BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

GULF POWER COMPANY'S STORM HARDENING PLAN, PSC DOCKET NO. 070299-EI

DIRECT TESTIMONY OF PETER J. RANT, P.E.

ON BEHALF OF

THE CITY OF PANAMA CITY BEACH, FLORIDA,

AND

THE PANAMA CITY BEACH COMMUNITY REDEVELOPMENT AGENCY

SEPTEMBER 7, 2007

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 070299-EI, GULF POWER COMPANY'S STORM HARDENING PLAN

DIRECT TESTIMONY OF PETER J. RANT, P.E.

Q: Please state your name and business address.

A: My name is Peter J. Rant. My business address is 1609 Heritage Commerce Court, Wake Forest, North Carolina 27587.

BACKGROUND AND QUALIFICATIONS

Q: By whom are you employed, and in what position?

A: I am employed by UtilityEngineering, Inc. as Vice President. My chief responsibilities include professional engineering oversight of electric power delivery projects including overhead and underground distribution. In my capacity as a Vice President of UtilityEngineering, I provide a range of consulting services to various clients, including municipal, cooperative, and investor-owned utilities, municipalities, federal and state government entities, and private-sector companies with regard to many electric issues. For example, I advise clients on system design and construction practices and costs associated with various configurations of equipment.

Q: Please summarize your educational background and any training relevant to your testimony in this proceeding.

A: I graduated from Clarkson University in Potsdam, New York with a Bachelor of Science degree in Electrical Engineering in 1990. While obtaining this degree, I specialized in courses within the electric power field including power systems analysis, electric power system control, transmission and distribution, and protective relaying for electric utility systems. A copy of my resume' is attached to my testimony as Exhibit ____ (PJR-1).

Q: Please summarize your employment history and work experience.

A: From 1990 to 1994 I served as a Lieutenant in the United States Army Signal Corps with responsibility for remote site power systems in various locations within the United States and Central America. In 1994 I joined Booth & Associates, Inc. in Raleigh, North Carolina and began consulting engineering for electric utilities and other owners of medium voltage electric systems, predominantly dealing with the design and construction of overhead and underground electric distribution systems. I held positions of increasing responsibility at that firm: Junior Engineer, Project Manager, Manager of Distribution Design, and Operations Manager for the Transmission and Distribution Division. In 2005, I joined UtilityEngineering, Inc., my current employer, as Vice President. I am responsible for all aspects of design of transmission and distribution lines in addition to other consulting tasks.

I have specific experience with storm hardening initiatives in coastal North Carolina. From 2000 until 2004, I was the project manager and engineer of record for an 88-mile overhead-to-underground electric distribution conversion project on four barrier islands in southeastern North Carolina. These islands, Oak Island, Holden Beach, Ocean Isle, and Sunset Beach were and are all served by Brunswick Electric Membership Corporation (BEMC), a cooperative utility. Following the severe hurricane impacts of the mid-1990's, particularly with Hurricanes Bertha and Fran, BEMC developed a plan to improve reliability and storm restoration time by placing all barrier island lines on their system underground.

I also have significant experience with design and construction standards for electric utilities. In 2005, I was the project manager for the complete re-write of the Design and Construction Guidelines for Transmission and Distribution for the Tennessee Valley Public Power Association. These guidelines are used by over 160 utilities in at least five states for design, construction, and operation of electric distribution systems.

Q: Have you previously testified before utility regulatory authorities, in administrative proceedings before other government agencies, or in courts of law?

A: I made a presentation, not formal sworn testimony, before the Florida Public Service Commission in April 2007 regarding Florida Power & Light Company's contributions in aid of construction for underground conversion projects. My comments addressed the appropriate treatment of the cost savings from undergrounding in determining the appropriate level of such contributions. I have also prepared to testify in a number of cases that settled before trial or hearing.

Q: Do you hold any professional registrations?

A: Yes. I am a Registered Professional Engineer in the States of Florida, North Carolina, Virginia, Maryland, Tennessee, Ohio, and Arizona, and in the District of Columbia.

SUMMARY AND PURPOSE OF TESTIMONY

Q: What is the purpose of your testimony in this proceeding?

A: I am testifying on behalf of the City of Panama City Beach ("PCB") and the Panama City Beach Community Redevelopment Agency, who have asked me to provide my professional opinions regarding Gulf Power Company's ("Gulf's") proposed Storm Hardening Plan with respect to its treatment of underground installations of electric distribution facilities.

Q: Please summarize your testimony.

A: While Gulf's Storm Hardening Plan ("Plan") includes good detailed design standards (though limited in scope) for the underground ("UG") installation of electric distribution facilities, Gulf's Plan fails to adequately evaluate the costs and benefits of undergrounding as a means of protecting electric distribution facilities against storms. In particular, while Gulf's Plan with respect to alternate standards of overhead ("OH") construction appears to be based on consideration of storm restoration cost and other cost savings from using "Grade B" construction as opposed to "Grade C" construction, Gulf's Plan fails to recognize that UG installation will provide even greater benefits, because overhead facilities are not vulnerable to wind alone, but even more vulnerable to windblown debris, or trees falling on lines. Additionally, while Gulf's assertion that UG facilities are more vulnerable to storm surge and flooding may be true in certain situations, Gulf has not provided data to support rejecting undergrounding on this basis. This conclusion on a blanket basis is not supported by my extensive experience and observations in the field including designs I have implemented for coastal utilities on barrier islands. Moreover, Gulf's own data for two of the largest cities on its system, one (Panama City Beach) a high-UG-percentage city and the other (Pensacola) a high-OH-percentage city, strongly indicate that UG provides substantial reliability and restoration benefits.

Because Gulf's Plan does not adequately address the benefits of undergrounding, the Commission should not approve Gulf's Plan, which is basically to delay gathering any further data until Gulf's customers get hit by additional named storms, while denying and minimizing the benefits of undergrounding because of a lack of "definitive proof." Instead, the Commission should require Gulf to further analyze available data and to make a real, meaningful evaluation and analysis of the benefits and costs of undergrounding as a storm hardening technique, and to return to the Commission in the near future – not 3 years from now, and not until waiting for additional named storms to strike Gulf's service area -- for further proceedings on the undergrounding aspects of Gulf's Plan. There is certainly more than adequate historical information concerning named storm impacts both in Florida and other east coast areas.

BENEFITS OF UNDERGROUNDING

Q: What are the benefits of undergrounding as a means of reducing storm restoration costs and customer outages as a result of major storms?

A: For the obvious reason that underground facilities are underground, they are "out of harm's way" with respect to wind, windblown debris, and trees that may fall across lines from outside the rights-of-way or easements within which distribution facilities are located. Accordingly, with the rare exception of instances where a tree falls on a transformer or switch cabinet and actually causes sufficient damage to create an outage, UG facilities are not vulnerable to damages caused by wind, windblown debris, or falling trees.

Gulf Power specifically recognizes these factors as being the principal causes of damage to overhead facilities in storms. Gulf's witness Edward Battaglia testifies, at page 13 of his prefiled testimony, that "Gulf's field experience strongly indicates that pole failures on its distribution system are not the result of the wind itself during a hurricane, but rather the wind-carried debris and off right-of-way trees."

Major storms will result in damage to any electric distribution system. The duration and number of outages depends upon the level of damage to the system, and the number of spot locations on the system which are damaged. Overhead systems are fully exposed to damage along their entire lengths, and

OH restoration often involves splicing many segments and components of the system back together because major events frequently affect every span in localized areas, particularly along the coast. Underground systems do not generally sustain this degree of damage, and the replacement of the affected parts (usually the pad-mounted equipment is comparable in time and effort to replacing overhead facilities performing the same function. With fewer locations to fix, restoration time is improved. In less severe storms, such as 2006's Tropical Storm Ernesto which struck the undergrounded barrier islands served by BEMC in North Carolina, properly designed underground systems may experience no outages at all.BEMC's UG system experienced no outages at all in Ernesto.

Q: How is this relevant to the consideration of undergrounding distribution facilities in the context of a utility's storm hardening efforts or planning?

A: In its Plan and in its witness's testimony and exhibits in this case, Gulf identified dollar benefits, in the form of additional storm restoration cost savings, from hardening of its overhead distribution system from NESC Grade C to Grade B standards/criteria. The reported benefits were shown as approximately $1,122,132 per year for each of the years 2007, 2008, and 2009, as compared to costs in those years of $53,600, $225,000, and $225,000, respectively.

Because underground facilities are not subject to any of these damages, UG facilities will necessarily provide greater benefits than will simply going to Grade B construction. Grade B facilities will, indeed, withstand higher wind speeds than Grade C, but they will be knocked out of service by flying debris and falling trees. This is important because stronger storms (Category 2 or higher), and frequently even weaker storms, will inflict significant damage on overhead facilities by windblown debris and falling trees. Furthermore, the stronger overhead structures and even shorter spans (associated with hardened OH facilities) have minimal improvement on outages associated with broken conductors or conductor damaged by trees and wind blown debris.

In short, if increasing the strength of OH facilities from Grade C to Grade B can save $1,122,132 a year, when the Grade B facilities remain overhead and therefore remain exposed to damage from windblown debris and falling trees, then undergrounding those facilities will save more (at least on an expected-value basis). This is because UG facilities are simply not subject to these impacts. When projected over the life of the system (thirty years or more) and considering the anticipated increased major storm activity, the resulting savings significantly reduces the difference between the cost of installation of the underground versus the overhead system. Thus, undergrounding should be carefully considered and evaluated in developing a utility's storm hardening plan. For example, promoting undergrounding is a key component of FPL's "Storm Secure" plan for improving reliability and restoration in the face of the predicted increase in major storms striking Florida.

Q: How should the PSC view this in its consideration of Gulf Power's Storm Hardening Plan?

A: The PSC should recognize that Gulf's Plan is deficient in that it fails to adequately consider the benefits that undergrounding can provide when implemented as part of a utility's storm hardening initiatives. The PSC should also recognize that Gulf's claim that its Plan is cost-effective is based on woefully incomplete analysis, in which Gulf even ignored or failed to fully account for its own data.

Q: Are there any other storm restoration benefits, either in terms of cost savings or in terms of restoration improvements that utilities can realize through undergrounding?

A: Yes, there are. In addition to direct storm restoration cost reductions due to the greatly reduced damage caused by wind, debris, and falling trees, where relatively large areas are served by underground distribution facilities, utilities realize significant additional benefits in the storm restoration environment because they don't have to deploy restoration crews to the UG-served areas, which frees up those crews to carry on restoration activities in OH-served areas. This means that the utility incurs not only less total cost, but also less overtime cost and also faster restoration of its OH-served customers.

Q: Have you observed these benefits in the real world?

A: Yes. Brunswick Electric Membership Corporation's UG-served barrier islands were impacted by a direct hit by Tropical Storm Ernesto in 2006. Not only did the UG-served barrier islands come through Ernesto without any loss of service, but BEMC's management advised me that the Coop was able to deploy restoration crews to its OH-served areas on the mainland, thereby achieving more rapid restoration of those OH areas. In fact, BEMC's operations and engineering managers have indicated that this is a frequent occurrence even during summer thunderstorms and similar events. The result is improved system reliability on a year round basis.

Additionally, these are among the benefits identified by Florida Power & Light Company as supporting and justifying the reduction in its Contribution in Aid of Construction (CIAC) for large-scale, government-sponsored UG conversion projects as currently approved in FPL's tariff.

Q: Are there additional benefits of undergrounding, i.e., benefits beyond those associated with reduced or avoided storm restoration costs?

A: Yes. Although such benefits may not technically be directly relevant in evaluating a utility's storm hardening plan, additional benefits of undergrounding include the following: (1) improved reliability and reduced restoration costs following weather events other than named tropical storms and hurricanes, such as severe summer thunderstorms, microbursts, and tornadoes; (2) preserved utility revenues, which accrue as a direct result of the utility's being able to maintain service to UG-served areas and also as a result of more rapid restoration of other areas; (3) reduced utility exposure to claims for damages due to contact with energized facilities and due to vehicular crashes with distribution poles; (4) reduced vegetation management costs; (5) reduced pole inspection costs; and (6) reductions in other operation and maintenance costs.

FLOODING AND STORM SURGE IMPACTS

Q: Some utilities, including Gulf, assert that UG facilities are more vulnerable to damage from flooding and storm surges. Do you have an opinion regarding this assertion?

A: Yes. In some extreme instances, major storm surges can literally "wash out" the land in which UG facilities are located. When this occurs, the UG facilities are damaged and rendered inoperative. (In such instances, if the facilities serving the area were OH facilities, they would also be washed out.) And, when this does occur, replacing the UG facilities is more expensive and usually takes longer than would replacing OH facilities in the same location.

However, these "washouts" are relatively rare instances. In cases where washouts occur, service can usually be restored through looped circuits as advocated by Gulf's storm hardening plan or may not need to be restored immediately due to the complete destruction of the structures which had been served.

Additionally, such "washouts" can largely be prevented by better, "smarter" design and placement of the UG facilities. In fact, Gulf's Plan sets forth design considerations, guidelines, and specifications for UG installations in coastal environments that, in my opinion, would go a long way to avoiding such "washout" events. Many of these practices with regard to placement of facilities and system design have been implemented on Brunswick EMC's barrier islands, which have experienced no complete "washouts" and only minimal erosion, which was easily repaired in the storms that have hit those areas.

In this context, having identified good design and location specifications and principles, Gulf set the table for a good comparison of well-designed underground facilities to OH facilities in the storm hardening context, and then simply didn't follow through with any appropriate evaluation or analysis of costs and benefits as a component of its storm hardening plan.

COSTS AND DURATION OF UNDERGROUND SYSTEM OUTAGES

Q: Isn't it true that when underground distribution facilities experience outages, such outages take longer and cost more to repair or restore than OH outages?

A: It is true that repairing certain types of equipment or cable failures resulting in an UG outage takes longer than repairing many types of OH outages. However, with good utility practices, underground facilities are normally designed with loop feeds and therefore the actual outage duration is much shorter even though the repair time is longer. Depending upon the type of damage, the repairs may not take longer than those on comparable overhead facilities. The repair time argument is often made in the context of locating, excavating, and repairing damaged underground cable. This definitely takes longer than splicing overhead conductors. Replacement of damaged pad mounted equipment such as transformers can generally be done in a comparable time to replacing an overhead piece of equipment such as a transformer.

