DEPARTMENT OF THE ARMY
U.S. ARMY ENVIRONMENTAL HYGIENE ACTIVITY - NORTH
FORT GEORGE G. MEADE, MARYLAND 20755-5225

REPLY TO
ATTENTION OF:

HSHB-AN-E (40-5f) 3 November 1992

MEMORANDUM FOR Commander, 44th Medical Brigade, Fort Bragg, North Carolina 28307-5000

SUBJECT: Information Paper on Disaster Relief - Water System Reconstruction

1. Enclosure 1 is the information paper you requested during 1LT Timothy G. Bosetti's out-brief in Miami on 16 September 1992. This paper provides information and guidance on the reestablishment of a public drinking water system after a natural disaster. It is based on 1LT Bosetti's experiences during the deployment with the 44th Medical Brigade to South Florida, after Hurricane Andrew, in September 1992. The steps taken to restore potable water to the communities and the criteria established during Joint Task Force Andrew are generalized in this paper and intended for use in any natural disaster.

2. Enclosure 2 is an information paper written by officers at the U.S. Army Environmental Hygiene Agency. This paper provides good information on the procedures used to bring a water system back in service after positive coliform results.

3. Enclosure 3 is the summary of findings and actions taken during 1LT Bosetti's deployment with the 44th Medical Brigade. This memorandum for record was presented to you during 1LT Bosetti's out-brief and is provided again for informational purposes.

4. If this paper does not meet your requirements, please contact the undersigned at DSN 923-6205/6502 or commercial (410) 677-6205/6502 and corrections to the paper will be made.

Encls

for STEVEN J. STONE
LTC, MS
Commanding

CF:
CDR, USAEHA, ATTN: HSHB-Z
CDR, USAEHA, ATTN: HSHB-ME-W
CDR, USAEHA, ATTN: HSHB-ME-S
CDR, USAEHA, ATTN: HSHB-CI-I

DEPARTMENT OF THE ARMY
U.S. ARMY ENVIRONMENTAL HYGIENE ACTIVITY - NORTH
FORT GEORGE G. MEADE, MARYLAND 20755-5225

REPLY TO
ATTENTION OF:

HSHB-AN-E (40-5f) 3 November 1992

INFORMATION PAPER

SUBJECT: Disaster Relief - Water System Reconstruction

1. Purpose. The purpose of this paper is to provide information and guidance on the reestablishment of a public drinking water system after a natural disaster.

2. References.

a. American Water Works Association, Standard C651-86, Standard for Disinfecting Water Mains, 26 January 1986.

b. American Water Works Association, Standard C652-86, Standard for Disinfection of Water Storage Facilities, 26 January 1986.

c. American Water Works Association, Standard D101-53, Standard for Inspecting and Repairing Steel Water Tanks, Standpipes, Reservoirs, and Elevated Tanks, for Water Storage, 26 January 1986.

d. Technical Bulletin, Number Medical 576, Occupational and Environmental Health, Sanitary Control and Surveillance of Water Supplies at Fixed Installations, 15 March 1982.

e. United States Army Environmental Hygiene Agency, HSHB-MW-E, 1 November 1983, subject: Water Quality Information Paper, Number 38, Response Guidance for Microbiological Contamination of Potable Water Systems.

3. General.

a. Background. This paper is based on experiences during the deployment of the 44th Medical Brigade to South Florida, after Hurricane Andrew, in September 1992. The steps taken to restore potable water to the communities and the criteria established during Joint Task Force Andrew are generalized in this paper and intended for use in any natural disaster.

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b. Goal. The goal of water distribution system reconstruction natural disaster relief is to provide assistance to a community in bringing the public drinking water system back in service, producing potable water as soon as possible without endangering human health.

c. Priorities. To accomplish this goal several priorities must be established and met. These are listed in a general chronological order; however, they can occur concurrently.

(1) Evaluation of the water treatment plant or water production facility.

(2) Repair of the water treatment plant or water production facility.

(3) Evaluation of the integrity of the water distribution system.

(4) Repairs of the water distribution system.

(5) Super chlorination and flushing of the water distribution system.

(6) Water quality testing program.

(7) Removal of the boil water order.

d. Criteria. The following criteria are the health and engineering standards which must be met prior to the water distribution system coming back in service and removal of the boil water order.

(1) **Good water source.** It is extremely important that the water source is adequate to meet peak flow requirements and not contaminated beyond the treatment and removal capabilities of the plant. The raw water source must also meet the standards or regulations established by the state.

(2) **Water Pressure.** The water pressure in the distribution system should be returned to normal operation, normally 55 pounds per square inch (psi) plus or minus 10 psi. This may be difficult to obtain until the major leaks are repaired or isolated by closing off valves. It is also important that the pressure does not fluctuate more than 5 psi. If this occurs, pipes can break and the system can pull in non-potable water or sewage, or a back pressure can develop which can severely damage the water treatment plant or water production facility.

(3) **Storage Capability.** The water treatment plant or production facility must have a place to adequately store potable water. This storage site, above or below ground, must have the ability to keep the water from becoming contaminated.

