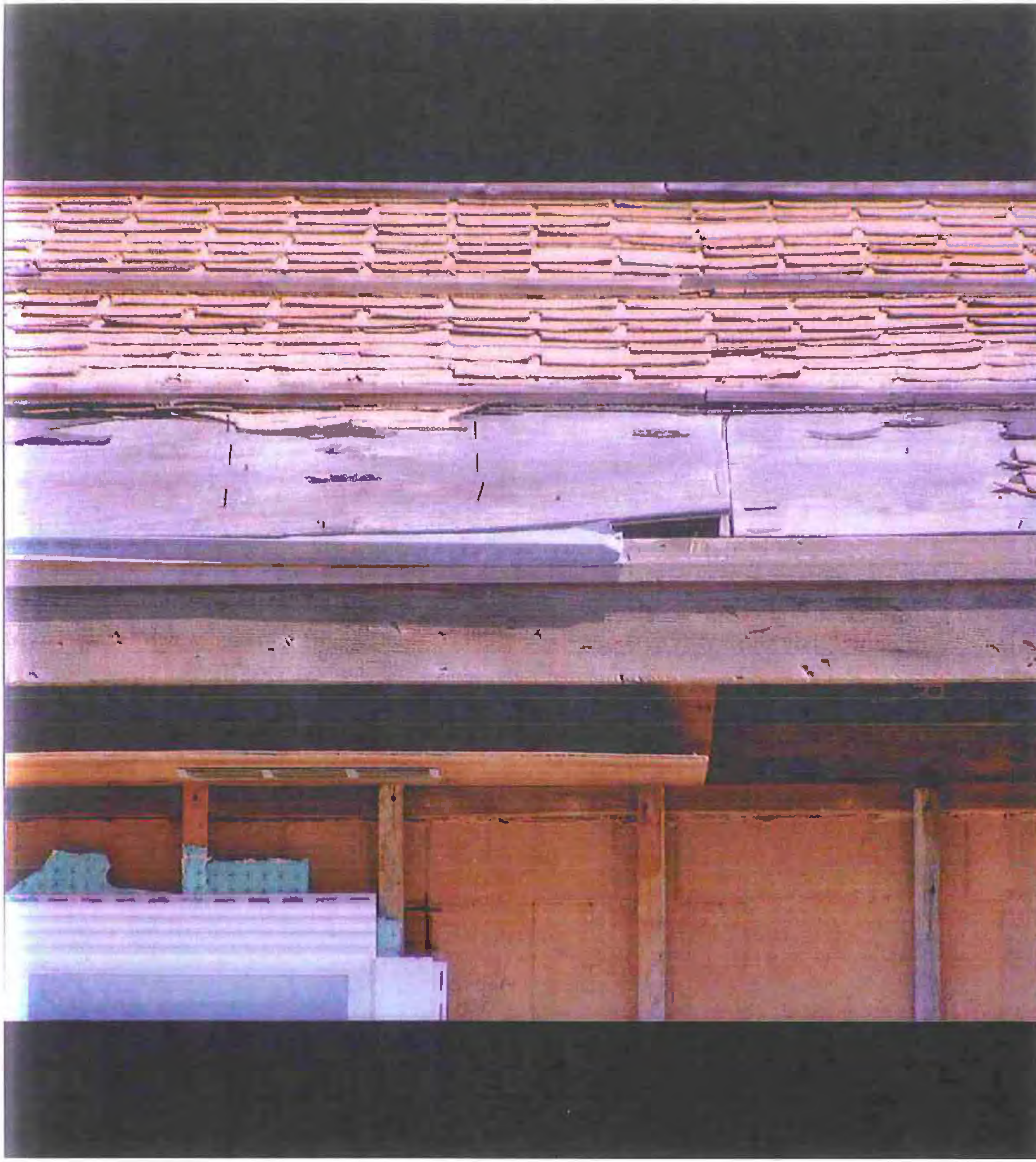

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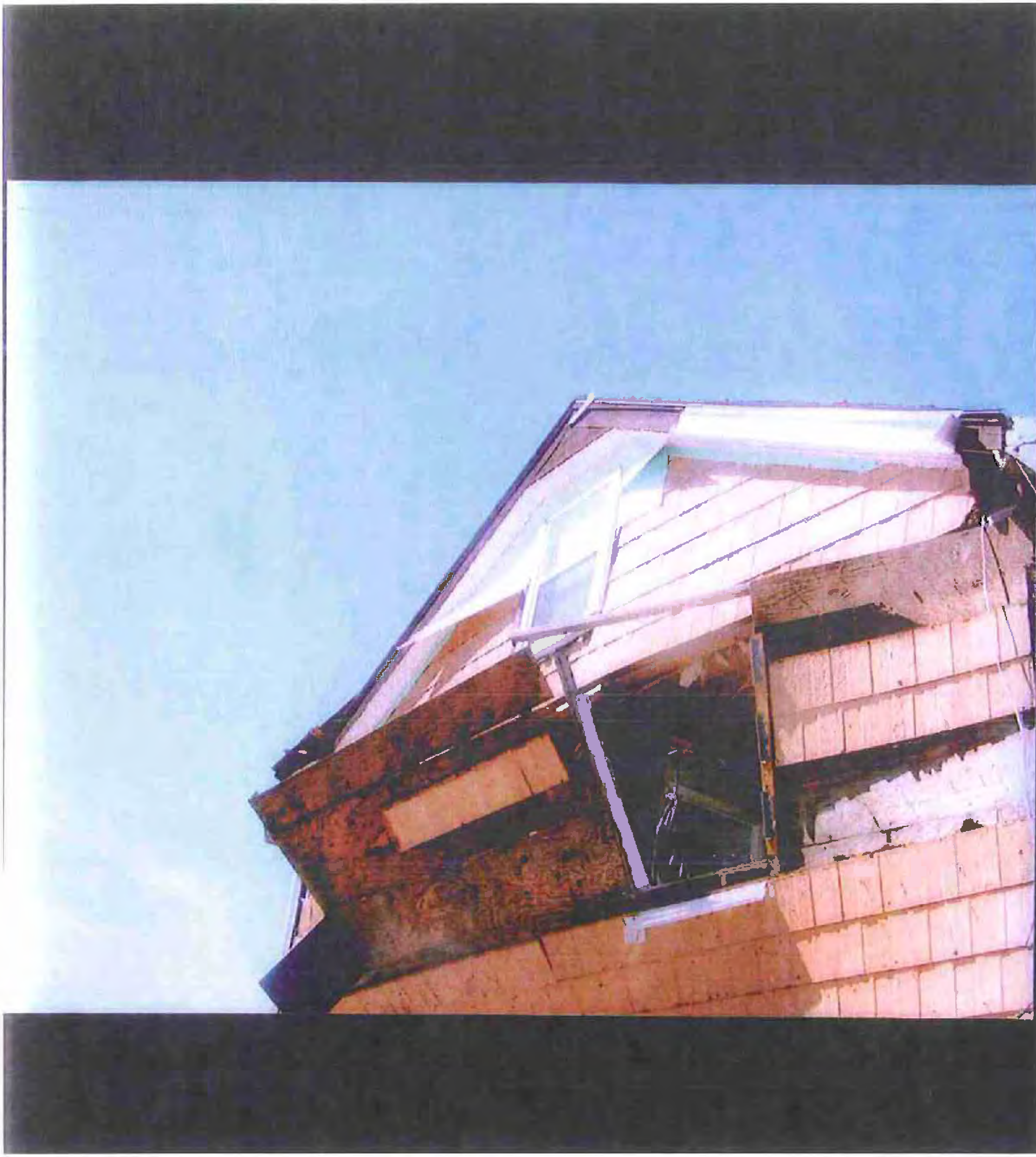

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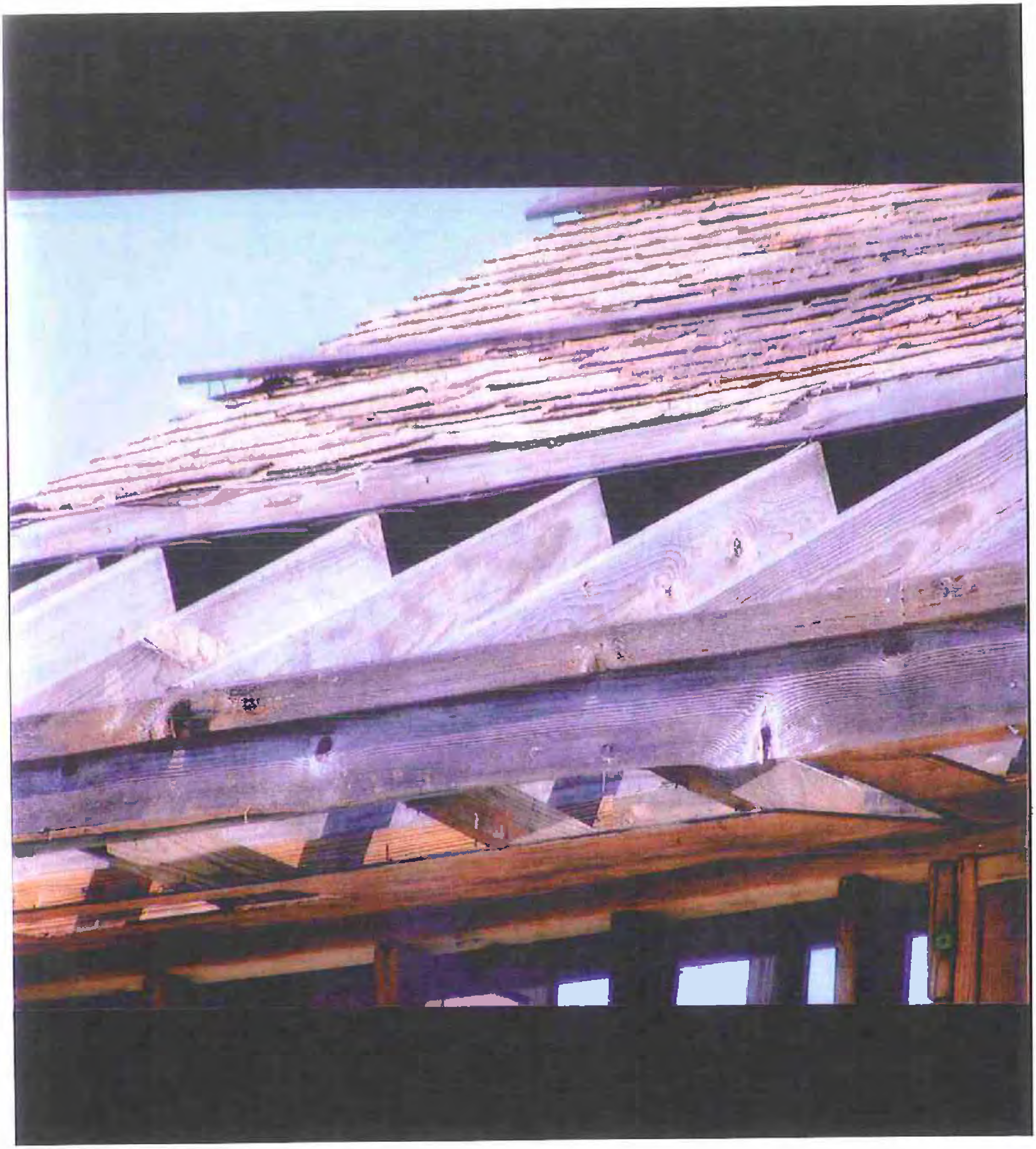

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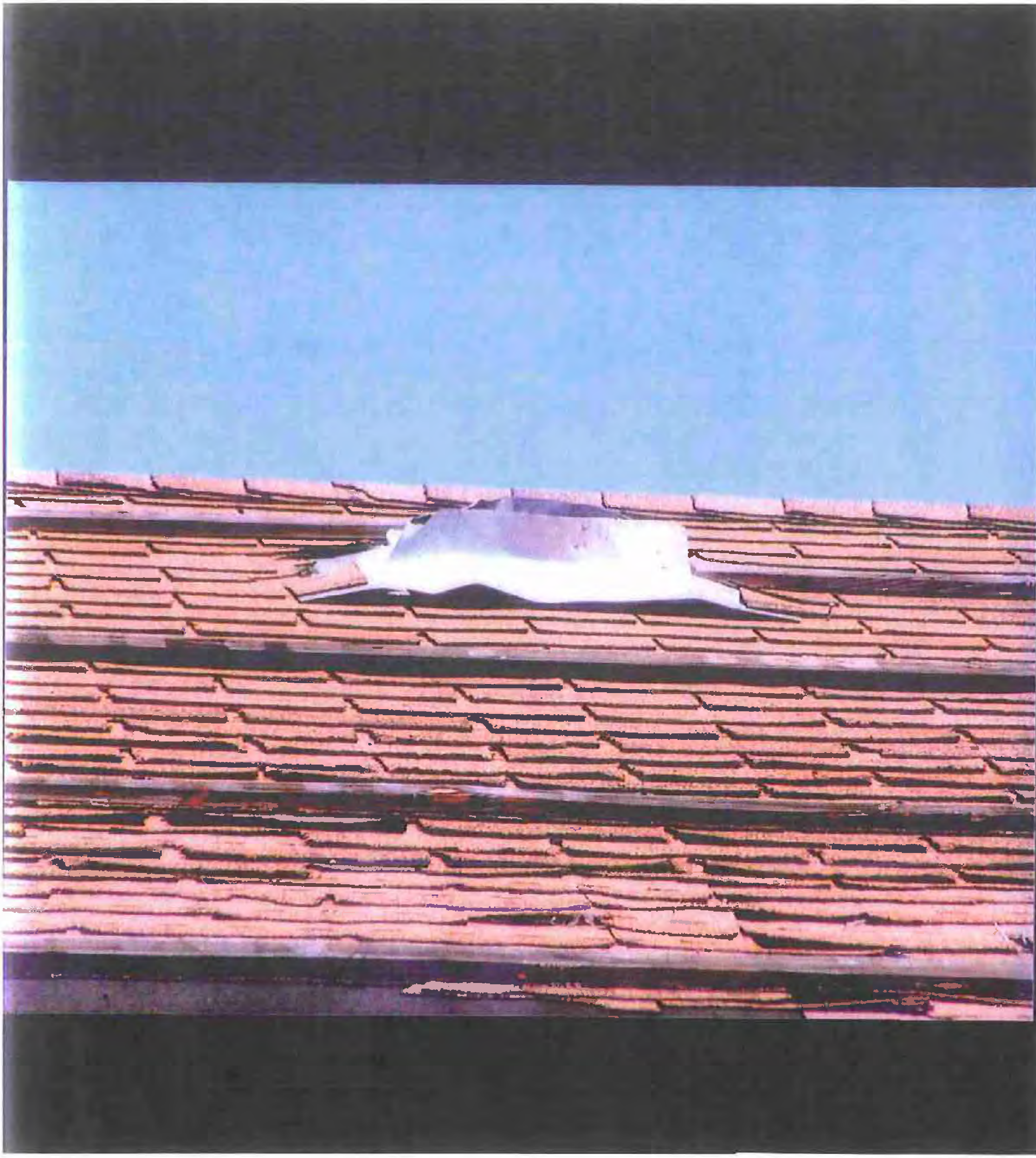

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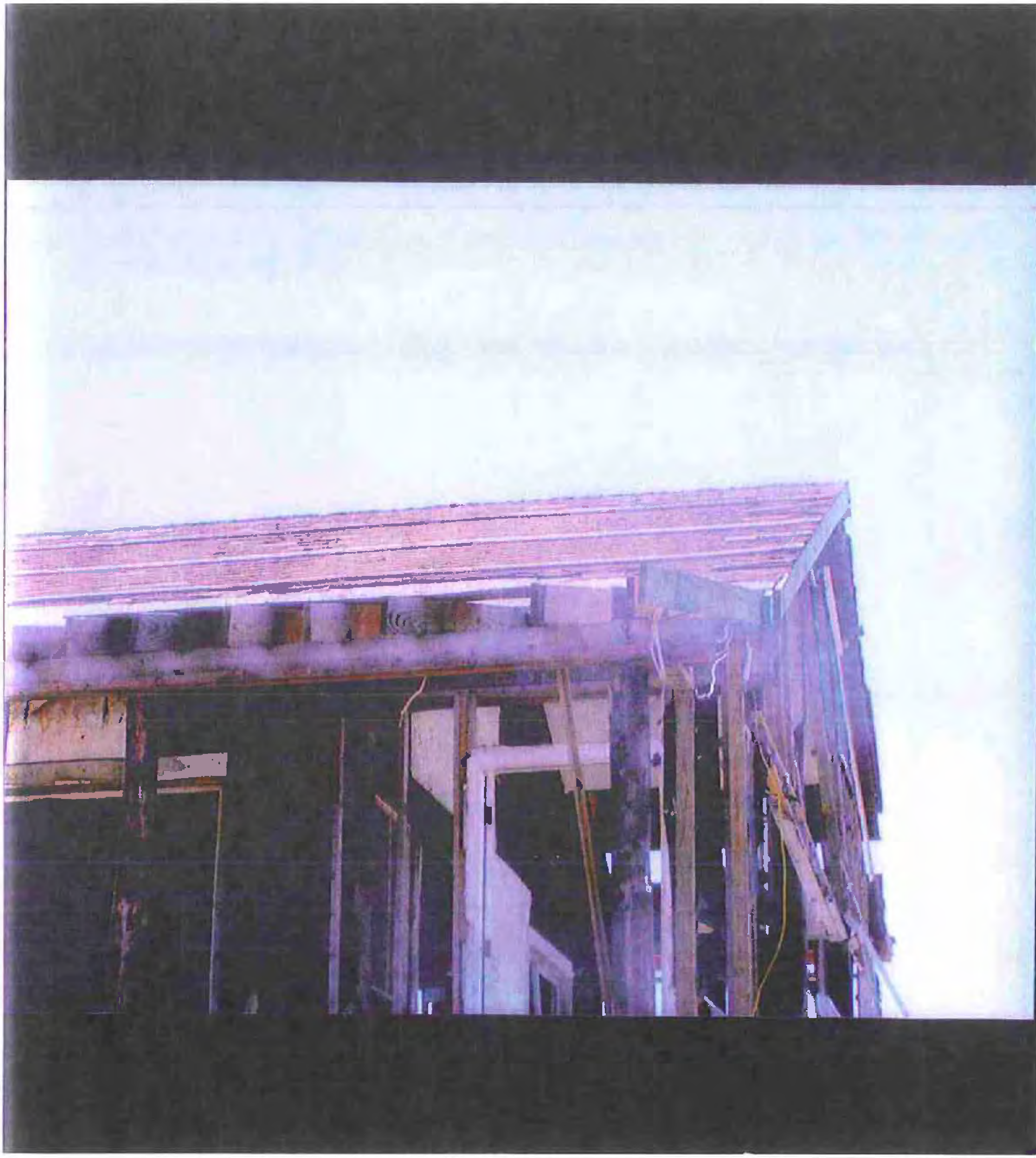

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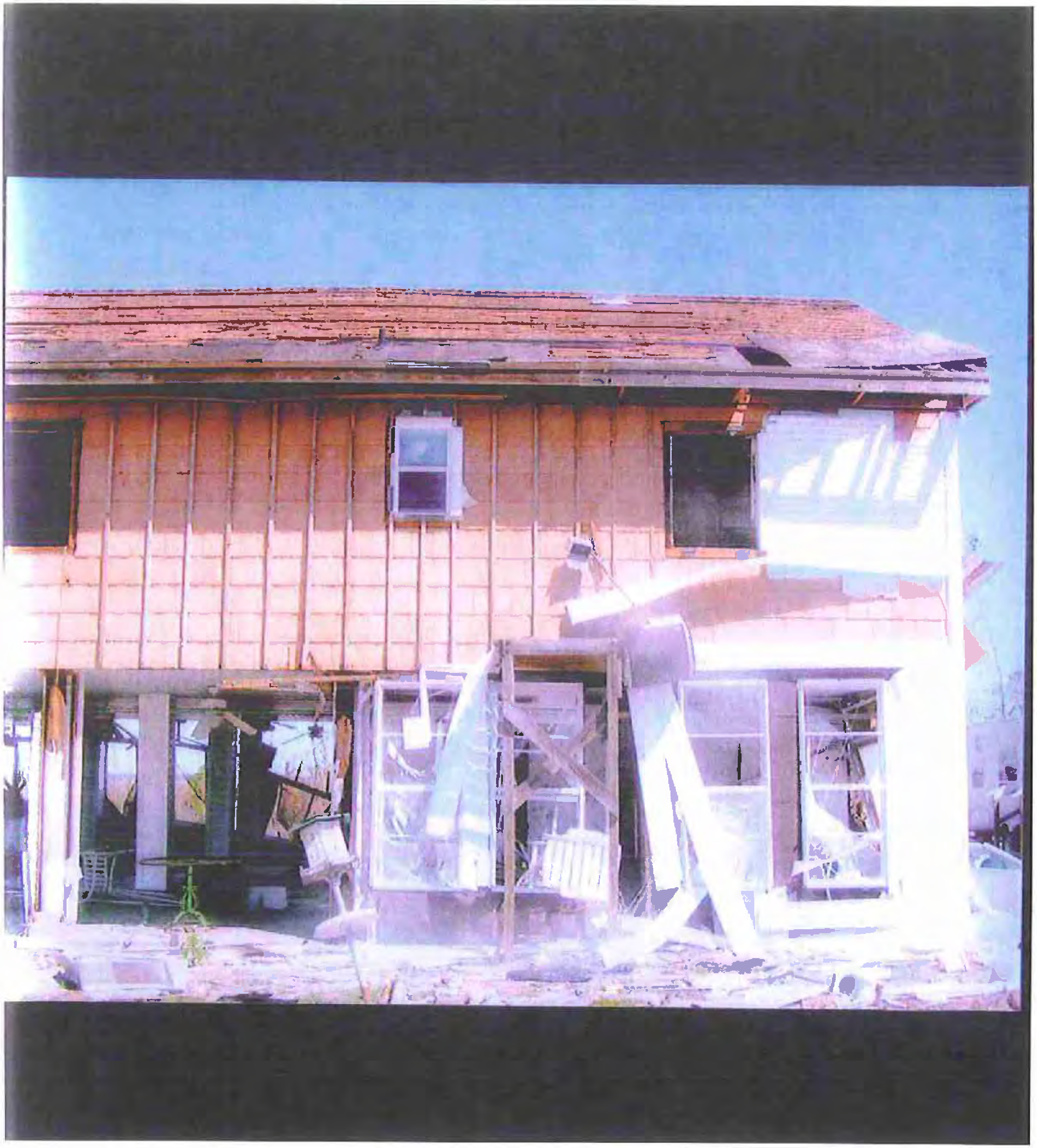

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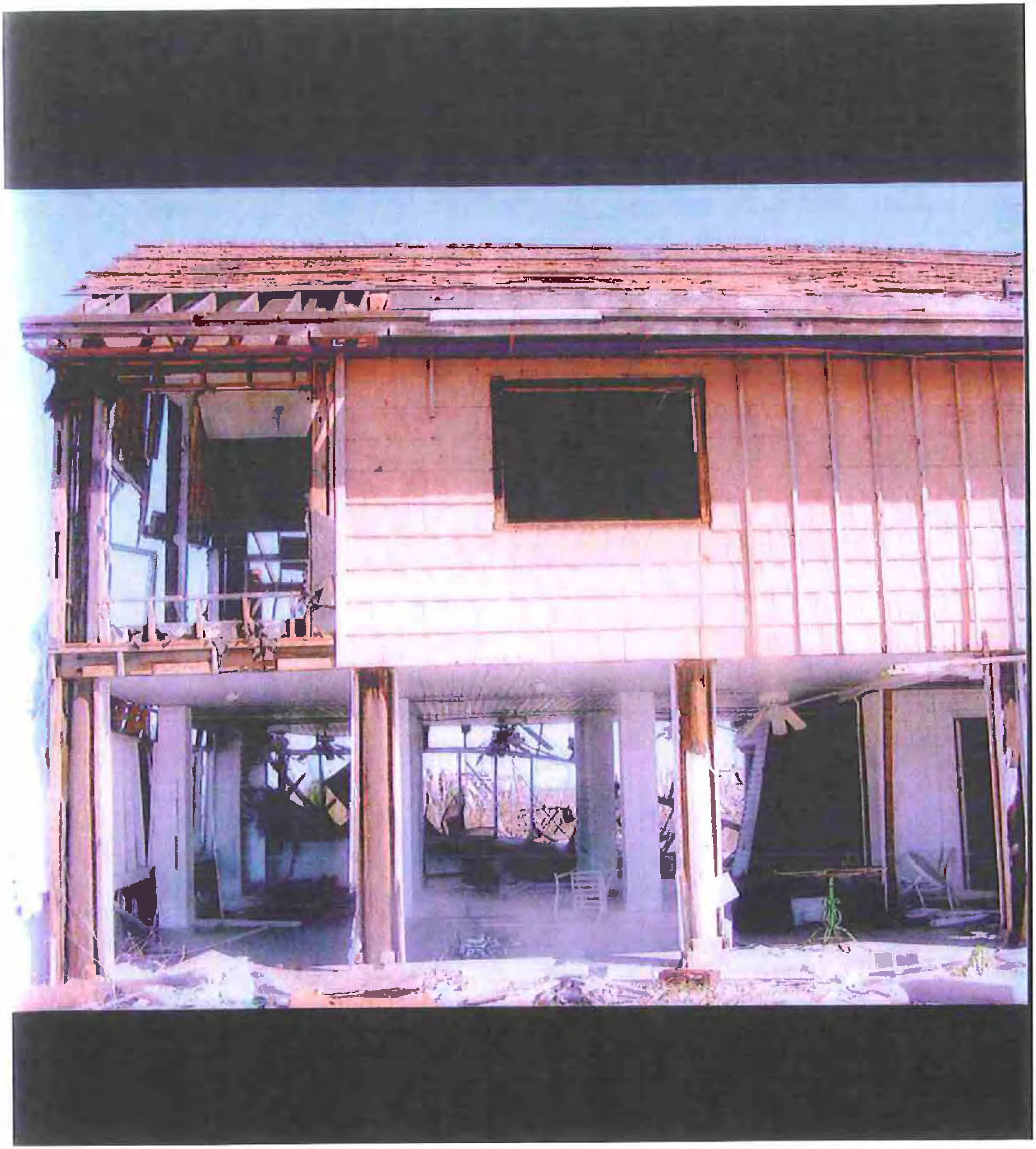