Q: Some utilities assert that it takes longer to locate problems on their UG systems. Do you have an opinion on that assertion?

A: Yes. This assertion is probably true for some utilities, but it should not be true for utilities that install and maintain modern, current-technology UG facilities including faulted circuit indicators on equipment that allows rapid detection of the line segment with a failure. Used in conjunction with proper sectionalizing and system protective devices, looped designs, and geographic information systems (GIS) (as indicated on page 13 of Gulf's plan), and outage management and AMR systems, location and isolation of problem areas can be accomplished very rapidly on UG systems.

UNDERGROUND VS. OVERHEAD RELIABILITY ON GULF'S SYSTEM

Q: Does any of the information or data furnished by Gulf in this docket indicate whether UG facilities or OH facilities fare better in storm conditions?

A: Yes. Reviewing Gulf's data for outages experienced in Hurricane Dennis indicates that Panama City Beach, which is served by a much higher percentage of UG facilities (45 percent) than Pensacola (21 percent), fared much, much better in 2005's Hurricane Dennis.

Q: Please explain the data that support this conclusion.

A: This conclusion is based on a macro-level comparison of Gulf's OH and UG facilities in the two cities, the number of electric customers (meters) in the two cities, and various performance statistics that can be computed from Gulf's discovery responses in this case.

First, I looked at information provided by Gulf regarding the mileage of OH and UG distribution lines in Panama City Beach and in Pensacola. This was provided by Gulf in response to PCB's Interrogatory No. 7. This data shows that PCB has about 74 miles (55 percent) of OH lines and about 61 miles of UG lines (45 percent). By contrast, Pensacola has about 395 miles of OH lines (79 percent) and about 84 miles of UG lines (21 percent). (Note: Gulf's interrogatory response appears to repeat the UG line data, in that the listing includes 22 entries for UG lines, and the first 11 entries are identical to the last 11 entries, down to the last decimal point. If one accepted this information as accurate, then the percentage of UG facilities in PCB would show as about 63 percent, instead of 45 percent. Believing this to have been an inadvertent error, I assumed for these analyses that only one set of the UG entries was real.) Additionally, according to Gulf's response to PCB's

Interrogatory No. 21, Gulf has 30,848 electric customers (meters) in Panama City Beach, and 46,222 customers (meters) in Pensacola. This customer information is useful for measuring the relative reliability and restoration performance of the two systems, PCB's high-UG system and Pensacola's high-OH system, on a per-customer basis and on a per-customer-per-line-mile basis.

Next, I tried to identify whether there is any data that would provide a reasonably fair comparison of the relative performance of Panama City Beach's relatively high-UG system against Pensacola's relatively high-OH system in a storm situation. Gulf only started collecting data for individual municipalities in 2005, but it did furnish customer outage information for Pensacola and Panama City Beach for Hurricanes Dennis and Katrina, and also for tropical Storm Cindy, in response to PCB's Interrogatory No. 17. Tropical Storm Cindy's impacts were minimal, and although Katrina impacted Pensacola much more than Panama City Beach, I did not consider that to be a fair comparison, because, as we all know, Katrina made its landfall to the west of Pensacola, such that its impacts were felt much more strongly in Pensacola, in particular because Pensacola got hit by the dangerous northeast quadrant of Hurricane Katrina.

Reviewing the National Hurricane Center's final report on Hurricane Dennis, however, indicates that the conditions experienced in Dennis were fairly comparable in Panama City Beach and in Pensacola. A copy of this report is included as Exhibit ____ (PJR-___) to my testimony. In fact, comparable detailed data for the two cities indicates that the storm conditions experienced in Panama City Beach were worse than in Pensacola; this is consistent with Dennis's having made landfall west of PCB, such that PCB was struck by the northeast quadrant of the storm. Specifically, for comparable National Ocean Service reporting stations in PCB and in Pensacola, the reported maximum sustained wind speeds were 51 knots in PCB and 35 knots in Pensacola (6-minute averages), and for the same stations, the maximum gust at PCB was 63 knots as compared to a maximum gust of 51 knots at Pensacola. (Hurricane Dennis Tropical Cyclone Report at pages 11-12.) Additionally, the storm surge and storm tide measurements – especially relevant to this discussion because of Gulf's assertion that storm surges and flooding are major drawbacks to UG installations, and also especially relevant because PCB is essentially a barrier island city – showed markedly higher values for Panama City Beach than for Pensacola: a storm surge of 5.72 feet in PCB vs. 4.16 feet in Pensacola, and a storm tide of 6.79 feet in PCB vs. 5.52 feet in Pensacola. Although other Pensacola reporting stations show two higher - and one lower - wind values for Pensacola, I believe that the specifically comparable reporting criteria for the above-cited wind data, along with the fact that the numbers are all within the same range, indicate that the conditions experienced in Dennis were, if anything, comparable as between PCB and Pensacola, and that they were probably worse in PCB.

Next, I used the customer outage data reported by Gulf for PCB and Pensacola to compare the performance of the two systems in various ways. These figures are summarized in Exhibit ____ (PJR-___) to my testimony, which also includes copies of the cited interrogatory responses. First, looking at customer outages per line-mile of total facilities, both at peak outages and on a day-by-day basis during the restoration period, shows that PCB fared much better than Pensacola. At peak, PCB had 32.4 customers out of service per line-mile, as compared to Pensacola's 112.5 customers out per line-mile at peak. PCB fared even better as the restoration went forward: on the third day following Dennis's impact, PCB was down to less than 1 customer out per line-mile, while Pensacola was still close to 70 customers out per line-mile.

Another way of looking at this information is to examine how many customers (meters), as a percentage of total customers, were out of service at peak: for Panama City Beach, about 14 percent of Gulf's customers were out at the peak outage level, as compared to 96 percent of Pensacola customers at peak.

Another meaningful way of looking at the data is to examine the restoration rates by looking at the percentage of peak customers out of service on the third and fourth days following peak outages: for Panama City Beach, by Day 3, more than 99 percent of customers were restored, while in Pensacola, about 62 percent remained out of service on Day 3.

Q: What, if anything, do these comparisons indicate with regard to Gulf's and the PSC's consideration of undergrounding as a storm hardening technique?

A: These measurements strongly indicate that undergrounding is, and should be recognized by Gulf and the PSC, as a meaningful tool for storm hardening, a tool that can greatly reduce restoration costs and that can greatly improve reliability in a storm situation. Even under storm conditions that were probably worse in Panama City Beach than in Pensacola, Gulf's customers in PCB fared much, much better than those in Pensacola. Because of Gulf's lack of specific data regarding failures and restoration of OH and UG facilities following the 2005 storms, we cannot know with absolute certainty how much of the better experience that PCB had is attributable to its much higher percentage of UG facilities than Pensacola, but these measurements – based directly on Gulf's own data – are compelling as an endorsement of undergrounding as a means of improving reliability in storm conditions in Gulf's service area.

These comparisons and data are even more compelling when viewed against Gulf's claimed concern about flooding and storm surges: Panama City Beach is a barrier island, exposed directly to the Gulf, and it also experienced a greater storm surge and a greater storm tide than did Pensacola, yet Gulf's customers in Panama City Beach came through Hurricane Dennis much, much better than those in Pensacola. This type of data should be considered as a part of any comprehensive storm hardening plan.

Q: In your opinion, what implications does this have for the Commission's consideration of Gulf's Storm Hardening Plan?

A: Again, as noted elsewhere in my testimony, this data, which is Gulf's data and thus readily available to Gulf, indicates that Gulf did not do an adequate job of considering UG as a storm hardening technique. Accordingly, the PSC should not approve this part of Gulf's Plan but should require Gulf to conduct meaningful additional and more detailed analyses, and to submit these analyses to the PSC no later than next year for further consideration of its Plan in light of these analyses.

Q: Does any of the information or data furnished by Gulf in this case indicate whether OH facilities or UG facilities perform better in day-to-day conditions?

A: Yes. Gulf's SAIDI, SAIFI, and CAIDI data for Pensacola and Panama City Beach indicate that the overall reliability of service to Panama City Beach, with its much higher percentage of UG distribution facilities, has been significantly better than Pensacola's. For 2002, 2004, 2005, and 2006, the SAIDI, SAIFI, and CAIDI data all show better reliability for Gulf's customers in PCB; the values for 2003 are very close for the two cities, while the reported values for 2004 and 2005 in particular are dramatically better for Panama City Beach.

CAIDI (Customer Average Interruption Duration Index) provides insight into the maintainability of the system and its impact on overall reliability. Gulf's CAIDI data for Pensacola and Panama City Beach, when considered in terms of the relative percentages of UG, fully supports my testimony that UG outages may not result in longer restoration time for a properly designed and constructed system. If customer interruption durations are reduced on a daily basis, it stands to reason that they can be restored more quickly following a storm event.

It is particularly surprising that Gulf did not carefully analyze this data and initiate further investigation of the relatively greater reliability shown by PCB vs. Pensacola, in light of Mr. Battaglia's testimony (page 9) that "In adopting a storm hardening activity, Gulf considers both cost-effectiveness and whether the activity meets the goal of reduced customer outages and restoration times . . . both in the aftermath of a storm occurrence and also on a day-to-day operations basis." The above analyses of Gulf's own data show that for two of the largest cities in its service area, one (Panama City Beach) with more than double the percentage of UG facilities as compared to the other (Pensacola), the high-UG city fared much better both in comparable, or even worse, storm conditions in Hurricane Dennis, and that the high-UG city also fared much better over 6 years worth of reliability observations.

Q: Is it your position that undergrounding is a panacea, and that it should be installed everywhere?

A: Not at all. There are surely some applications where UG is, at best, not cost-effective. On the other hand, based on the Gulf Power data discussed above and on other utilities' actions and my other experience in the field, we should carefully consider what the net, overall storm impacts might be (and might have been in 2004 and 2005) if Florida had undertaken a strong undergrounding initiative beginning 20 years ago.

The real point of my testimony is that undergrounding provides substantial benefits, and that those benefits have real value to utilities and their customers, both in terms of reduced storm restoration costs and other cost savings, and also in terms of reduced outage frequency and total outage duration. These benefits should be considered by utilities and the PSC, and they should be reflected in utility tariffs and programs relating to undergrounding. And thus, in the context of Gulf's Storm Hardening Plan, Gulf should have done, and should be required to do, a much better job of evaluating the benefits of undergrounding: Gulf's own data tells this story quite powerfully.

GULF POWER COMPANY'S DATA COLLECTION PROPOSALS

Q: What is your understanding of Gulf's proposals regarding data collection to evaluate the benefits and costs of undergrounding as a storm hardening measure?

A: It appears that Gulf's position on data collection is summarized in several of its responses to the PSC Staff's interrogatories, e.g., Nos. 12-15, in which Gulf indicates that it simply did not collect forensic data in either 2004 or 2005, and in which Gulf indicates that it will collect such data after future storms impact its customers. In other words, Gulf doesn't have the data because it chose not to collect it and has apparently chosen not to analyze data that it has readily available. Gulf does have a lot of photographs of worst-case impacts of storm surges on UG facilities (response to PSC Staff's Int. No. 16); if Gulf personnel could go to the field and take these photos, surely they could identify the places where these impacts were felt, and surely they could figure out what materials, and thus approximately what labor effort, were used in restoring service in these locations and other locations throughout the system for a full, thorough, and objective analysis.

Q: Please summarize your experience and familiarity with utility records concerning their UG and OH facilities, especially, as it relates to storm restoration costs.

A: I have extensive experience working with utility accounting records and "continuing property records." These are necessary tools for managing any utility system. Generally, while detailed records of labor effort for storm restoration activities are not always available, records of the materials used in storm restoration – poles, conductor (wire), conduit, transformers, cabinets, and the like – should be readily available. And, since most of these are applicable to either OH facilities or UG facilities, but not both, it should be relatively easy for a utility to evaluate how much material was used in restoring OH service and how much was used in restoring UG service following any given storm.

Furthermore, since utility line crews and contract crews are typically segregated into OH and UG designations with specific tools and equipment for each type of work, labor and equipment costs associated with this work can be figured directly from invoices. In fact these crew rates are often based on the type of work (OH vs. UG) that they perform and thus must be separated out.

Q: Should Gulf have such data, and if so, how should Gulf have used it in preparing its Storm Hardening Plan?

A: Gulf should have ready access to this data, and it should have used such data in evaluating the costs and benefits of undergrounding as a storm hardening technique. Gulf apparently had sufficient data to estimate the benefits and costs of going from Grade C to Grade B overhead construction, so it should have comparable data to enable it to evaluate the benefits and costs of undergrounding relative to storm restoration costs. Certainly Gulf should know how many OH and UG crews were dispatched for storm restoration and their corresponding costs.

CONCLUSIONS

Q: Do you have any advice or recommendations for Gulf or the Florida Public Service Commission?

A: Yes. I would recommend that Gulf Power Company immediately undertake a serious, in-depth analysis of available data relating to the reliability, costs, and benefits of undergrounding using data from its own experience and using analogous, comparable data "borrowed" from other utilities. Rather than sitting tight until it has definitive proof, Gulf should take the initiative to identify benefits of undergrounding and should act, reasonably, to promote undergrounding in order to promote reliability and reduced outages and to obtain the storm cost savings and other benefits that are available from undergrounding. The Florida PSC should require Gulf to present, within the next 6-9 months, better analyses and a better Storm Hardening Plan, as it relates to undergrounding.

Q: Does this conclude your testimony?

A: Yes, it does.

Utility Engineering

Engineering Services For Utilities®

PETER J. RANT, PE
VICE-PRESIDENT

PROFESSIONAL EDUCATION:

CLARKSON UNIVERSITY, Potsdam, NY
BS - Electrical & Computer Engineering, 1990
Concentration in Power Systems

REGISTRATION:

Professional Engineer: North Carolina, Virginia, Maryland, Tennessee, Florida, Ohio, Arizona, District of Columbia

EXPERIENCE:

2005-Present

Vice President
UTILITYENGINEERING, INC.
Wake Forest, North Carolina

Responsible for leadership and direction of staff completing design and management of power delivery projects. Develops projects from concept through completion. Responsible for staffing, budgeting, scheduling, and contractual agreements related to design and construction.

Allocates resources, develops partnering and subcontracting relationships, and directs bidding and other procurement methods to complete projects. Maintains professional engineering responsibilities over designs, studies, and reports, consistent with the work listed below.