(4) **Chlorine residuals greater than 1 milligram per liter (mg/L) free available chlorine.** The free available chlorine residuals throughout the distribution system, especially at the extremities and dead ends should be greater than 1 mg/L. To meet this, the chlorine feed at the water treatment plant or water production facility should be increased to 5 mg/L free available chlorine and maintained for several days following the release from the boil water order. There may be a change in palatability of the water as a result of the increased chlorine levels. High chlorine levels may also have a laxative effect on some people, but this should not persist more than a few days. The state or local water authority should consider issuing a public statement addressing elevated chlorine levels in the water account for the change in taste.

(5) **Flushing of the distribution system.** Flushing is an important part in maintaining a water distribution system, especially following a disaster. Flushing removes stagnant water and keeps the chlorinated water moving through the system. A systematic flushing program needs to be in place and carried out prior to and for several days after the release of the boil water order.

(6) **Two sources of electrical power.** A water treatment plant or water production facility needs two sources of power to operate the plant and maintain the pressure in the distribution system. The primary source of power should be through commercial power lines or through the use of a trailer mounted generator. The secondary source of power should be an emergency generator. The system will probably run on an emergency generator (secondary source) initially, but it should be switched over to the primary source of power as soon as possible. This is to prevent the over use of the emergency generator which is not designed to operate for extended periods of time. If a trailer mounted generator is used, it may be necessary to alternate the use of the two power sources to perform scheduled maintenance. As experienced in South Florida, trailer mounted generators are very effective in providing primary power to a water treatment plant until commercial power is restored.

(7) **Certification of the water distribution system.** Each state may have its own method of certifying a water system to release the boil water order. The most common standard is two consecutive days of testing with no total coliform bacteria

present. If total coliform bacteria are detected, the water distribution system fails the compliance test. The state may require two days of flushing before the compliance testing can resume. An alternative method of testing the distribution system after it has failed is to sample five service connections up and down stream of the positive coliform result. This is done by sampling three locations; one sample is a retest of the point that failed, and the other two come from points five connections up stream and five connections down stream of the positive result. This alternative method is also used to determine whether the initial point was bad or if the problem originates elsewhere within the distribution system. Only the state has the authority to determine what method will be used for the certification of the water distribution system.

4. Using the Priorities to Meet the Goal and Accomplish the Mission. The following is a more detailed explanation of the steps to bring a system back in service. They are listed in a chronological order but they can occur concurrently.

a. Evaluation of the water treatment plant or water production facility. This evaluation should be conducted by a sanitary and structural engineer. This includes checking the structural integrity of the water plant, pumps, water treatment structures, and the ability of the plant to treat and disinfect the water prior to it entering the water distribution system. An evaluation must be made to determine if the water storage tank is structurally sound and that the tower has the ability to store potable water without the possibility of contaminating the water. This also may involve flying over the water storage tank to visually inspect the condition of the hatch and screens. If the top hatch was open, the inspection may require divers to go inside the tank to determine if any debris has accumulated or could clog the system.

b. Repair of the water treatment plant or water production facility. Repairs to the water treatment plant or water production facility will probably be minor unless it was directly damaged by the natural disaster. They may include: disinfection of a well head, draining and cleaning of sedimentation/ flocculation basins, addition of an external power source, or the replacement of pumps. If the damage is more severe, such as damage to multimedia filter beds, repairs will require a longer time. However, in coordination with the state health officials, certain steps in the treatment process may be by-passed. Only state officials can issue such a variance. The main objective to the repairs is that the plant must be able to disinfect the water to remove or kill pathogens (i.e. bacteria) which may pose an imminent or acute threat to human health. The following criteria

must also be met prior to the water treatment plant or water production facility coming back in service.

(1) Good water source. Water source must be adequate to meet peak demands and free of contamination beyond the removal capabilities of the plant.

(2) Water pressure at the plant maintained at normal operating pressures, plus or minus 5 psi.

(3) Storage capability. The water storage tank can store potable water without contaminating it and the tank has enough storage capacity to meet fire protection standards.

(4) Chlorine residuals greater than 5 mg/l free available chlorine at the plant.

(5) Two sources of electrical power.

c. Evaluation of the integrity of the water distribution system. This can be an extremely lengthy process of walking the distribution system to detect leaks, breaks, and damaged service lines. During this evaluation and walk through the sweeping crew must have the ability to close valves to severely damaged sections of the distribution system such as trailer parks or demolished buildings. In doing this, the crews prioritize sections of the distribution system which need repair. High priority locations which need repair would include hospitals, emergency shelters, homes which people are occupying, and schools. Low priority locations would be areas totally devastated, such as trailer parks, homes, and buildings. These areas can be isolated by closing valves and repairing them at a later date.

d. Repairs to the water distribution system. As mentioned in the previous paragraph, the sweeping crews will have identified and prioritized the areas within the distribution system that need repair. Because most water distribution systems are below ground the integrity of the distribution and service mains will be good; however, the service connections to the customer may require extensive repair. It is these connections which go to schools, homes and office buildings. Most water distribution systems are laid out in a grid-type of system. Therefore, the repair crews should be assigned a portion of that grid to work. This should facilitate the reconstruction of the distribution system by isolating sections which may require more extensive work.

e. Super chlorination and flushing of the water distribution system. Once a section of the distribution system has been repaired it needs to be flushed, super chlorinated and flushed again. The initial flushing of the repaired section of the water distribution system is important because it removes the stagnant water and any debris in the system. The super chlorination phase can consist of several different methods. Each of the methods listed below requires a good, thorough flushing program after the chlorination phase.