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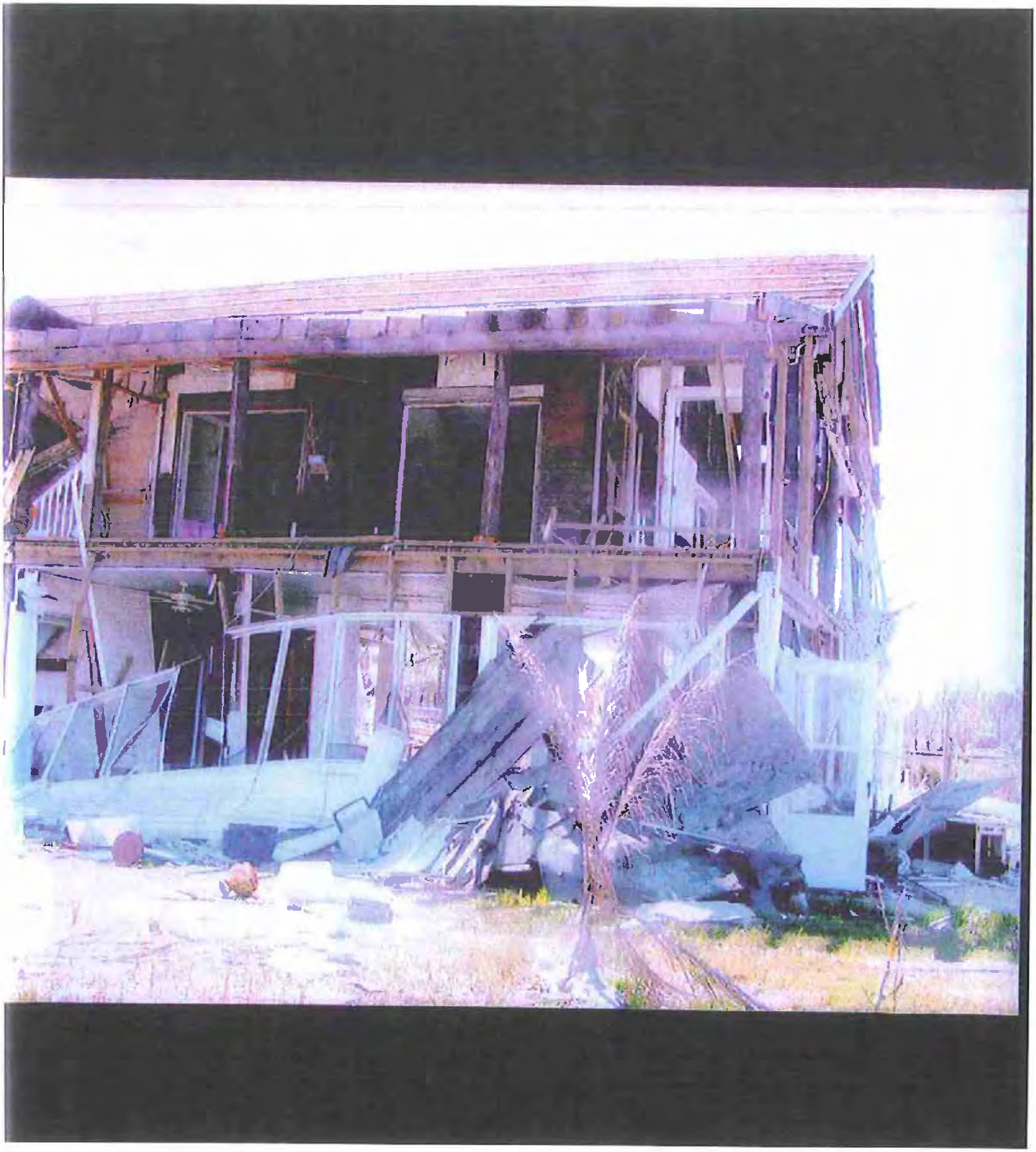

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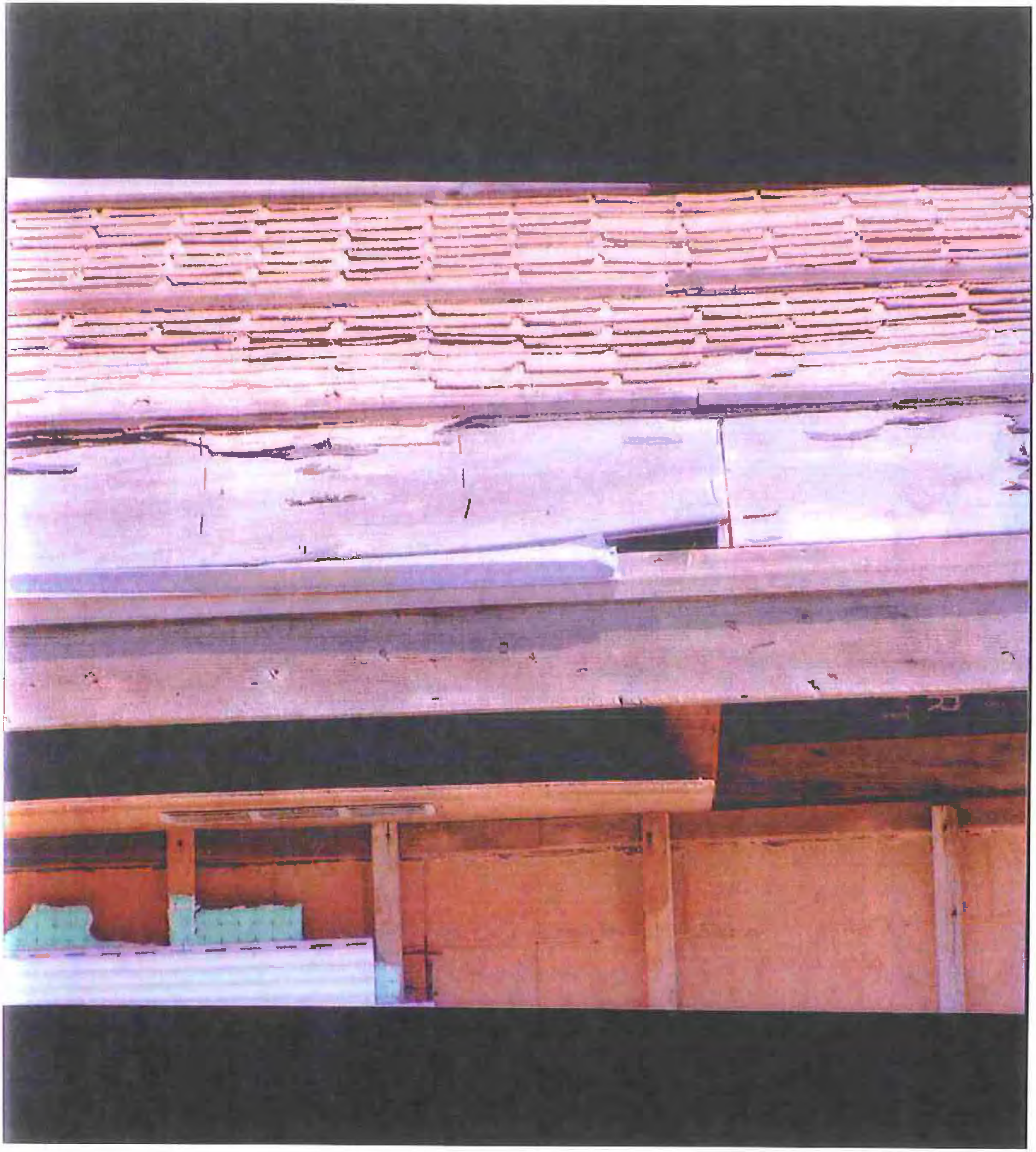

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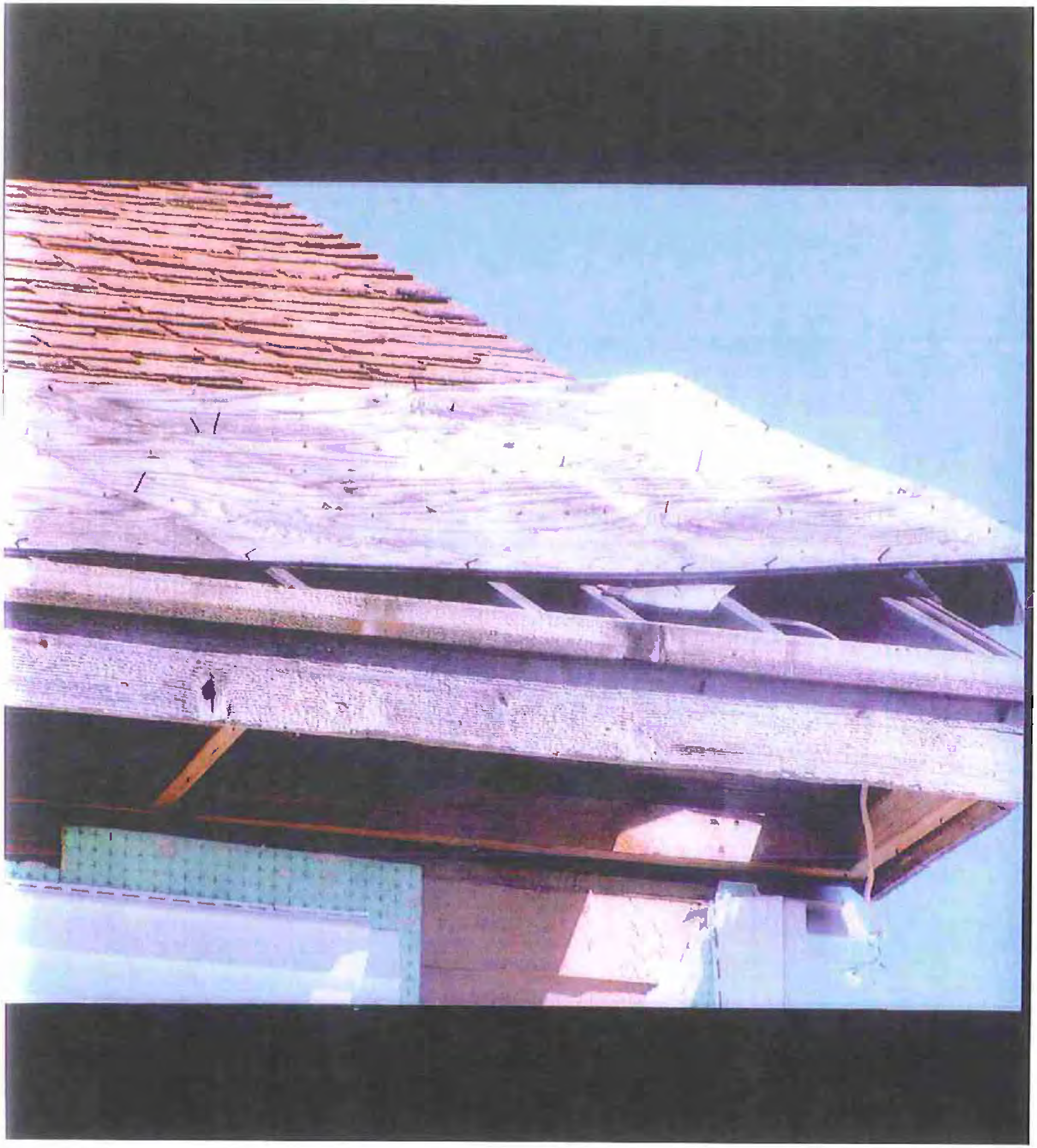


24-z180-557 (HO)
Anthony 100278

ATTACHMENT B-1

CERTIFICATE OF ELEVATION

ELEVATION CERTIFICATE

FEDERAL EMERGENCY MANAGEMENT AGENCY
NATIONAL FLOOD INSURANCE PROGRAM

O.M.B. No. 3067-007
Expires July 31, 199

TENTION: Use of this certificate does not provide a waiver of the flood insurance purchase requirement. This form is used only to provide elevation information necessary to ensure compliance with applicable community floodplain management ordinances, to determine the proper insurance premium rate, and/or to support a request for a Letter of Map Amendment or Revision (LOMA or LOMR). You are not required to respond to this collection of information unless a valid OMB control number is displayed in the upper right corner of this form. Instructions for completing this form can be found on the following pages.

SECTION A PROPERTY INFORMATION

	FOR INSURANCE COMPANY USE
BUILDING OWNER'S NAME: FRANK H ANTHONY	POLICY NUMBER
STREET ADDRESS (Including Apt., Unit, Suite and/or Bldg. Number) OR P.O. ROUTE AND BOX NUMBER: 506 RIVERVIEW DRIVE	COMPANY NAIC NUMBER
OTHER DESCRIPTION (Lot and Block Numbers, etc.): Lot 22 Section 29 Unit=4=Shoreline Est	
CITY: One Mile North of WAVELAND, MISS. STATE in HANCOCK ZIP CODE County	

SECTION B FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

Provide the following from the proper FIRM (See Instructions):

1. COMMUNITY NUMBER	2. PANEL NUMBER	3. SUFFIX	4. DATE OF FIRM INDEX	5. FIRM ZONE	6. BASE FLOOD ELEVATION (In AO Zones, use depth)
285254	145 of 195	0145-C	Nov 16, 1983	A-8	11.00

Indicate the elevation datum system used on the FIRM for Base Flood Elevations (BFE): ☐ NGVD '29 ☐ Other (describe on back)

For Zones A or V, where no BFE is provided on the FIRM, and the community has established a BFE for this building site, indicate the community's BFE: ☐☐☐☐☐☐.☐ feet NGVD (or other FIRM datum–see Section B, Item 7).

SECTION C BUILDING ELEVATION INFORMATION

Using the Elevation Certificate Instructions, indicate the diagram number from the diagrams found on Pages 5 and 6 that best describes the subject building's reference level 5. A One Story Wood Frame on Piling of unknown Age

a. FIRM Zones A1-A30, AE, AH, and A (with BFE). The top of the reference level floor from the selected diagram is at an elevation of ☐☐ 18.09 feet NGVD (or other FIRM datum–see Section B, Item 7).

b. FIRM Zones V1-V30, VE, and V (with BFE). The bottom of the lowest horizontal structural member of the reference level from the selected diagram, is at an elevation of ☐☐☐☐☐☐.☐ feet NGVD (or other FIRM datum–see Section B, Item 7).

c. FIRM Zone A (without BFE). The floor used as the reference level from the selected diagram is 9.5 feet above ☑ or below ☐ (check one) the highest grade adjacent to the building.

d. FIRM Zone AO. The floor used as the reference level from the selected diagram is 9.5 feet above ☑ or below ☐ (check one) the highest grade adjacent to the building. If no flood depth number is available, is the building's lowest floor (reference level) elevated in accordance with the community's floodplain management ordinance? ☑ Yes ☐ No ☐ Unknown

Indicate the elevation datum system used in determining the above reference level elevations: ☐ NGVD '29 ☐ Other (describe under Comments on Page 2). *(NOTE: If the elevation datum used in measuring the elevations is different than that used on the FIRM [see Section B, Item 7], then convert the elevations to the datum system used on the FIRM and show the conversion equation under Comments on Page 2.)*

Elevation reference mark used appears on FIRM: ☑ Yes ☐ No (See Instructions on Page 4)

The reference level elevation is based on: ☑ actual construction ☐ construction drawings

(NOTE: Use of construction drawings is only valid if the building does not yet have the reference level floor in place, in which case this certificate will only be valid for the building during the course of construction. A post-construction Elevation Certificate will be required once construction is complete.)

The elevation of the lowest grade immediately adjacent to the building is: ☐☐☐ 8.1 feet NGVD (or other FIRM datum–see Section B, Item 7).

SECTION D COMMUNITY INFORMATION

If the community official responsible for verifying building elevations specifies that the reference level indicated in Section C, Item 1 is not the "lowest floor" as defined in the community's floodplain management ordinance, the elevation of the building's "lowest floor" as defined by the ordinance is: ☐☐☐☐☐☐.☐ feet NGVD (or other FIRM datum–see Section B, Item 7).

Date of the start of construction or substantial improvement: Unknown

National Flood Insurance Program

2

SECTION E CERTIFICATION

This certification is to be signed by a land surveyor, engineer, or architect who is authorized by state or local law to certify ele information when the elevation information for Zones A1–A30, AE, AH, A (with BFE), V1–V30, VE, and V (with BFE) is require Community officials who are authorized by local law or ordinance to provide floodplain management information, may also si certification. In the case of Zones AO and A (without a FEMA or community issued BFE), a building official, a property owne owner's representative may also sign the certification.

Reference level diagrams 6, 7 and 8 - Distinguishing Features—If the certifier is unable to certify to breakaway/non-breakawa enclosure size, location of servicing equipment, area use, wall openings, or unfinished area Feature(s), then list the Feature(included in the certification under Comments below. The diagram number, Section C, Item 1, must still be entered.

I certify that the information in Sections B and C on this certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.

CERTIFIER'S NAME: Eugene O. Richardson State Land Surveyor
LICENSE NUMBER (or Affix Seal): RLS MISS. 1286

TITLE: Sole Owner & Proprietor - Richardson Land Surveys
COMPANY NAME:

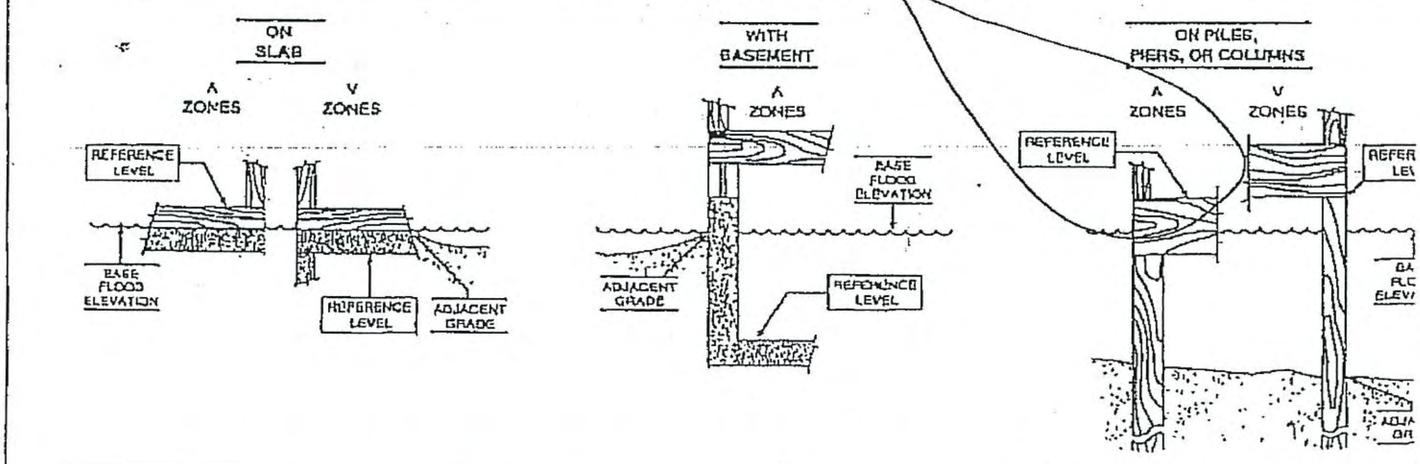
ADDRESS: 325 Carroll Ave
CITY: Bay St. Louis, MISS
STATE: Mississippi 39520

SIGNATURE: Eugene O. Richardson
DATE: June 27, 1998
PHONE: 1-601-467-7348

Copies should be made of this Certificate for: 1) community official, 2) insurance agent/company, and 3) building ov

COMMENTS: Floor Level of An Existing Apt One Story Wood Framed Res. Built in place at an Elevation of 13.91 ft Above Avg Mean Sea Level

EUGENE RICHARDSON
Registered Land Surveyor
RLS 1286
STATE OF MISSISSIPPI



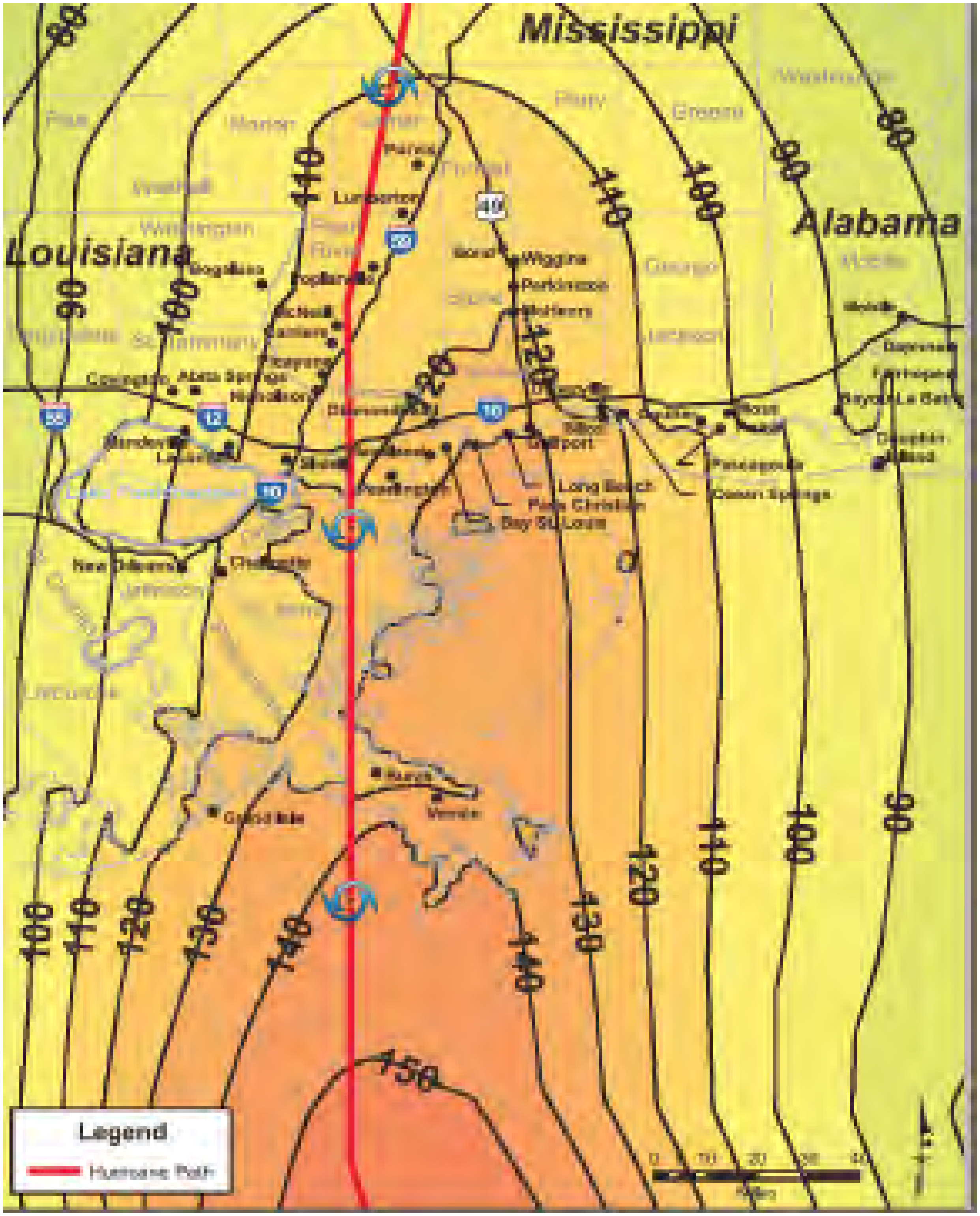
The diagrams above illustrate the points at which the elevations should be measured in A Zones and V Zones.

Elevations for all A Zones should be measured at the top of the reference level floor.

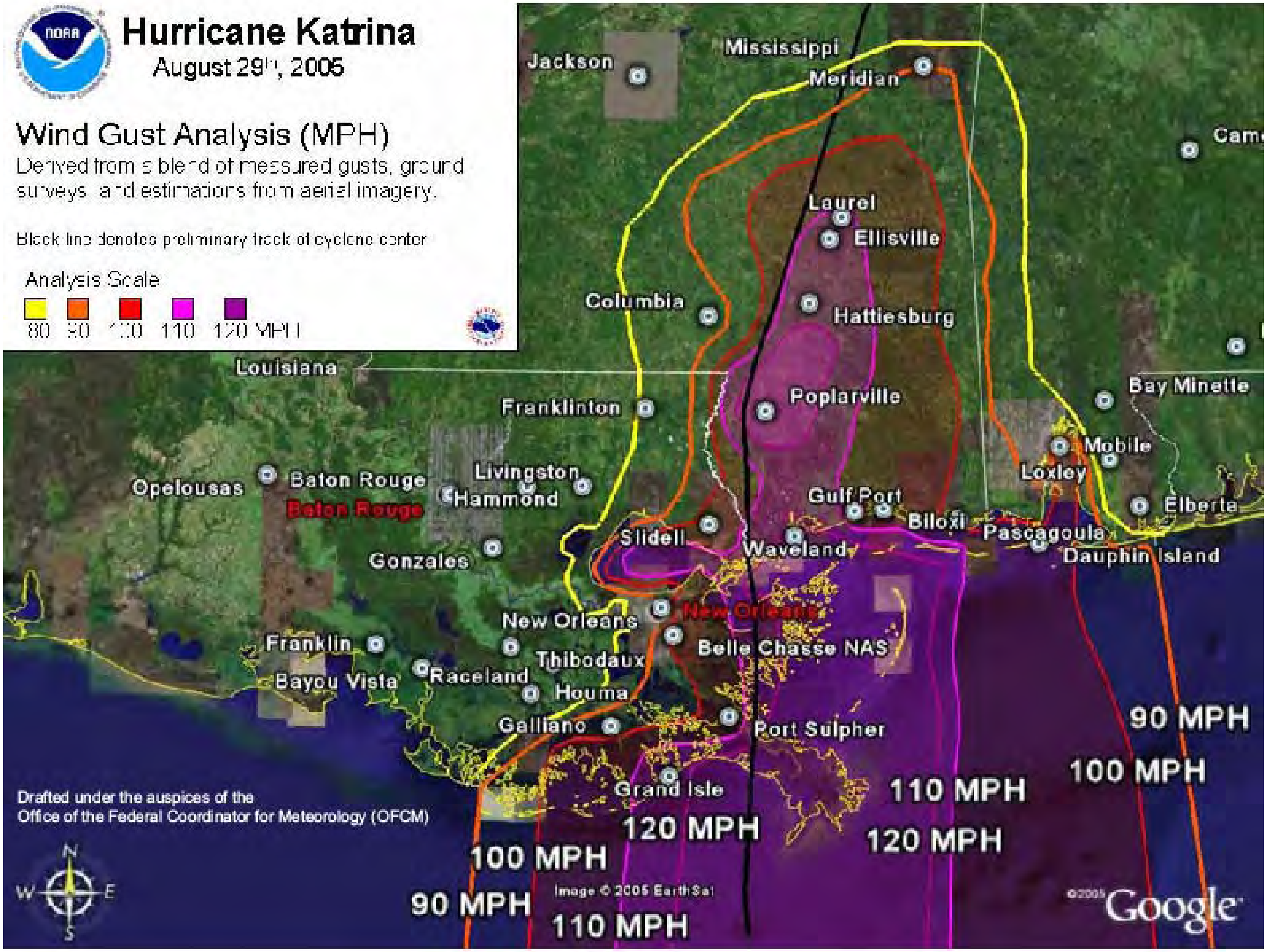
Elevations for all V Zones should be measured at the bottom of the lowest horizontal structural member.