Maintains availability to clients around the clock, seven days a week, to ensure engineering needs are met. Establishes and monitors Utility Engineering standards and priorities of work to meet or exceed client expectations.

2005

Operations Manager-Transmission & Distribution and Geographic Information & Technology
BOOTH & ASSOCIATES, INC., Consulting Engineers
Raleigh, North Carolina

Responsible for the daily operations and resource allocation for the largest division at Booth & Associates, Inc. Worked with Division Vice Presidents developing annual division budget and performance goals. Tracked project budgets and directed department and project managers to meet fiscal targets and project schedules.

Maintained relationships with diverse base of clients and vendors to develop engineering and design/build (EPC) projects. Developed studies and cost proposals supporting clients' technical and fiscal requirements. Designed, bid, and managed multiple construction projects.

PETER J. RANT, PE
(Continued)

Continuing professional engineering responsibilities for an array of projects. Project experience includes: design of 18 miles of static overhead ground wire replacement on a 69 kV Transmission System with Optical Ground Wire (OPGW), successful completion of a 3-year FEMA funded hurricane hazard mitigation project converting 88 miles of overhead distribution line to underground (approximate value of 15 million dollars), complete replacement and upgrade of a university medium voltage electric system, including station breakers, in two phases with a total project cost of 3.5 million dollars, and complete update of the TVPPA Design Guidelines for Transmission and Distribution.

1999-2005

Manager of Distribution Design
BOOTH & ASSOCIATES, INC., Consulting Engineers
Raleigh, North Carolina

Managed Electric Distribution Department for a seventy person electric utility engineering consulting firm; Responsible for distribution design standards and quality control of engineered solutions. Engineer of Record and Senior Project Manager for multiple projects. Directed engineers and technicians completing all design and management activities required for construction of multimillion-dollar capital projects. Developed new business through client contact, marketing efforts, and preparation of engineering proposals. Negotiated design and construction contracts.

Designed overhead and underground electric transmission and distribution facilities; Responsible for project scheduling and coordination, design calculations, field staking, right-of-way acquisition, permitting, and construction management of multiple projects. Prepared specifications, bid documents, labor and material contracts, construction cost estimates, various permit applications, construction drawings, design data books, design and construction standards manuals, Federal and State forms and reports, and system studies for municipalities, Investor Owned Utilities, Rural Electric Cooperatives, schools and universities, military bases and other owners of high and medium voltage electric systems.

Experience includes: major system improvement and revenue projects, voltage conversions, installation of metering, DOT relocations, roadway and decorative lighting, overhead and underground 69 kV transmission, substation upgrades, military base system privatizations, GPS/GIS mapping, system valuations, infrared inspections, and alternative materials specifications.

PETER J. RANT, PE
(Continued)

Specialized in complex underground construction projects for aesthetics and reliability including downtown streetscape enhancement and university campus electric and telecommunication systems.

Other Positions:	Project Manager	1997-1999
	Junior Engineer	1994-1997

1994-1999 **BOOTH & ASSOCIATES, INC.**, Consulting Engineers
Raleigh, North Carolina

Design and project management activities consistent with the experience listed above.

1990-1994 **UNITED STATES ARMY**, Fort Bragg, North Carolina.
First Lieutenant; Signal Operations Officer

Responsible for communications and site power for deployed Special Forces and major Joint Special Operations headquarters. Designed and supervised installation of communications networks and remote mobile power generation and distribution systems and serving base camps in Central America and the United States. Supervised up to 100 people installing and maintaining radio, telephone, and satellite communications systems during exercises and missions worldwide. Communications systems included single and multichannel HF, UHF, and SHF radios in point to point and point to multipoint secure voice and data networks as well as wireline systems. Employed technologies including spread spectrum radio, automatic link establishment (ALE), and Microsoft Windows based LAN's and WAN's.

Design of communications networks included selection and assignment of frequencies and antennas for wireless connections based on propagation analysis. Responsibilities also included allocation of bandwidth for trunked and dedicated channels, and assignment of individual subscriber priorities and privileges. Directed installation and troubleshooting of multiple layered networks.

Led individual and group training resulting in unit's 100% mission accomplishment in numerous deployments despite high personnel turnover. Responsible for maintenance and accountability of up to 5 million dollars worth of vehicles, generators, and communications equipment as well as control of classified documents and cryptographic materials.

PETER J. RANT, PE
(Continued)

Positions Held:	Signal Detachment Commander	1992 to 1994
	Platoon Leader	1991 to 1992
	(Military Training Schools)	1990 to 1991

MILITARY ACHIEVEMENTS:

Excelled academically graduating second in a class of eighty-four officers in the Signal Officer Basic Course, and in the top five at the Battalion/Brigade Signal Officer Course. These courses comprise nine months of training covering design, installation, and maintenance of military communications and power systems. Military training certifications include Parachutist, Senior Parachutist, Jumpmaster, Battalion/Brigade Signal Officer, Airlift Loadplanner, Range Operations and Ammunition Handling, and Substance Abuse Prevention and Control. Awarded Army Commendation Medal with Oak Leaf Cluster for meritorious service in the 7th Special Forces Group (Airborne) and the 112th Signal Battalion (Special Operations)(Airborne)

PROFESSIONAL AFFILIATIONS:

Institute of Electrical and Electronic Engineers (IEEE)
National Society of Professional Engineers (NSPE/PENC)
Society of American Military Engineers (SAME)

Tropical Cyclone Report
Hurricane Dennis
4 – 13 July 2005

Jack Beven
National Hurricane Center
22 November 2005
Updated for deaths, damages, forecast errors, and Jamaican data 17 March 2006

Hurricane Dennis was an unusually strong July major hurricane that left a trail of destruction from the Caribbean Sea to the northern coast of the Gulf of Mexico.

a. Synoptic History

Dennis formed from a tropical wave that moved westward from the coast of Africa on 29 June. The system began to organize on 2 July with the formation of a broad area of low pressure with two embedded swirls of low clouds. Convection increased near both low-level centers on 3 July. The western system moved through the southern Windward Islands on 4 July and lost organization over the southeastern Caribbean. The eastern system continued to develop, becoming a tropical depression over the southern Windward Islands near 1800 UTC 4 July. The "best track" chart of Dennis' path is given in Fig. 1, with the wind and pressure histories shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1.

The depression initially moved westward. It turned west-northwestward on 5 July as it became a tropical storm. Dennis reached hurricane strength early on 7 July, then rapidly intensified into a Category 4 hurricane with winds of 120 kt before making landfall near Punta del Ingles in southeastern Cuba near 0245 UTC 8 July. During this intensification, the central pressure fell 31 mb in 24 h.

Dennis weakened to a Category 3 hurricane while passing across southeastern Cuba. Once offshore in the Gulf of Guacanayabo, the hurricane moved west-northwestward parallel to the south coast of Cuba and again intensified to Category 4 status. Maximum sustained winds reached a peak of 130 kt at 1200 UTC 8 July, then decreased to 120 kt before Dennis made landfall near Punta Mangles Altos, Cuba near 1845 UTC that day. Dennis then traversed a long section of western Cuba before emerging into the Gulf of Mexico just east of Havana around 0900 UTC 9 July. Dennis weakened significantly over Cuba, with the maximum sustained winds decreasing to 75 kt by the time the center left the island.

Dennis gradually intensified for the next 6-12 h over the Gulf of Mexico, then began another cycle of rapid intensification near 1800 UTC 9 July, accompanied by a turn toward the north-northwest. During this intensification, the central pressure fell 37 mb in 24 h, including 20 mb in 6 h and 11 mb in 1 h 35 min. Maximum sustained winds reached a third peak of 125 kt near 1200 UTC 10 July. Thereafter, weakening occurred, likely due to mid/upper-level dry air from the western Gulf of Mexico entrained into the hurricane. The maximum sustained winds decreased to 105 kt and the central pressure rose to 946 mb before Dennis made landfall on Santa Rosa Island, Florida, between Navarre Beach and Gulf Breeze, about 1930 UTC 10 July.

Dennis continued north-northwestward after landfall, with the center moving across the western Florida Panhandle into southwestern Alabama before it weakened into a tropical storm. It became a depression as it moved into east-central Mississippi on 11 July. The cyclone turned northward later that day and northeastward on 12 July as it moved into the Ohio Valley. On 13 July, Dennis weakened to a low pressure area, which meandered over the Ohio Valley through 15 July. The Dennis-low accelerated northeastward on 16 July and was absorbed into a larger low over northwestern Ontario on 18 July.

b. Meteorological Statistics

Observations in Dennis (Figs. 2 and 3) include satellite-based Dvorak technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB), the Satellite Analysis Branch (SAB) and the U. S. Air Force Weather Agency (AFWA), as well as flight-level and dropwindsonde observations from flights of the 53rd Weather Reconnaissance Squadron of the U. S. Air Force Reserve Command and the NOAA Aircraft Operations Center. Microwave satellite imagery from NOAA polar-orbiting satellites, the NASA Tropical Rainfall Measuring Mission (TRMM), the NASA QuikSCAT, the NASA Aqua, and Defense Meteorological Satellite Program (DMSP) satellites were also useful in tracking Dennis.

The 53rd Weather Reconnaissance Squadron made 43 center fixes on Dennis, with the NOAA aircraft contributing an additional 10 fixes. The maximum flight-level winds measured by the aircraft at 700 mb were 150 kt at 1325 UTC 8 July. Additionally, the aircraft measured 700 mb flight-level winds of 134 kt at 2314 UTC 7 July and 140 kt at 0801 UTC 10 July. Dropsondes in the eyewall of Dennis reported 116-kt surface winds at 1515 UTC 10 July and 114 kt at 1705 UTC 8 July. The minimum aircraft-reported central pressure was 930 mb at 1143 UTC 10 July, with a 937 mb pressure measured at 1517 UTC 8 July. The last aircraft-reported pressure near landfall was 946 mb at 1930 UTC 10 July.

Ship reports of winds of tropical storm force associated with Dennis are given in Table 2, and selected surface observations from land stations and data buoys are given in Table 3.

Dennis brought hurricane conditions to portions of southeastern Cuba, and to a swath through central and western Cuba (Table 3). Cabo Cruz reported 116-kt sustained winds with a gust to 129 kt at 0200 UTC 8 July, with a minimum pressure of 956 mb at 0240 UTC just before the eye passed over the station. The anemometer was destroyed, and it is possible more extreme winds occurred. Unión de Reyes reported sustained winds of 96 kt with a gust to 107 kt at 2350 UTC 8 July, and there are numerous other reports of sustained hurricane-force winds.

Dennis also brought hurricane conditions to portions of the western Florida Panhandle and southwestern Alabama. An instrumented tower run by the Florida Coastal Monitoring Program (FCMP) at Navarre measured 1-min average winds (5-m elevation) of 86 kt and a gust to 105 kt at 1921 UTC 10 July. This tower was a few miles east of the radius of maximum winds. Another FCMP tower at the Pensacola Airport measured 1-min average winds (10-m elevation) of 71 kt with a gust to 83 kt just west of the eye at 1946 UTC. A Florida Automated Weather Network station at Jay reported sustained winds of 62 kt at 1845 UTC.

While hurricane-force winds associated with Dennis covered only a small area near the eye, the hurricane had a large cyclonic envelope with tropical storm-force winds extending well to the east of the center over southern Florida and the Florida Panhandle. The Coastal Marine Automated Station (C-MAN) at Sand Key, Florida, reported 10-min average winds (13.1-m elevation) of 54 kt with a gust to 68 kt at 0820 UTC 9 July, while the C-MAN station at Sombrero Key, Florida, reported 2-min average winds (48.5-m elevation) of 64 kt with a gust of 76 kt at 0800 UTC 9 July. A National Ocean Service station at Panama City Beach, Florida, reported 6-min average winds (6.1-m elevation) of 51 kt with a gust to 63 kt at 1800 UTC 10 July. Tropical storm conditions also occurred over the metropolitan areas of southeastern Florida, elsewhere along the Florida west coast and the Florida Big Bend region, over portions of southwestern Alabama, and across Jamaica. Wind gusts to tropical-storm force occurred as far inland as eastern Mississippi and as far west as southeastern Louisiana.

Shipping avoided the intense core of Dennis. The highest marine wind was 56 kt at 2300 UTC 8 July from the **Caribbean Princess**.

The lowest official pressure from any land station was 956 mb at Cabo Cruz, Cuba, at 0240 UTC 8 July. The FCMP tower at the Pensacola Airport measured a pressure of 956.3 mb at 1943 UTC 10 July, while the FCMP tower in Navarre measure a pressure of 965.2 mb at 1909 UTC that day. A storm chaser in Pace, Florida, measured an unofficial pressure of 945 mb at 1910 UTC 10 July as the eye passed over.

Dennis produced a storm surge of 6-7 ft above normal tide levels on Santa Rosa Island near where the center made landfall. This surge overwashed Santa Rosa Island near and west of Navarre Beach. A storm surge of 6-9 ft above normal tide levels occurred in Apalachee Bay, Florida, which inundated parts of the town of St. Marks and other nearby areas (Figure 4). This surge was higher than currently known wind reports would support for that area, and roughly 3.5 ft higher that the surge forecast from the Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model. This surge was likely triggered by an oceanic trapped shelf wave that propagated northward along the Florida west coast. Modeling results from the Center for Ocean-Atmospheric Prediction Studies at Florida State University suggest that although Dennis was roughly 150 n mi west of the area, this remotely generated sea-level rise added 3-4 ft to the surge in and around Apalachee Bay. (Reference: Personal communication with James O'Brien, Steve Morey, and Dimitri Dukhovskoy, COAPS, FSU.) A storm surge of 4-6 ft occurred elsewhere in the Florida Panhandle. Storm surges of 3-5 ft above normal tide levels occurred elsewhere along the Florida west coast, in the Florida Keys, and along the coast of Alabama. Tides of 2-4 ft above normal were reported along the coasts of Mississippi and southeastern Louisiana. Storm surge data from Cuba are currently not available.

Dennis produced widespread heavy rainfall over Cuba. Topes de Collantes reported a 24-h total of 27.67 in, while Las Piedra reported a 24-h total of 15.13 in. Storm totals for both places were likely higher. Rainfalls of 6-12 in were reported from other Cuban stations. Very heavy rains also occurred in Jamaica, where Mavis Bank reported a storm total of 24.54 in and Shirley Castle reported a total of 23.27 in (Table 4). In the United States, Dennis produced widespread heavy rainfall along the track from the western Florida Panhandle to the Ohio Valley, and east of the track in Georgia and the remainder of Florida. A station 10 miles northwest of Camden, Alabama, reported a storm total rainfall of 12.80 in, while Monticello, Florida, reported 6.95 in (Table 4).