(1) The first and most practical method is to increase the chlorine feed at the plant to 5-10 mg/L free available chlorine and systematically flush the distribution system starting at the water treatment plant or water production facility and working radially outward away from the plant. This method takes a little more time and will have to be done repeatedly until a the chlorine residuals at the extremities of the distribution system have free available chlorine residuals greater than 1 mg/L and preferably close to the residual levels at the water treatment plant.

(2) The second method is the addition of a chlorine solution to a fire hydrant, in a loop of the water distribution system, which is enough to achieve 50 mg/L free available chlorine residual and allowed to stay within the distribution system for approximately 24 hours. The distribution system needs to be thoroughly flushed until the chlorine residuals are returned to normal. This method is used for the disinfection of a replaced line or disinfection of a loop or branch of the distribution system.

(3) The third and quickest method is placing bulk calcium hypochlorite or common bulk chlorine used in swimming pools such as HTH into a fire hydrant, upstream from the replaced or repaired line, in the form of a slurry which will elevate the chorine levels to approximately 100 mg/L. The other hydrants in the system should be opened just enough to allow the super chlorinated slug of water to move through the distribution system. This slurry should remain in the system to allow a three hour contact time. Once this is accomplished the system should be thoroughly flushed to return the chlorine levels to normal. This method is best for disinfection of repaired or replaced lines; however, it can be used to disinfect loops or branches in the water distribution system that are contaminated.

f. Water quality testing program. This is one of the most important aspects of getting a water distribution system back on line. An initial wide spread, random testing program of branches or loops in the distribution system can greatly assist in

identifying areas in the water distribution system which are contaminated, require repair, and/or more flushing. This random approach to sampling should continue until the results from the analysis show no coliform bacteria present and good chlorine residuals throughout the distribution system. Once this has been accomplished, the system is ready to be tested to remove the boil water notice.

g. Removal of the boil water order. Prior to the removal of the boil water order, all of the priority steps listed above should have been accomplished and sample points identified for the compliance test. The sample points in the compliance testing phase should be two to three times the number of routine sampling points. These sampling points should be determined by the State officials who have the authority to release the boil water order. All sample analysis, whether random sampling or compliance testing, should be done through a certified state lab and reviewed by state officials. This validates the results.

5. Manpower. Now that the priorities and the criteria to reestablish the water system are outlined, the manpower required to accomplish these tasks needs to be identified. The following paragraphs address the type of manpower required. However, this is only a guide , actual manpower requirements are dependent upon the situation and configuration of the individual water system.

a. Technical Engineering Support. Sanitary engineers are required for the evaluation of the water treatment plant or production facility and to advise or troubleshoot problems that may arise during the reconstruction of the water system. Structural engineers may also be required to evaluate the structural integrity of the water treatment plant or production facility and of the water storage tanks.

b. Plant Operators. Because of the loss of homes and personnel property in the disaster area, plant operators from outside the affected area may need to be brought in to operate and troubleshoot the water treatment plant or production facility initially.

c. Sweeping Crews. Personnel from surrounding counties or cities will need to brought in to walk the distribution system to detect leaks, identify and prioritize repairs, and shut off valves to sections of the distribution system which are in need of extensive repair.

d. Repair Crews. Repair crews from surrounding counties or city water authorities will be required to fix or repair service mains and customer connections. Most of the equipment they will

require needs to be brought with them because hardware may be scarce or exhausted quickly in the disaster area.

e. Liaison Officials. A liaison between the state officials and the water treatment plants or water production facilities is required. A liaison should be a sanitary engineer able to make professional assessments and recommendations to the state and local officials on what needs to be done and what assets need to be in position to accomplish the mission. The liaison not only acts as a mediator between the state and local officials but a coordinator for the relief effort. The liaison is the eyes and ears of the command cell, and a facilitator in bringing the water system back in service.

f. Water Storage Tank Inspectors. If the water storage tank was damaged during the natural disaster, then water storage tank inspectors need to be on hand to evaluate the extent of the damage and conduct minor repairs. This may include replacing hatches or screens, repairing access ladders, or conducting visual inspections inside the tower to detect and remove debris.

g. Water Sampling Personnel. Personnel will be required to conduct random and compliance sampling of the water distribution system. These people need to be trained on the state's method of water sampling. Samples need to be analyzed by state certified labs. Therefore, extra manpower may be required in the labs to perform the analysis.

6. Equipment. The equipment required for the rehabilitation of the water system is dependent upon the severity of the disaster. Crews or personnel brought in to assist in the disaster relief will need to bring their own equipment and supplies. As mentioned previously, replacement equipment or hardware may be scarce or exhausted in the disaster area. This may include items such as pipe fittings, sample containers, hose bibs, and valve wrenches. Trailer mounted generators are also needed to supply primary power to water treatment plants until commercial power is restored. Portable generators, such as 10 KW generators are also required for water pumps and sewage lift stations. These are essential for maintaining water pressure in the water distribution system and keeping sewage flowing away from hospitals, homes, schools, and buildings.