ATTACHMENT C

WIND & FLOOD DATA



ARA WIND MODEL FOR FEMA HAZUS


Hurricane Katrina
August 29th, 2005
Wind Gust Analysis (MPH)
Derived from a blend of measured gusts, ground surveys, and estimations from aerial imagery.
Black line denotes preliminary track of cyclone center
Analysis Scale
80 90 100 110 120 MPH
Jackson
Mississippi
Meridian
Laurel
Ellisville
Columbia
Hattiesburg
Louisiana
Franklinton
Poplarville
Bay Minette
Mobile
Loxley
Opelousas
Baton Rouge
Livingston
Hammond
Gulf Port
Biloxi
Elberta
Slidell
Waveland
Pascagoula
Dauphin Island
Gonzales
New Orleans
Franklin
Belle Chasse NAS
Thibodaux
Bayou Vista
Raceland
Houma
Galliano
Port Sulpher
90 MPH
100 MPH
110 MPH
120 MPH
Grand Isle
Drafted under the auspices of the
Office of the Federal Coordinator for Meteorology (OFCM)
Image © 2005 EarthSat
©2005 Google

ATTACHMENT C-1

FITZPATRICK REPORT

The wind and surge of Hurricane Katrina on 506 River View Road, Bay St. Louis, MS

Dr. Pat Fitzpatrick
Consultant meteorologist
180B Lakeview Drive
Slidell, LA 70458

Satellite image from on August 28, 2005, at 12:00 PM. Hurricane Katrina was about 200 miles from southeast Louisiana at this time as a Category 5 hurricane.

This report presents information about Katrina's wind and storm surge elements at 506 River View Road in Bay St. Louis, MS. Section 1 provides background information on the physics of the storms surge. Section 2 describes Katrina's wind field, its storm surge, and the timing of both events. Section 3 summarizes the findings.

1. Background on the hurricane storm surge

Accompanying a landfalling hurricane is the *storm surge*, defined as an abnormal rise of the sea along the shore generated by an intense storm such as a hurricane. The storm surge is caused primarily by the winds pushing water toward the coast and wave breaking, which propels water further inland. A secondary contribution to surge is made by the reduced barometric pressure within the storm, which causes a dome of water level higher than the surrounding ocean. However, wind and wind-generated waves are the primary contributors to storm surge. The surge rises gradually, then more quickly as the storm makes landfall. Despite some ill-conceived notions, it is not like a tsunami or a wall of water, but instead a steady increase in water levels. Typically the surge peaks after landfall, with a region experiencing tropical storm- and hurricane-force winds several hours before landfall.

Factors which impact storm surge elevation include:

- *Storm size*: The larger the areal extent of tropical storm-force winds, the higher the water elevation
- *Storm central pressure:* Lower interior atmospheric pressure increases the water level. Pressure is essentially the "weight" of the atmosphere. The atmospheric pressure is much lower in the center than at the periphery of the storm. This means the weight of air pushing down on the water column is greater at the edges of the storm than it is at the storm's center. Consequently, a slight bulge, or increase, in the water surface occurs within the storm, and the magnitude of the bulge is greatest at the storm's center and decreases to near zero at the storm's periphery. This water expansion due to lower interior pressure is known as the *inverse barometer effect*. It causes water to expand 3.9 inches for every 10-mb pressure drop. Overall, this is a minor but non-negligible contribution to the storm surge (between 2-3 feet in the inner core of Katrina).
- *Storm intensity*: The maximum wind speed is the most important factor. The more intense the hurricane, the higher the water elevation.
- *Bathymetry:* As the surface currents driven by the wind reach shallow coastlines, bottom friction impedes the seaward return flow near the bottom, causing water to pile up. Shallow areas with a gradual slope will experience greater storm surges than areas with a shelf that drops off rapidly near the coast. This is because water cannot sink and flow outward to the ocean, thereby causing more water to pile up offshore when the water is shallow. Because of Louisiana and Mississippi's proximity to shallow water that gradually deepens offshore, these states are prone to high storm surges.

- *Speed of motion of the system:* Because a slow moving hurricane has a longer time to transport water onshore, slow systems are associated with higher storm surge values. Slower moving hurricanes can cause a storm surge 50-70% higher than fast moving hurricanes. Fast moving hurricanes cause the surge to "spike" over a few hours with an overall lower surge.
- *Wave setup:* Water levels can increase from onshore waves in windy conditions. Under normal conditions, waves that reach the coast break and water flows back out to the sea under the next incoming wave. In hurricane conditions, the water may not retreat in time before the next wave arrives, a situation called wave setup. This wave setup can be quite large and is most pronounced when deepwater is near the shore, because in shallow water waves break further offshore. Wind-induced surge enables waves to penetrate much further inland before they break. On the shallow Mississippi coast, this effect is minor.
- *Track angle*: Storms which make landfall perpendicular to the coastline produce larger storm surges than those which hit at an angle. Storms which make landfall at an angle have a smaller surge because some transported water experiences reflection and cross-current transport.
- *Local effects:* The shoreline trajectory can enhance or weaken the surge through trapping mechanisms.

The storm surge is always highest on the side of the eye corresponding to onshore winds, which is usually the right side of the point of landfall. Winds are also fastest in the right front quadrant because storm motion (which averages about 10 mph but varies substantially) is added to the hurricane's winds. Because winds spiral inward, the storm surge is greatest along the eyewall but high water can impact other regions as well.

The total elevated water includes three additional components - the astronomical tide, the steric effect, and ocean waves. The astronomical tide results from gravitational interactions between the earth and the moon and sun, generally producing two high and two low oceanic tides per day in most U.S. locations, but only one high and one low tide per day in Louisiana. Should the storm surge coincide with the high astronomical tide, the additional elevation will be added to the water level. However, tide ranges along the northern Gulf of Mexico are small, only contributing to one-foot of additional water at high tide, often less. Waves are another important contributor to water level. In addition to contribution of wave setup to the surge, waves can be expected on top of the surge. The final contributor is water temperature. Because warm water expands, water levels are naturally highest in the summer, known as the *steric effect*. In the Gulf of Mexico, this contributes about 0.52 feet of water in late summer.

By definition, storm surge does not include waves (other than the contribution due to wave setup). Waves will be superimposed on the storm surge. Miles offshore in deep water, the waves will be large. However, as the depth decreases toward the shore, waves are impacted by the ocean floor and slow down while their period remains constant. As a result, the wavelength decreases and the amplitude increases. Eventually the wave will get too steep and break. New waves will be generated with less height, but as the depth continues to decrease, they will again break and reform as smaller waves. In theory locally generated shallow water wave heights can reach 73% of the water depth, but the distance traveled to reach its potential maximum height (called the fetch) is too short near the shore; because the depth keeps decreasing, wave growth becomes disrupted and the wave will break again and again. In addition, shallow water waves also lose energy due to frictional interaction with the ocean floor. Frictional loss is even greater over flooded, vegetated land. In Mississippi, In the surf zone, wave heights will reach 1-4 feet on top of the surge. Further inland, the wave height will be less than 2 feet, reducing with distance from the coast or with land elevation.

2. The wind and storm surge of Katrina at 506 River View Road

I. Katrina's windfield

Katrina was a major hurricane when it made landfall in Bay St. Louis. Because it was also an unusually large hurricane, Mississippi and Louisiana were exposed to hurricane-force winds for many hours, including several hours before landfall. Katrina's hurricane-force winds extended 120 miles from the storm center, and tropical storm-force winds 230 miles outwards. Katrina also maintained a large eye, thereby providing a large areal-coverage of its most fierce winds. Satellite, National Weather Service radar, airborne radar (from the Hurricane Research Division), and dropsonde data, provide intriguing insight into the three-dimensional structure of the hurricane. Another band of strong thunderstorms from a second eyewall also impacted the region. The strong winds aloft also created a situation where potent wind gusts could occur in thunderstorms and boundary layer turbulent eddies. National Weather Service radar data indicates many tornadoes, and satellite shows mesovortices on the inner edge of the eyewall capable of extreme wind damage (similar to the damage caused by mesovortices in Hurricane Andrew). The widespread wind damage is likely due to the longevity of hurricane-force wind exposure, fierce wind gusts, tornadoes, and mesovortices.

NOAA'a Hurricane Research Division sustained wind analysis (HWINDS) was used to determine the sustained winds at 506 River View Road. Tropical storm-force winds began around 1:00AM August 29 on River View Road, with hurricane-force winds beginning 6:45AM. Peak winds occurred on River View Road between 9:00-9:30AM with 110-115 mph sustained winds associated with the inner eyewall. Land inundation begins between 4-5AM at River View Road, but it did not reach a level to impact the elevated house until mid-morning. Hurricane-force, then tropical storm-force winds continued for another few hours, but of less intensity. In summary, River View Road was subject to tropical storm-force winds from conservatively 1AM to the late afternoon, and hurricane-force winds from 6:45AM to 11:45AM. The early morning winds are conservative; it's possible the sustained winds were even stronger.

Wind gusts 20-40% higher than the sustained winds frequently impacted the residence. The peak wind gust at River View Road is 125 to 135 mph, which is also consistent with radar and dropsonde wind data. This general area (Bay St. Louis) received the strongest wind gusts on the Mississippi coast. Two dropsondes were deployed near Bay St. Louis and Gulfport around 6:00AM which recorded winds of 115 mph and 119 mph at an altitude between 500 and 1000 feet, three hours before landfall (and the peak sustained winds). Downbursts associated with severe squall lines can transport these winds to the surface. The first squall line containing a radar reflectivity of between 45-50 dBZ arrived at 5:45AM, signifying when such winds gusts could be transferred downward. Microwave imagery, which is strongly attenuated by hydrometeors (suspended water and ice particles, as well as precipitation), clearly shows this squall to be a well-formed curved band which is likely an outer eyewall. This outer eyewall reached River View Road about 6:00AM, initiating peak wind gusts reaching 100 mph, with even stronger gusts possible in isolated regions. The inner eyewall reached River View Road around 9:00AM. At landfall, another dropsonde in Bay St. Louis showed winds of 155 mph at 1000 feet. This indicates that wind gusts between 130 and 140 mph were possible in this region at this time.

Based on this analysis, pre-landfall USGS tide gauge data, and other National Weather Service observations, a timeline can be established for the wind at 506 River View Road, and is summarized in Table 2.

II. Timing of wind and storm surge in Katrina at River View Road

Observations of Katrina's storm surge life cycle generally do not exist because all tide gauges failed in the southeast Louisiana marsh and Mississippi during the brunt of the storm. The previous few days of water levels, as well the first few hours of the storm surge, were documented. Typically, one to two days before a storm such as Katrina makes landfall, the water increases 2-3 feet, known as the *surge forerunner*. On the day of landfall, water starts to slowly increase, then rises faster as the hurricane eyewall makes landfall.

Despite the shortcomings of the gauges, they do provide a record of the wind and the surge before the eyewall comes onshore. They show unequivocally that tropical storm-force winds arrived several hours before the surge. A sample of Mississippi and Louisiana tide gauges are shown in Table 1, indicating that winds greater than 39 mph, and approaching hurricane strength, arrived between 4 and 8 hours before surge values of 8 feet occurred, less than would flood most homes.

Table 1. Summary of wind and surge at three USGS Mississippi gauges (Ocean Springs, Mississippi Sound, and the mouth of the Pearl River). Two from Louisiana are also shown (Bay Gardene and Bayou La Loutre). Note that tropical storm-force winds occurred for several hours with surge insufficient to inundate most properties.

Wind (mph)	*Storm surge (feet)*	*Location*	*Time*
42	3.2	Ocean Springs	8/29 at 2:30AM
74	8.5	Ocean Springs	8/29 at 7:15AM
36	2.3	Mississippi Sound	8/29 at 12:00 AM
53	5.9	Mississippi Sound	8/29/ at 4:00AM
40	4.4	Bay Gardene	8/28 at 5:15 PM
58	6.9	Bay Gardene	8/29 at 12:00AM
35	1.3	Bayou La Loutre	8/28 at 9PM
56	3.3	Bayou La Loutre	8/29 at 5AM
55	3.0	Mouth of Pearl River	8/29 at 12:00 AM

The gauges are not designed to withstand the eyewall region at landfall, and do not present a complete picture of the surge cycle. Since observations are lacking, three methods exist to document the storm surge: computer model simulations, post-storm high-water measurements, and eyewitness accounts. A computer model approximates time-dependent hydrodynamic equations which represent water flow n by wind and pressure fields. It can be used to explore the qualitative evolution of the storm surge, to fill in data gaps, and to explore physical relationships. High water mark surveys are conducted by government agencies (such as the National Weather Service, the Army Corps of Engineers, and the USGS), and private companies such as URS and Haag Engineering. Usually the elevations are recorded relative to vertical datum NAVD 88. They reflect either the stillwater elevation of the storm surge (areas outside the influence of breaking wave and wave runup, either far inland or inside buildings) or the stillwater elevation plus the wave runup component (areas in the wave swash zone - either breaking waves or wave runup). Stillwater elevation is recovered inside of commercial or residential structures as mud lines on walls or doors. The storm surge plus wave runup high water marks are generally found as debris or trash lines along coastal dunes, sloping terrain of the bay shoreline or the outside perimeter and exterior area of a structure. Based on the high water marks, 506 River View Road experienced a 22.5-foot storm surge, with wave action of 1.5 feet or less superimposed on the surge.

To assess the timeline of the surge versus wind, the U.S. Army Corps of Engineers ADvanced CIRCulation (ADCIRC) hydrodynamic model is used to simulate Katrina's storm surge. ADCIRC was initially developed under the Dredging Research Program, a 6-year program funded by the Army Corps of Engineers, Office of the Chief of Engineers. The model was developed as a family of 2- and 3-dimensional finite element based codes with the capability of simulating tidal circulation and storm surge propagation over very large computational domains, while simultaneously providing high-resolution output in areas of complex shoreline and bathymetry. In addition to numerous Army Corps of Engineer applications, ADCIRC has also been used by many universities, including LSU and Notre Dame, and companies such as WorldWinds, Inc., and the URS Corporation. The latter companies have performed work for Louisiana Natural Resources Department for research on the storm surge in Mississippi River Gulf Outlet, storm surge simulations for NASA, and other applications.

The ADCIRC simulation provides a timeline of the surge evolution. A video by Paul Russell (who stayed at Diamondhead) and the Betty Plombon book *Katrina and the Forgotten Coast*, (which includes interviews of residents who stayed), provided timing information as well. East of the hurricane's onshore winds, the surge moved up the Pearl River, Jordan River, and Bay St. Louis River at 5AM. Marsh regions near Pearlington and Pascagoula began to experience inundation. Islands offshore, the Louisiana marsh, as well as Dauphin Island in Alabama, are partially underwater. The surge is below 5 feet in most regions.

At 7AM and 9AM, this pattern continues, with surge values increasing along the Mississippi coast. The water elevation is below 13 feet in most regions, but enough to begin covering the land around River View Road, which had a land elevation of 3.5 feet. However, the elevated floor is 13.2 feet, and is not impacted by the surge until mid-to-late morning. It is estimated the surge reached the floor between 9:00 and 10:00AM, peaking at 22.5 feet at 11AM (8.7 feet water inundation in the house). This location also experienced 3 hours of wind gusts over 100 mph before inundation. Several videos, including the Diamondhead video, show inland waves of 1.5 feet or less during inundation.

Data was output from ADCIRC every 30 minutes to a spreadsheet for 506 River View Road. Based on all available data, a time series of the sustained wind speed, wind gusts, and the surge is shown in Table 2.

Table 2. Summary of sustained winds, wind gusts, and inundation (relative to land elevation) from storm surge for August 29, 2005 at 506 River View Road. Wave action less than 1.5 feet will be superimposed on the surge. Wind gusts of 100 mph likely began about 6:00AM. The elevated floor of the house is at 13.2 feet. The surge peaked at 22.5 feet at 11AM.

Time (Aug. 29)	*Sustained wind (mph)*	*Wind gusts (mph)*	*Storm surge relative to sea level (feet)*	*Storm surge relative to land (feet)*	*Inundation in elevated floor (feet)*
1:00AM	40 (northeast)	50	NA	land dry	house dry
4:00AM	55 (northeast)	70	4.0	0.5	house dry
5:30AM	60 (east-northeast)	80	5.5	2	house dry
6:30AM	70 (east-northeast)	105	7.0	3.5	house dry
7:00AM	85 (east-northeast)	110	8	4.5	house dry
8:30AM	100 (east-northeast)	125	11.0	7.5	house dry
9:30AM	110 (east-southeast)	135	14	10.5	0.8
10:00AM	100 (east-southeast)	125	16	12.5	2.8
10:30AM	95 (southeast)	110	20	16.5	6.8
11:00AM	80 (southeast)	95	22.5	19	9.3
12:00PM	70 (south)	85	20.0	16.5	6.8
1:00PM	60 (south-southwest)	75	17.0	13.5	3.8
4:00PM	45 (southwest)	55	9.0	5.5	house dry

3. Conclusions

The following conclusions can be stated about Hurricane Katrina's impact on 506 River View Road on August 29, 2005:

- Tide gauges show tropical-storm force winds arrived several hours before significant flooding from surge

- Computer models, National Weather Service radar, reconnaissance radar, dropsondes, surface observations, tide gauge data, eyewitness accounts, newspaper reports, and video show hurricane-force winds, tropical storm-force winds, and strong wind gusts occurred hours before the surge impacted River View Road. The Hurricane Research Division wind analysis concurs with this assessment. An outer eyewall contributed to strong winds and winds gusts hours before the eye (and an inner eyewall) impacted this location.

- The elevated floor at 506 River View Road is at 13.2 feet, and became inundated between 9AM and 10AM. The peak surge occurred at 11:00AM reaching 22.5 feet (9.3 feet inundation in the house). Waves of 1.5 foot or less were superimposed on the surge. Tropical storm-force winds occurred from 1AM to the late afternoon, and hurricane-force winds from 6:45AM to 11:45. Peak sustained winds were 110 to 115 mph between 9AM and 9:30AM. The early morning winds are conservative; it's possible the sustained winds were even stronger.

- Wind gusts were 20-40% higher than the sustained winds from downbursts and turbulent eddies in association with one squall line at 6:00AM, followed briefly afterwards by an outer eyewall. Wind gusts over 100 mph began at 6:00AM. Wind gusts peaked between 125 and 135 mph. The open exposure of the structure to wind gusts along the water made this structure particularly prone to wind damage. Therefore, the structure experienced strong winds for a considerable period of time before the surge, and also experienced penetration by wind-driven rain.

- In addition, radar indicates numerous mesocyclones along the Mississippi coast during landfall. 20-30% of mesocyclones spawn tornadoes. While no definitive statement can be made on whether a tornado impacted 506 River View Road, it is a certainty some properties on the Mississippi coast were affected by tornadoes.

This report is based on current data, and subject to modifications from any new information.

Report prepared by Dr. Pat Fitzpatrick:

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ATTACHMENT D

BIOGRAPHICAL SKETCHES

Neil B. Hall, Ph.D., A.I.A.

Neil B. Hall & Associates, LLC
1923 Corporate Square Boulevard, Ste. B
Slidell, Louisiana 70458
985-690-6008 neilbhall@gmail.com

Neil Hall served as a commissioned officer in both the Army Corps of Engineers and the Navy Civil Engineer Corps. He holds undergraduate and professional degrees in Architecture, graduate degrees in Systems Management and Landscape Architecture and a Ph.D. in Urban Studies.

Since 1995, Neil has specialized in the forensic investigation of building performance, structural health and failure analysis. He has been qualified by Federal and State Courts as an Expert Witness in the fields of Architecture, Landscape Architecture, Civil and Structural Engineering, Mold Remediation, Highway Design, Traffic Safety and Building Codes. He has inspected thousands of buildings and structures damaged by hurricanes, tornados, floods, earthquakes, sinkholes, vibration, foundation settlement, hidden decay and construction defects.

Neil is a member of the American Institute of Architects, American Society of Civil Engineers, Roof Consultants Institute and American Indoor Air Quality Council. He served as a member of the FEMA Building Performance Appraisal Team (BPAT) for Hurricane Georges. He is a designated wind engineer for the Texas Department of Insurance and wind investigator for the U.S. Department of Energy. Neil is a Certified Fire Investigator, Certified Microbial Remediation Supervisor, Third-Party EIFS Inspector and an expert in the field of building pathology. He is a Level 1 Infrared Thermographer and has completed the LSU Master Termite Technician training program.

Neil is a member of the ASCE/SEI Standards Committee for the Structural Condition Assessment and Rehabilitation of Existing Buildings. The committee is responsible for the publication of *Guideline for Structural Condition Assessment of Existing Buildings* (SEI/ASCE 11) and *Guideline for Condition Assessment of the Building Envelope* (SEI/ASCE 30). Neil is a member of the AIA's Knowledge Center for Building Performance, Codes and Standards and the RCI's research committee on mold.

Neil has held teaching positions at the University of Iowa, University of Maryland, Troy State University and Tulane University. He teaches Project Management at the University of Phoenix and Research Methods at Troy State University. He also lectures at the University of Texas (Arlington) Building Professional Institute and the Louisiana State University Building Contractors Institute.

Jim H. Moore, P.E.

Moore Forensic Engineering, P.A.
1775 W. Williams Street, PMB 134
Apex, North Carolina 27523
919-363-2113

Jim Moore is a licensed Professional Engineer with over thirty years engineering experience including sixteen years of consulting and forensic engineering in insurance claim and litigation matters. Engineering investigations performed cover a broad range of industrial, commercial and residential categories and include fire cause determination of commercial and domestic appliances, failure analyses of electrical/mechanical devices, vehicle mechanical failures and vehicle fires.

Jim holds Bachelor of Science degrees in both Mechanical Engineering and Civil Engineering. He has been accepted in State and Federal courts as an expert in the fields of engineering and fire investigation. His technical certifications include Certified Fire and Explosion Investigator (CFEI), Certified Fire Investigation Instructor (CFII) and Certified Vehicle Fire Investigator (CVFI).

Jim started his engineering career in Kansas City as a Mechanical Design Engineer for Black & Veatch Consulting Engineers in power plant design and also designed commercial HVAC and plumbing systems with Stewart Enterprises in New Orleans. He worked as a Reliability Analyst for Martin Marietta Manned Space Systems performing failure analyses and functional check-out and modification of critical systems supporting the Space Shuttle system. Since 1987 he has specialized in forensic engineering working with System Engineering & Laboratories (Tyler, Texas), Engineering & Fire Investigations (Kingwood, Texas) and McClancy Engineering (Apex, North Carolina). Currently he is Principal of his own firm in Apex, North Carolina specializing in forensic engineering, fire investigation, inspection of buildings damaged by hurricanes and building damage assessment report reviews.

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
SOUTHERN DIVISION

FRANK ANTHONY AND CLARE ANTHONY

CIVIL ACTION NO. 1:08CV300 LTS-RHW

VERSUS

STATE FARM FIRE AND CASUALTY COMPANY, et al.

****
****

Deposition of Dr. Neil Hall, taken at the offices of deponent, Neil B. Hall & Associates, 1923 Corporate Square Boulevard, Slidell, Louisiana 70458 on Wednesday, May 27, 2009, commencing at/about 8:00 a.m.

Reported by: Sharon J. Cemo, CCR

Exhibit "N"

I N D E X

E X H I B I T S

the storm event. In this case I think a lot of that was ripped off by wind before the water got there. Absent wind, yeah, there would have been some removal of the cladding material by the flood water, but no structural racking of the building.

Q. Could it have penetrated into the interior of the home?

MR. GIBSON:

Objection.

BY MR. SHANLEY:

Q. I'm sorry. Surge?

A. Yes, even without taking off the cladding, it is going to get inside and wet the entire interior.

Q. But in your opinion, the force of that surge would not have racked this building?

A. No, in fact, not only in the hypothetical, I didn't see any evidence of racking, meaning permanent defamation of the structural frame in the photographs to say that either wind or flood did that.

Q. In other words, wind didn't rack this building either?

A. No.

Q. No, wind didn't?

A. No, wind did not rack the building.
Q. The gentleman that you spoke with on the phone, what was his name?
A. Mr. Michael Brandner.
Q. He represented himself as being the grandson of the Anthonys?
A. Mr. and Mrs. Anthony, yes.
Q. Do you know why the home or the debris that was once the home was removed leaving only the slab subsequent to the storm?
A. I don't know why the decision was made to do it. I think it is a reasonable decision. Had I been asked, I would have said, yeah, take the house down and start over again. It is going to cost more to repair it, then to remove and replace it.
Q. Again, it is your opinion nor would it be necessary for your opinion that there was an unusual atmospheric event, such as localized convection of a tornado or micro burst at this location?
A. No, it is not essential for my analysis, if that occurred. Whether or not it actually did and if a meteorologist establishes it, that is one thing. I generally go by straight

A. It was supporting a deck and a shed roof which was enclosed and attached to the building.
Q. Was the deck heated and cooled?
A. I don't know.
Q. I am going to read to you from a report of Compton Engineering under date 5-10-2006. It states as follows: Floating debris (pine cone silt branches, et cetera was observed in the attic). Do you have an opinion if that is the case, of how floating debris, silt branches were observed in the attic or why they were observed in the attic, assuming that is true?
A. I have already said there is a chance that some water got up into the attic space. But if I got debris, it is more likely the debris got through openings. The water could have gotten high enough to get into the attic space. I don't think that the water was strong enough to breach the outside and it wouldn't have dropped the ceilings until the water receded. So if there was water born debris in the attic space, there were wind caused openings through which water got some debris in the attic space.
Q. How could you have silt in the attic

The Structures Group, Inc.
Consulting Engineers

February 11, 2009

Dion J. Shanley, Esq.
Hickman, Goza, and Spragins, PLLC
Attorneys at Law
115 Homestead Drive
Madison, MS 39110

Privileged & Confidential
Attorney Work Product

Re: HGS/Anthony/506 Riverview Drive
TSG No. VA09006.LIT

Dear Mr. Shanley:

At your request, we performed a peer review of the documentation compiled to date by your firm for the former elevated single family residence located at 506 Riverview Drive within Hancock County, Mississippi, just west of the City of Bay St. Louis. In addition to our peer review, we also provided a review of historic weather and satellite information of the site. The purpose of our peer review of these documents was to assess the nature and extent of distress to the residence resulting from high winds, storm surge, and/or fallen trees due to Hurricane Katrina.

A site visit to the location of the former residence located at 506 Riverview Drive has not yet been provided at this time by our firm prior to our engagement and submission of this peer review. Discussions with counsel revealed that, at the time of our firm being retained, while portions of the former residence remained, debris from the storm surge had been removed from the site. Prior to our deposition and/or testimony, a site visit to the residence will be performed. However site reviews had been performed by our firm at nearby residences shortly after the storm, including 903 Deer Drive, Hancock County, Mississippi, which is located approximately 454 yards south-southeast of 506 Riverview Drive. Further, we note that our local site visits included four (4) additional properties within a 1 mile radius of 506 Riverview Drive. These locations included 36 Dolphin Circle, Hancock County, MS; 124 Edith Drive, Bay St. Louis, MS; 3037 Washington Avenue and 22 Wolf Street, Hancock County, MS.

We note that the former single family residence was an elevated timber framed residence constructed over a cast-in-place concrete slab on grade and supported on timber piles. The "A" frame roof was surfaced with metal panel roofing over a former asphalt shingle finish and the exterior of the residence was surfaced with horizontal siding over a former rigid shake style siding. The site of the former single family residence is located on a canal that provided direct access to the Jourdan River and St. Louis Bay. A timber boat dock and bulkhead were located on the property abutting the canal. Further, the residence is located approximately 0.2 miles south of the Jourdan River.