So far, Dennis is known to have caused nine tornadoes in Florida and one in Georgia. All were rated F0 except for an F1 near Bradenton, Florida. Additionally, numerous strong squalls occurred in the outer bands of Dennis over southern Florida. These produced a gust of 73 kt at the Fowey Rocks C-MAN station and a gust of 63 kt at Chekika in southern Miami-Dade County.

c. Casualty and Damage Statistics

Reports from Meteorological Service of Jamaica and the media indicate Dennis is directly responsible for 42 deaths – 22 in Haiti, 16 in Cuba, 3 in the United States, and 1 in Jamaica. The fatalities in the U. S. included a drowning on a sunken boat in the Florida Keys, a drowning in rough surf at Dania Beach, Florida, and a man crushed by a falling tree near Atlanta, Georgia. Dennis was also indirectly responsible for twelve deaths in Florida – two from electrocution, two from carbon monoxide poisoning, four from automobile accidents, two accidental falls during clean-up, and two cases of natural causes exacerbated by storm stress.

The American Insurance Services Group estimates the insured property damage in the United States at $1.115 billion. Based on a doubling of this figure to account for uninsured property damage, the total U. S. damage estimate for Dennis is $2.23 billion. The Meteorological Service of Jamaica estimates the damage from Dennis at 1.9 billion Jamaican dollars (approximately $31.7 million U. S. dollars).

d. Forecast and Warning Critique

Average official track errors (with the number of cases in parentheses) for Dennis were 25 (26), 36 (26), 51 (26), 61 (26), 65 (22), 74 (18), and 154 (14) n mi for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. These errors are significantly lower than the average official track errors for the 10-yr period 1995-2004[1] (42, 75, 107, 138, 202, 236, and 310 n mi, respectively), (Table 5). These errors were also lower than the corresponding track forecast errors for the vast majority of the guidance, as none of the models consistently outperformed the official forecasts.

Average official intensity errors were 11, 18, 16, 16, 23, 16, and 37 kt for the 12, 24, 36, 48, 72, 96, and 120 h forecasts, respectively. For comparison, the average official intensity errors over the 10-yr period 1995-2004 are 6, 10, 12, 15, 18, 20, and 22 kt, respectively. The

[1] Errors given for the 96 and 120 h periods are averages over the four-year period 2001-4.

relatively large intensity errors mainly resulted from underforecasting how quickly Dennis would intensify over both the Caribbean and the Gulf of Mexico.

Table 6 gives the watches and warnings associated with Dennis.

Acknowledgements

Much of the data for this report was supplied by the National Weather Service WFOs in Key West, Miami, Tampa, and Tallahassee FL, Mobile, AL, and Slidell, La, as well as by the Meteorological Service of Jamaica. Additional data was provided by the University of South Florida Coastal Ocean Monitoring and Prediction System (COMPS) and the Florida Automated Weather Network (FAWN). NOAA buoy and C-MAN data were provided by the National Data Buoy Center. NOS data were provided by the NOAA National Ocean Service. Remote Automated Weather Stations (RAWS) data were provided by the National Interagency Fire Center. United States Geological Survey (USGS) data were provided by the NWISWeb web site. Supplementary rainfall data and portions of the remnant low track were provided by David Roth of the Hydrometeorological Prediction Center. Several of the unofficial observations were obtained from the Weather Underground web site. Jennifer Pralgo of the TPC Storm Surge unit provided the storm surge figure.

Table 1. Best track for Hurricane Dennis, 4 – 13 July 2005.

Date/Time (UTC)	Latitude (EN)	Longitude (EW)	Pressure (mb)	Wind Speed (kt)	Stage
04 / 1800	12.0	60.8	1010	25	tropical depression
05 / 0000	12.2	62.5	1009	30	"
05 / 0600	12.5	64.2	1008	30	"
05 / 1200	13.0	65.9	1007	35	tropical storm
05 / 1800	13.6	67.3	1005	40	"
06 / 0000	14.3	68.5	1000	45	"
06 / 0600	14.7	69.7	995	50	"
06 / 1200	15.1	70.9	991	55	"
06 / 1800	15.6	71.9	989	60	"
07 / 0000	16.2	73.0	982	70	hurricane
07 / 0600	16.7	74.1	972	80	"
07 / 1200	17.6	74.9	967	90	"
07 / 1800	18.5	76.1	957	100	"
08 / 0000	19.4	77.1	951	120	"
08 / 0600	20.3	78.4	953	110	"
08 / 1200	20.9	79.5	938	130	"
08 / 1800	22.0	80.6	941	120	"
09 / 0000	22.7	81.6	960	100	"
09 / 0600	23.4	82.5	973	75	"
09 / 1200	24.3	83.4	967	80	"
09 / 1800	25.2	84.2	962	90	"
10 / 0000	26.1	85.0	942	110	"
10 / 0600	27.2	85.8	935	125	"
10 / 1200	28.5	86.3	930	120	"
10 / 1800	29.9	86.9	942	110	"
11 / 0000	31.5	87.7	970	45	tropical storm
11 / 0600	32.6	88.5	991	30	tropical depression
11 / 1200	33.9	88.8	997	25	"
11 / 1800	35.3	89.1	1002	20	"
12 / 0000	36.4	89.2	1003	20	"
12 / 0600	37.1	89.0	1005	15	"
12 / 1200	37.7	88.7	1007	15	"
12 / 1800	38.1	88.3	1008	15	"
13 / 0000	38.5	87.8	1009	15	"
13 / 0600	38.9	87.2	1010	15	"
13 / 1200	39.2	86.5	1010	15	remnant low
13 / 1800	39.2	85.8	1010	15	"
14 / 0000	39.2	85.7	1009	10	"
14 / 0600	39.0	85.6	1009	10	"
14 / 1200	38.7	85.6	1010	10	"
14 / 1800	38.4	85.6	1010	10	"

15 / 0000	38.1	85.9	1009	10	"
15 / 0600	37.9	86.2	1010	10	"
15 / 1200	38.1	86.4	1012	10	"
15 / 1800	38.4	86.6	1012	10	"
16 / 0000	38.6	86.8	1011	10	"
16 / 0600	39.4	86.5	1013	10	"
16 / 1200	40.2	86.2	1014	10	"
16 / 1800	40.8	85.2	1014	10	"
17 / 0000	41.3	84.1	1013	10	"
17 / 0600	42.2	83.2	1013	10	"
17 / 1200	43.1	82.3	1013	10	"
17 / 1800	43.9	81.4	1012	10	"
18 / 0000	44.6	80.5	1010	10	"
18 / 0600	45.8	79.8	1009	10	"
18 / 1200					absorbed by larger low
04 / 2100	12.1	61.6	1009	30	landfall on Grenada
08 / 0245	19.9	77.6	956	120	landfall near Punta del Ingles, Cuba
08 / 1845	22.1	80.7	941	120	landfall just west of Punta Mangles Altos, Cuba
10 / 1930	30.4	87.1	946	105	landfall on Santa Rosa Island, Florida, 10 miles west of Navarre Beach
10 / 1200	28.5	86.3	930	120	minimum pressure
08 / 1200	20.9	79.5	938	130	maximum wind

Table 2. Selected ship reports with winds of at least 34 kt for Hurricane Dennis, 4 – 13 July 2005.

Date/Time (UTC)	Ship call sign	Latitude (EN)	Longitude (EW)	Wind dir/speed (kt)	Pressure (mb)
07 / 1800	**UBC Stavanger**	15.3	76.8	260 / 43	N/A
07 / 1800	**Lombok Strait**	18.3	74.9	160 / 41	1007.0
08 / 2300	**Caribbean Princess**	24.9	79.8	110 / 56	1008.1
09 / 0000	C6FM9	26.0	79.6	100 / 35	1012.0
09 / 1800	**Sealand Florida**	23.6	82.6	190 / 37	1003.8
09 / 2000	**Julius Hammer**	23.6	82.4	160 / 37	1007.0
09 / 2100	**Sealand Florida**	23.8	81.6	140 / 40	1006.6
10 / 0530	**Explorer of the Seas**	26.3	79.2	120 / 44	1012.5
10 / 0600	**Sea Horse**	25.3	80.0	140 / 35	1019.0
10 / 0600	KS049	25.9	83.3	160 / 39	999.9
10 / 0600	**Carnival Glory**	26.5	78.9	140 / 40	1015.0
10 / 0657	**Explorer of the Seas**	26.0	79.6	100 / 41	1012.0
10 / 1500	KS049	27.6	83.2	190 / 48	1001.8
13 / 2200	**Canadian Enterprise**	42.0	81.5	130 / 40	N/A

Table 3. Selected surface observations for Hurricane Dennis, 4 – 13 July 2005.

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Jamaica								
Montego Bay			07/2049	60				
Cuba								
Aguada de Pasajeros	08/2100	977.9	08/2108	96	104			
Bainoa	09/0250	974.5	09/0230	62	67			9.34
Batabanó	09/0455	991.7	09/ N/A	38	48			5.26
Bauta	09/0410	988.9	09/ N/A	35	43			5.55
Cabo Cruz	08/0240	956.0	08/0200	116[h]	129[h]			
Caibarién	08/1800	1000.0	08/1600	31	46			
Camagüey	08/0600	1007.0	08/0500	38	51			
Camilo Cienfuegos	08/1000	1007.1	08/ N/A	36	41			
Casa Blanca	09/0445	975.0	09/0610	68	75			3.64
Cayo Coco	08/0900	1008.3	08/ N/A	30	49			
Cienfuegos	08/1800	982.1	08/1850	81	85			
Colón	08/2110	988.6	08/2110	58	73			10.76
El Jíbaro	08/1400	1002.0	08/1315	56	63			9.27
Esmeralda	08/0700	1005.9	08/0650	35	47			
Florida	08/0900	1005.2	08/0803	38	51			
Guantánamo	07/ N/A	1001.3	07/1850	37	41			
Güines	09/0210	981.1	09/0200	50	57			
Güira de Melena	09/0515	994.2	09/ N/A	29	36			4.23
Indio Hautey	08/2200	994.0	08/2000	62	67			
Jovellanos	08/2200	985.2	08/2350	58	73			12.26
Júcaro	08/1200	1004.5	08/ N/A	45	57			9.57
Jucarito	08/0200	1006.2	08/0440	35	46			
Las Piedra	08/1550	1000.9	08/1543	64	99			15.13
Las Tunas	08/0200	1008.0	08/0950	35	42			
Manzanillo	08/0215	1003.6	08/0135	38	51			
Melena del Sur	09/0230	990.8	09/ N/A	44	56			10.40

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Nuevitas	08/0700	1000.8	08/0600	43	51			
Palo Seco	08/0600	1007.5	08/0600	29	39			
Puerto Padre	08/0000	1008.4	07/1910	35	44			
Sagua la Grande	08/2100	1002.1	08/1700	43	59			
Sancti Spíritus	08/1500	1003.3	08/1750	46	60			9.25
Santa Cruz del Sur	08/0645	999.4	08/0600	71	89			
Santiago de las Vegas	09/0540	989.0	09/0610	68	75			5.54
Santo Domingo	08/1750	1000.9	08/1700	56	63			12.46
Tapaste	09/0230	977.0						11.28
Topes de Collantes			08/1555	81	89			27.67
Trinidad	08/1620	988.6	08/1600	94	103			14.11
Unión de Reyes	09/0000	972.5	08/2350	96	107			11.59
Varadero	09/0000	994.2	08/2330	54	67			6.62
Veguitas	08/0200	1002.8	08/0000	28	41			
Venezuela	08/1200	1005.6	08/ N/A	45	50			
Yabú	08/1800	1001.3	08/1300	31	51			8.06
Florida								
Apalachicola (KAAF)	10/1646	1000.7	11/0420	28	33			2.07
Apalachicola[f h]	10/1700	1001.5	10/1124	41	56	6.94	8.11	
Big Pine Key			09/1600	34	48			
Brooksville (KBKV)	09/2228	1009.1	10/1652	24	37			1.82
Cache[j]			09/0716		50			
Carysfort Reef Light			09/1500	51	59			
Chekika[j]			09/0337		63			4.08
Crestview (KCEW)	10/2009	989.5	10/2024	37	50			
Clearwater Beach[f]	10/1000	1006.4	09/2100	30	42	3.87	5.15	
Cross City (KCTY)	10.1754	1008.5	09/2318		39			4.32
Destin (KDTS)			10/1929	49	64			
Destin (FCMP tower)	10/1858	986.9	10/1921	55	70			
Eglin AFB A-5	10/1844	983.1	10/1544	73				

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Eglin AFB A-13B			10/1934	73	90			
Eglin AFB B-71	10/1958	982.1	10/1906	51	82			
Eglin AFB B-75	10/1940	977.7	10/1958	46	77			
Eglin AFB Valparaiso (KVPS)	10/1923	986.1	10/1923	48	72			
Eglin AFB Yellow River	10/1952	968.5						
Everglades City	09/1201	1007.2	09/1601	22	39			
Flamingo	09/0703	1005.5	09/0703	52	59			
Ft. Lauderdale (KFLL)	09/0841	1010.9	09/0857	26	41			
Ft. Lauderdale (KFXE)	09/0921	1011.2	09/1008	29	39			
Ft. Myers (KFMY)	09/2336	1007.8	09/2000	30	40			4.54
Ft. Myers (KRSW)	09/2336	1007.5	09/1929	29	37			
Ft. Myers[f]	09/2300	1008.7	09/2000		36	2.85	3.20	
Homestead ARB (KHST)	09/0555	1007.5	09/0102	24	38			
Jay[j]			10/1845	62				
Kendall Tamiami (KTMB)	09/0728	1007.5	09/0112	38	56			3.59
Key West (KEYW)	09/0853	1001.9	09/1017	53	64			5.81
Key West[f]	09/0848	1002.3	09/1524	27	44	1.67	2.97	
Marathon (KMTH)	09/0853	1006.5	09/0752	33	47			1.88
McKay Bay[f]			09/1706	28	47	3.38	4.84	
Miami Beach	09/0902	1005.8	09/0202	35	60			1.92
Miami Intl. (KMIA)	09/0622	1009.7	08/2222	36	44			2.39
Naples (KAPF)	09/2210	1005.8	09/1759	33	47			2.95
Naples[f]	09/2300	1009.4	09/0800		38	2.99	4.26	
Navarre (FCMP tower)	10/1909	965.2	10/1921	86	105			
New Pass Mote Lab[g]	10/0000	1005.0	09/1630		40			
Oasis[j]			00/0034		37			
Ochopee[j]			09/1536		37			3.29
Old Port Tampa[f]			09/1712		33	3.20	4.63	
Opa Locka (KOPF)	08/0140	1010.9	09/0315	44	58			2.45
Panama City (KPFN)	10/1707	1001.5	10/1757	33	48			3.46
Panama City Beach[f]	10/1800	994.1	10/1800	51	63	5.72	6.79	