7. Command and Control. With any disaster there will be confusion and perhaps an initial lack of leadership and guidance. When dealing with the water system there definitely needs to be a command cell, preferably the state's department that regulates the public drinking water systems. If the site is declared a natural disaster area, federal government agencies, such as the

Federal Emergency Management Agency (FEMA), Corps of Engineers, and possibly members of the Armed Services, will arrive to assist in the reconstruction.

a. Command Cell. As mentioned earlier, the command cell for the water system reconstruction should be the state's department which regulates the public drinking water system. This department should be the focal point for all activities concerning the water system. This is necessary because it allows the state to be in control from the beginning, so the hand-off or return to normal function is smoother and faster. In this command cell there should be liaison officers from FEMA, the Army (preferably a sanitary engineer), and the Army Corps of Engineers and representatives from the local and state health department, local and state water authorities, the state lab, the city or state district engineer, and the city or state district environmental manager. The chairperson of the command cell should be the city or state district health department manager or an equivalent representative from the state. A wire diagram is provided as an enclosure to assist in the visualization of one possible command and control chain.

b. Support Agencies. Through the use of the liaison officers, the command cell can go to the different support agencies to assign tasks, task surrounding water authorities, and distribute assistance where it is needed.

(1) **Army Preventive Medicine Detachments.** The Army has several Preventive Medicine Detachments which are trained and capable to conduct wide-spread, random sampling to identify contaminated areas within the water distribution system and assist the state with the compliance testing.

(2) **Sanitary Engineers.** Within the preventive medicine field, the Army has Sanitary Engineers which can serve the state as both liaison officers and technical advisors to troubleshoot and evaluate the water treatment plant and distribution system. The advantage of Army sanitary engineers is the vital link between professional engineering and preventive medicine skills to identify and solve a problem while protecting public health.

(3) **The Army Corps of Engineers.** Personnel from the Army Corps of Engineers can assist the state by providing engineers to evaluate the structural integrity of water treatment plants and water storage tanks. The Army Corps of Engineers can also task Army engineer units to provide assistance during the reconstruction or award contracts for emergency or long term repairs.

(4) **FEMA and ESF3 (engineering) and ESF8 (medical).** Through these agencies the state can get assistance on funding and tasking the Army Corps of Engineers. The Federal Emergency Management Agencies will also have to provide liaison officers to the state to assist in identifying the individual agencies capabilities and responsibilities.

(5) **State Assistance.** The purpose for having the state as the leader of the command cell lies primarily on the state being able to use its own in-state assets to solve the problem. For example, the state can deputize or activate other city and county water authorities to assist the water authorities in the disaster area to conduct sweeps, walk the lines, make repairs, assist with plant operation and troubleshooting, and water certification.

8. Coordination Requirements. Coordination plays an essential role in the reconstruction of a water system. In most disaster situations the assets needed to accomplish the mission are on-site, but if there is no coordination between the different parties the work may be ineffective or duplicated. This is why a liaison officer from the different agencies, working with the state officials is so important. A liaison is the technical advisor, coordinator, and the link between the water system in the disaster area, the support agency, and the command cell.

9. Appropriate Hand-off or Return to Civilian Authorities. The hand-off or return of functions back to the municipal or county officials is a phased process, dependent upon the situation and the role of the supporting agency. If the state is the command cell, the return is much easier and quicker.

a. Army Preventive Medicine Detachments. The withdrawal of the Army Preventive Medicine Detachments depends upon the completion of the water testing, recertification of the water systems, and release of the boil water order, or the state's ability to resume water testing with its organic assets.

b. Other Support Agencies. The withdrawal of the other federal and state agencies depends upon their preset criteria and whether their mission has been accomplished.

10. Conclusion. This information paper has identified the goal of disaster relief as it pertains to the public drinking water system. The priorities and criteria outlined in this paper were established and defined based upon experience during the relief efforts following Hurricane Andrew. As experienced during the hurricane relief, there needs to be a command cell consisting of state water authority officials and liaison officers from the