REVIEW OF REPORT PREPARED BY COMPTON ENGINEERING, INC.

We reviewed the Property Inspection report prepared for Mr. Frank Anthony by Compton Engineering, Inc. (CE), dated May 15, 2006. According to the Property Inspection report, CE was to evaluate any structural damage that could have been caused by the effects of Hurricane Katrina. Further, the report states that it is based on visual observations only and does not include design calculations, subsurface investigations, or destructive inspections.

1200 Old Colony Lane
Williamsburg, VA 23185

Exhibit "O"

Phone (757) 220-0163
Fax (757) 220-1546

Based on our review of the report, we noted that Mr. Nicholas A. Mignone, P.E. of CE provided a site visit to the property on May 10, 2006. At the time of the site visit, the remaining elements of the residence included the walls, floors, and roof assemblies supported on timber piles and girders. The property also included a timber boat dock on a canal. The report we received had attachments containing photos. A copy of this report has not been included in the appendices of this report since it was provided to us by counsel.

We noted the following in our review of the CE report:

- Capital Engineering, Inc. (CE) is listed as a Mississippi Professional Engineering Firm as Compton Engineering, P.A. with Certificate of Authority No. 00000092.
- CE's office is listed with the Mississippi Engineering Board as 1706 Convent Ave. located in Pascagoula, Mississippi.
- Our research revealed that CE has offices at 1706 Convent Avenue, Pascagoula, Mississippi; 156 Nixon Street, Biloxi, Mississippi; and 3036 Longfellow Drive, Bay St. Louis, Mississippi.
- The CE report was signed and sealed by Nicholas A. Mignone, P.E.
- Our research revealed that Mr. Mignone is a licensed Professional Engineer within the State of Mississippi, holding License No. 10647.
- Our research revealed Mr. Mignone is listed as working for International Paper.
- Our research revealed Mr. Mignone's address as 3890 Lakefront Drive, Mobile, Alabama.
- The CE report included a cover letter dated May 15, 2006, signed by Geoffrey F. Clemens, P.E., who was titled as a Vice President for Compton Engineering, Inc. working out of the Bay St. Louis office.
- Our research revealed that Mr. Clemens is a registered Professional Engineer in the State of Mississippi holding License No. 14037.
- The CE report noted that the subject property was located on a canal connected to Edwards Bayou, which empties into the Jourdan River, approximately 0.2 miles north.
- The CE report noted the structure was an elevated, residential, wood framed building with the east elevation facing Riverview Drive.
- The CE report noted the roof was originally covered with asphalt shingles which had been covered with a metal roof and vinyl trim.
- The CE report noted the exterior walls were originally shingled and subsequently sheathed over with horizontal vinyl siding.
- The CE report noted the house framing to be connected to twenty-four (24) eight (8) inch diameter, creosote impregnated wood posts buried six (6) feet in the ground.
- The CE report noted a cast-in-place concrete slab on grade beneath the residence.
- The CE report noted an enclosed single car garage was located on the southeast corner of the cast-in-place on grade concrete slab.
- The CE report noted the heated and cooled area of the residence to be 2,350 square feet.
- The CE report noted floating debris (pine cones, silt, branches, etc.) in the attic.
- The CE report cites records from the storm indicate water levels of 15 to 17 feet and wind gusts of approximately 125 mph. (*However, no source for these records is named.*)
- The CE report noted the structure was located in an A8 (elevation 11 feet) flood zone.
- The CE report noted the topography was flat with trees either broken or stripped of bark to the north, and living large trees to the east and south.
- The CE report noted fallen trees in the area were generally lying in the west, northwest direction.

- The CE report noted that all of the surrounding residences were elevated wood construction and had received extensive structural damage.
- The CE report noted that the roof rafters were 2 x 8, 16" on center, which rested on 2 x 12's on the north and south walls, and were connected by hurricane straps.
- The CE report noted the 2 x 12's were bolted to the 8" diameter posts extending from the grade.
- The CE report noted the entire metal roofing was missing and approximately 20% of the shingled roofing was missing. Several sections of the plywood roof sheathing were missing or damaged.
- The CE report noted that the vinyl trim on the soffit and fascia board was missing.
- The CE report noted that the double 2 x 10 ridge beam was fractured.
- The CE report noted one fractured wood rafter.
- The CE report noted the northeast corner of the roof was the only section of the roof that collapsed.

- The CE report noted that the majority of the exterior ground floor walls had failed.
- The CE report noted that the floor frame was bolted to the perimeter posts.
- The CE report reveals that the post foundation extends from the ground to the roof.
- The CE report noted that, after the storm, several level measurements revealed the four (4) posts at ground level inclined to the south. However, all of the posts measured vertical on the second floor.

- The CE report noted two (2) fractures in the cast-in-place concrete slab on grade.
- The CE report concluded:
  - Rising water and wave action was responsible for much of the exterior wall structural damage observed on the ground and second floor.
  - All the roof damage including the missing metal roof, failed roof deck, missing vinyl trim on the soffit and fascia board and the fractured wood members seen at the top of the roof ridge line is believed to have been caused by the wind.
  - A case can be made for a high wind event (tornado or wind shear) occurring during the storm on the east side of the structure.
    - The large trees that had been located on the northeast corner of the structure. Two had their trunks twisted off several feet above the ground and the one dead one still standing had all of the bark removed from its trunk. (*Photographs of these trees or there location are not provided.*)
    - The failure of the northeast corner foundation post (snapped in two approximately ten feet above grade). The way the house floor frame and roof had been connected to the perimeter supporting post had provided excellent lateral bracing in the east/west and the north/south orientation. It is difficult to understand how this support post failed from just storm surge yet none of the other post (some of which were longer) show any signs of structural damage. (Yet water borne debris or debris impact not noted or considered.)
    - The east bearing wall on the second floor failed at the top (not the bottom which is common for water pressure), the bottom still being connected to the floor. (*However, the gable end above is intact.*)
    - The structural wood members that fractured were on the east side of the structure. Most of these failings were on the north side of the ridge line. (*?.*)

- The 23 undamaged support posts seem to be structurally sound, are plumb and are reusable.
- Except for the damage at the northeast corner support post, the floor frame did not appear damaged.
- Except for the two (2) fractures seen in the ground level, the concrete slab on the southwest side of the structure, the concrete slab looked in good condition.
- Except for the components mentioned under Section 2.4, that part of the roof frame that could be observed (east half of structure) looked to be in good structural condition.

- Approximately 80 percent of the 2" by 4" wall members observed seem to be in good structural condition.
- The boat dock on the southeast side of the structure looked to be in good condition.

REVIEW OF WEATHER REPORT PREPARED BY DR. PAT FITZPATRICK

We reviewed the report titled "The wind and surge of Hurricane Katrina on 506 River View Road, Bay St. Louis, MS" prepared by Dr. Pat Fitzpatrick (DPF) of Slidell, Louisiana. While the report is not dated, Dr. Fitzpatrick did provide a date with his signature of January 15, 2009. Dr. Pat Fitzpatrick's office is located at 180 B Lakeview Drive, Slidell, Louisiana.

While we note that the title, Consultant meteorologist, was below Dr. Pat Fitzpatrick on the cover of the report, our research revealed that Dr. Pat Fitzpatrick is not listed as a Certified Consulting Meteorologist with the American Meteorological Society. Our research does reveal that Dr. Pat Fitzpatrick is an Associate Research Professor in the Geosystems Research Institute (GRI) of Mississippi State University located in the Thad Cochran Research and Technology Park in Starkville, Mississippi. The GRI also includes operations at NASA's John C. Stennis Space Center (SSC) located on the Mississippi/Louisiana state line just north of Interstate 10. A copy of this report has not been included in the appendices of this report since it was provided to us by counsel.

Based on our review of the Fitzpatrick report, we note the following:

- The DPF report stated it presents information about Katrina's wind and storm surge elements at 506 River View Road in Bay St. Louis, Mississippi. It divides this information into three (3) sections.

- The DPF report defined the storm surge as an abnormal rise of the sea along the shore generated by an intense storm such as a hurricane.
- The DPF report stated that storm surge is caused primarily by the winds pushing water toward the coast and wave breaking, which propels water further inland.
- The DPF report stated that a secondary contribution to the surge is made by the reduced barometric pressure within the storm.
- The DPF report stated wind and wind-generated waves are the primary contributors to storm surge.

- The DPF report stated that the storm surge rises gradually, then quickly as the storm makes landfall.

- The DPF report stated that the factors that impact storm surge elevation include storm size, storm central pressure, storm intensity, bathymetry, speed of motion of the system, wave setup, track angle, and local effects.

With regard to surge heights, the DPF report states:

- The larger the aerial extent of tropical storm-force winds, the higher the water elevation.
- That lower interior atmospheric pressure increases the water level.
- That the more intense the hurricane, the higher the water elevation.
- Shallow areas with a gradual slope will experience greater storm surge than areas with a shelf that drops off rapidly near the coast. Further, the report stated that Louisiana and Mississippi are prone to high storm surges.
- Slower moving hurricanes can cause a storm surge 50% to 70% higher than fast moving hurricanes.

- In hurricane conditions, the water may not completely retreat before the next wave arrives.
- Wind-induced surge enables waves to penetrate much further inland before they breakdown on the shallow Mississippi coast, this effect is minor.
- Storms which make landfall perpendicular to the coastline produce larger storm surges than those hit at an angle.
- The DPF report stated that the storm surge is always the highest on the side of the eye corresponding to onshore winds (usually right side of the point of landfall). Winds are also fastest in the right front quadrant because storm motion is added to the hurricane's winds.
- The DPF report stated that because winds spiral inward, the storm surge is greatest along the eyewall but high water can impact other regions as well.
- The DPF report stated the total elevated water is composed of the astronomical tide, the steric effect (warm water in the summer versus cooler winter water), and ocean waves.
- The DPF report noted that by definition, storm surge does not include waves.
- The DPF report stated Katrina's hurricane force winds extended 120 miles from the storm center and tropical storm force winds 230 miles outward.
- The DPF report stated that National Weather Service radar data indicates many tornadoes, and satellite shows mesovortices on the inner edge of the eyewall capable of extreme wind damage.
- The DPF report stated that widespread wind damage is likely due to the longevity of hurricane-force wind exposure, fierce wind gusts, tornadoes, and mesovortices.
- The DPF report referenced NOAA's Hurricane Research Division sustained wind analysis (HWINDS) to determine the sustained wind at 506 River View Road.
- The DPF report referenced two (2) dropsondes deployed near Bay St. Louis and Gulfport between 6:00 a.m. which recorded wind of 115 mph and 119 mph at an altitude of 500 feet and 1,000 feet three hours before landfall. (*No wind speeds at the ground surface were noted.*)
- The DPF report established a timeline for wind at 506 River View Road.
- The DPF report denotes the outer eyewall reached River View Road around 6am and the inner eyewall at 9am.
- The DPF report stated that observations of Katrina's storm surge life cycle generally do not exist because all tide gauges failed in the southeast Louisiana marsh and Mississippi during the brunt of the storm.
- The DPF report denotes that still water elevations of the storm surge are recorded inside of commercial or residential structures as mud lines on wall or doors.
- The DPF report stated that, based on high water marks, 506 River View Road experienced a 22.5' storm surge with wave action of 1.5' or less superimposed on the surge.

- The DPF report relied on data from the U.S. Corps of Engineers ADvanced CIRCulation (ADCIRC) hydrodynamic modeling program to provide a timeline for surge evolution on the Mississippi coast. (*This program simulates the storm surge.*)
- The DPF report also referenced a video by Paul Russell, a resident of Diamondhead, and a book, Katrina and the forgotten coast, by Betty Plombon in the surge timeline. (*Neither document was provided for our review*).
- The DPF report stated that 506 River View Road had an elevated first floor elevation of 13.9 feet above sea level.
- The DPF report estimated the surge reached the elevated floor of the house between 9:00 a.m. and 10:00 a.m., peaking at 22.5 feet above see level at 11:00 a.m.
- The DPF report stated the location also experienced 3 hours of wind gusts over 100 mph before inundation.
- The DPF report concluded:
    - Tide gauges show tropical-storm force winds arrived several hours before significant flooding from surge.
    - Computer models, National Weather Service radar, reconnaissance radar, dropsondes, surface observations, tide gauge data, eyewitness accounts, newspaper reports, and video show hurricane-force winds, tropical storm-force winds, and strong wind gusts occurred hours before the surge impacted River View Road. (*However, none of this data was attached to the report and the correct address is Riverview Drive.*)
    - The elevated floor at 506 River View Road is at 13.9 feet, and became inundated between 9:00 a.m. and 10:00 a.m. The peak surge occurred at 11:00 a.m. reaching 22.5 feet. Waves of 1.5 foot or less were superimposed on the surge. Tropical storm-force winds occurred from 1:00 a.m. to the late afternoon, and hurricane-force winds from 6:45 a.m. to 11:45. Peak sustained winds were 110 to 115 mph between 9:00 a.m. and 9:30 a.m.
    - Wind gusts were 20-40% higher than the sustained winds from downbursts and turbulent eddies in association with one squall line at 6:00 a.m., followed briefly afterwards by an outer eyewall. Wind gusts over 100 mph began at 6:00 a.m. Wind gusts peaked between 125 and 135 mph. The open exposure of the structure to wind gusts along the water made this structure particularly prone to wind damage. Therefore, the structure experienced strong winds for a considerable period of time before the surge, and also experienced penetration by wind-driven rain.
    - In addition, radar indicates numerous mesocyclones along the Mississippi coast during landfall. 20-30% of mesocyclones spawn tornadoes. While no definitive statement can be made on whether a tornado impacted 506 River View Road, it is a certainty some properties on the Mississippi coast were affected by tornadoes.
- Note: Other than text below a photo on the title page, no mention is made about what category storm Hurricane Katrina was (including on impact) other than "it was unusually large."

REVIEW OF REPORT PREPARED BY NEIL B. HALL & ASSOCIATES, LLC

We reviewed the "Building Damage Assessment" report prepared by Neil B. Hall and Associates, LLC (NBHA), dated January 15, 2009. According to the Building Damage Assessment, report number 90,000, NBHA was to determine the extent of damaged caused by wind and flood to the Anthony residence at 506 Riverview Road, Bay St. Louis, Mississippi as a result of Hurricane Katrina. Further, the report states that the report was reviewed for consistency of data and use of a systematic approach desirable and necessary in the analysis of building failure.

Based on our review of the report, we noted that a representative of NBHA provided a site visit to the property on January 15, 2009. At the time of the site visit, the remaining elements of the previous residence included four (4) timber piles and cast-in-place concrete slab on grade. The report we received had attachments containing maps and aerial photos, as well as photos from the NBHA site inspection, wind and flood data, an elevation certificate, and a copy of a report prepared by Dr. Pat Fitzgerald. A copy of this NHBA report has not been included in the appendices of this report since it was provided to us by counsel. We noted the following in our review of the NBHA report:

- The NBHA report was signed by Neil B. Hall, Ph.D. Below the name Neil B. Hall, Ph.D. are national organizations; American Institute of Architects and American Society of Civil Engineers.
- The NBHA report was reviewed by Jim H. Moore, P.E. However, the report was not signed by Mr. Moore or sealed with a Mississippi Professional Engineer stamp by Mr. Moore.
- Our research revealed that Mr. Moore is a licensed Professional Engineer within the State of Mississippi, holding license No. 10709.
- NBHA's office is located at 1923 Corporate Square Boulevard, Suite B, within the City of Slidell, Louisiana.
- Our research revealed that Mr. Hall has an undergraduate degree in Architecture, a graduate degree Systems Management and Landscape Architecture, with a Ph.D. in Urban Studies. We note Mr. Hall is not a licensed Architect or Professional Engineer within the State of Louisiana, or the State of Mississippi. Our research also revealed that Mr. Hall is a licensed Professional Engineer in the State of Texas.
- However, our research also revealed that Mr. Hall is licensed as a ***limited*** Professional Engineer within the State of Mississippi with license No. 18831. (*Our research revealed that a "limited" Professional Engineer license is now issued in the State of Mississippi for persons who are **not** authorized to perform engineering but are **authorized** to provide expert testimony n the field of engineering in the form of an opinion in an administrative or judicial proceeding*).
- The NBHA report was not sealed by Mr. Hall with a Professional Engineer seal.
- The NBHA report did not provide all of the aerial photographs, maps, and the referenced data used in the evaluation; however, it was noted that this information was on file.
- The NBHA report noted an interview with Mr. Michael Brandner, grandson of the owner, conducted on January 14, 2009.
- The NBHA report noted Hurricane Katrina made its third landfall on the Louisiana/Mississippi border at about 11:00 CDT on August 29, 2005 with sustained winds at 125 mph at the eyewall.
- The NBHA report included public domain documents including a FEMA HAZUS 3-second wind gust ARA map.
- The NBHA report noted the FEMA HAZUS map showed a 128 mph 3-second wind gust in the Bay St. Louis area.
- The NBHA report noted the NOAA wind gust map showed a 120 mph wind gust.
- The NBHA report noted the NOAA wind gust map has a ±15% margin of error.
- The NBHA report included the ARA maps developed for the FEMA HAZUS program. They denoted a wind gust speed of 125 mph near Diamondhead, Mississippi. (*It should be noted that the FEMA HAZUS program is a risk assessment software program for analyzing potential losses from floods, hurricane winds, and earthquakes. It should be noted that the key word here is "potential"*

"potential" losses, not actual losses.)

- The NBHA report noted the elevation certificate denotes the first elevated floor level to be 13.91 feet above sea level.
- The NBHA report noted and included a FEMA flood hazard map with a high water mark of 20.4 feet located 500 feet from the Anthony residence.
- The NBHA report referenced and included the report by Dr. Pat Fitzpatrick. However, the copy of the report included was not signed by Dr. Fitzpatrick, or dated.
- The NBHA report used the 13.2' floor elevation from Dr. Fitzpatrick's report.
- The NBHA report noted that after construction, the exterior cladding was covered with insulation and with vinyl or aluminum horizontal siding. Further, the NBHA report assumed aluminum siding was used.
- The NBHA report noted exterior walls were constructed under the elevated portion of the house so that the vinyl siding was uniformly applied from the eave to ground level. *(We note that the NBHA report previously assumed the siding was aluminum.)*
- The NBHA report notes the residence was originally built in the 1970s and about 2002 an addition was added to the rear of the house.
- The NBHA report noted that the residence was completely demolished and removed prior to their site visit.
- The NBHA report noted that the "wood plank" dock was still intact.
- The NBHA report noted the metal roof being removed leaving the battens and the former shingle roof below exposed. Some shingles were also lost, exposing building paper and some roof sheathing was noted as missing.
- The NBHA report noted the siding was removed from most locations, exposing the original cladding. Further, under the elevated structure, the ceiling and fans remained intact.
- The NBHA report stated the roof over the screened-in patio was removed by wind exposing the original structure to wind and wind driven rain.
- The NBHA report referenced the time line developed by Dr. Fitzpatrick, which listed a 135 mph wind gusts crossed the property when only 2.8 feet of water was above the finished floor.
- The NBHA report referenced the EF Scale (Enhanced Fujita Scale) and stated that a significant amount of metal roof awning and sections of roof deck would have been lost as early as 6:30 CDT (central daylight time) when the wind reached 105 mph.
- The NBHA report noted that the loss of roof covering on the residence would have occurred by 8:30 CDT and would have rendered the elevated portion of the building and its contents a total economic loss prior to the arrival of the storm surge.
- The NBHA report noted the surge eventually rose to 9.3 feet above the finish floor of the elevated portion of the building. *(This would place the storm surge at 13.91 + 9.3 = 23.01 above sea level)*
- The NBHA report concluded:
  - Wind damaged the elevated portion of the building.
  - Wind also removed the siding at the lower level before the rise of storm surge.
  - The building was rendered a total economic loss due to wind load prior to the rise of the storm surge level of the elevated structures.
  - Flood damaged the lower portion of the building under the elevated floor level (collapse of break-away walls and water-damage to the lower floor level in advanced of damage caused by wind).
- The NBHA report included Google aerial photos and maps with the property location noted.

- We note that the highest elevation and first aerial photo has the location of the residence noted incorrectly.
- The aerial photos are taken both prior to and after Katrina.

- The NBHA report included photos taken during their site visit on January 15, 2009. The photos illustrate:
  - The elevated residence has been demolished except for four (4) timber piles along the rear elevation and the cast-in-place concrete slab on grade.
  - Broken light poles on the property.
  - The timber dock was still generally intact.
  - Photos of other residences adjacent to the Anthony residence.
  - Broken and demolished trees on Chapman Road and uprooted trees on Riverview Road.
- The NBHA report included photos taken prior to the storm. These photos included prior to and during renovation.
  - The original residence was elevated with an "A" frame roof, with rigid shake style siding, and an open porch with a shed roof.
  - The residence is flanked by trees.
  - The renovation included enclosing the lower ground floor.
  - The renovation added horizontal vinyl siding to the lower and upper elevations of the residence.
  - The renovation added metal roofing over the existing roof surface.
  - The renovation included an elevated first floor addition to the rear elevation.
- The NBHA report included photos of the residence taken after Hurricane Katrina. The photos illustrate:
  - The structure was generally intact except for the rear elevation addition built during the previous renovation which was demolished.
  - The roof structure appeared intact and most of the shingles from the original roof finish were still in place.
  - The elevated wall on the front elevation had a significant loss of sheathing and exterior finish. A portion of this wall was leaning outward.
  - The left elevation walls were generally still intact without most of the exterior horizontal siding finish applied during the renovation.
  - The property is separated from a broad marsh by a canal.
  - The property has standing trees and is surrounded with properties with standing trees.
- The NBHA report included a copy of an elevation certificate dated June 27, 1998 for 506 Riverview Drive.
  - The elevation certificate was sealed by Eugene O. Richardson, noted to have license No. RLS 1286.
  - Our research did not reveal Mr. Eugene Richardson as being a professional land surveyor at this time.
  - The elevation certificate noted the residence to be in an A-8 Flood Zone with a base flood elevation of 11 feet above sea level.
  - The elevation certificate noted the top of the first floor was 9.5 feet above the highest grade adjacent to the building.
  - The elevation certificate noted the top of the referenced elevated floor level to be 13.91 feet above sea level.

  - The elevation certificate denotes the top of the lowest grade immediate adjacent to the building to be 4.1 feet.
- The NBHA report included a copy of the ARA wind model for FEMA HAZUS for portions of Louisiana, Mississippi, and Alabama.
- The NBHA report included a copy of the NBHA Hurricane Katrina Wind Gust Analysis for parts of Louisiana, Mississippi, and Alabama.

REVIEW OF STATE FARM DOCUMENTATION

We reviewed information denoted to be from State Farm, including claim file photos and wind and water inundation illustrations. Our review of these documents revealed the following:

- Copies of Google maps were provided denoting the property location as west of Bay St. Louis and the St. Louis Bay, and south of the Jourdan River.
- A copy of the Saffir-Simpson Hurricane Scale published by NOAA was provided with the text under the heading "Category Two Hurricane" highlighted.
- A copy of the NOAA Katrina Impact Assessment Map showing the wind speed ranges for the Bay St. Louis and Pass Christian area was provided which indicated the wind speed in the area of 506 Riverview Drive to be 95 to 100 mph.
- High altitude photos of the insured property following the hurricane were provided and revealed:
  - An extensive debris field in and around the residence and adjacent residences.
  - The insured residence was one of several neighboring residences still standing.
  - The insured residence appeared to have lost roof finishes and some sheathing on the lower portion of the north slope.
  - Several adjacent residences do not exhibit significant roof damage or roof covering damage.
  - The residence is located the convergence of canals that empty into a river to the north.
  - One photo was provided with topographic elevation contours superimposed. The residence is located between the water (0') and the 4' above sea level contour. Further, the photo has a label noting the FEMA topography to equal approximately 4' above sea level.
  - One photo was provided with the hurricane surge elevation superimposed. We note the residence is located between the 22' and 23' above sea level surge lines.
  - Original claim photos were also provided.
  - An undated photo of the residence located at 512 Riverview Drive, located 118 yards south-southeast of 506 Riverview Drive, revealed that most of the residence was demolished, except for a damaged on grade framed segment.

- Review of the owner provided photos revealed:
  - Several photos are noted to have been taken prior to the residence being enlarged and new exterior finished added.
  - Prior to renovation, the residence was generally open at the on-grade level.
  - We note photos taken during renovation that added to the size of the elevated residence, enclosed the lower elevation and re-covered the existing exterior walls with horizontal vinyl siding.
  - Photos taken after the hurricane reveal:

- The ground floor walls generally collapsed on the front, right, left, and rear elevations.
- A portion of the elevated first floor front elevation wall was deflected outward.
- Exterior metal roofing removed.
- Exterior horizontal vinyl siding removed with the exception of the front corner of the left elevation.
- Roof surface damage along the eaves.

- A photo of the insured property dated October 1, 2008 revealed the structure as unrepaired and generally open to the elements.
- A photo dated September 13, 2007 of the residence located at 250 Tarpon Drive, located 458 feet south-southwest of 506 Riverside Drive, revealed a damaged one story elevated residence. The residence was missing wall finishes (interior and exterior), but retained most or all of its roof covering.
- An undated photo of the residence located at 636 Riverview Drive, located 742 feet south-southeast of 506 Riverside Drive, revealed an elevated single story residence. We note the isolated damaged roof finishes on the residence.
- An undated photo and a photo dated August 21, 2007 of the residence located one lot west of 419 Tarpon Drive, located 842 feet west-southwest of 506 Riverview Drive, revealed an elevated single story residence with missing exterior wall finishes, missing windows, and missing doors. However, the second floor windows were intact and the roof does not appear to be damaged.
- A photo dated August 24, 2007 of the residence located at 133 Edith Drive, located 927 feet northwest of 506 Riverview Drive, revealed a former elevated two (2) story residence. The residence appeared to be missing a portion of the second floor and most of the exterior wall finishes. However, the second floor windows were intact and the roof was still attached.
- Photos undated and dated October 30, 2006 of the residence located at 141 Janelle Drive, located 957 feet north-northwest of 506 Riverview Drive, revealed an elevated two (2) story residence. The exterior and interior walls shown lost most finishes, and the roof has lost a significant number of shingles.
- A photo dated September 13, 2007 of the residence located at 245 Skyline Drive, located 1,136 feet east of 506 Riverview Drive, revealed an elevated one story residence. We note the exterior wall has no interior or exterior finishes, and the windows and doors are missing. However, the roof was still attached.
- A photo dated August 21, 2007 of the residence located at 33 Pompano Circle, located 1,320 feet south of 506 Riverview Drive, revealed a covered boat dock with metal roofing. The roofing is generally intact.
- A photo dated October 30, 2006 of the residence located at 100 Elaine Drive, located 2,372 feet northwest of 506 Riverview Drive, revealed an elevated single story residence. We note only the structural frame remains with all of the interior walls and exterior walls missing. Most of the roof surface remained.