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Pembroke Pines (KHWO)	09/0706	1010.5	09/0753	33	50			3.09
Pensacola (KPNS)	10/1952	956.6	10/2002	66	81			4.11
Pensacola (FCMP tower)	10/1943	956.3	10/1946	71	83			
Pensacola[f]	10/1900	968.7	10/1900	35	51	4.16	5.52	
Pemsacola NAS (KNPA)	20/1956	976.6	10/1750	39	50			
Pompano Beach (KPMP)	09/0900	1011.6	09/1025	30	43			1.02
Port Manatee[f]			09/2242	28	41	2.87	4.09	
Punta Gorda (KPGD)	09/2359	1008.5	08/2038	35	44			4.39
St. Marks East[j]			10/2114		37			
St. Marks West[j]			10/1546		44			3.75
St. Petersburg (KPIE)	09/2353	1007.5	09/1044	38	50			2.40
St. Petersburg (KSPG)	09/2350	1007.1	09/1706	37	45			2.45
St. Petersburg[f]			10/1212	31	42	3.15	4.49	
Sarasota (KSRQ)	10/0009	1006.1	09/2057	31	38			1.83
Summerland Key			09/0800	36	50			
Tallahassee (KTLH)	10/2027	1005.4	10/1537	33	44			6.64
Tampa Bay C-CUT[f]	09/2252	1004.1	09/2222	39	48			
Tampa Intl. (KTPA)	09/2354	1008.5	09/1718	27	37			1.73
Tampa MacDill AFB (KMCF)			10/1155	33	43			1.63
Tenraw[j]			09/0723		48			
The Villages (KVVG)			09/2225		41			
Vaca Key[f]	09/0718	1005.8	09/0600		44		1.2	
Vandenburg (KVDF)			09/1757		35			
Virginia Key[f]	09/0700	1009.8	09/0300	31	51	0.6	2.6	
West Palm Beach (KPBI)	09/0709	1012.2	09/1053	27	38			2.04
Winter Haven (KGIF)	09/2226	1009.8	09/2314	26	35			2.40
Alabama								
Covington Cnty[j]			10/2220		43			
Dothan (KDHN)	10/2237	999.2	10/1839	33	44			3.07
Mobile (KMOB)	10/2228	990.5	10/1837	32	42			3.71

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Tuskegee[j]			10/2325		36			
Georgia								
Adel[j]			10/2000		34			
Albany	10/2310	1007.5	10/1853	25	37			4.59
Valdosta	10/2048	1009.8	10/1858	24	34			3.91
Mississippi								
Bienville[j]			11/0505		34			
Biloxi (KBIX)			10/1923	26	40			
Biloxi[f]						2.21	3.36	
Greene[j]			10/2310		34			
Gulfport (KGPT)	10/2254	997.6	10/1952	27	36			0.43
Lauderdale[j]			10.2310		48			
Neshoba[j]			11/0310		41			
Ocean Springs[f]	10/2242	995.9				2.50	2.97	
Pascagoula (KPQL)	10/2325	994.2	10/1931		34			1.06
Wausau[j]			11/0105		37			
Waveland	10/2254	1000.0				1.66	2.11	
Louisiana								
Lake Ponchartrain Mid-lake			10/2210	34	42			
New Orleans Lakefront (KNEW)	11/0030	1003.7	10/2120	31	41			0.08
SW Pass[f]	10/2306	1004.0	10/0636	33	38	1.29	2.54	
Buoys/C-MAN								
NOAA 42003 (26.0N 85.9W)	10/0000	991.5	09/2310	38[e]	49			
NOAA 42007 (30.1N 88.8W)	10/2150	995.1	10/1940	34	45			
COMPS 42013 (27.2N 82.9W)[g]	09/2210	1004.5	10/0210	45				

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
COMPS 42014 (25.3N 82.2W)[g h]	09/1129	1001.6						
COMPS 42021 (28.3N 83.3W)[g]	10/1100	1005.4						
NOAA 42036 (28.5N 84.5W)[h]	10/1150	996.4	10/0640	46[e]	58			
NOAA 42039 (28.8N 86.0W)[h]	10/1250	979.0	10/1050	47	58			
NOAA 42058 (15.0N 75.0W)	07/0750	1006.9	07/1350	27	35			
USM 42067 (30.0N 88.7W)[i]			10/2140	34	45			
Burrwood, LA (BURL1)	10/2300	1003.7	10/0640	33	39			
Cedar Key, FL (CDRF1)	10/1000	1009.7	10/0050	42[e]	51	4.81	7.79	
Dauphin Island, AL (DPIA1)	10/2100	990.6	10/1740	44[e]	57	2.76	3.51	
Fowey Rocks, FL (FWYF1)	09/0800	1009.7	09/0720	52[e]	73			
Grand Isle, LA (GDIL1)	11/0000	1004.7	10/2120	27	35	1.05	2.01	
Homosassa, FL (HSSF1)[g]	10/0948	1008.8	09/1948	36	52			
Keaton Beach, FL (KTNF1)	10/1500	1008.1	10/1918	34	48			
Long Key, FL (LONF1)	09/0700	1005.7	09/1250	41[e]	54			
Molasses Reef, FL (MLRF1)	09/0700	1007.6	09/0000	45	58			
NW Florida Bay (NFBF1)[g]	09/0724	1006.1	09/0600	41	54		1.2	
Sand Key, FL (SANF1)	09/0900	999.4	09/0920	54[e]	68			
Shell Point, FL (SHPF1)[g]	10/1430	1006.0	10/1700	32	41			
Sombrero Key, FL (SMKF1)	09/0800	1005.5	09/0800	64	76	1.3	2.6	
Tyndall Tower, FL (SGOF1)	10/1400	1000.4	10/1440	55[e]	68			
Venice, FL (VENF1)	10/0000	1006.0	10/1500	36	41			
Unofficial Observations								
Florida								
Boca Grande[k]	09/2300	1006.3	09/2225		34			
Cape Coral[k]	09/2340	1006.3	09/1924		40			
Cudjoe Key			09/0756		57			

Location	Minimum Sea Level Pressure		Maximum Surface Wind Speed			Storm surge (ft)[c]	Storm tide (ft)[d]	Total rain (in)
	Date/ time (UTC)	Press. (mb)	Date/ time (UTC)[a]	Sustained (kt)[b]	Gust (kt)			
Duck Key			09/1045		66			
Largo[k]	09/2330	1007.3	09/2130		40			
New Port Richey[k]	09/2230	1007.3	09/1745		37			
Niceville[k]	10/1750	988.4	10/1919	39	61			
Pace			10/1956		92		3.5	6.90
Pace	10/1910	945.0						
Pensacola			10/1943		69			
Pensacola (WEAR)	10/ N/A	968.5	10/ N/A		46			7.67
Perdido Key			10/1515	30	42			
St. Petersburg[k]	09/2320	1005.0	09/2200		38			
St. Petersburg[k]	09/2315	1007.3	09/2120		35			
St. Petersburg Beach[k]	09/2345	1002.6	09/2231		45			
Southwood (Florida High)	10/2015	1005.6	10/2350	24	34			6.96
Tallahassee (FSU)								6.64
Venice HS[k]	09/2310	1006.0	08/2115		36			
Alabama								
Foley[k]	10/1925	983.6	10/1600		37			
Lillian	10/2127	986.8	10/1829		38			
Loxley			10/1945		43			
Mobile[k]	10/2200	991.4	09/2000		35			
Mobile Bay (USS Alabama)	10/2137	987.8	10/1948		67			

[a] Date/time is for sustained wind when both sustained and gust are listed.
[b] Except as noted, sustained wind averaging periods for C-MAN and land-based ASOS reports are 2 min; buoy averaging periods are 8 min.
[c] Storm surge is water height above normal astronomical tide level.
[d] Storm tide is water height above National Geodetic Vertical Datum (1929 mean sea level).
[e] 10-min average.
[f] National Ocean Service station – sustained winds are 6-min averages.
[g] University of South Florida COMPS station.
[h] Incomplete record – more extreme values may have occurred.
[i] University of Southern Mississippi station.

[j] RAWS station.
[k] Weather Underground station.
[l] Florida Automated Weather Network station.

Table 4. Supplemental storm-total rainfall observations for Hurricane Dennis, 4 – 13 July 2005.

Location	Rainfall (in)		Location	Rainfall (in)
Jamaica			**Florida**	
Amity Hall	14.27		Andytown 2N	4.13
Beckford Kraal	9.61		Big Cypress	4.65
Bois Content	4.44		Coral Springs	3.27
Brandon Hill	13.28		Coral Springs 11W	3.06
Bybrook	7.85		Ft. Lauderdale WP	4.36
Castleton Gardens	12.60		Hillsboro Canal	3.05
Charm Hole	17.02		Hollywood	5.03
Constant Spring	15.51		Lakeland	3.02
Enfield	10.71		Marco Island	3.03
Ft. George Botanical Gardens	12.44		Mariana (MARF1)	3.75
Golden Spring	17.10		Miles City	4.13
Grass Piece	10.26		Miramar 17W	4.66
Hordley Estate	9.85		Monticello (MTCF1)	6.95
Industry	6.60		Moore Haven	3.05
Kingston Norman Manley Aprt.	12.28		Niceville	5.15
Lawrence Tavern	12.78		Oasis Ranger Station	3.05
Long Road	14.56		Ona	3.33
Mavis Bank	24.54		Ortona	4.88
Monn	14.20		Pennsuco	4.30
Moore Town	18.36		Perrine	6.89
Morant Bay	11.75		Plantation	4.49
New Hall	10.09		Quincy (QCYF1)	4.97
New Works	10.18		Racoon Point	4.09
Norbrook	15.03		South Bay	3.25
Norris	15.38		Steinhatchee (SHMF1)	3.75
Plantain Garden	9.96		Sweetwater 14N	4.07
Ramble	13.92			
Ritchies	13.94		**Georgia**	
Rock River	12.16		Ashburn (ASHG1)	4.70
Rose Hill	18.13		Bainbridge (BAIG1)	5.79
Shirley Castle	23.27		Camilla (CAMG1)	4.37
Spring Garden	8.02		Crisp Cnty Power Dam (WWCG1)	5.86
Swanson	12.14		Dawson (DAWG1)	5.78
Swift River	12.24		Leesburg (LEEG1)	6.14
Thompson Town	11.46		Moultrie (MOUG1)	6.00
Trout Hall	10.00		Tifton (TFTG1)	4.52
Wakefield	7.60			
Worthy Park Estate	7.87		**Alabama**	
			Bay Minette	4.65
			Brewton	3.50
			Camden 10 NW	12.80
			Evergreen	3.81
			Geneva (GVAA1)	3.48
			Jackson	4.24

Table 5. Preliminary forecast evaluation (heterogeneous sample) for Hurricane Dennis, 4 – 13 July 2005. Forecast errors (n mi) are followed by the number of forecasts in parentheses. Errors smaller than the NHC official forecast are shown in bold-face type. Verification includes the depression stage, but does not include the extratropical stage, if any.

Forecast Technique	Forecast Period (h)						
	12	24	36	48	72	96	120
CLP5	32 (27)	62 (27)	96 (27)	135 (27)	192 (23)	266 (19)	354 (15)
GFDI	36 (26)	64 (26)	84 (26)	100 (26)	113 (22)	122 (18)	162 (14)
GFDL*	34 (26)	69 (26)	87 (26)	103 (26)	118 (23)	109 (19)	**152** (15)
GFNI	31 (21)	58 (21)	79 (21)	102 (21)	152 (18)	217 (14)	253 (10)
GFDN*	27 (18)	60 (17)	81 (17)	95 (16)	140 (13)	231 (11)	289 (6)
FV4	53 (25)	89 (25)	112 (24)	113 (24)	89 (21)	121 (17)	230 (13)
AFII	31 (21)	64 (21)	97 (21)	140 (21)	254 (17)		
AFW1*	36 (11)	60 (11)	83 (11)	118 (11)	195 (9)		
COAI	**23** (13)	45 (13)	75 (13)	106 (13)	213 (9)		
COAL*	32 (8)	50 (8)	83 (8)	104 (7)	193 (5)		
COEI	39 (20)	75 (20)	107 (20)	129 (18)			
COCE*	29 (10)	64 (10)	106 (10)	121 (9)			
ETAI	43 (23)	89 (23)	125 (23)	148 (22)	201 (17)		
ETA*	37 (25)	82 (25)	118 (25)	142 (23)	198 (18)		
GFSI	31 (25)	46 (25)	57 (25)	64 (25)	77 (21)	132 (17)	229 (13)
GFSO*	38 (25)	56 (25)	63 (25)	71 (25)	73 (22)	105 (18)	179 (14)
AEMI	33 (19)	54 (18)	68 (18)	76 (18)	92 (15)	104 (12)	**113** (9)
AEMN*	35 (22)	53 (21)	68 (20)	76 (19)	89 (16)	91 (13)	**102** (10)
NGPI	**21** (23)	42 (23)	61 (23)	82 (23)	101 (19)	122 (15)	**136** (11)
NGPS*	25 (25)	44 (24)	66 (24)	84 (23)	107 (19)	134 (15)	**134** (11)
UKMI	25 (25)	38 (25)	52 (25)	68 (25)	98 (21)	179 (17)	288 (13)
UKM*	26 (14)	36 (14)	**50** (14)	63 (13)	98 (11)	141 (9)	250 (7)
A98E	30 (27)	53 (27)	72 (27)	84 (27)	121 (23)	174 (19)	255 (15)
A9UK	26 (12)	44 (12)	56 (12)	62 (12)	87 (10)		
BAMD	26 (27)	40 (27)	56 (27)	74 (27)	106 (23)	175 (19)	278 (15)
BAMM	27 (27)	45 (27)	65 (27)	82 (27)	114 (23)	156 (19)	235 (15)
BAMS	39 (26)	63 (26)	84 (26)	101 (26)	136 (22)	190 (18)	275 (14)
LBAR	29 (27)	45 (27)	68 (27)	90 (27)	137 (23)	143 (19)	210 (15)
CONU	**23** (25)	41 (25)	55 (25)	70 (25)	84 (21)	124 (17)	173 (13)
GUNS	**22** (23)	40 (23)	56 (23)	70 (23)	82 (19)	114 (15)	**147** (11)
GUNA	**22** (23)	41 (23)	53 (23)	65 (23)	75 (19)	106 (15)	155 (11)
FSSE	**23** (22)	40 (22)	**48** (22)	62 (21)	78 (16)	148 (14)	273 (9)
OHPC	31 (25)	46 (25)	58 (25)	70 (25)	77 (21)	125 (17)	224 (13)
OFCI	26 (25)	39 (25)	54 (25)	62 (25)	68 (21)	90 (17)	192 (13)
OFCL	25 (26)	36 (26)	51 (26)	61 (26)	65 (22)	74 (18)	154 (14)
NHC Official (1995-2004 mean)	42 (3400)	75 (3116)	107 (2848)	138 (2575)	202 (2117)	236 (649)	310 (535)

* Output from these models was unavailable at forecast time.