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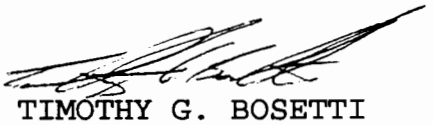
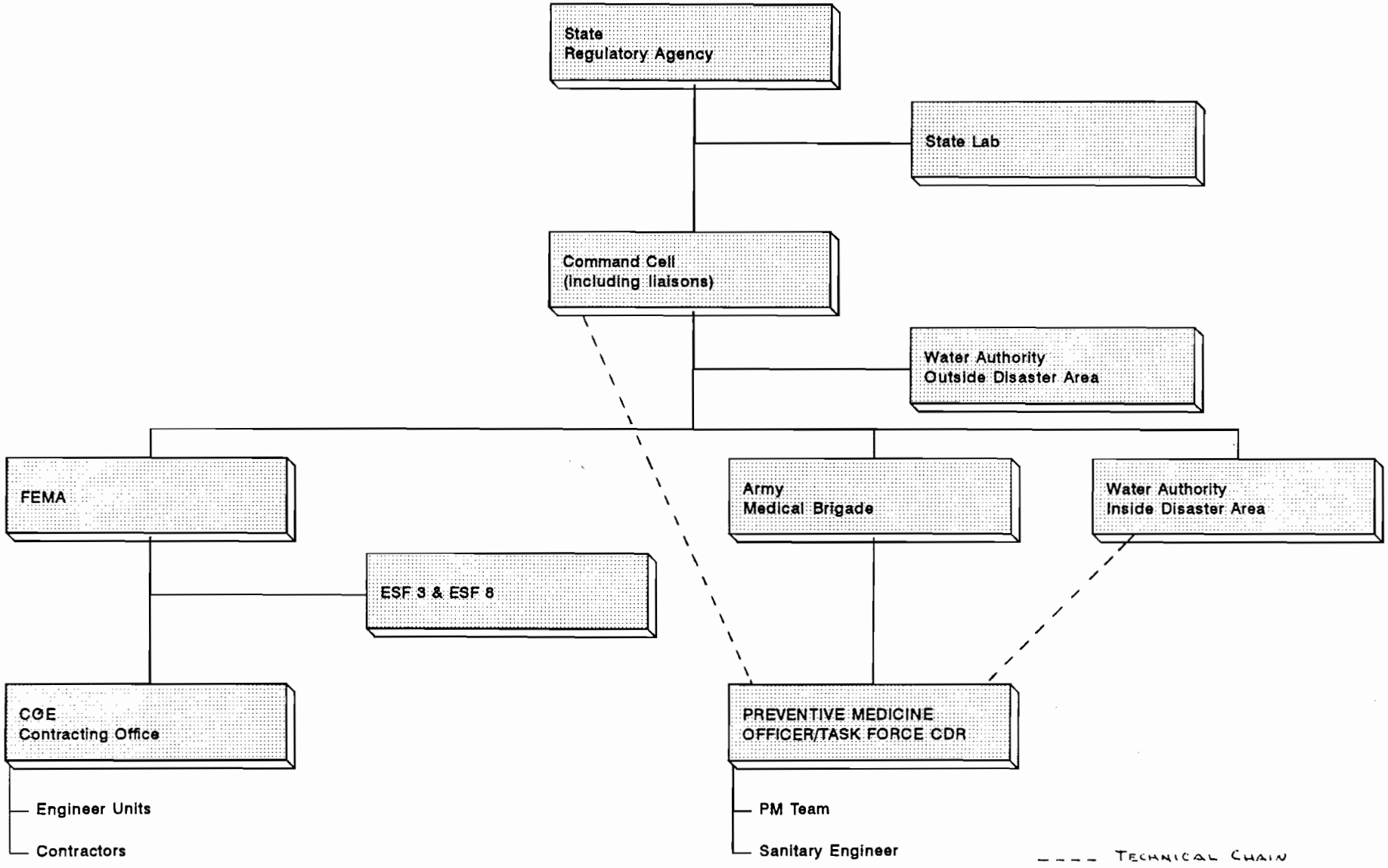
different supporting agencies. This was essential in the reconstruction of the water system and the return of those functions back to the state, city, or county water authority. Communication and coordination are important to reduce the duplication of efforts and speed the restoration of potable water to the community while maintaining and protecting public health.



TIMOTHY G. BOSETTI
1LT, MS
Sanitary Engineer

Organizational Chart

For Disaster Relief



DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
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REPLY TO
ATTENTION OF

HSHB-MW-E

1 November 1993

SUBJECT: Water Quality Information Paper No. 38

RESPONSE GUIDANCE FOR MICROBIOLOGICAL CONTAMINATION OF POTABLE WATER SYSTEMS

I. PURPOSE. To provide guidance for local Preventive Medicine Activity (PVNTMED Actv) personnel when routine microbiological samples are positive, indicating possible water system contamination.

II. REFERENCES. A list of references is provided in Inclosure 1.

III. BACKGROUND AND OVERVIEW. The overall concept of this information paper is that local PVNTMED Actv personnel must take immediate corrective action when a water microbiological problem is indicated. Implementing timely corrective action can frequently rectify problems long before a full-scale incident develops. Maintaining open communication with the Facilities Engineering (FE) Utilities Staff is essential to return potability to the water distribution system. Local PVNTMED Actv personnel should assume the lead in coordinating with the FE Staff on operations planning during water emergencies. It must be emphasized that protection of the consumer is of the highest priority, and this must be kept in mind during implementation and performance of any water system purging operation.

IV. GENERAL GUIDANCE.

A. Actions to be Taken Before Positive Microbiological Results Occur - Day 0.

1. Review sample data for low chlorine residual results or other collection irregularities.

2. Notify the FE if chlorine residuals are not in compliance with TB MED 576 (maintaining a measurable residual in the distribution system).

3. Discuss remedial actions with the FE to immediately bring the chlorine residuals back in compliance with TB MED 576.

B. Actions to be Taken in the Event of Positive Microbiological Results - Day 1.

1. Review all microbiological quality control data.

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2. Verify that correct procedures are being followed in laboratory technique and sample collection, preservation, transportation, and storage techniques. Be particularly cognizant of procedures or conditions which may have contaminated the samples or equipment and caused false positives. This is by far the most common cause of positive results.