REVIEW OF INSURED'S DOCUMENTATION

We also reviewed information denoted to be provided by the insured. This information included photographs taken prior to and following Hurricane Katrina. Our review of this information revealed the following:

- Pre-storm photos were provided for the residence before renovation. We note that:
  - The residence was a one (1) story elevated residence.
  - The structure was supported on round timber posts.
  - The "A" style roof was covered with asphalt shingles.
  - The exterior walls were finished with rigid shake style siding.
  - The residence had a covered deck on two (2) elevations.
  - The ground floor of the residence had an enclosed area below a portion of the first floor.
- Pre-storm photos taken during circa 2002 renovation also were provided. Our review reveals:
  - The ground floor was completely enclosed with wood stud framing finished with windows and horizontal siding.
  - The existing roof posts were enclosed in square timber framing finished with the horizontal siding.
  - Insulation board and horizontal vinyl siding was installed over the exiting exterior rigid shake style siding on all elevations.
  - The existing roof was recovered with metal roof panels installed over the existing asphalt shingles.
  - An addition was added to the elevation facing the canal.
  - The renovation included enclosing the ground floor with walls, windows, and doors.
- Post-storm photos were provide and reviewed. We note that:
  - Most of the horizontal vinyl siding has been removed on all elevations.
  - All of the metal panel roofing had been removed.
  - Portions of the former asphalt shingle roof covering had been removed along the roof eave.
  - A number of sheets of roof sheathing are missing along the roof eave.
  - All of the ground floor wall framing is demolished or displaced.
  - The rear elevation additional had been demolished with only the vertical piles remaining.
  - All roof framing and floor framing of the addition was missing.
  - The former exterior elevation facing the canal had exposed gable framing and the lower wall framing was demolished or displaced.
  - Post-Katrina photographs illustrate that the timber bulkhead and boat dock located on the canal bordering the property was still intact.
  - We note standing trees adjacent to the front elevation of the former residence.

HISTORICAL RESEARCH

As part of our review process, we contacted the local government to determine when the residence was originally constructed and the building code that was in force at the time of construction. Construction within the unincorporated areas (cities and towns) of Hancock County and the required building codes, zoning, and permits are managed by Hancock County staff. The Hancock County Courthouse is located at 152 Main Street in the City of Bay St. Louis, Mississippi. We note that the Hancock County Courthouse and Emergency Operations Center were severely damaged during the hurricane, forcing evacuations of the Emergency Operations Center and emergency staffed county offices. Due to the damage to the Hancock County government facilities, communication systems, and public records, the county was not able to provide building permit information. However, in our discussions with municipal staff at Hancock County, we understand that Hancock County did not have a governing building code prior to the hurricane.

In addition, we reviewed the topographic maps prepared by the United States Geological Survey (USGS) to determine the elevation of the exterior finish grade adjacent to the property. We also reviewed the flood insurance rate map prepared by the United States Federal Emergency Management Agency (FEMA) to determine the floodplain elevation for the property. Copies of the USGS and FEMA maps have been attached in the appendices for reference. We have summarized the results of our research below for your convenience.

Jurisdiction:	Hancock County, Mississippi
Present Building Code:	No building code adopted prior to Hurricane Katrina
Original Construction Date of Residence:	1980
Design Wind Speed:	Information not available for Hancock County, 100 mph in adjacent Harrison County, MS to the east
Property Exterior Grade Elevation:	Original grade shows as 2'-0" above sea level prior to construction of the residence. (Currently approximately 4'-0" above sea level adjacent to residence, as shown on current flood certificate.)
Flood Zone/Flood Elevation:	A8 (Base Elevation 11 feet)

HURRICANE KATRINA TIMELINE

We have reviewed the information published by the United States National Climatic Data Center (NCDC) and the National Oceanographic and Atmospheric Agency (NOAA) related to Hurricane Katrina. We note that the National Weather Service (NWS) defines sustained winds as the average speed measured over a two (2) minute period unless otherwise noted. Wind gusts are significantly higher and deviate from the two (2) minute sustained average since they are measured in three (3) second intervals. NOAA defines peak wind speeds as the maximum instantaneous wind speed. We also note that the time standard is Central Daylight Savings Time, with all events noted below occurring on August 29, 2005. We have provided our findings below for your convenience.

Time (CDT)	Event
4:12 am	Storm tide depth recorded at 8.98 feet above mean sea level at Waveland, MS by NOAA/AMOL/Hurricane Research Division. (Gage failed shortly after recording.)
5:30 am	74.8 mph one-minute sustained wind speed recorded in Waveland, MS by NOAA/AMOL/ Hurricane Research Division.
6:10 am	The eye of Hurricane Katrina made landfall as a Category 4 hurricane (Saffir-Simpson Scale) at Grand Isle, LA.

6:30 am	86.3 mph one-minute sustained wind speed recorded in Waveland, MS by NOAA/AMOL/ Hurricane Research Division.
7:57 am	Normal scheduled high tide at Waveland, MS of 2.2 feet above mean lower low water (MLLW).
8:18 am	Storm tide depth of 13.26 feet above mean sea level recorded at Ocean Springs, MS published in September 15, 2005 NOAA Preliminary Report on Hurricane Katrina Storm Tide Summary. (Transmitter failed during storm.)
8:30 am	103.6 mph one-minute sustained wind speed recorded in Waveland, MS by NOAA/AMOL/Hurricane Research Division.
8:54 am	85.2 mph peak wind speed recorded at NOAA Buoy 42007 located approximately 22 nautical miles south southeast of Biloxi, MS.
9:42 am	92.1 mph one-minute sustained wind speed recorded in Waveland, MS by NOAA/AMOL/Hurricane Research Division.
10:00 am	The eye of Hurricane Katrina made landfall as a Category 3 hurricane (Saffir-Simpson Scale) with reported 125 mph sustained winds near the eye wall at Pearlington, MS at the mouth of the Pearl River.
10:35 am	69.0 mph sustained wind speed recorded at NOAA Buoy 42007 located approximately 22 nautical miles south southeast of Biloxi, MS.
12:00 pm	86.3 mph one-minute sustained wind speed recorded in Waveland, MS by NOAA/AMOL/Hurricane Research Division.
*NTR	Storm tide depth of 24 feet above mean sea level recorded by the United States Geological Survey team at gulf side of Interstate 10 (I-10) overpass over Mississippi Route 43.
*NTR	Storm tide depth of 28 feet above mean sea level recorded by the United States Geological Survey team at gulf side of Interstate 10 (I-10) over the Jourdan River.
*NTR	Storm tide depth of 27'-0" above mean sea level recorded by The Structures Group, Inc. forensic team in the Comfort Inn at 441 Yacht Club Drive, Diamondhead, MS.
*NTR	Storm tide depth of 23'-6" above mean sea level recorded by The Structures Group, Inc. forensic team in Sherwood Heights Condominiums at 534 North Second Street, Bay St. Louis, MS.
*NTR	Storm tide depth of 21'-0" above mean sea level observed by The Structures Group, Inc. forensic team at 622 Sandy Hook Drive, Pass Christian, MS.
*NTR	Storm tide depth of 24.41' above mean sea level recorded by NOAA at 409 St. Joseph Street, Waveland, MS.

*NTR Storm tide depth of 22.46' above mean sea level recorded by NOAA at 230 Old Spanish Trail, Waveland, MS.

*NTR Storm tide depth of 25.52' above mean sea level recorded by NOAA at 630 N. Central Avenue, Waveland, MS.

*NTR Storm tide depth of 25'-8" above mean se level recorded by FEMA at 659 Beach Boulevard, Bay St. Louis, MS.

*NTR Storm tide depth of 25'-8" above mean sea level recorded by FEMA at 410 north Beach Road, Bay St. Louis, MS.

*NTR NOAA recorded a high water mark of 20.35 feet above sea level at 425 Skyline Drive, Hancock County, MS.

*NTR FEMA and NOAA recorded a high water mark of 20.64 feet at 64 Wolfe Street, Hancock County, MS.

*NTR FEMA recorded a high water mark of 16.3 feet at 1001 Blue Meadow Road, Hancock County, MS.

*NTR-Watermarks with no time recorded.

PUBLIC DOMAIN PHOTO REVIEW

Additionally, as part of our peer review, we reviewed satellite photos provided by the enhanced version of Google Earth Pro and additional satellite photos published by USGS in The National Map. The photos were taken by different satellites prior to and after the August 29, 2005 landfall of Hurricane Katrina.

The photo prior to the storm denotes a number of residential dwellings on marshes, natural watercourses, and numerous canals. Closer review of the specific property revealed it was located on a point where several canals in the Edwards Bayou combine and provide canal access to the Jourdan River and the Bay of St. Louis. Further, the residence was generally rectangular shaped with trees on the property and adjacent properties. There are residences located to the north, west, south, and east.

The photos immediately after the hurricane exhibit the residence as still standing with debris spread around it and the adjacent properties. We further noted that several nearby residences were standing, while several others were demolished. Many of the surrounding trees remained standing.

Additionally, we reviewed street level photos following the hurricane, taken circa 2008, also provided by the enhanced version of Google Earth Pro. This street level photo illustrates the former elevated single family residence is still standing with all storm debris removed from the property. The remaining structural elements have been repaired.

Copies of the public domain before and after photos of the property have been included in the appendices for reference.

TSG SITE VISIT OBSERVATIONS OF NEARBY PROPERTIES

Site reviews had been performed by our firm at nearby residences shortly after the storm, including 903 Deer Drive, Hancock County, Mississippi, which is located approximately 454 yards south-southeast of 506 Riverview Drive. Further, we note that our local site visits included four (4) additional properties within a one (1) mile radius of 506 Riverview Drive. These locations included 36 Dolphin Circle, 124 Edith Drive, 3037 Washington Avenue, and 22 Wolf Street, all within Hancock County, MS. For the purpose of clarity, we have included a property location map of these nearby properties, as well as photographs of representative observations noted during our site visits.

903 Deer Drive, Hancock County, MS

The single family residence located at 903 Deer Drive within Hancock County, Mississippi, was an elevated one (1) story timber framed residence with a hip and gable style roof constructed on timber piles above a concrete slab on grade. The residence is located approximately 454 yards south-southeast of the former residence located at 506 Riverview Drive.

A site visit to this residence was performed by our firm on Saturday, January 21, 2006. However, a site visit was provided by an insurance adjuster on September 16, 2005.

Our review of TOPO 2002 National Geographic topographic maps revealed that the elevation of the exterior finish grade adjacent to the residence located at 903 Deer Drive is denoted as approximately 3'-0" above sea level. The finish floor of the first floor was elevated 8'-10" above the cast in place concrete slab. We noted that water was identified in the heating ducts approximately 8" above the elevated first floor finish ceiling, which was 8'-0" above the first floor. Therefore, based on researched topography and water heights, as well as measurements taken during our review, it is our opinion that the storm tide at this residence reached a minimum height of approximately 20'-6" above sea level during the storm.

We noted the following observations of the single family residence located at 903 Deer Drive:

- The front elevation of the residence faced in a generally southerly direction. (Photo A.)
- The residence was a conventional timber framed pile supported structure with the elevated first floor constructed over a concrete cast in place slab on grade.
- A section of roof ridge vent missing along the front end of the ridge
- Missing fascia and soffit along the front elevation roof eave. We also noted missing roof shingles at the front elevation roof slope.
- The right elevation of the residence faced in a generally easterly direction. (Photo B.)
- The ground floor consisted of the storage and carport with stairs and an elevator access to the first floor.
- Missing and loose soffit as well as vinyl siding on the upper part of the elevator shaft.
- Isolated areas of asphalt shingles and roofing felt were missing on the right elevation roof slope.
- Missing fascia and soffit at the roof overhang of elevator shaft.
- The rear elevation of the residence faced in a generally northerly direction. (Photo C.)
- Soffit damage to the underside of the roof overhang at the rear corner of the right elevation.

- The absence of handrails, screens, or guardrails at the first floor elevated deck.
- The left elevation of the residence faced in a generally westerly direction. (Photo D.)
- A significant amount of missing horizontal vinyl siding above the elevated first floor of the residence.
- Lattice screening still in place at grade along the left elevation.
- The interior finishes had been removed and the site cleaned up. However, we noted water in the heating system ducts in the attic and a damaged ceiling fan at the rear corner of the left elevation. (Photo E.)

Photos taken on September 16, 2005, by an insurance adjuster revealed the following:

- Missing soffits on both elevations as well as missing fascia on the front elevation. (Photo F.)
- An elevator shaft was under construction along the right elevation.
- A satellite dish attached to the roof eave on the left elevation was noted to be still intact. (Photo G.)
- Missing or loose vinyl siding was noted along the left elevation.
- Areas of missing shingle tabs on the front slope and missing shingle tabs, shingles, and felt paper on the right elevation. (Photo H.)
- The ceiling within the residence had generally collapsed with mud on the ceiling HVAC vents. (Photo I.)
- Damaged finishes were noted on the walls with mud on the tops of the appliances and tables.

36 Dolphin Circle, Hancock County, MS

The single family residence located at 36 Dolphin Circle within Hancock County, Mississippi, was an elevated two (2) story timber framed structure constructed on timber piles over a concrete slab on grade ground floor. The residence is located approximately 484 yards south-southwest of the former residence located at 506 Riverview Drive.

A site visit to this residence was performed by our firm on Monday, March 20, 2006. Our review of TOPO 2002 National Geographic topographic maps revealed that the elevation of the exterior finish grade adjacent to the residence located at 36 Dolphin Circle is denoted as approximately 3'-0" above sea level. The finish floor of the concrete slab on grade was approximately 4" above the exterior finish grade. Based on researched topography and water heights, as well as measurements taken during our review, it is our opinion that the storm tide at this residence reached a height of approximately 21'-9" above sea level during the storm.

We noted the following observations of the single family residence located at 36 Dolphin Circle:

- The front elevation of the residence faced in a southwesterly direction. (Photo J.)
- The exterior finish grade was relatively flat with several small standing trees along the front elevation.
- Exterior windows remained intact on both the first and second floors of the front elevation.
- The right elevation faced in a southeasterly direction. (Photo K.)

- Exterior windows on the second floor were intact.
- Soffit and fascia damage had been corrected above the windows.
- The exterior finish grade along the right elevation was flat and without trees.
- An intact boathouse along the edge of the canal.
- The roof of the residence or the roof of the adjacent boat house did not appear to have missing shingles, damaged, or loose soffits or fascia.
- A timber deck with stairs leading to the driveway and to a boat house directly behind.
- The rear elevation faced in a northeasterly direction. (Photo L.)
- The rear elevation faced a canal.
- The exterior finish grade along the rear elevation was generally flat and partially submerged by the existing tide adjacent to the canal.
- Standing trees and trees snapped in half. Closer review revealed the snapped portion of the trees was above the elevation of the adjacent boat house roof.
- The left elevation faced in a northwesterly direction. (Photo M.)
- The left elevation also faced a canal.
- The exterior finish grade along the left elevation was generally flat.
- The remaining trees on the front and rear elevations were standing.
- The detached boat house adjacent to the residence and its roof finish were intact without visible evidence of distress. (Photo N.)
- A storm tide water mark at the top of the rear elevation staircase leading from the first floor family room to the second floor balcony. (Photo O.)

124 Edith Drive, Hancock County, MS

The former single family residence located at 124 Edith Drive within Hancock, Mississippi, was an elevated one (1) story timber framed residence with a gable style roof constructed on timber piles over a concrete slab on grade. The residence is located approximately 414 yards northwest of the former residence located at 506 Riverview Drive.

A site visit to this residence was performed by our firm on Saturday, October 21, 2005. Our review of TOPO 2002 National Geographic topographic maps revealed that the elevation of the exterior finish grade adjacent to the residence located at 124 Edith Drive is denoted as approximately 2'-0" above sea level. The finish floor of the elevated first floor was 12'-4" above the concrete slab on grade. We feel that the residence was submerged during the storm and destroyed by the storm surge. It is our opinion that the storm tide in the area of this residence reached a height of approximately 28'-0" above sea level during the storm, based on researched topography and water heights, as well as measurements taken during our review.

We noted the following observations of the former single family residence located at 124 Edith Drive:

- The front elevation of the former residence faced in a southerly direction. (Photo P.)
- The presence of 8" x 8" square timber piles in a 3 wide by 6 deep pattern with the two (2) rearmost comprising a double pile post. Closer review revealed the piles extended approximately 7'-4" above the finish slab of the driveway.
- A small intact deciduous tree at the left corner of the front elevation of the property.
- The right elevation of the former residence faced in an easterly direction. (Photo Q.)

- The majority of the timber piles were intact and vertical, with the exception of the five (5) in the front right corner of the residence.
- The neighborhood beyond the property line on the left elevation of the residence was lacking in trees and other vegetation.
- The adjacent residences within the neighborhood had been dislodged from their foundations and/or destroyed.
- The rear elevation of the former residence faced in a northerly direction. (Photo R.)
- The brush and small tress along the rear elevation had uprooted along the canal bank.
- Water borne debris was evident in the trees beyond the front elevation of the residence at a height of approximately 15'-0" above the exterior grade.
- The left elevation of the former residence faced in a westerly direction. (Photo S.)
- Again, we noted that the adjacent residences had been dislodged from their foundations and/or destroyed. However, two (2) residences in the tree line beyond the canal were heavily damaged but remained intact on their foundations.

3037 Washington Street, Hancock County, MS

The single family residence located at 3037 Washington Street within Hancock County, Mississippi, was a timber framed one and a half (1 1/2) story structure constructed over a cast-in-place concrete slab on grade. The residence is located approximately 1,372 yards south-southeast of the former residence located at 506 Riverview Drive.

A site visit to this residence was performed by our firm on Saturday, November 5, 2005. Our review of TOPO 2002 National Geographic topographic maps revealed that the elevation of the exterior finish grade adjacent to the residence located at 3037 Washington Street is denoted as approximately 7'-0" above sea level. The finish floor of the cast-in-place concrete slab on grade was approximately 4" above the exterior finish grade. We noted a high water mark on the interior surface of the upper floor approximately 15'-11" above the first floor concrete slab on grade finish floor. Therefore, based on researched topography and water heights, as well as measurements taken during our review, it is our opinion that the storm tide at this residence reached a minimum height of approximately 23'- 3" above sea level during the storm.

We noted the following observations of the single family residence located at 3037 Washington Street:

- The front elevation of the residence faced in a northeasterly direction. (Photo T.)
- The exterior finish grade along the front elevation sloped away from the residence at the perimeter and was otherwise relatively flat with no trees.
- The surface of the ground was covered in a thick gray mud up to 1/2" thick.
- The timber framed residence was constructed over a cast in place concrete slab on grade.
- Most of the exterior wall finishes and some windows were no longer in place.
- The fascia and soffit along the roof eaves were damaged and loose.
- The front elevation roof slope sustained minimum damage to the lower left corner.
- The right elevation faced in a northwesterly direction. (Photo U.)
- The exterior finish grade along the right elevation sloped away from the residence at the perimeter but was otherwise generally flat.

- The exterior wall finishes and some of the wall sheathing on the residence were missing, exposing the timber framing on both floors. Closer review revealed that the height of the missing wall sheathing corresponded to the location of missing plywood roof sheathing on the rear elevation roof slope.
- The rear elevation faced in a southwesterly direction. (Photo V.)
- The exterior finish grade along the rear elevation sloped away from the residence at the perimeter but otherwise was relatively flat with no trees.
- The exterior wall finishes and most of the wall sheathing on the residence were missing with a significant portion of the timber framing was exposed.
- The center of the rear elevation wall was leaning inward at the top of the wall.
- The roof was missing a significant amount of roof sheathing as well as shingles along the center section and above the leaning wall.
- The fencing along the right, left, and rear property lines was bent.
- The left elevation faced in a southeasterly direction. (Photo W.)
- The exterior finish grade along the left elevation sloped away from the residence at the perimeter but otherwise was generally flat and littered with debris.
- The first floor exterior wall finish on the left elevation of the residence was missing and the gable end wall sheathing was loose.
- A high water mark on the right interior wall of the upstairs landing at the center of the residence. (Photo X.) Closer review revealed the high water mark to be approximately 7'-0" from the finished surface of the upper floor elevation.
- The ceilings and interior wall finishes in the rooms of the upper floor were damaged with the finishes partially demolished, insulation partially demolished, and general debris on the floor.

22 Wolfe Street, Hancock County, MS

The single family residence located at 22 Wolfe Street within Hancock County, Mississippi, was a two (2) story timber framed structure with a horizontal vinyl siding exterior constructed on a concrete slab on grade. The residence is located approximately 1,494 yards east-northeast of the former residence located at 506 Riverview Drive.

A site visit to this residence was performed by our firm on Friday, October 7, 2005. Our review of TOPO 2002 National Geographic topographic maps revealed that the elevation of the exterior finish grade adjacent to the residence located at 22 Wolfe Street is denoted as approximately 7'-0" above sea level. The finish floor of the concrete slab on grade was approximately 4" above the exterior finish grade. The finish floor of the second floor was found to be approximately 9'-0" above the concrete slab on grade first floor. We noted a high water mark of approximately 7'-2" above the finish floor of the second floor. Therefore, based on researched topography and water heights, as well as measurements taken during our review, it is our opinion that the storm tide at this residence reached a height of approximately 23'-6" above sea level during the storm.

We noted the following observations of the single family residence located at 22 Wolfe Street:

- The front elevation of the residence faced in an easterly direction. (Photo Y.)
- The stairway leading up to the second floor front elevation porch was missing.
- Minor damage to the gutter along the front elevation roof eave.

- The majority of the trees behind the residence remained standing, with only minor limb damage.
- The right elevation of the residence faced in a northerly direction. (Photo Z.)
- The screen in the frontmost window on the right elevation on the second floor was hanging from the window sill.
- The vertical conduit from the power meter to the roof, which contained the power lines and was located along the right elevation exterior wall adjacent to the external elevator, had been detached from the residence.
- A fallen tree was located adjacent to the right elevation with a pile of debris beneath the branches.
- The rear elevation of the residence faced in a westerly direction. (Photo AA.)
- Damage to the roof overhang framing, soffits, and metal roofing along the right and rear elevation roof eaves at the right corner of the screened porch.
- The gutter along the right half of the rear elevation roof eave had been damaged as well as the downspout at the right corner.
- Fallen tree limbs and other debris were spread across the backyard of the residence.
- The left elevation of the residence faced in a southerly direction. (Photo BB.)
- Several broken windows on the ground floor of the left elevation.
- The tree near the rear corner of the residence remained standing, but had damaged limbs.
- The neighboring former residence to the south had been moved off its foundation and the remaining roof structure had the majority of its shingles still attached. (Photo CC.)
- A high water mark within the residence at 22 Wolfe Street was measured to be approximately 7'-2" above the finish floor of the second floor. (Photo DD.)

NOAA/FEMA RESEARCH

A review of the NOAA web site reveals a Katrina Impact Assessment prepared by NOAA's National Coastal Development Center. This coordinated data management system contains NOAA and FEMA databases for both sustained wind speeds and high water levels within the proximity of the residence. We noted the following for our review of this data:

- Wind speed ranges published by NOAA indicate sustained wind speeds in the range of 95 to 100 mph in the Bay St. Louis area.

- NOAA high tide documentation reveals that high tide at the entrance of the St. Louis Bay was scheduled to occur around 8:00 a.m. CDT on Monday, August 29, 2005.

- NOAA recorded a high water mark of 20.35 feet above sea level at 425 Skyline Drive, Hancock County, MS. This location is located approximately 236 yards northeast of 506 Riverview Drive.

- FEMA and NOAA recorded a high water mark of 20.64 feet at 64 Wolfe Street, Hancock County, MS. This location is approximately 1,562 yards east-northeast of 506 Riverview Drive.

- FEMA recorded a high water mark of 16.3 feet at 1001 Blue Meadow Road, Hancock County, MS. This location is located approximately 2,434 yards east-southeast of 506 Riverview Drive.

WIND/WATER FORCE ANALYSIS

We note that hurricanes have a number of bands of wind that increase in speed and intensity as they approach the center, or eye wall, of the storm. In addition, we note that there are areas of wind gusts embedded within the bands. Gusts are short duration periods of localized high winds commonly lasting less than 20 seconds in duration. Further, we note that a hurricane storm surge results from the high winds that compose the center bands of the storm pushing water ahead of the storm. As the storm approaches the coast, the water being pushed ahead of the storm center is forced up by the reduced water depth to the sea floor. This water comes ashore as the storm surge.

To facilitate the understanding of the forces applied to this structure by both wind and water, we have provided in the appendices to this report, calculations for both wind and water forces based on recorded wind speeds and storm surge heights. In all cases, the formulas for the determination of forces have been referenced to the engineering documents from which they were obtained. Further, where appropriate, the calculations have been tailored to match the conditions of the specific site and residence. The purpose of the calculations was to apply recognized engineering principles and formulas to quantify the magnitude of wind and/or water forces acting on the residence during Hurricane Katrina.

From the information taken at our site visits to adjacent properties, coupled with our review of public domain aerial and at grade photographs, as well as NOAA/FEMA research data, storm surge heights reached a minimum of 20'-3" and a maximum of 21'-9". We have utilized a storm surge height of 20'-3" above sea level and a sustained wind speed of 100 mph in our wind/water force analysis. We note that our wind/water force analysis at the residence located at 506 Riverview Drive results in a calculated resultant lateral wind force per linear foot of wall of approximately 192 plf. Again, this is based on a maximum sustained wind speed of 100 mph, which is equivalent to a 3 second wind gust of 130 mph. Further, we note that, based on the geometry of the roof of the residence, coupled with the means and methods of its construction, the sustained wind speed does not result in a net uplift for the entire roof structure. Rather, the net wind uplift analysis on the low sloped roof structure resulted in a neutral or downward pressure.

Alternately, our analysis reveals that the maximum resultant lateral water force resulting from hydrodynamic water pressures is calculated to be approximately 3,314 plf, based on a storm surge of approximately 20'-3" above mean sea level. Based on these calculations, we note that the lateral forces imparted by the storm surge were roughly 17.3 times the lateral forces imparted by the wind.

Additionally, the net buoyancy forces uplift on the structure, resulting from a differential water height of 1'-0" on the interior and exterior of the residence, was calculated to be 39,950 lbs. This calculated uplift force does not include the additional component of buoyancy due to the difference in specific weight of wood versus water resulting from the submerged wood framing.

CONCLUSIONS AND RECOMMENDATIONS

Based on our experience with similar structural damage, site visit observations of nearby properties, and our research, as well as the information noted and reviewed in this report, coupled with our review of the climatological data, topographical data, and satellite photography for the residence, we feel that the predominant damage to the exterior and interior of the elevated single family residence located at 506 Riverview Drive was a result of the wave action and water borne debris of the storm surge. However, we feel that a portion of the roof surface damage observed in the upper slope area as well as the damage to the horizontal vinyl siding on the horizontal vinyl siding on the gable ends were due to wind.

In coastal hurricanes, mouths of rivers along the coast are more susceptible to high storm surges, as the water normally flowing from the rivers is prevented from exiting by the hurricane storm surge. We note that the residence located at 506 Riverview Drive is located 0.2 miles south of the Jourdan River.