Table 6. Watch and warning summary for Hurricane Dennis, 4 – 13 July 2005.

Date/Time (UTC)	Action	Location
5 / 1500	Tropical Storm Watch issued	Barahona Dominican Republic to Port au Prince Haiti
5 / 2100	Tropical Storm Warning issued	Barahona Dominican Republic to Port au Prince Haiti
5 / 2100	Hurricane Watch issued	Jamaica and the southwest peninsula of Haiti west of the Dominican Republic border
6 / 0300	Hurricane Watch issued	Cayman Is.
6 / 0600	Hurricane Watch issued	Eastern Cuba including Las Tunas, Granma, Santiego de Cuba, Guantanamo, and Holguin
6 / 0900	Hurricane Warning issued	Jamaica and the southwest peninsula of Haiti west of the Dominican Republic border
6 / 0900	Tropical Storm Warning issued	South coast of the Dominican Republic from Barahona westward to the Haiti border
6 / 1500	Hurricane Watch issued	Cuba including Sancti Spiritus, Ciego de Avila, and Camaguey
6 / 2100	Hurricane Warning issued	Eastern Cuba including Granma, Santiago de Cuba, and Guantanamo
7 / 0000	Tropical Storm Warning discontinued	Dominican Republic
7 / 0300	Hurricane Warning issued	Cayman Is.
7 / 1500	Tropical Storm Watch issued	Florida west coast from Bonita Beach southward and Florida east coast from Golden Beach to Ocean Reef
7 / 1500	Hurricane Warning issued	Cuba including Matanzas, Villa Clara, Cienfuegos, Sancti Spiritus, Camaguey, and Las Tunas
7 / 1500	Hurricane Watch issued	Cuba including Isle of Youth, Pinar del Rio, La Habana, Ciudad de la Habana, and Holguin
7 / 1500	Hurricane Watch issued	Florida Keys and Florida Bay
7 / 2100	Tropical Storm Warning issued	Florida Keys east of Seven Mile Bridge to Ocean Reef including Florida Bay
7 / 2100	Hurricane Warning issued	Florida Keys from Seven Mile Bridge westward

Date/Time (UTC)	Action	Location
8 / 0300	Tropical Storm Warning issued	Florida west coast from Bonita Beach southward and Florida east coast from Golden Beach to Ocean Reef
8 / 0300	Tropical Storm Watch issued	Florida west coast north of Bonita Beach to Longboat Key
8 / 0300	Hurricane Warning issued	Cuba including La Habana and Ciudad de la Habana
8 / 0300	Hurricane Warning discontinued	Southwest peninsula of Haiti
8 / 0900	Hurricane Warning discontinued	Jamaica
8 / 1200	Hurricane Warning changed to Tropical Storm Warning	Cayman Brac and Little Cayman
8 / 1200	All warnings discontinued	Grand Cayman Is.
8 / 1500	Tropical Storm Warning discontinued	Cayman Brac and Little Cayman
8 / 2100	Tropical Storm Watch discontinued	Long Boat Key to Bonita Beach
8 / 2100	Tropical Storm Warning issued	Florida west coast from Anclote Key to Longboat Key
8 / 2100	Tropical Storm Watch issued	Florida west coast north of Anclote Key to the Steinhatchee River
8 / 2100	Hurricane Watch issued	Steinhatchee River, Florida to the mouth of the Pearl River
9 / 0300	Tropical Storm Watch issued	Mouth of the Pearl River to Grand Isle, Louisiana including metropolitan New Orleans and Lake Ponchartrain
9 / 0900	Hurricane Warning issued	Steinhatchee River, Florida to the mouth of the Pearl River
9 / 0900	Tropical Storm Warning issued	Mouth of the Pearl River to Grand Isle, Louisiana including metropolitan New Orleans and Lake Ponchartrain
9 / 0900	Tropical Storm Warning issued	Florida west coast north of Anclote Key to the Steinhatchee River
9 / 0900	Hurricane Warning discontinued	Cuba including all provinces from Sancti Spiritus eastward
9 / 1500	Hurricane Watch discontinued	Florida Keys east of Seven Mile Bridge to Ocean Reef
9 / 1500	All watches and warnings discontinued	Cuba
9 / 2100	Hurricane Warning changed to Tropical Storm Warning	Florida Keys west of the Seven Mile Bridge

Date/Time (UTC)	Action	Location
9 / 2100	Tropical Storm Warning discontinued	Florida coast from Golden Beach to Flamingo and the Florida Keys from the Seven Mile Bridge eastward
10 / 0300	Tropical Storm Warning discontinued	Florida west coast south of Bonita Beach
10 / 0900	Tropical Storm Warning issued	Louisiana coast west of Grand Isle to Morgan City
10 / 0900	Tropical Storm Warning discontinued	Florida Keys
10 / 1300	Hurricane Warning changed to Tropical Storm Warning	Florida coast east of the Ochlockonee River to the Steinhatchee River
10 / 1500	Tropical Storm Warning discontinued	West of Grand Isle, Louisiana and south of Longboat Key, Florida
10 / 2100	Hurricane Warning modified to	AL/MS border to Destin, Florida
10 / 2100	Tropical Storm Warning modified to	Destin to Longboat Key, Florida
10 / 2100	Tropical Storm Warning modified to	Mouth of the Pearl River to AL/MS border
10 / 2300	Hurricane Warning changed to Tropical Storm Warning	AL/MS border to Destin, Florida
11 / 0300	All warnings discontinued	U. S. Gulf coast

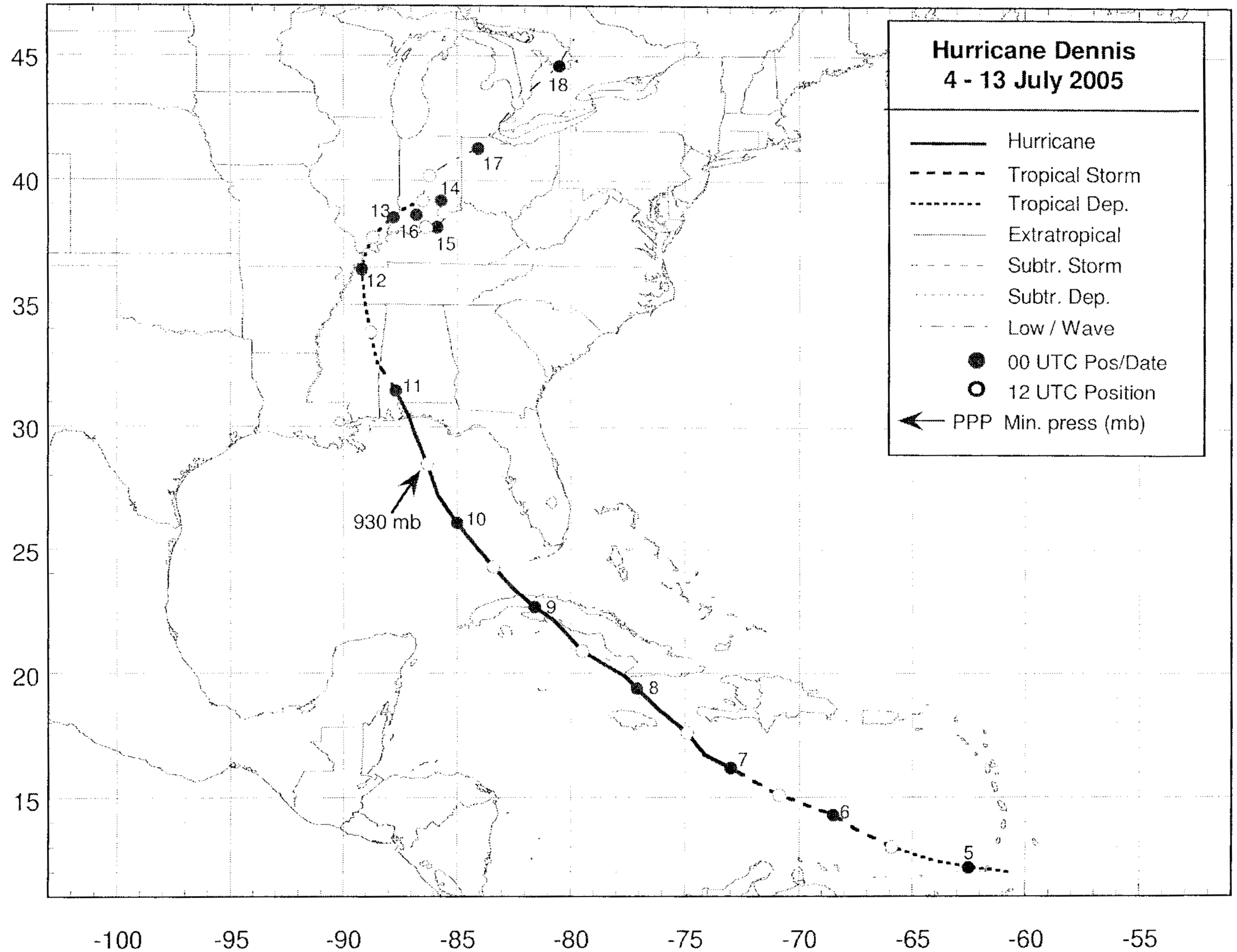

Figure 1. Best track positions for Hurricane Dennis, 4-13 July 2005.

Docket No. 070299-EI
Gulf Storm Hardening Plan
PJR-2, Page 22 of 25

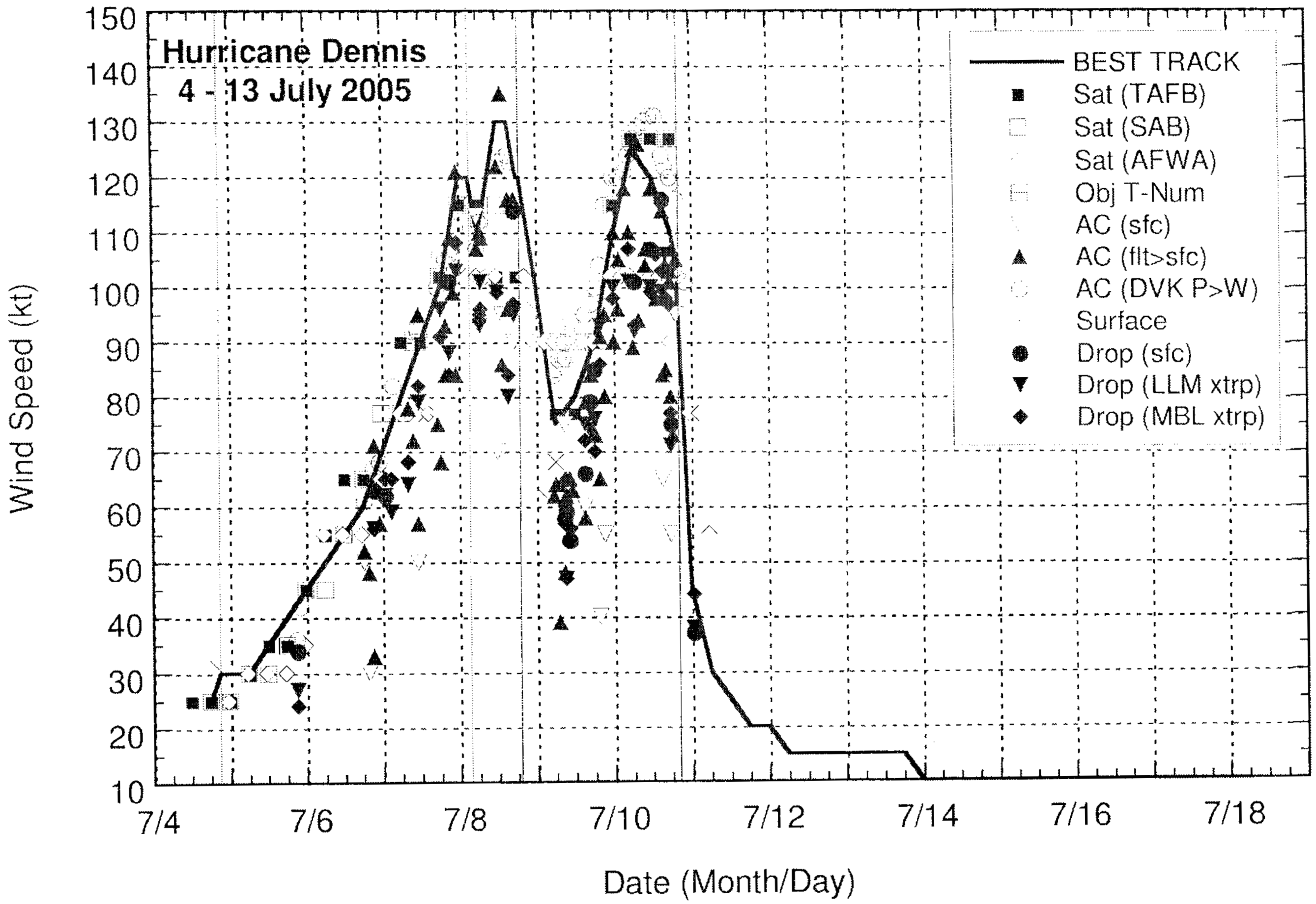

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for Hurricane Dennis, 4-13 July 2005. Aircraft observations have been adjusted for elevation using 90% and 80% reduction factors for observations from 700 mb and 850 mb, respectively. Dropwindsonde observations include actual 10 m winds (sfc), as well as surface estimates derived from the mean wind over the lowest 150 m of the wind sounding (LLM), and from the sounding boundary layer mean (MBL). Objective Dvorak estimates represent linear averages over a three-hour period centered on the nominal observation time. Solid vertical lines indicate times of landfall.