3. Recheck the previous day's residual levels and the history of the affected sample point(s) for past problems and solutions.

4. Notify the FE of positive microbiological results and discuss the possible causes with him (i.e., construction, chlorinator failure, main breaks/repairs, main flushing, etc.).

5. Collect confirmatory samples IAW TB MED 576 and State Laws as appropriate, and perform bracket sampling in the area of the sample point(s) which had the positive results. Remember to measure the chlorine residual at each sample point.

6. Perform total coliform (TC), fecal coliform (FC), and standard plate count (SPC) analyses on all samples collected.

7. Review the chlorine residual results from the confirmatory sampling for compliance with TB MED 576. Notify the FE of any noncompliance, and request that appropriate measures be implemented so that the residuals comply with TB MED 576.

8. Inform the Chief, PVNTMED Actv, of the positive results, the corrective actions implemented by FE, the resampling program, and potential problems which may exist if the system is actually contaminated.

C. Actions to be Taken When Confirmatory Microbiological Samples Are Positive - Day 2.

1. Review the microbiological quality control data again.

2. Verify again that correct procedures are being followed in the laboratory technique and sample collection, preservation, transportation, and storage techniques. Investigate even the most remote possibilities of sample and/or equipment contamination.

3. Review the chlorine residual and bracket-sampling data for trends.

4. Notify the FE of the results of confirmatory samples that were positive.

a. Request that the chlorine dose be increased to provide a free available chlorine (FAC) residual of 1.0 mg/L in the distribution system. NOTE: A sudden increase in the chlorine residual will begin to clean the mains, and may

cause "dirty water" complaints from consumers. This must be taken into consideration and a plan must be devised to handle this problem.

b. Discuss state notification as required by State Law with the FE. It is not the PVNTMED Actv's responsibility to notify the state, this is an installation function.

c. Review with the FE any work performed on the potable water or wastewater systems, such as flushing, fire flow testing, pressure testing, or any unusual incident, to determine if there is a correlation between any of these and the positive microbiological results. Additionally, ask about other types of construction or digging in the area that may have resulted in damage to and contamination of the potable water system.

d. Review the cross-connection-prevention-control program. The following is a list of potential areas which should be investigated for cross connections as the problem continues ("investigated" means to look at plumbing plans, talk to people familiar with the facility, and physically go to the facility and look around to see if evidence of a contamination source exists).

1. Dining facilities
2. Laboratories
3. Wastewater treatment plants and pump stations
4. Maintenance facilities
5. Vehicle washracks
6. Fire protection systems
7. Well fields
8. Water treatment plants
9. Plating shops
10. Swimming pools
11. Boiler plants
12. A/C systems
13. Morgues
14. Photo labs
15. Any temporary construction, digging, spraying, mixing, or other industrial-type operations.

5. Expand the resampling program to determine the magnitude of the problem after the FAC has been raised to 1 mg/L. Insure that all major distribution loops and raw water sources are sampled.

6. Coordinate with the Chief, PVNTMED Actv, and evaluate the need to notify the installation medical authority and the Post Commander. Note: Before the State is notified, notify the Public Affairs Officer, the Post Commander, and the Medical Authority.

7. Perform laboratory analyses to identify fecal and total coliform organisms. Review the current resample collection logs for FAC residuals and unusual circumstances before the laboratory performs the analyses.

8. Initiate preliminary planning to provide an emergency water supply.

9. Perform a preliminary onsite investigation at the water treatment plant to evaluate the disinfection process.

10. Monitor patient data from the hospital emergency room, the outpatient clinic, and the hospital admissions office (the Chief, PVNTMED Actv, may wish to coordinate with hospital personnel regarding culturing of patients). NOTE: The Hospital Commander should be notified before implementing item 10.

D. Actions to be Taken When Positive Microbiological Results Continue to Occur - Day 3.

1. Check the quality control procedures and procedures involving sample collection, preservation, transportation, and microbiological analyses for any and all subsequent resampling.

2. Review FAC residual data and boost the chlorine residual to cysticidal and virucidal levels if epidemiological evidence remotely implicates the presence of nonbacterial organisms or pathogens (see TB MED 576).

3. Evaluate the collected microbiological data to include the specific identification of the organisms cultured in any resampling. NOTE: If the organisms are pathogenic and the technique is validated, the water system is probably contaminated, and human ingestion should be prohibited.

4. Coordinate with the PVNTMED Actv Chief, and notify the Installation Medical Authority, the Post Commander, and the Public Affairs Officer, concerning the extent of the contamination.

5. Contact the appropriate Regional Division Activity (RDA), USAEHA, for technical assistance. As the problem continues, the RDA will in turn contact the USAEHA Water Quality Engineering Division (WQED) for guidance.

6. Coordinate the notification of State and/or Federal authorities with the Post Commander as required. The Commander is responsible for official notification; however this authority is often delegated to the FE. Public notification requirements should be discussed with appropriate representatives designated by the Commander.

