



SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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Memorandum

To: George Horne, Interim Deputy Executive Director
Water Resource Operations

From: Allen Vann, Inspector General

Date: July 16, 2001

Subject: Diver Study - Report # 00-11

Background

Water Resource Operations (WRO) requested that our office perform a study of the District's Diver program. WRO has a need for certified divers to assist in the inspection and repair of the District's structures as a part of the overall maintenance of the District's Central & Southern Florida Flood Control Project to District and federal standards.

WRO has historically used volunteer District employees who are certified divers to perform this function. These fifteen divers are full time employees of the District who work at the Okeechobee, West Palm, and Miami field stations. In addition to their field station assignments, they are also "on-call" as divers for a yearly dive pay stipend of \$1,300. Upon volunteering, these employees receive two weeks of training to be certified as District divers and are re-certified every three years.

Management expressed a concern about the safety of this function and liability to the District along with a second concern of the cost efficiency of performing this function in-house.

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Objectives, Scope and Methodology

The objectives of the study were:

- Determine the potential liability of the diver program to the District regarding the issue of safety.
- Determine the total cost of the District's diver program including dive pay, equipment, and training and highlight potential opportunities for efficiencies.
- Determine the District's responsibility to the United States Army Corp of Engineers for maintaining a diver program under the United States Code of Federal Regulations.
- Determine the potential benefits of outsourcing diver operation using contracted divers.

This engagement was limited to a study of the District's diver program and the associated costs of the program.

Our study methodology included:

- Determination of the District's potential liability for Diver injuries under the District's diving conditions,
- Analysis of two years of diver program costs,
- Interviews of diver personnel and supervisors,
- Observation of a dive,
- Analysis of the District diver manual and comparison to United States Navy Diver manual,
- Analysis of District maintenance responsibilities to the Corp of Engineers under the Code of Federal Regulations and any other District/state/federal criteria, and
- Determination of contractual diver availability and their hourly cost under District diving conditions.

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- Recommendation of whether the District's diving program is a candidate for outsourcing.

This study relied on representations made by management in formulating our conclusions and recommendations. While many of these representations were corroborated through evidence, it lacks the sufficiency of evidence that is required of an audit, and we do not represent that this study was performed in accordance with generally accepted governmental auditing standards.

Study Summary

Despite the hazards inherent to District diving conditions (Divers may deal with very poor visibility, hazardous chemicals in water, and predatory animals), overall, we found that the District's liability for diver injuries and accidents is no greater than the liability for other District occupational activities.

During the fiscal years 1999 and 2000 the District spent approximately \$132,000 and \$125,000 on the Diving program, respectively. During this same period, total diving program hours were 1,606 and 1,623 for an average cost per hour during the two-year period of \$80.

The District is not required to maintain a diving program as part of its responsibilities under the *Code of Federal Regulations, PART 208 - Flood Control Regulations*; however, the District is required to maintain structures to the same degree of readiness as they were received. A diving inspection program is crucial to this maintenance requirement. The District Diving program has been closely affiliated with the structure maintenance program.

We found that contractual diving services are available to perform the duties of the Diver program and have been used in the past. We recommend that the District Diving teams be maintained for emergency needs and the structure maintenance program. We also recommend that the District negotiate contracts with contractual divers for all other diving needs.

Dive Program Overview

The Diving program predominately uses the surface supplied air (SSA) technique of diving. The SCUBA diving technique has been used in the past but is now infrequently used.

During a SSA dive, the diver is outfitted in a wetsuit (a dry suit is also available for colder or contaminated water) and a dive helmet. The dive helmet is tethered to an air supply hose, a communications wire and a power supply wire for the helmet light.

A line tender, standby diver, communicator and supervisor assist the Diver. The line tender keeps the air supply line properly taut to allow for unrestricted flow of air. The standby diver is available to assist the diver should he/she come under distress. The communicator is stationed at the dive trailer where instructions are provided to the diver through an intercom and communications wire.

The primary customer of the diving program is the structure maintenance program and most District divers are structure mechanics at the field stations. The divers perform underwater inspections of the structure and gates using an underwater camera equipped with an infrared light. Through the communicator, the diver is provided with instructions for the inspection with the camera images projected on a television/VCR set up in the dive trailer and captured on tape. These structure inspections are crucial for determining gate and structure condition and providing feedback for maintenance scheduling. During gate refurbishing, the divers remove the gates after de-watering the structure and re-install the gates upon completion of the refurbishing. District divers also support research and construction activities.

We discussed the dive program with management of the field stations who stated that the program has many benefits including the availability of trained divers at immediate notice for emergency situations. Total dive hours per year are less than one full time equivalent.

Diving Program Liability Does Not Exceed That of Other District Occupational Activities

We evaluated the potential liability of the Diver Program through discussions with the District's Safety Department and Office of Counsel. We concluded that similar to other District occupational activities, the liability of the Diver program is generally limited to worker's compensation claims.

We also inquired about the program history of injuries and accidents. Safety did not have any record of any injuries other than a few slip and fall claims and some ear and skin infections caused by contact with the water.

The District maintains an undated *Dive Manual* that contains safety information, operating procedures and requirements and emergency procedures. Much of the emergency contact information appears out dated and should be updated or removed. Risk Management also maintains a *Dive Safety Program* document, revised June 13 1989, that provides guidance on dive operations.