Our review of TOPO 2002 National Geographic Maps, and the United States Geological Survey's The National Map revealed that the original elevation of the exterior finish grade adjacent to the residence at 506 Riverview Drive was approximately 2'-0" above sea level. Based on our site visit observations of the local area and the local survey data, we feel that the storm surge at the former residence located 506 Riverview Drive reached heights ranging from approximately 20'-3" to 21'-9" above sea level during Hurricane Katrina. With this original topo data and storm surge height, the high water on the property would have reached the attic of the elevated first floor. The elevation certificate dated June 27, 1998, which was provided with the NBHA report, denoted the elevation of the lowest grade immediately adjacent to the building as 4.1 feet. We also noted from the photos provided that a bulkhead was constructed along the edge of the property adjacent to the canal. Therefore, it is surmised that the exterior finish grade was raised during the construction of the residence.

We noted in our review that the finish floor elevation of the elevated first floor of the residence was denoted to be approximately 9.5' above the adjacent exterior finish grade in the elevation certificate. Further, the engineering report by Compton Engineering, Inc. (CE) denoted that the attic contained floating debris.

From our review of the engineering report prepared by CE, we note that the perimeter timber piles of the original portion of the residence were continuous up to the roof framing. This information is confirmed in the photos provided in the NBHA report. This means of construction provides a positive connection at both the roof and the first floor framing to the pile foundation to resist the transient buoyancy forces that the original structure was exposed to during the rising storm surge.

Further, we note from the homeowner provided photos that the circa 2002 addition to the rear elevation of the residence was not constructed in a likewise fashion. Rather, the timber piles of the rear elevation addition terminated at the elevated first floor framing. It is our opinion that the disproportionate damage exhibited by the former rear elevation addition to the residence is a direct result of this difference in construction, which allowed the buoyancy, uplift, and lateral forces of the storm surge to displace the rear elevation addition to the residence.

Therefore, it is our opinion that the residence was partially submerged by the storm surge. We feel that the predominant distress to the original portion of the residence was a result of wave action and water borne debris of the storm surge. It is also our opinion that the damage to the addition was due to the wave and buoyancy forces of the storm surge. The collapse of the addition's dislodged wall and roof framing further resulted in additional damage to the original structure by the wave action and water borne debris from the storm surge. As we noted earlier, we feel that the high winds associated with the hurricane may have dislodged the metal roof and damaged isolated roof shingles on the upper areas of the roof slopes and damaged horizontal siding on the gable ends. Further, we feel that the loss of the metal roof and the horizontal siding was not significant enough to provide a means for wind and wind borne water intrusion through the roof into the dwelling, since the original asphalt shingles still remained on the roof, and the original rigid shake style siding still remained on the exterior walls. Additionally, we feel that the damage to the roof along the roof eaves is a result of the storm surge height.

It is also our opinion that the residence could be rebuilt to its original condition prior to the storm. However, we recommend the use of hurricane straps and anchors to transfer wind loads from the roof and walls down to the floor framing and into the pile foundation. Below grade plumbing systems not damaged should be flushed out. Potable plumbing should be tested for bacteria before placing back in service.

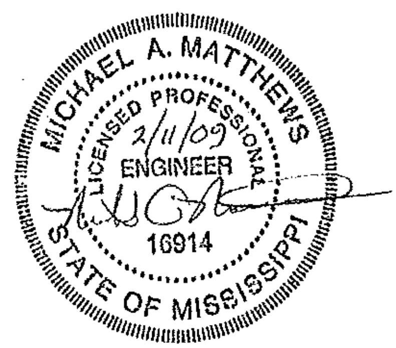
We further note that reconstruction must conform to the local building codes as well as the state and federal flood elevation and coastal resources management regulations. It should be noted that FEMA will review the storm surge from major events and make revisions to Federal Insurance Maps, denoting flood zones which will govern the minimum elevations for habitable spaces. Following a significant hurricane such as Camille and in this case Katrina, floodplain elevations and minimum design wind speeds are usually altered.

We appreciate the opportunity to be of service in this matter. If you have any questions, please feel free to contact our office.

Sincerely,
The Structures Group, Inc.

William F. Hinson, Jr., P.E.
Principal

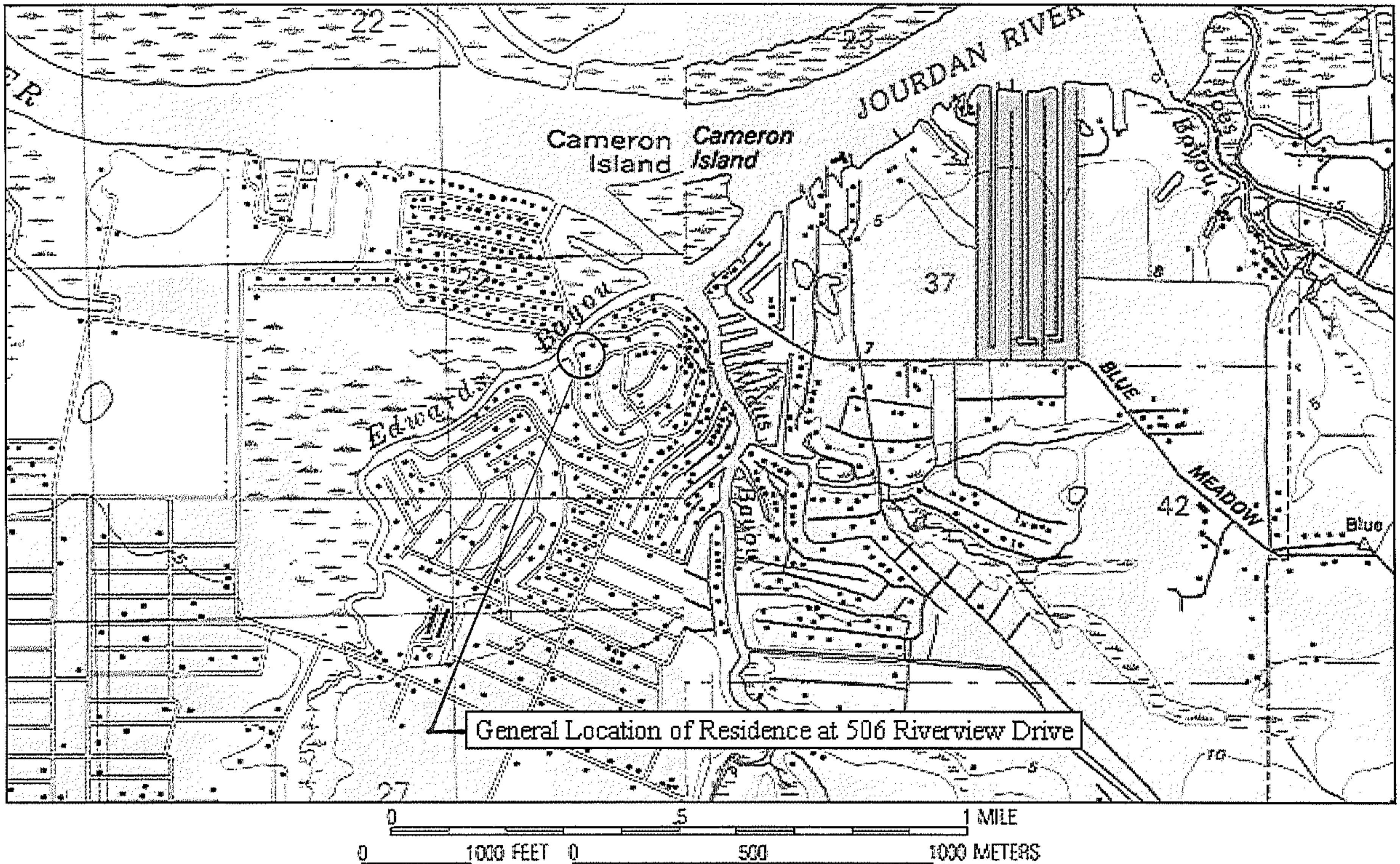
Michael A. Matthews, P.E.
President



MAM/dlm

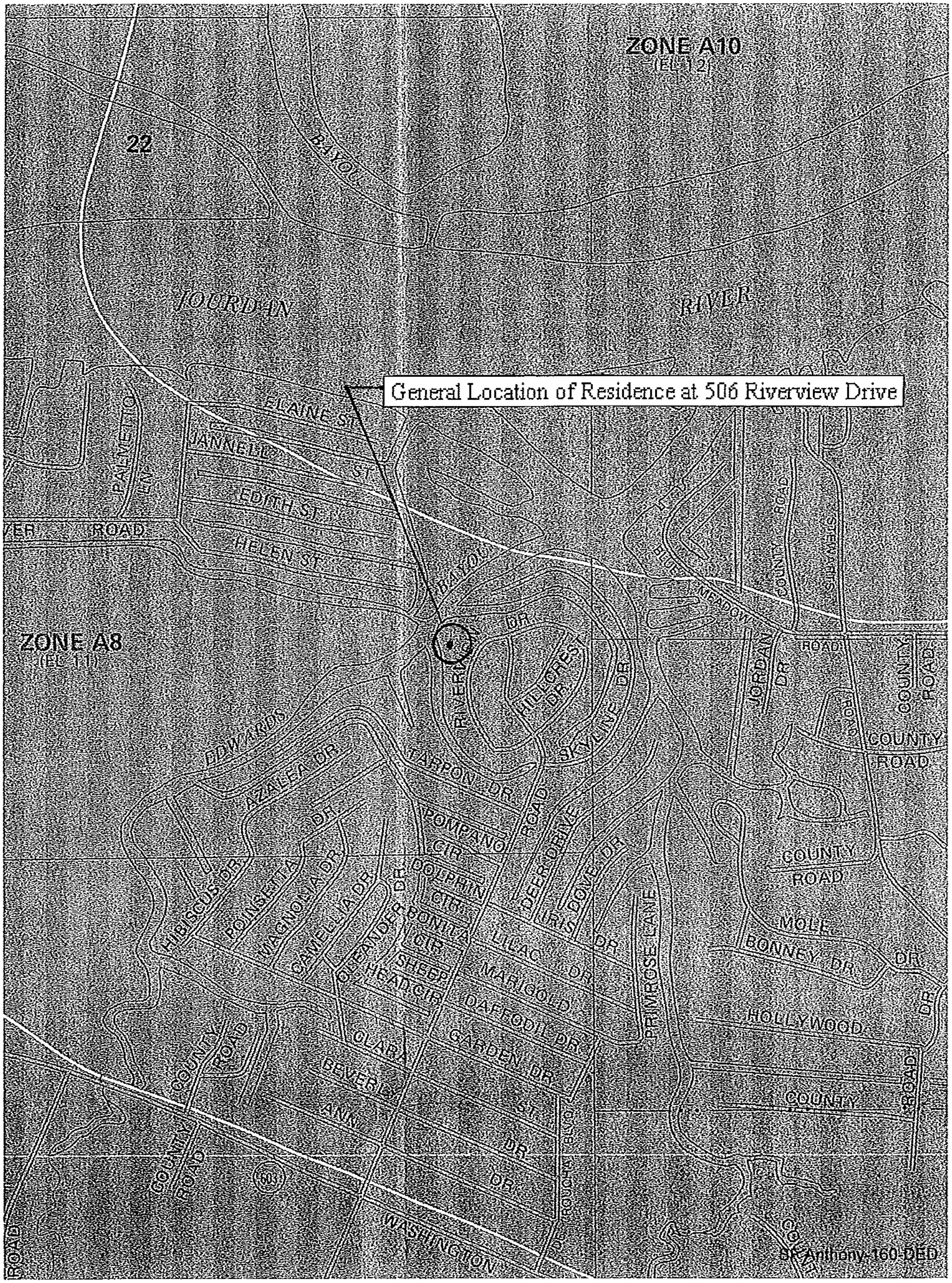
attachments

USGS MAP	■
FEMA FLOOD MAP	☐
PUBLIC DOMAIN PHOTOS	☐
PROPERTY LOCATION MAP	☐
PHOTOS OF NEARBY PROPERTIES	☐
WIND/WATER CALCULATIONS	☐

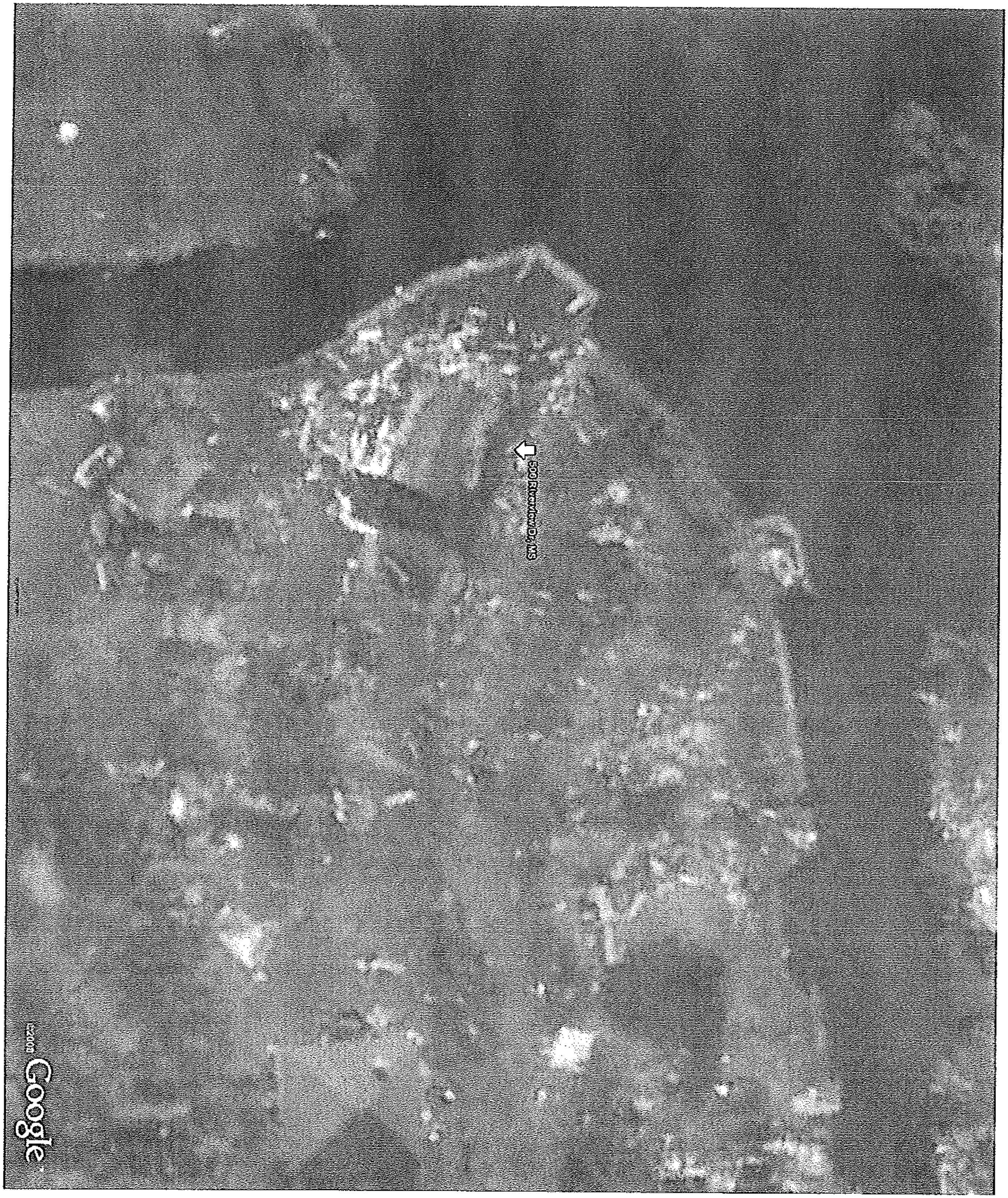


Map created with TOPO!® ©2002 National Geographic (www.nationalgeographic.com/topo)

- [ ] USGS MAP
- [x] FEMA FLOOD MAP
- [ ] PUBLIC DOMAIN PHOTOS
- [ ] PROPERTY LOCATION MAP
- [ ] PHOTOS OF NEARBY PROPERTIES
- [ ] WIND/WATER CALCULATIONS


ZONE A10
(EL 12)
22
BAYOU
JOURDAN
RIVER
General Location of Residence at 506 Riverview Drive
ELAINE ST
JANNELLE ST
EDITH ST
HELEN ST
PALMETTO LN
ROAD
ZONE A8
(EL 11)
RIVERVIEW DR
HILLCREST DR
SKYLINE DR
EDWARDS
AZALEA DR
TARPON DR
POMPANO CIR
DOLPHIN CIR
BONITA CIR
DEER DRIVE
IRIS DR
DOVE DR
HIBISCUS DR
POINSETTIA DR
MAGNOLIA DR
CAMELLIA DR
OLEANDER DR
SHEEP HEAD CIR
LILAC DR
MARIGOLD
DAFFODIL DR
GARDEN DR
PRIMROSE LANE
JORDAN DR
COUNTY ROAD
MOLE
BONNEY DR
HOLLYWOOD
WASHINGTON
603
SR Anthony-160-DED

USGS MAP	☐
FEMA FLOOD MAP	☐
PUBLIC DOMAIN PHOTOS	■
PROPERTY LOCATION MAP	☐
PHOTOS OF NEARBY PROPERTIES	☐
WIND/WATER CALCULATIONS	☐



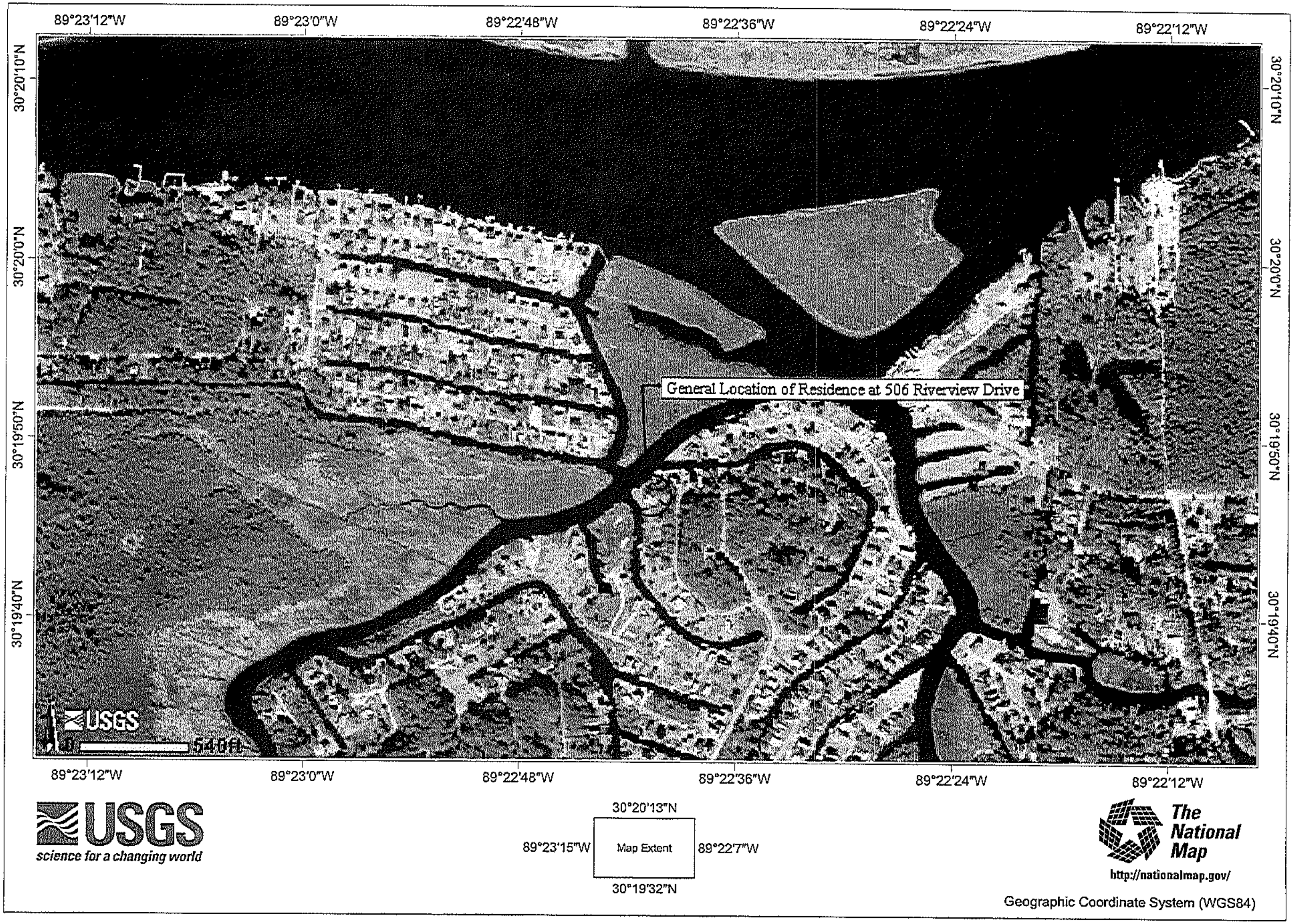
After Hurricane Katrina
506 Riverview Drive
TSG No. VA09006.LIT

SF Anthony-162-DED

After Hurricane Katrina
506 Riverview Drive
TSG No. VA09006.LIT

SF Anthony-163-DED

After Hurricane Katrina
506 Riverview Drive
TSG No. VA09006.LIT



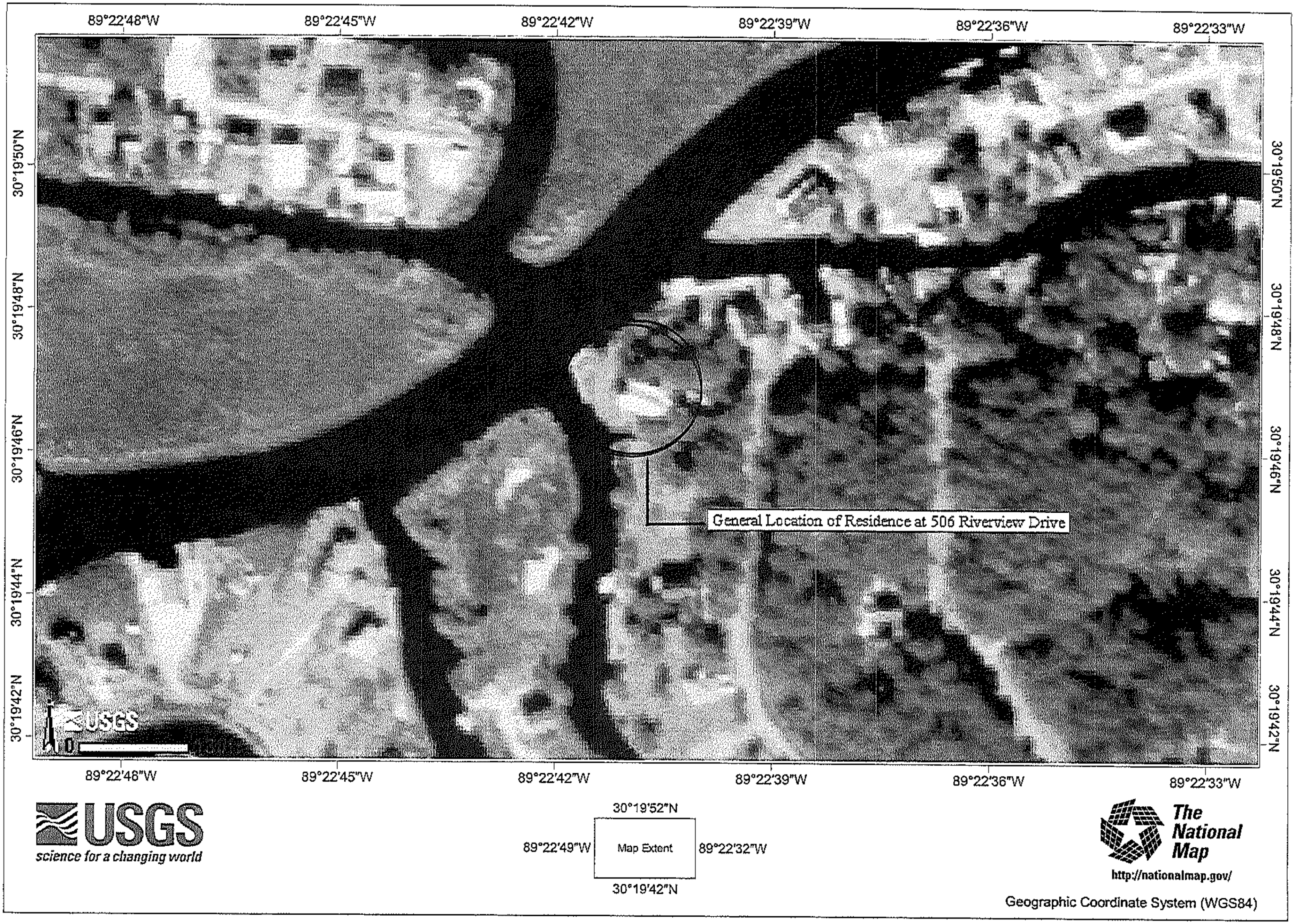
Before Hurricane Katrina
506 Riverview Drive
TSG No. VA09006.LIT

Before Hurricane Katrina
506 Riverview Drive
TSG No. VA09006.LIT

SF Anthony-166-DED

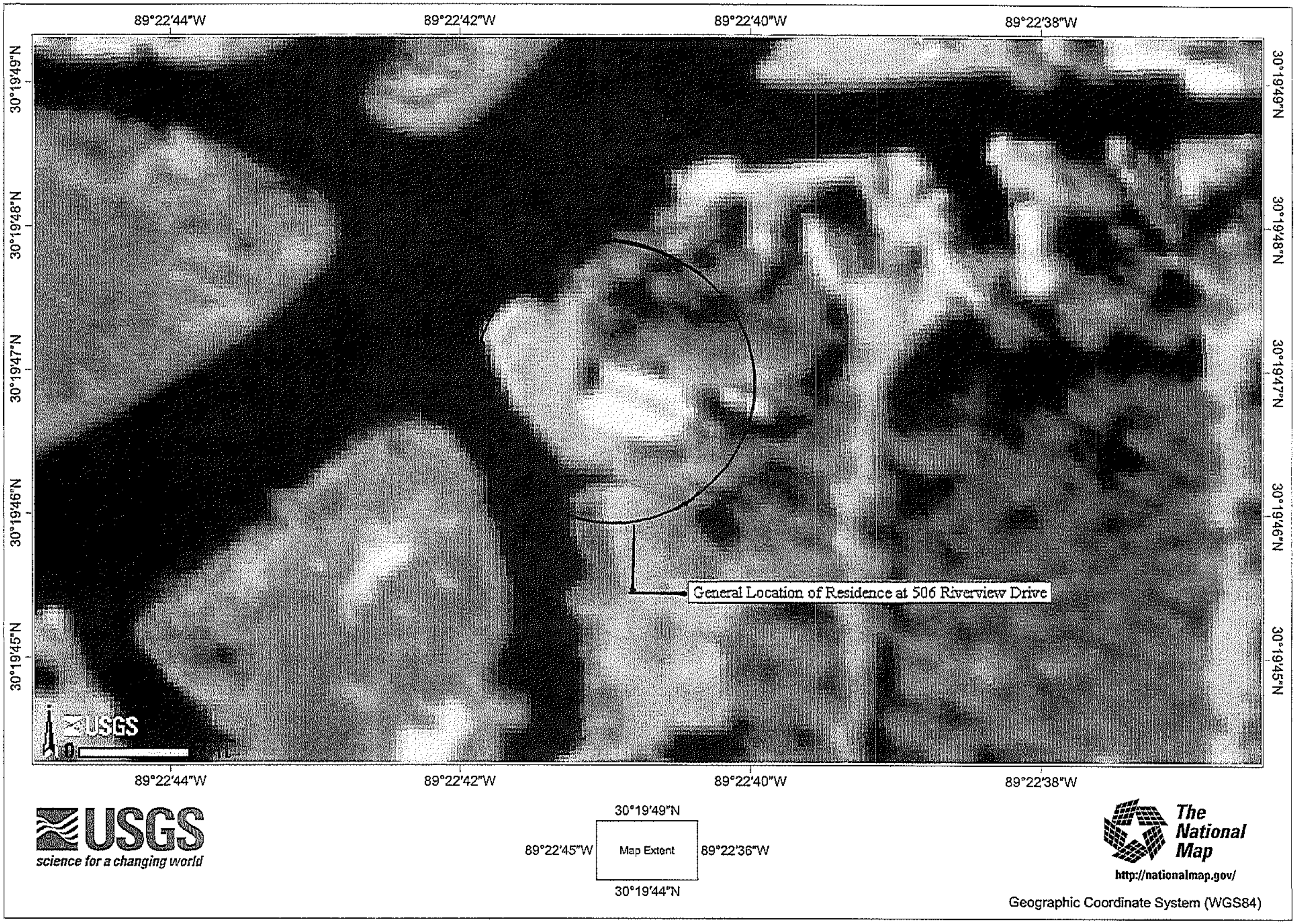
Before Hurricane Katrina
506 Riverview Drive
TSG No. VA09006.LIT