7. Assist with the implementation of an accurate public notification program that does not unduly alarm the consumers.

8. Establish an emergency water supply source, and institute distribution procedures as necessary. The following are offered only as possible atlernatives. The Installtion Medical Authority has the final approval authority for the methods and procedures selected.

a. Family housing/dining facilities. Boil water in accordance with local medical policy.

b. Administrative offices/troop units/barracks. Establish field water points utilizing organic engineering assets. The Installation Medical Authority will establish FAC residual criteria (in most cases, five (5) mg/L FAC residual should be adequate). PVNTMED Actv personnel should inspect all water trailers and verify the FAC residuals in the trailers at the point of consumption. Engineering assets should be tasked to ensure that water in trailers is chlorinated as necessary to maintain the established FAC residuals. Field PVNTMED units should be contacted if additional medical personnel or resources are needed during the emergency.

9. Monitor patient data from the hospital emergency room, the troop medical clinics, the outpatient clinics, and the hospital admissions office. Ensure that the treatment staffs are aware of the need to culture patients who have the appropriate symptoms, in an attempt to determine the cause of the illness. Correlate the patients' culture results with the microbiological analyses of the potable water system.

10. Initiate or expand a program for monitoring the raw water source for a minimum of TC, FC, and SPC. Analyze the raw water data and the microbiological data for possible trends. If the source appears to be microbiologically contaminated, conduct an investigation to identify and eliminate the source of the contamination.

11. Check or further investigate the operation of the water treatment plant if the raw water source is not microbiologically contaminated. Ensure that the chlorine dose is adequate to provide the desired FAC residual after the specified contact time. Ensure that the contact time provided is adequate.

12. Coordinate with the FE and establish a definite course of action which may include but not be limited to:

a. Conduct a joint building-by-building inspection in an effort to locate the source of the problem if the contamination is isolated to one area.

b. Reevaluate the pressure testing data.

(1) Identify any areas of low pressure.

(2) Check for negative pressures and for the potential for back siphonage.

(3) Check for water main and lateral leakage in low pressure areas if possible.

c. Check for areas of low water use which often results in low chlorine residuals.

(1) Identify any unused water lines that can be valved off to streamline the water flow in the used lines and therefore help to maintain an effective chlorine residual.

(2) Flush each dead end in turn until an acceptable FAC is attained. Establish this practice as a routine FE task to be accomplished in conjunction with the hydrant flushing program.

d. Expand the chlorine residual monitoring program using FE personnel to ensure that all distribution system loops are checked for low FAC residuals. Ensure that distribution system loops with low FAC residuals are flushed to bring the residuals up to the proper levels. Check these loops for potential cross connections.

e. Flush and superchlorinate the distribution system if the microbiological contamination persists (guidance on flushing and superchlorinating is provided in Inclosures 2 and 3, respectively).

13. Collect samples for microbiological analysis after the above corrective actions have been completed, to assess the effects of the corrective actions.

E. Actions to be Taken Based on the Results of Corrective Actions - Day 4.

1. If the microbiological contamination continues -

a. Intensify medical and facilities engineering efforts. Review and repeat the corrective actions previously performed. Identification of the microbiological contaminant source is essential to solve the problem.

b. Ensure that key personnel are accurately informed in a timely manner as to the status of the corrective actions being implemented.

2. If there has been an apparent correction of microbiological problem (two days of negative microbiological testing at the elevated FAC levels established by the medical authority):

a. Reduce the chlorine dose at the water treatment plant in steps with concurrent microbiological analyses so that a minimum of two consecutive days of negative results are observed at each level. Microbiological analysis should not commence at each step until the reduced chlorine level has equilibrated throughout the distribution system. The size of the decrement used to reduce the FAC residual to normal levels should be based on such factors as problem severity, difference between emergency and normal chlorine residuals, and other unique site-specific items. Contact WQED or the appropriate RDA of USAEHA if assistance is necessary in selecting an appropriate step size.

b. Collect samples from representative points in the distribution system after the chlorine residuals have returned to the normal levels until negative results are reported for at least two consecutive days.

3. Remove the water use restrictions only after microbiological verification that potability has been reestablished.

4. If positive microbiological results are reported during the FAC residual step-down phase, immediately raise the residual back to the previous evergency levels. Reevaluate all microbiological data to formulate a plan of action. Once corrective actions have been completed, repeat the FAC residual step-down process.

F. Actions to be Taken After Returning the Distribution System to Normal.

1. Continue the expanded microbiological monitoring for a suitable period of time (e.g., two or more weeks) after the water distribution system has been returned to normal.

2. Review and document the entire incident and discuss how the contamination might have been avoided and how the problem could have been handled smoother and more effectively after the problem did occur. It is important to learn as much as possible from these incidents to be able to avoid future problems or at least deal with them effectively when they do happen.

James J. Evenden

JAMES J. EVENDEN
MAJ, MSC
Chief, Environmental Health Engineering Branch
USAEHA, Regional Division-West

Eugene A. Miller

EUGENE A. MILLER, P.E.
CPT, MSC
Chief, Water Quality Studies Branch
Water Quality Engineering Division

REFERENCES

1. AR 40-5, Health and Environment, 25 September 1974.

2. TB MED 576, Sanitary Control and Surveillance of Water Supplies at Fixed Installations, 15 March 1982.

3. TM 5-660, Operation of Water Supply and Treatment Facilities at Fixed Army Installations, 24 November 1952.

4. TM 5-661; Inspection and Preventive Maintenance Services for Water Supply Systems at Fixed Installtions, 21 September 1945.