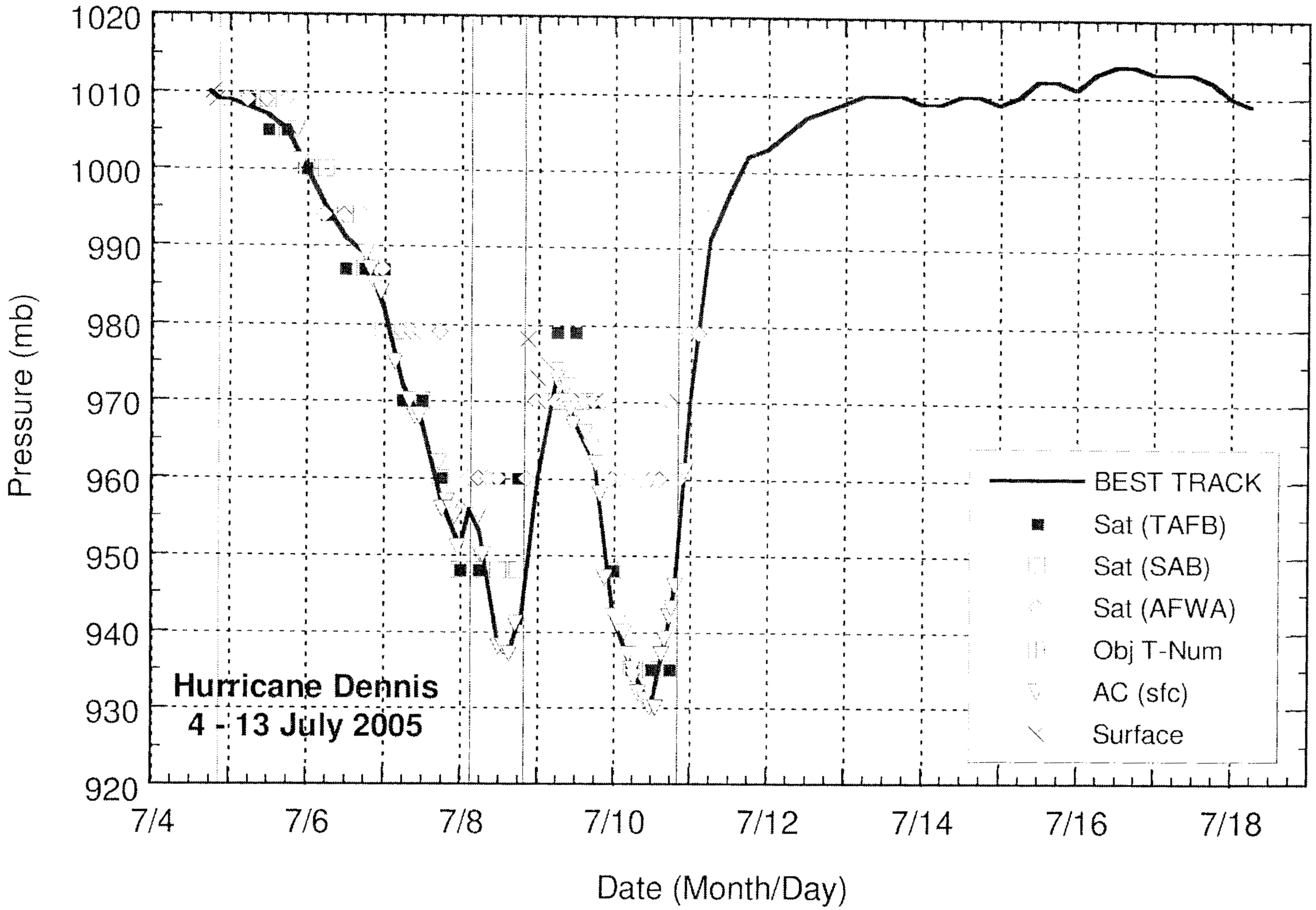

Figure 3. Selected pressure observations and best track minimum central pressure curve for Hurricane Dennis, 4-13 July 2005. Objective Dvorak estimates represent linear averages over a three-hour period centered on the nominal observation time. Solid vertical lines indicate times of landfall.

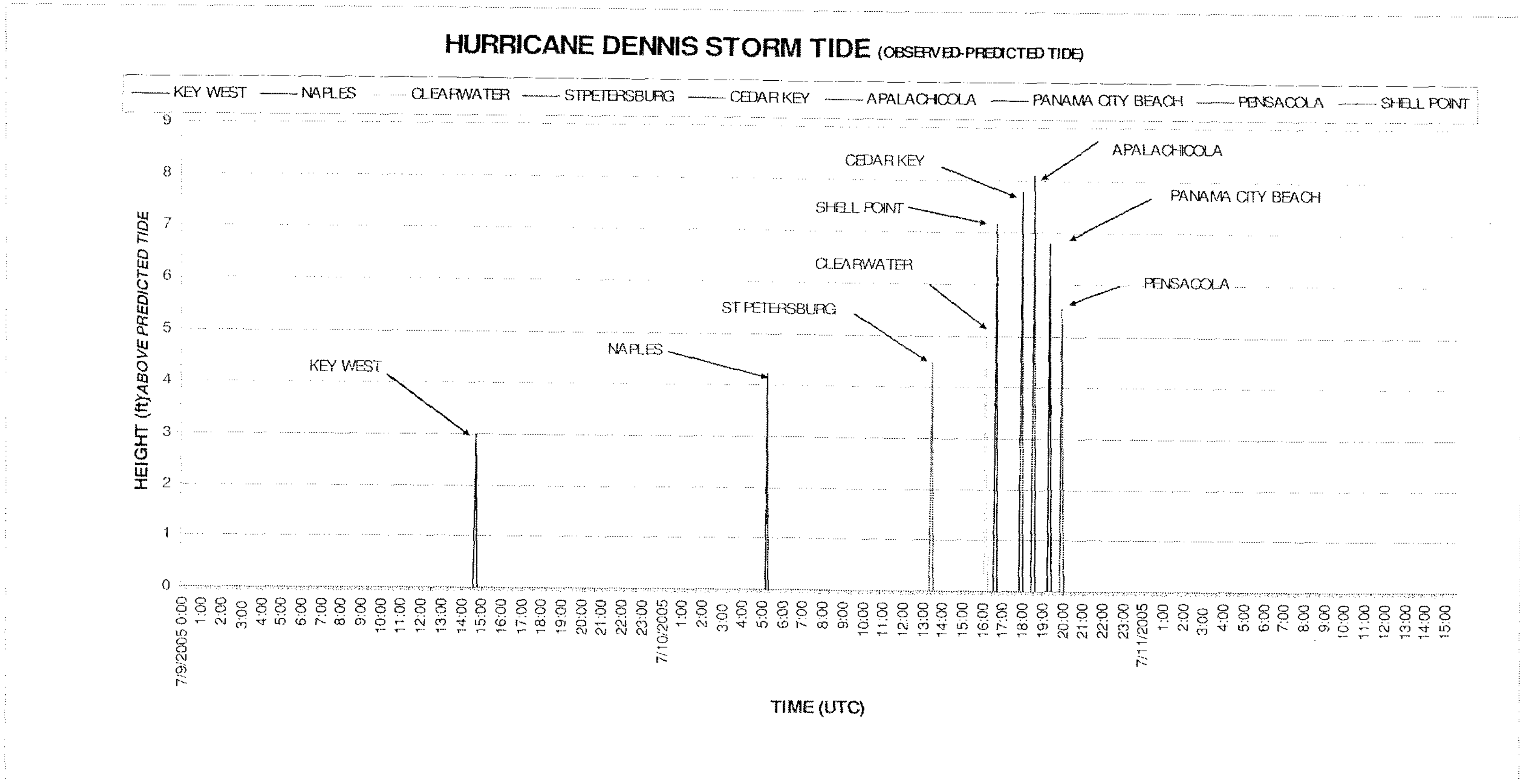

Figure 4. Storm-induced tides (surges) for Hurricane Dennis plotted versus time for the stations along the Florida west coast and Apalachee Bay. Image courtesy of the TPC Storm Surge unit.

Comparative Customer Outage Information, Panama City Beach and Pensacola, Hurricane Dennis (2005)

Factor/Variable	Panama City Beach	Pensacola
OH lines (miles)	73.67	310.35
OH percent	54.67	78.67
UG lines (miles)	61.08	84.17
UG percent	45.33	21.33
Total lines (miles)	134.75	394.51
Total customers	30,848	46,222
Hurricane Dennis-Customers out of service, by day:		
Peak	4,363	44,375
Day 1	3,882	43,234
Day 2	1,843	42,003
Day 3	30	27,334
Day 4	14	16,103
Day 5	11	6,773
Hurricane Dennis-Customers out of service per line-mile, by day:		
Peak	32.4	112.5
Day 1	28.8	109.6
Day 2	13.7	106.5
Day 3	0.2	69.3
Day 4	0.1	40.8
Day 5	0.1	17.2

7. For each of the 3 Municipalities, please provide the total miles of overhead and underground lines by voltage class and size of conductor.

ANSWER:

Municipality	Type	Miles	Design Voltage	Conductor Size 1	Conductor Size 2	Conductor Size 3
Fort Walton Beach	Overhead	0.307		1/0		
Fort Walton Beach	Overhead	0.003		2		
Fort Walton Beach	Overhead	4.684	12.47			
Fort Walton Beach	Overhead	12.065	12.47	1/0		
Fort Walton Beach	Overhead	31.508	12.47	2		
Fort Walton Beach	Overhead	0.061	12.47	2	3	
Fort Walton Beach	Overhead	0.380	12.47	2	6	
Fort Walton Beach	Overhead	1.495	12.47	3		
Fort Walton Beach	Overhead	1.186	12.47	336		
Fort Walton Beach	Overhead	6.461	12.47	4		
Fort Walton Beach	Overhead	0.283	12.47	4/0		
Fort Walton Beach	Overhead	14.313	12.47	477		
Fort Walton Beach	Overhead	33.673	12.47	6		
Fort Walton Beach	Overhead	0.076	12.47	6	2	
Fort Walton Beach	Overhead	7.199	12.47	795		
Fort Walton Beach	Underground	0.564		1/0		
Fort Walton Beach	Underground	1.733	12.47			
Fort Walton Beach	Underground	2.426	12.47	1/0		
Fort Walton Beach	Underground	7.130	12.47	2		
Fort Walton Beach	Underground	0.260	12.47	6		
Fort Walton Beach	Underground	0.245	12.47	795		
Panama City Beach	Overhead	0.050		1/0		
Panama City Beach	Overhead	0.022		2		
Panama City Beach	Overhead	0.258		3		
Panama City Beach	Overhead	0.040		6		
Panama City Beach	Overhead	2.547	12.47			
Panama City Beach	Overhead	5.685	12.47	1/0		

Municipality	Type	Miles	Design Voltage	Conductor Size 1	Conductor Size 2	Conductor Size 3
Panama City Beach	Overhead	4.904	12.47	2		
Panama City Beach	Overhead	0.343	12.47	250		
Panama City Beach	Overhead	19.944	12.47	3		
Panama City Beach	Overhead	0.019	12.47	350		
Panama City Beach	Overhead	0.316	12.47	4		
Panama City Beach	Overhead	6.146	12.47	4/0		
Panama City Beach	Overhead	5.312	12.47	477		
Panama City Beach	Overhead	15.774	12.47	6		
Panama City Beach	Overhead	12.153	12.47	795		
Panama City Beach	Overhead	0.024	7.2	1/0		
Panama City Beach	Overhead	0.086	7.2	2		
Panama City Beach	Overhead	0.044	7.2	3		
Panama City Beach	Underground	0.136				
Panama City Beach	Underground	3.036		1/0		
Panama City Beach	Underground	0.183		1000		
Panama City Beach	Underground	26.071	12.47			
Panama City Beach	Underground	25.669	12.47	1/0		
Panama City Beach	Underground	0.919	12.47	1000		
Panama City Beach	Underground	3.783	12.47	2		
Panama City Beach	Underground	0.321	12.47	3		
Panama City Beach	Underground	0.020	12.47	6		
Panama City Beach	Underground	0.059	12.47	795		

Municipality	Type	Miles	Design Voltage	Conductor Size 1	Conductor Size 2	Conductor Size 3
Panama City Beach	Underground	0.887	7.2	1/0		
Panama City Beach	Underground	0.136				
Panama City Beach	Underground	3.036		1/0		
Panama City Beach	Underground	0.183		1000		
Panama City Beach	Underground	26.071	12.47			
Panama City Beach	Underground	25.669	12.47	1/0		
Panama City Beach	Underground	0.919	12.47	1000		
Panama City Beach	Underground	3.783	12.47	2		
Panama City Beach	Underground	0.321	12.47	3		
Panama City Beach	Underground	0.020	12.47	6		
Panama City Beach	Underground	0.059	12.47	795		
Panama City Beach	Underground	0.887	7.2	1/0		
Pensacola	Overhead	0.037				
Pensacola	Overhead	1.318		1/0		
Pensacola	Overhead	0.076		2		
Pensacola	Overhead	101.035	12.47			
Pensacola	Overhead	0.041	12.47	1		
Pensacola	Overhead	28.624	12.47	1/0		
Pensacola	Overhead	0.014	12.47	1/0	6	
Pensacola	Overhead	0.262	12.47	1000		
Pensacola	Overhead	16.808	12.47	2		
Pensacola	Overhead	1.501	12.47	2/0		
Pensacola	Overhead	10.126	12.47	250		
Pensacola	Overhead	2.054	12.47	3		
Pensacola	Overhead	3.645	12.47	336		
Pensacola	Overhead	4.608	12.47	4		
Pensacola	Overhead	12.016	12.47	4/0		
Pensacola	Overhead	64.432	12.47	477		
Pensacola	Overhead	33.622	12.47	6		
Pensacola	Overhead	0.309	12.47	6		

Municipality	Type	Miles	Design Voltage	Conductor Size 1	Conductor Size 2	Conductor Size 3
Pensacola	Overhead	16.206	12.47	795		
Pensacola	Overhead	7.759	4.16			
Pensacola	Overhead	2.858	4.16	1/0		
Pensacola	Overhead	0.149	4.16	2		
Pensacola	Overhead	0.044	4.16	3		
Pensacola	Overhead	1.005	4.16	4/0		
Pensacola	Overhead	1.798	4.16	6		
Pensacola	Underground	0.019				
Pensacola	Underground	2.251		1/0		
Pensacola	Underground	46.004	12.47			
Pensacola	Underground	0.032	12.47	1		
Pensacola	Underground	17.328	12.47	1/0		
Pensacola	Underground	3.621	12.47	1000		
Pensacola	Underground	12.946	12.47	2		
Pensacola	Underground	1.361	12.47	350		
Pensacola	Underground	0.055	12.47	4/0		
Pensacola	Underground	0.071	12.47	477		
Pensacola	Underground	0.116	12.47	6		
Pensacola	Underground	0.189	12.47	750		
Pensacola	Underground	0.117	12.47	795		
Pensacola	Underground	0.057	4.16			

17. For each of the 3 Municipalities, please provide the following outage data, including:

    a. Summary tables for annual outages for each year of the most recent 10-year period, which include data showing:

        (1) cause of outages;
        (2) number of customers without power;
        (3) length of outages; and
        (4) cost to restore power.

    b. For major storms (named tropical storms and hurricanes), please provide by storm for the most recent 10 years:

        (1) name of storm;
        (2) number of customers without power;
        (3) length of outage, including a distribution of the number of customers experiencing outages for 1 day, 2 days, 3 days, and so on until 100 percent of customers were capable of receiving service from Gulf's facilities; and
        (4) cost to restore power.