We reviewed the *United States Navy Diving Manual*, dated February 1993, (includes all changes to July 1996) for a comparison of the Navy safety procedures to the District's. Overall, the District's diving procedures, safety procedures and diving equipment are comparable to the Navy's. The Navy manual's section about surface supplied air diving contains guidance for deep sea diving, and decent and decompression requirements that are not relevant to the District's program. The District's dives are generally 30 feet or less in depth. The Navy manual notes that dive depths below 35 feet do not generally require decompression. The Navy's manual goes into considerable more detail than the District and contains relevant operational information not covered in the District's manual. WRO should review the following areas of the Navy manual and consider adopting them:

- Air supply flow requirements (6-3.2.1)
- Air Purity Standards (6-7.1.1)
- Air Compressors (6-7.2.1)
- Line Pull Signals (6-8.2)

Although the Navy manual does not discuss the dangers of alligators (or crocodiles), it does discuss the dangers of sharks and other marine

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animals. It details the hazards of these animals and recommended first aid treatment. The District dive manual does not contain a similar section.

The Navy has a pre-dive checklist for Surface-Supplied Air Diving Operations, which was compared to the Districts checklist. Again the Navy checklist is more detailed than the District's checklist and contains areas that are not applicable to the District. Applicable areas not as thoroughly addressed in the District's checklist include:

- Testing of air hoses and activated air supply equipment,
- Maintenance of equipment,
- Protection against harmful water life, and
- Tagging equipment to prevent accidental shut-down.

Diving Program Costs

The Dive program is operated out of the Okeechobee, West Palm Beach and Miami Field Stations. Each field station has certified divers on-call to perform the dive activities. Each field station has a fully equipped dive trailer that is transported to the dive sites. The dive trailer has a gasoline-powered air-compressor that is used for surface supplied air dives. Separate air tanks are also available for scuba diving and as a back-up air supply for the divers. In total the field stations have dive equipment with the following estimated valued:

Dive Equipment Inventory			
Okeechobee	West Palm	Miami	Total
\$ 56,621	\$ 49,911	\$42,101	\$ 148,633

Source: Field Stations

During fiscal years 1999 and 2000, the dive crews recorded the following hours of time related to diving operations:

Dive Hours				
Fiscal Year	Okeechobee	West Palm Beach	Miami	Totals
1999	248	465	894	1,607
2000	445	312	866	1,623
Totals	693	777	1,760	3,230

Source: Field Station Dive Logs

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These hours include:

- Pre and post dive time for setting up and breaking down equipment,
- Standby hours for the crew member acting as the standby diver,
- Tender hours for the crew member tending the air supply and communicator lines,
- Communicator time for a crew member assigned to provide instruction to the diver, and
- Supervisory time.

Each of the Field Stations collects dive hour time on logs. However, the Field Stations differ in the hours collected on Dive logs for standby, tender, supervisor, and pre and post dive time. This is partly due to the Field Stations using different forms to collect the dive operations time. In order to make the dive operation hours equivalent, we estimated the hours for duties not collected by the field station based upon a standard crew size.

The combined fiscal years 1999 and 2000 costs of the dive program were:

Field Station Dive Program Costs				
Cost Category	Okeechobee	West Palm Beach	Miami	Total
Labor ¹	\$ 27,700	\$ 22,516	\$ 59,915	\$110,131
Maintenance & Equipment	5,372	4,800	5,831	16,003
Training	7,268	6,220	3,588	17,076
Physicals	1,060	1,272	848	3,180
Dive Stipend ²	12,566	15,114	11,900	39,580
Overhead ³	20,685	19,135	31,462	71,282
Total	\$ 74,651	\$ 69,057	\$ 113,544	\$ 257,252

Source: Field Station Budget / Actual Reports

These costs were obtained from budget reports for the dive program reporting category. West Palm Beach Field Station did not charge labor costs to the dive program reporting category so their labor costs were

¹ Labor includes fringe benefits.

² Divers are paid an annual stipend of \$1,300 per year through the bi-weekly payroll. The labor number includes the stipend paid for hours while diving. The separate dive stipend was calculated for dive stipend pay for hours not diving.

³ Overhead is applied at the Operations Department rate of 38.33% of total costs.

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estimated based upon dive hours, average hourly rates and a fringe benefit factor (per diver).

The average cost of the dive program for the study period was \$80 per hour.

The District has contracted with commercial diving services over the years for inspections and other services. Based upon our review of selected invoices, rates ranged from \$150 to \$200 per hour for a three-diver team and equipment for underwater inspections of structures. Other services such as welding and cutting are quoted at additional rates. Diving services have also been procured at a fixed price per job. It was not evident what the hourly rate was for these services but these types of contracts could have a reduced hourly rate.

Based upon our calculated rate, a four person District dive crew costs \$320 per hour. This rate is for all services including removing and installing gates. The experience and institutional knowledge that District divers/structure mechanics provide to a diving operation is a valuable intangible asset.

Recommendations:

1. Water Resource Operations should continue to maintain the diving program for emergency and structure maintenance activities. In order to evaluate outsourcing options for existing in-house services, a Request for Information should be issued. If found to be in the best interest of the District, Water Resource Operations should contract to augment the existing dive teams.

Management Response: Water Resource Operations will issue a Request for Information by August 2001.

Responsible Division: Water Resource Operations

Estimated Completion Date: August 2001.

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2. The Field Stations should consistently capture all hours, costs and activities of the diving program through the use of consistent forms, and recordation methods. This will allow Management to determine a benchmark cost per hour of the dive program.

Management Response: Water Resource Operations will add specific reporting protocols and quality controls in CMMS so each field station may consistently charge the costs to develop an “umbrella” benchmark across the field stations. We will establish this procedure and train field station staff by the end of July 2001.

Responsible Division: Water Resource Operations

Estimated Completion Date: August 2001

3. Water Resource Operations should improve the District dive manual and dive checklist through adoption of the relevant Navy manual sections noted in the report.

Management Response: Water Resource Operations will update the manual and thoroughly communicate the additions to field station divers by the end of July 2001.

Responsible Division: Water Resource Operations

Estimated Completion Date: August 2001

c: Governing Board
Henry Dean
John Fumero