SF Anthony-166-DED



Before Hurricane Katrina
506 Riverview Drive
TSG No. VA09006.LIT

SF Anthony-167-DED



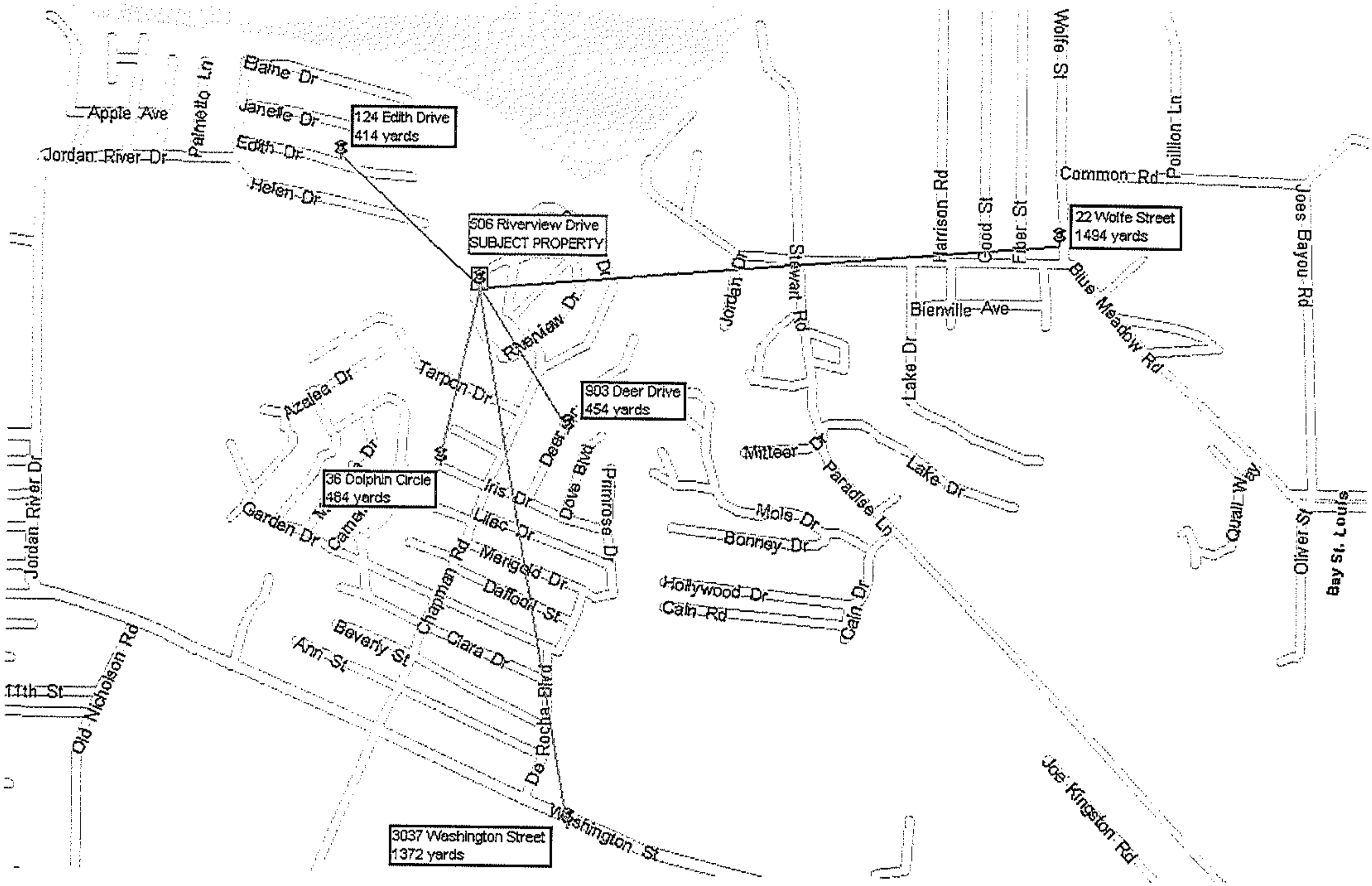
Before Hurricane Katrina
506 Riverview Drive
TSG No. VA09006.LIT

After Hurricane Katrina

Street Level View
506 Riverview Drive
TSG No. VA05219K091
Circa 2008

USGS MAP	☐
FEMA FLOOD MAP	☐
PUBLIC DOMAIN PHOTOS	☐
PROPERTY LOCATION MAP	■
PHOTOS OF NEARBY PROPERTIES	☐
WIND/WATER CALCULATIONS	☐

Distances from Nearby Properties to 506 Riverview Drive



USGS MAP	☐
FEMA FLOOD MAP	☐
PUBLIC DOMAIN PHOTOS	☐
PROPERTY LOCATION MAP	☐
PHOTOS OF NEARBY PROPERTIES	■
WIND/WATER CALCULATIONS	☐

Photo A

View of the front elevation of the elevated (1) story single family residence located at 903 Deer Drive within Hancock County, Mississippi. The front elevation faces in a generally southerly direction. We noted that the residence was a conventional timber framed pile supported structure with the elevated first floor constructed over a concrete cast-in-place slab on grade. We noted missing fascia, soffit, and finish roof shingles at the front elevation roof slope.

Photo B

View of the right elevation of the single family residence located at 903 Deer Drive. The right elevation faces in a generally easterly direction. We noted that the ground floor consisted of storage and a carport, with stairs and an elevator personnel access to the first floor. We noted missing and loose soffits as well as vinyl siding on the upper part of the elevator shaft.

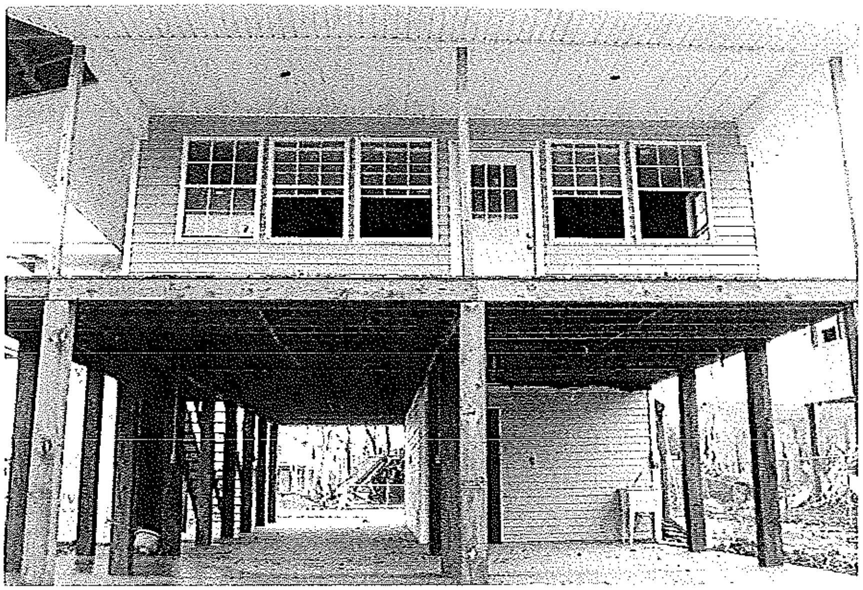


Photo C

View of the rear elevation of the single family residence located at 903 Deer Drive. The rear elevation faces in a generally northerly direction. We noted soffit damage to the underside of the roof overhang at the rear corner of the right elevation. We also noted the absence of handrails, screens, or guardrails at the first floor elevated deck.

Photo D

View of the left elevation of the single family residence located at 903 Deer Drive. The left elevation faces in a generally westerly direction. We noted a significant amount of missing horizontal vinyl siding above the elevated first floor of this elevation. We also noted lattice screening still in place at grade.

Photo E

Interior view of the rear corner of the left elevation of the single family residence located at 903 Deer Drive. We noted that the interior finishes had been removed and the site cleaned up. However, we noted water in the heating system ducts and a damaged ceiling fan.

Photo F
View of the front and right elevations of the residence located at 903 Deer Drive. Missing soffits on both elevations as well as missing fascia were noted on the front elevation. Note the elevator shaft was under construction along the right elevation.

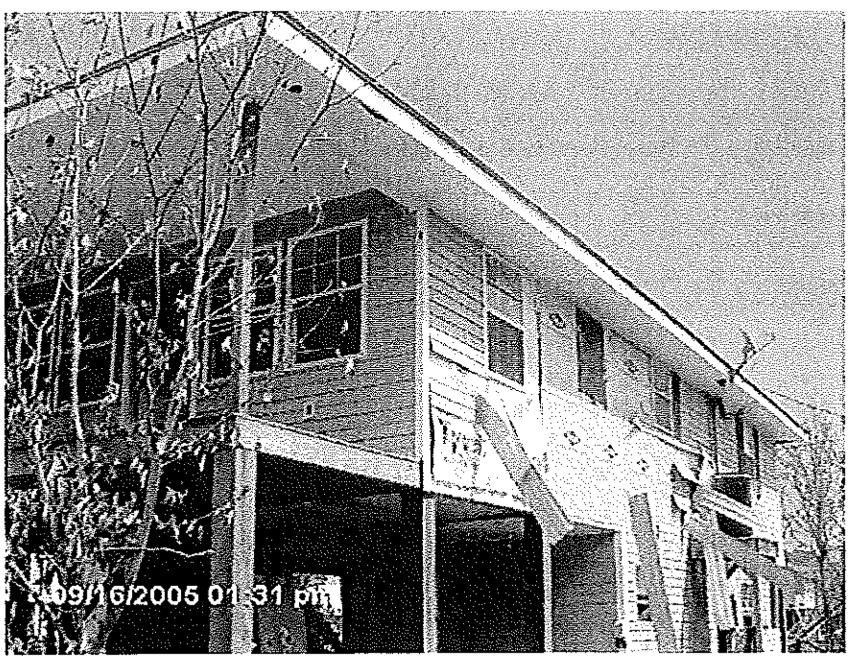


Photo G
View of the left elevation of the residence located at 903 Deer Drive. A satellite dish attached to the roof eave was noted to be still intact. Missing or loose vinyl siding was noted along the left elevation of the residence.

Photo H

View of the front and right elevation roof slopes of the residence located at 903 Deer Drive. Areas of missing shingle tabs on the front slope and missing shingle tabs, shingles, and felt paper on the right elevation were noted.

Photo I

Interior view of the kitchen on the left elevation of the elevated first floor of the residence located at 903 Deer Drive. The ceiling had generally collapsed within the residence with mud on the ceiling HVAC vents. Damaged finishes were noted on the walls with mud on the tops of the appliances and tables.

Photo J

Front elevation view of the elevated two (2) story single family residence located at 36 Dolphin Circle within Hancock County, Mississippi. The front elevation faces in a southwesterly direction. The exterior finish grade was relatively flat with several small standing trees along the front elevation of the residence.

Photo K

Right elevation view of the elevated two (2) story single family residence located at 36 Dolphin Circle. The right elevation faces in a southeasterly direction. The exterior finish grade was flat and without trees. We noted that the roof of the residence or the roof of the adjacent boat house did not appear to have missing shingles, damaged, or loose soffits or fascia. We noted a timber deck with stairs leading to the driveway and to a boat house.

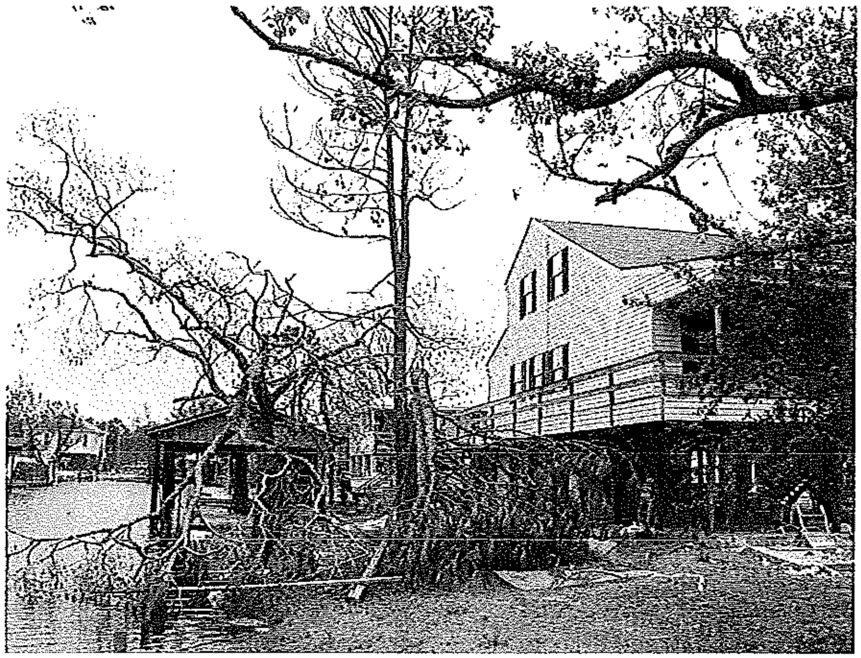


Photo L

Rear elevation view of the elevated two (2) story single family residence located at 36 Dolphin Circle. The rear elevation faces in a northeasterly direction. We noted that the rear elevation faced a canal. We noted an intact boat house along the edge of the canal. The exterior finish grade was generally flat and partially submerged by the existing tide adjacent to the canal. We noted standing trees and trees snapped in half. Closer review revealed that the snapped portion of the trees was above the elevation of the adjacent boat house roof.

Photo M

Left elevation view of the elevated two (2) story single family residence located at 36 Dolphin Circle. The left elevation faces in a northwesterly direction. The left elevation also faced a canal. The exterior finish grade was generally flat. We noted standing trees along the front and rear elevation of the residence.

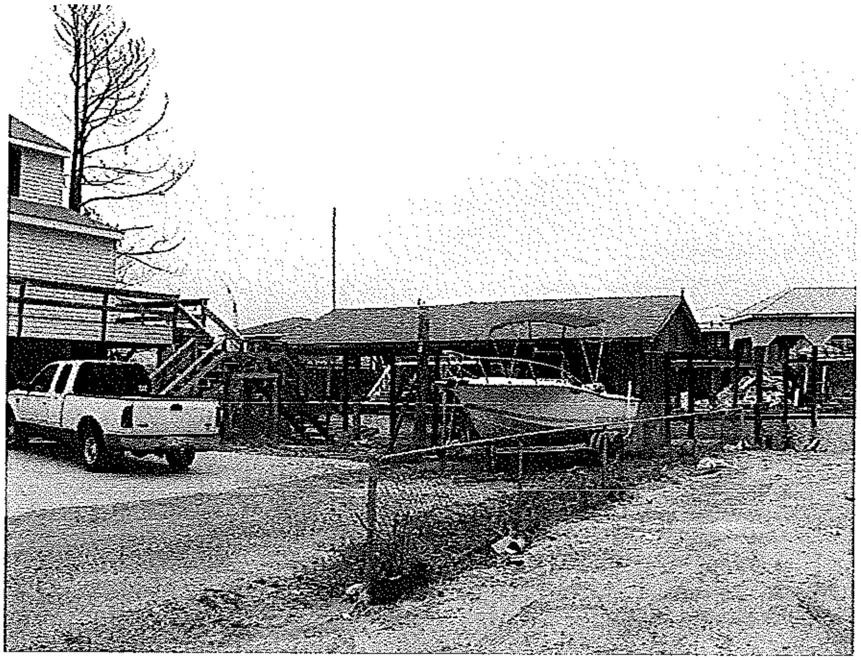


Photo N

View of the front elevation of the detached boat house adjacent to the residence located at 36 Dolphin Circle. We noted the roof finish and structure to be intact without visible evidence of distress.

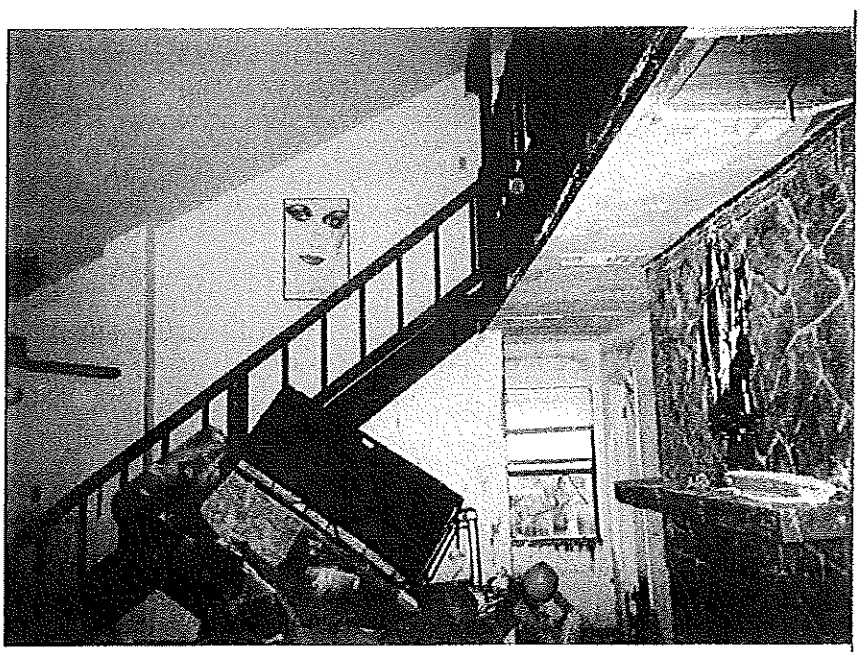


Photo O

Interior view of the rear elevation staircase within the first floor family room of the residence located at 36 Dolphin Circle leading to the second floor balcony taken by the insured following the storm. We noted the storm tide high water mark at the top of the stairs just below the painting.

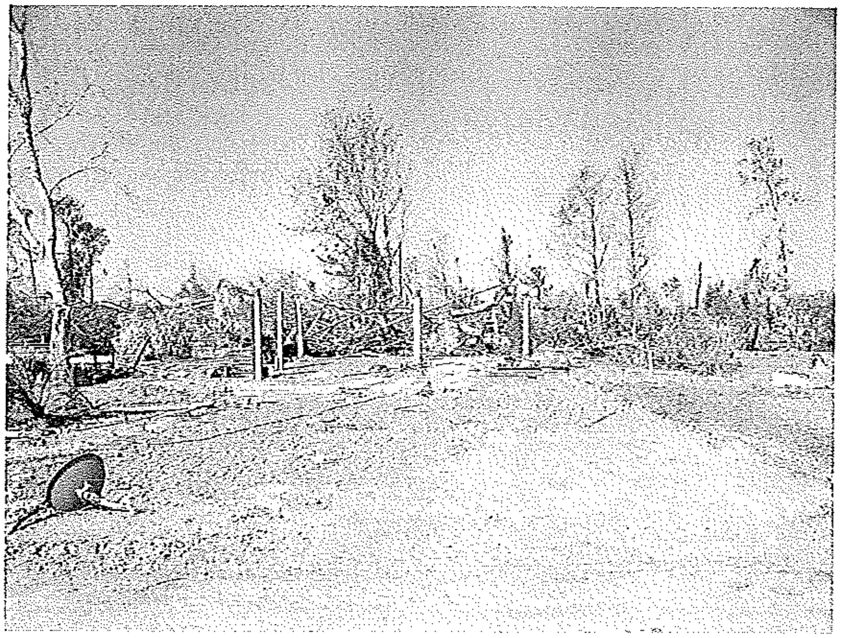


Photo P

Front elevation view of the former elevated single family residence located at 124 Edith Drive within Hancock County, Mississippi. The front elevation faced in a southerly direction. We noted the presence of 8" x 8" square timber piles in a 3 wide by 6 deep pattern with the two (2) rearmost comprising a double pile post. Closer review revealed that the piles extended approximately 7'-4" above the finish slab of the driveway. We further noted a small intact deciduous tree at the left corner of the front elevation of the property.

Photo Q

Right elevation view of the former elevated single family residence located at 124 Edith Drive. The right elevation faced in an easterly direction. We noted that the majority of the timber piles were intact, with the exception of the five (5) in the front right corner of the residence. We further noted that the neighborhood beyond the property line on the left elevation of the residence was lacking in trees and other vegetation. Closer review of the adjacent residences revealed that those residences had also been dislodged from their foundations and destroyed.

Photo R

View towards the rear elevation of the former elevated single family residence located at 124 Edith Drive. The rear elevation faced in a northerly direction. We noted that the brush and small trees along the rear elevation had uprooted along the canal bank. We also noted that water borne debris was evident in the trees beyond the front elevation of the residence at a height of approximately 15'-0" above the exterior grade.

Photo S

Left elevation view of the former elevated single family residence located at 124 Edith Drive. The left elevation faced in a westerly direction. Closer review of the adjacent residences revealed they had been dislodged from their foundations and destroyed. However, we noted two (2) residences in the tree line beyond the canal which were heavily damaged but remained intact on their foundations.

Photo T

Front elevation view of the one and a half (1 1/2) story single family residence located at 3037 Washington Street within Hancock County, Mississippi. The front elevation faces in a northerly direction. The exterior finish grade sloped away from the residence at the perimeter but otherwise was relatively flat with no trees. The surface of the ground was covered in a thick gray mud up to 1/2" thick. We noted that the timber framed residence was constructed over a cast-in-place concrete slab on grade. We also noted that the exterior wall finishes and some windows were missing. The fascia and soffit were damaged and loose. The front elevation roof slope sustained minimum damage to the lower left corner.

Photo U

Right elevation view of the single family residence located at 3037 Washington Street. The right elevation faces in a northwesterly direction. The exterior finish grade along the right elevation sloped away from the residence at the perimeter but otherwise was generally flat. The exterior wall finishes and some of the wall sheathing on the residence were missing, exposing the timber framing on both floors. The height of the missing wall sheathing corresponded to the location of missing plywood roof sheathing on the rear elevation roof slope.

Photo V

Rear elevation view of the single family residence located at 3037 Washington Street. The rear elevation faces in a southwesterly direction. The exterior finish grade sloped away from the residence at the perimeter but otherwise was relatively flat with no trees. The exterior wall finishes on the residence were missing and a significant portion of the timber framing was exposed. Further, we noted that the center of the wall was leaning inward at the top of the wall. The roof was missing a significant amount of roof sheathing as well as shingles along the center section and above the leaning wall. We also noted that the fencing along the right, left, and rear property lines was bent.

Photo W

Left elevation view of the single family residence located at 3037 Washington Street. The left elevation faces in a southeasterly direction. The exterior finish grade sloped away from the residence at the perimeter but otherwise was generally flat and littered with debris. The first floor exterior wall finish on the residence was missing and the gable end wall sheathing was loose.

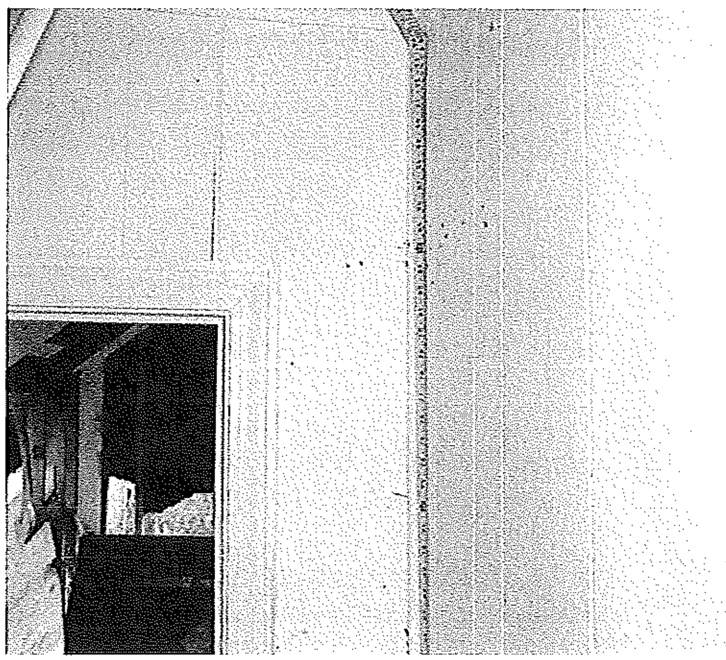


Photo X

Interior view of the right interior wall of the upstairs landing at the center of the residence located at 3037 Washington Street. We noted the high water mark to be approximately 7'-0" from the finished surface of the upper floor elevation. Further, we noted damaged ceilings and interior wall finishes in the rooms of the upper floor.

Photo Y

Front elevation view of the elevated one (1) story single family residence located at 22 Wolfe Street within Hancock County, Mississippi. The front elevation faces in an easterly direction. We noted that the stairway leading up to the elevated front porch was missing. We also noted that the front door was missing. We further noted minor damage to the gutter along the front elevation roof eave. The majority of the trees behind the residence remained standing, with only minor limb damage.

Photo Z

Right elevation view of the single family residence located at 22 Wolfe Street. The right elevation faces in a northerly direction. We noted that the screen in the frontmost window on the elevated first floor was hanging from the window sill. We also noted that the conduit from the power meter to the roof, which contained the power lines and was located along the exterior wall adjacent to the external elevator, had been detached from the residence. Further, we noted a fallen tree adjacent to the right elevation and a pile of debris beneath the branches.