ANSWER:

See attached pages.

a.

1999 – Pensacola		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	12,255	61.45
Lightning	8,166	148.85
Deterioration	8,702	103.59
Tree	6,475	115.92
Other	10,213	55.02
Equipment Failure	76	163.55
Vehicle	128	119.75
Overload	2,121	91.44
Wind/Rain	301	124.57
Dig-In	3,169	105.67
Vandalism	124	113.89
All Others	337	78.00
Total	52,067	96.74

1999 – Fort Walton		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	3,418	51.66
Deterioration	1,293	87.63
Lightning	1,531	108.49
Other	2,187	54.41
Tree	276	72.73
Equipment Failure	236	148.27
Vehicle	2,008	103.40
Overload	559	81.38
Dig-In	1,402	182.80
Vandalism	1,653	57.30
All Others	2,149	84.42
Total	16,712	73.78

1999 – Panama City Beach		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Lightning	13,997	135.44
Deterioration	4,874	110.50
Animal	382	77.44
Equipment Failure	82	225.00
Overload	776	103.40
Vehicle	275	155.46
Other	334	68.73
Tree	58	76.71
Dig-In	69	146.80
Wind/Rain	57	110.67
Contamination/Corrosion	1,065	43.00
All Others	192	88.00
Total	22,161	123.52

2000 – Pensacola		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	14,997	61.81
Lightning	10,752	120.55
Deterioration	4,090	122.03
Tree	11,814	105.84
Unknown	1,846	97.78
Overload	1,589	84.18
Vehicle	1,096	134.38
Other	3,490	63.38
Wind/Rain	1,037	138.90
None	2,279	125.58
All Others	2,646	93.71
Total	55,636	93.46

2000 – Fort Walton		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	3,902	54.85
Lightning	7,769	143.76
Deterioration	3,004	126.96
Unknown	2,493	74.02
Tree	1,092	105.56
Other	1,521	81.53
Vehicle	4,622	107.80
Overload	1,030	70.69
Contamination/Corrosion	93	111.40
Dig-In	2,449	78.00
Wind/Rain	335	90.00
All Others	2,774	61.68
Total	31,084	87.22

2000 – Panama City Beach		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Deterioration	1,695	132.77
Lightning	1,868	136.45
Animal	155	87.42
Overload	872	150.43
Unknown	534	137.89
Vehicle	2,939	168.59
Tree	3,672	103.08
Wind/Rain	1,174	124.85
Other	1,919	75.82
Contamination/Corrosion	64	188.50
All Others	2,928	144.24
Total	17,820	131.53

2001 – Pensacola		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	8,044	71.01
Tree	19,507	108.65
Deterioration	3,095	132.43
Lightning	8,300	132.24
Unknown	7,732	79.56
Vehicle	1,592	228.77
Wind/Rain	381	119.13
Vines	41	66.64
Overload	40	87.07
Other	3,856	72.86
All Others	305	116.39
Total	52,893	98.64

2001 – Fort Walton		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	5,541	58.65
Deterioration	2,294	99.56
Lightning	2,684	102.43
Unknown	5,895	70.79
Tree	357	85.06
Vehicle	711	95.90
Other	116	66.22
Wind/Rain	203	154.14
Overload	137	63.86
Dig-In	387	165.33
Contamination/Corrosion	105	90.00
All Others	13	124.90
Total	18,443	76.76

2001 – Panama City Beach		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Lightning	1,649	131.30
Deterioration	1,454	134.89
Animal	341	57.20
Unknown	1,092	86.55
Vehicle	1,197	168.29
Tree	560	126.67
Overload	802	90.92
Dig-In	116	122.33
None	6	57.50
Improper Installation	21	104.25
All Others	167	127.25
Total	7,405	117.36

2002 – Pensacola		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	7,357	68.00
Deterioration	8,426	132.06
Lightning	6,901	177.77
Tree	9,280	121.61
Unknown	6,690	109.09
Vehicle	2,855	124.64
Overload	770	106.73
Vines	144	85.30
Other	158	100.50
Wind/Rain	112	92.43
All Others	365	116.59
Total	43,058	105.49

2002 – Fort Walton		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	5,321	55.90
Deterioration	3,257	125.18
Lightning	9,514	92.62
Unknown	4,720	85.37
Tree	471	101.84
Vehicle	1,492	138.96
Overload	3,298	112.00
Dig-In	57	227.57
Other	201	85.00
Vines	26	59.20
Contamination/Corrosion	16	126.00
All Others	197	73.28
Total	28,570	81.38

2002 – Panama City Beach		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Deterioration	8,371	139.99
Unknown	2,033	123.86
Lightning	2,250	103.24
Animal	748	71.88
Tree	763	120.60
Overload	813	138.74
Other	3,396	89.62
Dig-In	163	249.36
Vehicle	1,858	126.55
Wind/Rain	101	125.60
All Others	4,634	97.30
Total	25,130	22.72

2003 – Pensacola		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	4,369	64.85
Unknown	3,943	101.94
Deterioration	3,968	128.53
Lightning	6,910	140.50
Tree	10,247	102.02
Vehicle	3,628	229.57
Vines	79	102.40
Overload	165	76.14
Wind/Rain	215	99.58
Other	23	103.00
All Others	489	120.87
Total	34,036	102.28

2003 – Fort Walton		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	3,346	58.57
Unknown	5,097	73.25
Deterioration	2,907	107.90
Lightning	5,518	101.86
Tree	698	86.71
Vehicle	3,805	123.32
Vines	77	60.69
Overload	104	69.38
Wind/Rain	493	113.57
Dig-In	36	129.00
Other	1,197	65.00
Improper Installation	11	85.33
Contamination/Corrosion	3	79.00
All Others	20	53.00
Total	23,312	78.86

2003 – Panama City Beach		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Deterioration	2,368	128.19
Lightning	3,514	112.21
Unknown	1,987	95.57
Animal	2,433	78.56
Overload	6,820	110.49
Tree	427	123.29
Vehicle	2,248	100.80
Contamination/Corrosion	18	178.00
Dig-In	975	182.33
Wind/Rain	1,825	79.00
Improper Installation	106	82.00
All Others	921	110.00
Total	23,642	111.26

2004 – Pensacola		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	4,862	76.85
Deterioration	4,860	203.06
Unknown	6,330	176.88
Tree	15,778	132.70
Lightning	8,371	182.96
Vehicle	7,548	192.61
Vines	157	122.33
Wind/Rain	485	116.20
Overload	98	120.11
Other	473	142.72
All Others	237	133.30
Total	49,199	147.48

2004 – Fort Walton		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	2,517	71.43
Deterioration	5,832	144.48
Unknown	3,782	89.93
Lightning	6,139	122.13
Tree	3,569	102.84
Vehicle	1,035	141.33
Wind/Rain	401	115.00
Overload	359	119.64
Other	2,480	95.36
Dig-In	60	123.50
All Others	2,220	93.50
Total	28,394	103.11

2004 – Panama City Beach		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Deterioration	2,017	130.59
Lightning	5,771	164.31
Unknown	6,359	120.81
Animal	342	73.54
Contamination/Corrosion	320	87.14
Vehicle	526	158.16
Overload	706	144.47
Dig-In	112	175.50
Other	33	130.10
Tree	186	118.89
All Others	311	91.90
Total	16,683	128.44

2005 – Pensacola		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Unknown	16,244	164.91
Deterioration	3,450	211.58
Lightning	6,738	274.98
Animal	1,885	101.97
Tree	9,278	147.99
Vehicle	6,812	157.97
Wind/Rain	1,414	145.50
Overload	666	112.96
Contamination/Corrosion	35	166.86
Dig-In	62	404.89
All Others	208	111.96
Total	46,792	180.49

2005 – Fort Walton		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	1,664	75.64
Deterioration	10,546	139.50
Unknown	2,924	111.99
Lightning	7,851	146.53
Tree	1,032	106.80
Vehicle	841	213.41
Wind/Rain	176	112.00
Contamination/Corrosion	164	169.17
Overload	503	140.36
Dig-In	105	173.89
Other	75	103.67
All Others	1,784	101.24
Total	27,665	119.68

2005 – Panama City Beach		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Deterioration	2,587	125.99
Unknown	3,792	109.91
Lightning	4,641	120.58
Animal	994	89.93
Vehicle	701	131.60
Tree	2,916	105.07
Contamination/Corrosion	83	220.07
Dig-In	72	159.92
Wind/Rain	1,278	71.58
Overload	601	113.18
All Others	34	97.71
Total	17,699	119.47

2006 – Pensacola		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Deterioration	6,524	178.86
Lightning	11,260	210.41
Tree	8,003	141.73
Animal	1,693	90.69
Unknown	6,133	122.82
Wind/Rain	7,184	155.48
Vehicle	4,418	144.53
Overload	519	112.64
Vines	75	124.19
Other	2,629	82.24
All Others	1,761	175.59
Total	50,199	158.74

2006 – Fort Walton		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Animal	3,095	79.32
Deterioration	2,939	161.03
Lightning	3,423	134.05
Tree	1,791	109.59
Wind/Rain	5,588	151.65
Unknown	6,854	95.70
Vehicle	1,614	122.91
Contamination/Corrosion	95	90.17
Dig-In	244	241.89
Other	162	105.23
All Others	375	92.53
Total	26,180	122.52

2006 – Panama City Beach		
Cause	**Customers Interrupted**	**Average Duration (L-Bar)**
Deterioration	3,589	140.35
Lightning	5,531	111.24
Unknown	2,272	112.88
Animal	2,372	78.20
Wind/Rain	6,453	144.34
Tree	377	99.56
Vehicle	2,932	192.03
Contamination/Corrosion	3,528	107.88
Overload	737	123.35
Other	472	106.88
All Others	2,799	87.67
Total	31,062	120.72

b. No municipality storm data exists prior to Tropical Storm Cindy.

Tropical Storm Cindy Restoration Timeline			
Municipality	**Pensacola**	**Fort Walton**	**Panama City Beach**
Peak	2,364	6	14
7/6/2005	36	3	18
7/7/2005	-	-	-

Hurricane Katrina Restoration Timeline			
Municipality	**Pensacola**	**Fort Walton**	**Panama City Beach**
Peak	34,517	5,182	692
8/29/2005	34,013	4,991	281
8/30/2005	10,744	3,438	95
8/31/2005	1,176	64	-
9/1/2005	281	17	136

Hurricane Dennis Restoration Timeline			
Municipality	**Pensacola**	**Fort Walton**	**Panama City Beach**
Peak	44,375	23,487	4,363
7/10/2005	43,234	19,643	3,882
7/11/2005	42,003	16,570	1,843
7/12/2005	27,334	17,813	30
7/13/2005	16,103	7,842	14
7/14/2005	6,773	318	11
7/15/2005	350	74	-
7/16/2005	57	27	68

21. For each of the 3 Municipalities, what is the total number of customers (meters) in each local area?

ANSWER:

Customers (Meters) per Municipality	
Municipality	**Customers**
Fort Walton	32,614
Panama City Beach	30,848
Pensacola	46,222

35. For each of the 3 Municipalities, please provide SAIDI, SAIFI, CAIDI, and MAIFI indices for the past 5 years.

ANSWER:

2002				
Municipality	**SAIDI**	**SAIFI**	**CAIDI**	**MAIFI**
Fort Walton	71.31	0.88	81.40	Not available per municipality
Panama City Beach	66.60	0.81	81.75	
Pensacola	84.09	0.93	90.27	

2003				
Municipality	**SAIDI**	**SAIFI**	**CAIDI**	**MAIFI**
Fort Walton	51.58	0.71	72.16	Not available per municipality
Panama City Beach	68.70	0.77	89.65	
Pensacola	67.15	0.74	91.19	

2004				
Municipality	**SAIDI**	**SAIFI**	**CAIDI**	**MAIFI**
Fort Walton	76.15	0.87	87.46	Not available per municipality
Panama City Beach	65.85	0.54	121.76	
Pensacola	136.00	1.06	127.77	

2005				
Municipality	**SAIDI**	**SAIFI**	**CAIDI**	**MAIFI**
Fort Walton	88.45	0.85	104.27	Not available per municipality
Panama City Beach	54.41	0.57	94.83	
Pensacola	112.74	1.01	111.37	

2006				
Municipality	**SAIDI**	**SAIFI**	**CAIDI**	**MAIFI**
Fort Walton	99.10	0.80	123.46	Not available per municipality
Panama City Beach	118.01	1.01	117.20	
Pensacola	142.60	1.09	131.30	