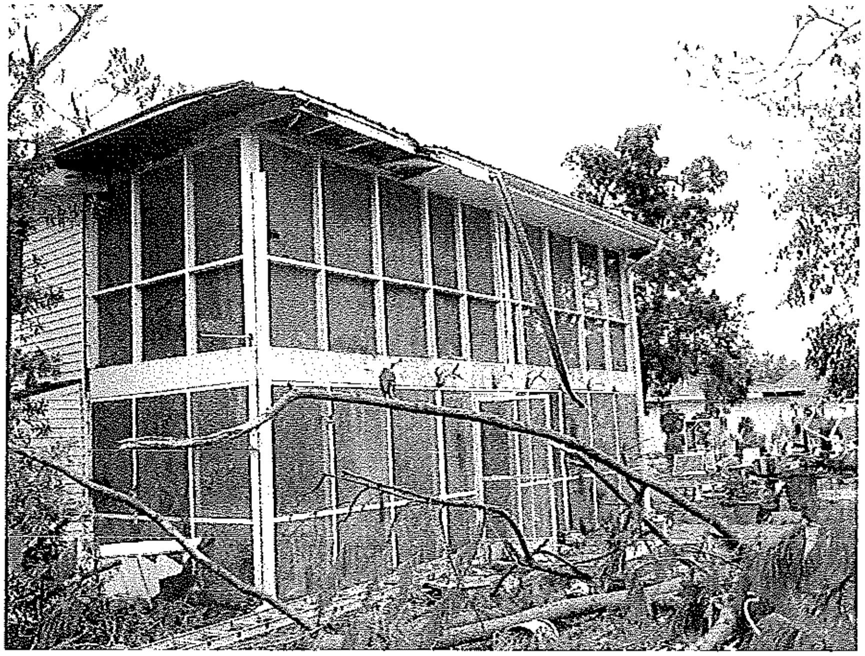


Photo AA

Rear elevation view of the single family residence located at 22 Wolfe Street. The rear elevation faces in a westerly direction. We noted damage to the roof overhang framing, soffits, and metal roofing along the right and rear elevation roof eaves at the right corner of the screened porch. We also noted that the gutter along the right half of the rear elevation roof eave had been damaged as well as the downspout at the right corner. Fallen tree limbs and other debris were spread across the backyard of the residence.

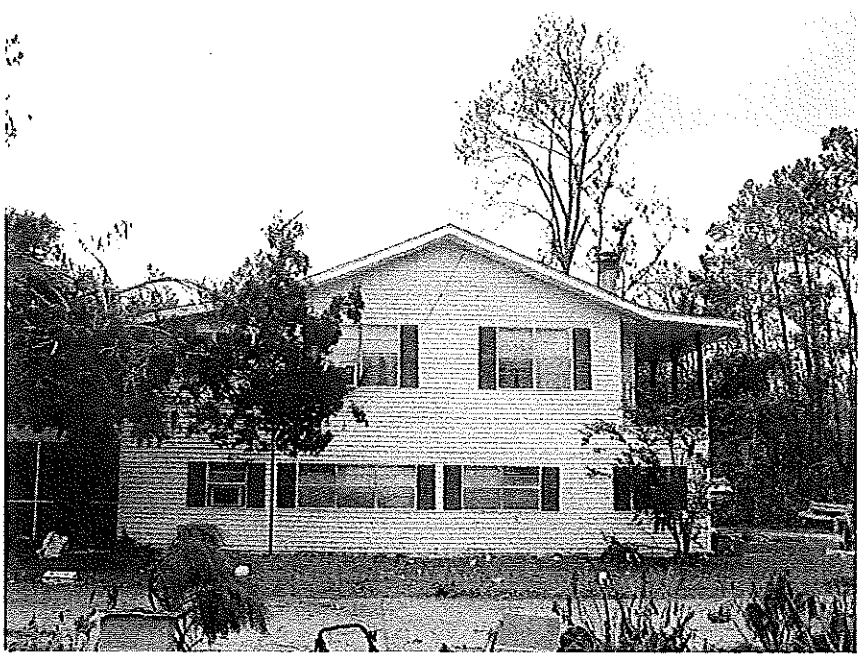


Photo BB

Left elevation view of the single family residence located at 22 Wolfe Street. The left elevation faces in a southerly direction. We noted several broken windows on the ground floor of the left elevation. We also noted that the tree near the rear corner of the residence remained standing, but had damaged limbs.

Photo CC

View looking south towards the neighboring property from the left elevation of the residence located at 22 Wolfe Street. We noted that the neighboring former residence had been moved off its foundation. We also noted that the remaining roof structure had the majority of its shingles still attached.

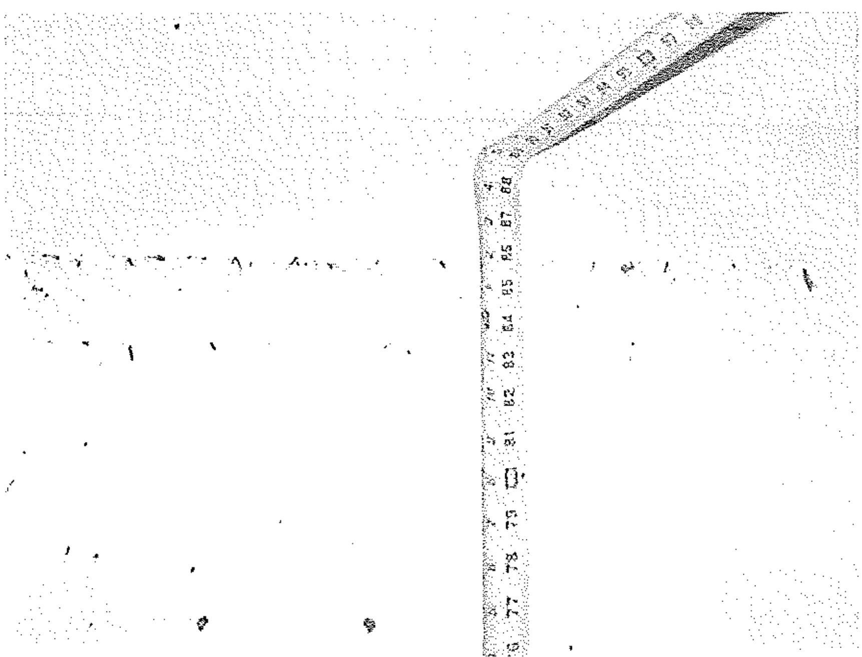


Photo DD

Close-up view of the high water mark remaining on the interior of the residence located at 22 Wolfe Street. We measured the high water mark to be approximately 7'-2" above the finish floor of the elevated first floor. This equates to the water mark being approximately 17'-0" above the exterior finish grade.

USGS MAP	☐
FEMA FLOOD MAP	☐
PUBLIC DOMAIN PHOTOS	☐
PROPERTY LOCATION MAP	☐
PHOTOS OF NEARBY PROPERTIES	☐
WIND/WATER CALCULATIONS	■

DETERMINATION OF WIND AND WATER FORCES

I. Lateral Wind Pressure on Walls of the Structure

American Society of Civil Engineers Standard – Minimum Design Loads for Buildings and Other Structures (ASCE 7-02) provides the following formula for determination of velocity pressure, q_z:

$$q_z = 0.00256 K_z K_{zt} K_d V^2 I \ (lb/ft^2) \quad [EQ\ 6\text{-}15]$$

Where: K_z = Velocity pressure exposure coefficient
K_{zt} = Topographic factor
K_d = Wind directionality factor
V = Basic wind speed
I = Importance factor

This velocity pressure q is then multiplied by several coefficients and factors for the determination of the design wind pressure. For the structural elements that are designed to provide support and stability for the overall structure, defined in Chapter 6 of ASCE 7-02 as the "main wind force resisting system", the main wind force design wind pressure p, for the windward and leeward walls, is determined by the following equation:

$$p = qGC_p - q_i(GC_{pi})(lb/ft^2) \quad [EQ\ 6\text{-}17]$$

Where: $q = q_z$ For windward walls and leeward walls
$q_i = q_h$ For windward walls and leeward walls
G = Gust effect factor
C_p = External pressure coefficient
(GC_{pi}) = Internal pressure coefficient

To get the total pressure on the structure (p_{tot}), add the windward and leeward main wind force design wind pressures and subtract out the internal pressure component:

$$p_{tot} = p_{wind} + p_{lee} - p_{int}$$

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I. Lateral Wind Pressure on Walls of the Structure (Continued)

For relatively flat ground with trees and other similar nearby residential structures 25' tall or less, the values for the velocity pressure exposure coefficient, topographic factor, wind directionality factor, and importance factor are [from Sections 6.5.6.6, 6.5.4.4, 6.5.7.2, and 6.5.5, respectively, of ASCE 7-02]:

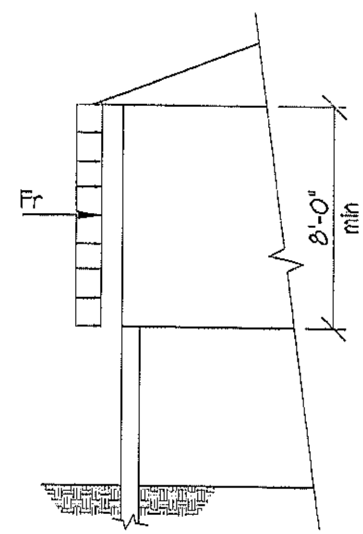
$K_z = 0.70$ $K_{zt} = 1.00$ $K_d = 0.85$ $I = 1.00$

Additionally, the values for gust effect factor, as well as the external and internal pressure coefficients are [from Fig 6-10 and 6-5 of ASCE 7-02]:

GC_p = 0.56 Windward Wall $(GC_{pi}) = \pm 0.18$
GC_p = -0.37 Leeward Wall
GC_p = 0.21 Windward Roof
GC_p = -0.43 Leeward Roof

Using the equations given above, the main wind force design wind pressures for various wind speeds are:

Basic Wind Speed	Velocity Pressure (q_z)	Main Wind Force Design Wind Pressure On Wall (p_{tot})	Resultant Force On 8' Tall Wall
90 MPH	12.33 PSF	11.47 PSF	91.76 PLF
100 MPH	15.23 PSF	14.16 PSF	113.28 PLF
110 MPH	18.43 PSF	17.14 PSF	137.12 PLF
120 MPH	21.93 PSF	20.39 PSF	163.12 PLF
130 MPH	25.74 PSF	23.94 PSF	191.52 PLF
140 MPH	29.85 PSF	27.76 PSF	222.08 PLF



II. Lateral Water Pressure on Walls of Structure

Lateral forces imparted from flood waters are a combination of hydrostatic and hydrodynamic forces as graphically indicated in the figure below.

Coastal Construction Manual
FEMA 55, Edition 3 / August 2005

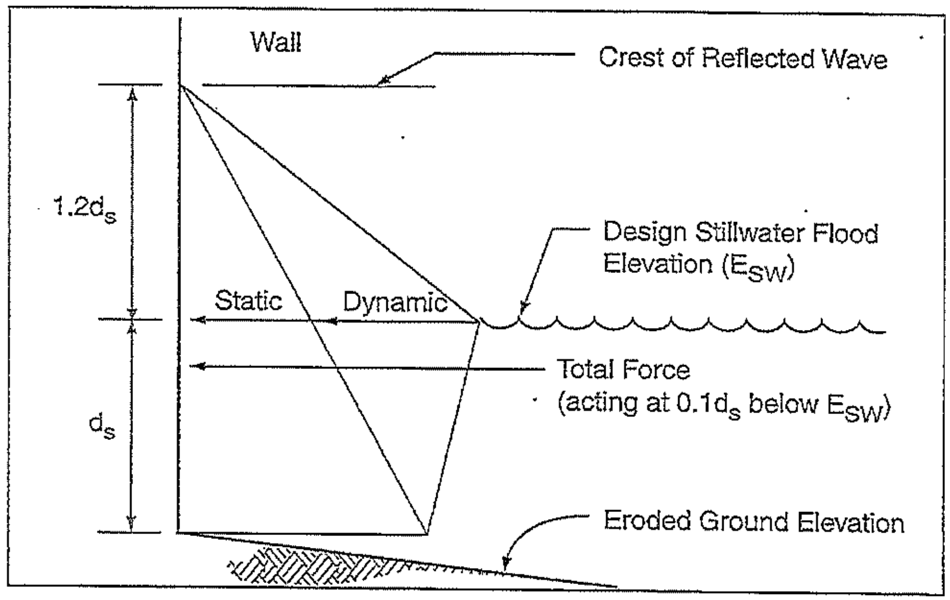


Figure 11-7

II. Lateral Water Pressure on Walls of Structure (Continued)

A. Hydrostatic Pressure

Water located on only one (1) side of a wall will result in lateral force against the wall as graphically indicated in the figure below.

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FEMA 55, Edition 3 / August 2005

If you have water on only one side, the resultant force from the hydrostatic pressure F_{sta} is:

$$F_{sta} = 0.5 d_s^2 \gamma_w$$

Where: d_s = Depth of Water
γ_w = Specific Weight of Water (64 lbs/ft^3) for salt water

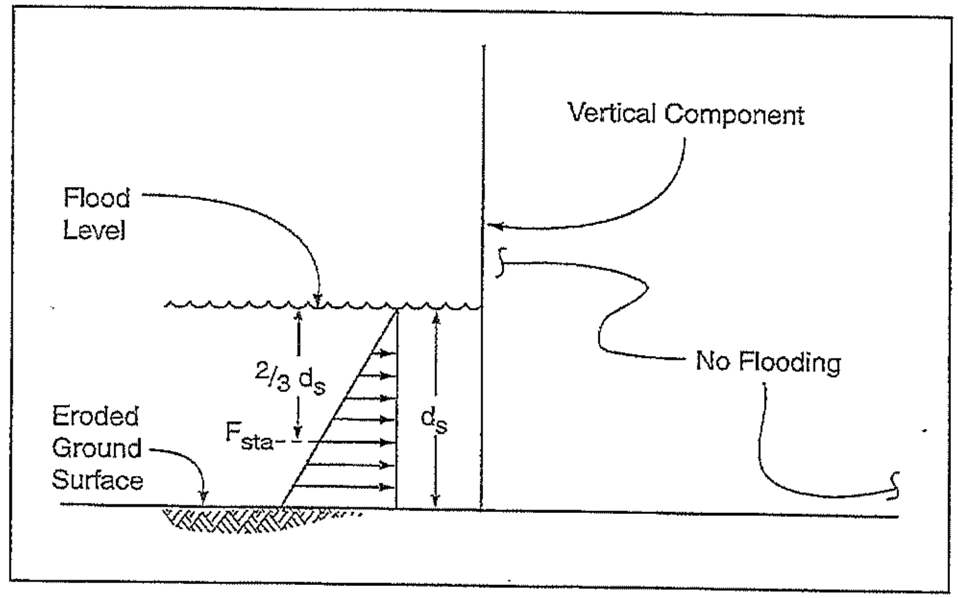


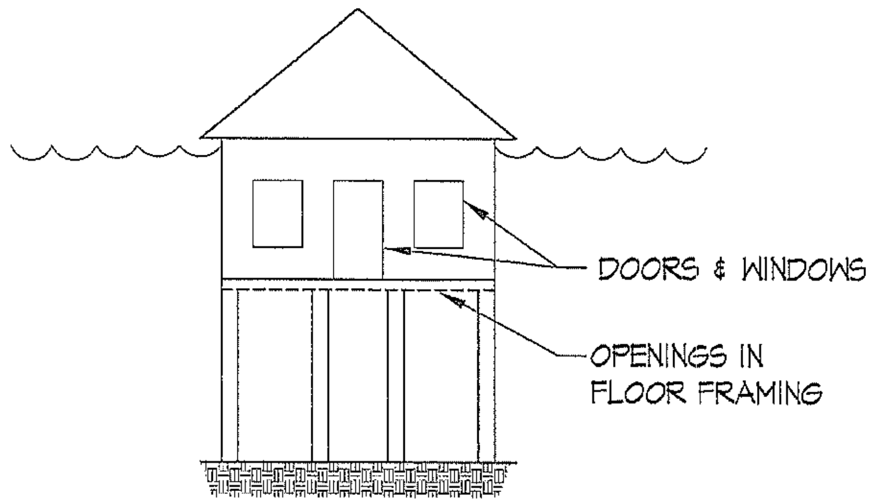
Figure 11-5

So, for example, if the depth of the water is 10'-0" deep:

$$F_{sta} = 0.5(10)^2(64) = 3{,}200 \text{ Pounds}$$

Acting at a distance of $\frac{2}{3}d_s$ below the surface or $\frac{2}{3}(10)$ = 6'-8" below the water surface

With multiple openings within which rising water can eventually enter the structure, such as openings in the elevated floor framing, doors, and windows, it is unlikely that significant differential water heights will exist between the exterior and interior of the structure over extended periods of time.



If an equal depth of water is on both sides of the wall, the hydrostatic component of the lateral water pressure is zero since the pressure on each side is the same, but acting in the opposite direction. Since the lateral water pressure is a combination of both hydrostatic and hydrodynamic forces, the lateral water pressure is not necessarily equal to zero when the hydrostatic component is zero.

II. Lateral Water Pressure on Walls of Structure (Continued)

B. Hydrodynamic Pressure

Hydrodynamic loads can be caused by both flow of water (velocity) and waves.

1) Velocity Component - which is the force resulting from flowing water

FEMA 55 sets a lower bound for design flood velocity at $V = d_s/t$ [Formula 11.2]

Where: d_s = depth of water and t = 1 second.

Therefore, for 10 foot water depth: V = 10/1 = 10 ft/sec

For velocities of 10 ft/sec or greater, FEMA 55 provides the following formula for determination of the velocity component of hydrodynamic loading:

$$F_{dyn} = \frac{1}{2} C_d \rho V^2 A$$ [Formula 11.8]

Where: C_d = Drag coefficient which ranges between 1.25 and 2.00 (Per Table 11.2 FEMA 55)
ρ = Mass density of fluid 1.99 slugs/ft^3 for salt water
V = Velocity (See Formula 11.2 above)
A = Surface area of obstruction normal to flow

2) Wave Component – which is the force resulting from waves breaking against an obstruction

FEMA 55 provides the following formula for determination of the breaking wave component of hydrodynamic loading:

$$F_{brkw} = (1.1 C_p \gamma d_s + 1.91 \gamma d_s^2) W$$ [Formula 11.6]

Where: C_p = dynamic pressure coefficient, 2.8 per Table 11.1
γ = specific weight of water, 64.0 lbs/ft^3 for salt water
d_s = depth of water
W = width of wall

For broken waves, FEMA recommends that the non-breaking wave forces be treated as hydrodynamic loads as part of Formula 11.8 (see above).

II. Lateral Water Pressure on Walls of Structure (Continued)

C. Site Specific Lateral Water Pressure Calc.

The lowest exterior finish grade for the residence is approximately 2'-0" above mean sea level and the finished first floor elevation was approximately 9'-6" above mean sea level. Further, the storm surge height was approximately 20'-3" above mean sea level. Therefore, the height of the water above the finished first floor elevation was approximately 20'-3" – 9'-6" = 10'-9".

For a water depth of 10'-9" above the finished first floor, assuming 8'-0" tall walls, the total water pressure would be:

Hydrostatic Component

$F_{sta} = 0$ Assuming water rose slowly enough to allow somewhat equal heights on interior and exterior of wall

Hydrodynamic Velocity Component

$F_{dyn} = \frac{1}{2} C_d \rho V^2 A$
$= \frac{1}{2}(1.25)1.99(18.25)^2(8.0)$
$= 3{,}314$ PLF
acting at 2'-8" above the first floor

Where:

$C_d = 1.25$ for Vertical Wall per Table 11.2 of FEMA 55
$\rho = 1.99$ Slugs/ft^3
$V = d_s/1 = 18.25$ ft/sec
$A = 8' \times 1' = 8.0$ ft^2

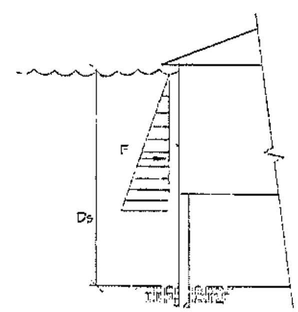
Wave Component

In hurricane surge, broken wave flow is more accurate, which is accounted for in the Velocity component

Lateral Water Pressure = Hydrostatic + Hydrodynamic

$$F_{lat} = F_{sta} + F_{dyn}$$

$= 0 + 3{,}314$ PLF
$F_{lat} = 3{,}314$ PLF



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III. Wind Uplift Pressure on Roof

American Society of Civil Engineers Standard – Minimum Design Loads for Buildings and Other Structures (ASCE 7-02) provides the following formula for determination of velocity pressure, q_z:

$$q_z = 0.00256 K_z K_{zt} K_d V^2 I \text{ (lb/ft}^2\text{)} \quad \text{[EQ 6-15]}$$

Where:
- K_z = Velocity pressure exposure coefficient
- K_{zt} = Topographic factor
- K_d = Wind directionality factor
- V = Basic wind speed
- I = Importance factor

This velocity pressure q is then multiplied by several coefficients and factors for the determination of the design wind pressure. For the structural elements that are designed to provide support and stability for the overall structure, defined in Chapter 6 of ASCE 7-02 as the "main wind force resisting system", the main wind force design wind pressure p is determined by the following equation:

$$p = qGC_p - q_i(GC_{pi}) \text{ (lb/ft}^2\text{)} \quad \text{[EQ 6-17]}$$

Where:
- $q = q_h$ For roofs
- $q_i = q_h$ For roofs
- G = Gust effect factor
- C_p = External pressure coefficient
- (GC_{pi}) = Internal pressure coefficient

III. Wind Uplift Pressure on Roof (Continued)

For relatively flat ground with trees and other similar nearby residential structures 25'-0" tall or less, the values for the velocity pressure exposure coefficient, topographic factor, wind directionality factor and importance factor are [from Sections 6.5.6.6, 6.5.7, 6.5.4.4, and 6.5.5 respectively of ASCE 7-02]:

$K_z = 0.70$ $K_{zt} = 1.00$ $K_d = 0.85$ $I = 1.00$

A sustained wind speed of 100 mph was recorded by NOAA-AOML.

Additionally, the Atlantic Oceanography and Meteorological Laboratory indicates that sustained wind speeds can be converted to three-second gust wind speed by multiplying the sustained wind speed by a factor of 1.3.

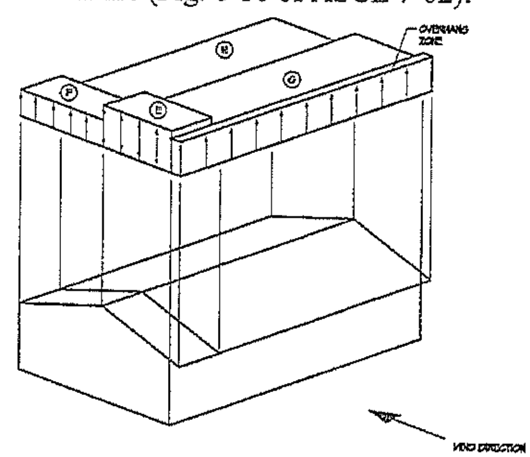
$$V_{sec} = 1.3\ V_{sustained}$$
$$V_{3sec} = 1.3\ (100) = 130 \text{ mph}$$

Values for the internal pressure coefficients are:

$(GCpi) = \pm 0.18$ (Fig. 6-5 of ASCE 7-02)

Further, values for the combined gust effect factor and external pressure coefficient are (Fig. 6-10 of ASCE 7-02):

Roof Location	Zone	GCp
End Windward	E	0.27
End Leeward	F	-0.53
Interior Windward	G	-0.69
Interior Leeward	H	-0.43
Overhang		-0.68



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III. Wind Uplift Pressure on Roof (Continued)

Using the equations given above, the main wind force design wind uplift pressures on a typical roof are:

Zone	Total Wind Uplift Pressure (p)
E	2.50 psf
F	-19.71 psf
G	-24.15 psf
H	-15.70 psf
Overhang	-23.87 psf
Average	-16.19 psf

Therefore, the net uplift on the roof structure P_{net} is:

$$P_{net} = P_{uplift} - P_{dead\ load}$$

Where:

P_{uplift} = Total wind uplift pressure
$P_{dead\ load}$ = Dead load of the structure

Note that applying an average wind uplift pressure of -16.19 psf to the entire roof square footage of the residence (approximately 2,350 square feet) and subtracting out the dead load of the roof/ceiling structure (20 psf) results in a net downward pressure of +3.81 psf, i.e. based on the geometry of the roof and the design wind speed, this roof structure would not result in a net uplift force for the entire structure.

IV. Water Buoyancy Force on Residence

If you have air trapped within the roof space of a residence during rising storm surge waters, a vertical force will be exerted upward on the roof structure that is equal to the weight of the water multiplied by the volume of the displaced water. In other words:

$$F_{buoy} = \gamma\,(Vol)$$ [Formula 11.4 of FEMA 55]

Where:

γ = Specific weight of water, 64 lb/ft^3 for salt water

Vol = Volume of flood water displaced by a submerged object in ft^3

Further, since the specific weight of wood framing members is less than that of water, there is an additional component of buoyancy resulting from the submerged wood framing. So as not to have to quantify the volume of wood framing, this second component of buoyancy acting on the structure has been neglected, making the buoyancy calculation conservative.

For example, the one (1) story residence has an area of approximately 2,350 square feet would have an upward force (buoyant force) that the water exerts for each foot of differential water height between the interior water surface and the exterior water surface of:

$$\begin{aligned} F_{buoy} &= \gamma\,(Vol) \\ F_{buoy} &= 64\,(2{,}350)(1'\text{-}0'') \\ &= 64\,(2{,}350)(1'\text{-}0'') \\ &= 150{,}400 \text{ lbs uplift per foot of differential water height} \end{aligned}$$

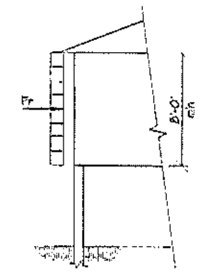
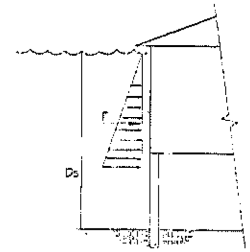
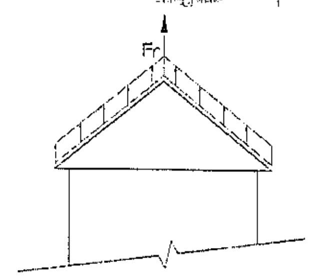
Conversely, the downward gravity load of a one (1) story wood structure is approximately 20 psf for roof loads and 12 psf for floor loads, plus an additional load of approximately 15 psf for walls, which results in a gravity load of:

$$\begin{aligned} F_{grav} &= (20+12+15)(2{,}350) \\ &= (47)(2{,}350) \\ &= 110{,}450 \text{ lbs vertical load} \end{aligned}$$

Therefore, with only one (1) foot of differential water height, the structure would have a net uplift of:

$$\begin{aligned} F_{net} &= F_{buoy} - F_{grav} \\ &= 150{,}400 - 110{,}450 \\ &= 39{,}950 \text{ lbs net uplift} \end{aligned}$$

V. Wind and Water Force Results

Lateral Wind Pressure on Walls: (Acting at mid-height of wall)	191.5 PLF	
Lateral Water Pressure on Walls: (Acting at height/3 of wall)	3,314 PLF	
Wind Uplift Pressure on Roof:	0 lbs	
Water Buoyancy Force on Residence:	39,950 PLF