5. HSC-PAM 40-3, Environmental Health Program, February 1981.

6. American Water Works Association, Standard C601, Standard for Disinfection Water Mains, 2 June 1968.

7. American Water Works Association, Standard D105, Standard for Disinfection of Water Storage Facilities, 15 June 1980.

8. American Water Works Association Standard A100, Standard for Deep Wells, 23 January 1966.

Incl 1

HSHB-MW-E
SUBJECT: Water Quality Information Paper No. 38

DISTRIBUTION SYSTEM FLUSHING INSTRUCTIONS

1. Clean all reservoirs/storage tanks prior to flushing. See Section 2 - Cleaning, AWWA Standard D105, for specific guidance.

2. Develop a detailed flushing plan using current water distribution system maps. As a general rule, the flushing should begin near the water treatment plant and then follow the general water flow pattern in the distribution system, working away from the plant to the outer areas. Ensure that the flushing crew is provided with a water distribution system map showing the flushing plan.

3. Ensure that a minimum flushing velocity of 2.5 feet per second is achieved as required by para 4-3, TM MED 576. Higher velocities may be necessary in severe cases.

4. Ensure that all hydrants are flushed.

5. Perform microbiological analyses to determine the presence of and to identity the types of organisms found in the water or residue flushed from the lines.

Incl 2

HSHB-MW-E
SUBJECT: Water Quality Information Paper No. 38

SUPERCHLORINATING INSTRUCTIONS

1. Determine the chlorine requirements for disinfecting all storage tanks/ reservoirs and distribution system piping using one of the three alternative methods listed in AWWA Standard D105 and AWWA Standard C601.

2. Disinfect all water storage reservoirs IAW AWWA Standard D105.

3. Disinfect the distribution system - one major loop at a time - using the method described in AWWA Standard C601.

a. Divide the water distribution system into major loops.

b. Pump the superchlorinated water into a selected major loop. Pull the chlorinated water into all mains and laterals. PVNTMED Actv personnel should verify that the correct residual is achieved in the main and lateral.

c. When the proper residual is achieved, the loop should be valved off and operating pressure should be provided with superchlorinated water from the storage reservoir. Normal water consumption will draw the superchlorinated water through the service connections and throughout the buildings.

d. Ensure a continuous supply of superchlorinated water is supplied to the isolated loop using dosage and time requirements found in AWWA Standard C601.- NOTE: This may involve batch chlorination of the storage reservoir. PVNTMED Actv personnel should verify the chlorine residual in the loop after the appropriate detention time.

e. Superchlorinate each major loop in this manner.

5. Return the FAC residual to the emergency levels previously recommended by medical authority.

6. Reinstitute microbiological monitoring.

Incl 3

DEPARTMENT OF THE ARMY
U.S. ARMY ENVIRONMENTAL HYGIENE ACTIVITY-NORTH
FORT GEORGE G. MEADE, MARYLAND 20755-5225

HSHB-AN-E (40-5f)

MEMORANDUM FOR JTF SURGEON 16 September 1992

SUBJECT: Executive Summary, Sanitary Engineering Support in Support of Operation Andrew and Hurricane Disaster Relief

1. My mission as a sanitary engineer in support of Hurricane Andrew Disaster Relief was as a liaison officer between the city and state authorities to coordinate and expedite repair of the water distribution systems in South Dade County. My secondary function was to provide technical engineering recommendations to flush and disinfect water distribution systems, and to assist the local water authorities in bringing the water distribution systems back on line producing potable water to the communities. The end goal was to return water sampling and coordination back to the Department of Health and Rehabilitative Services (HRS) and the civilian authorities when the systems were at pre-hurricane status.

2. At the present time all water distribution systems in South Dade County: the Miami-Dade Water and Sewer Authority (WASA), the REX system-Everglades Migrant Worker Camp (owned by WASA), and the City of Homestead have been removed from the boil water order except Florida City. Florida City system is back on line but has not been released from the boil water order because of the questions concerning how long the top hatch of the water tower was open and what debris may have accumulated in the tower still needs to be resolved. Florida City has already coordinated with the Corps of Engineers to resolve the issues concerning the water tower.

3. I have coordinated with several parties involved in the reconstruction and reestablishment of the water distribution systems: the Department of Health and Rehabilitative Services (HRS), city water authorities, county officials, Army Corps of Engineers, the Armed Forces, and other Federal Agencies. My job and role as a liaison officer and technical advisor has been completed and is now run completely by the civilian authorities. The Army Preventive Medicine Task Force (155th Medical Detachment) has handed over compliance and certification sampling of Florida City and other water distribution systems in South Dade County back to HRS personnel, at the request of the local authorities. I have also made coordination with HRS, USPHS, and Florida City that further coordination between HRS and Florida City should be made directly rather than through the liaison officer.

Encl 3 94

4. There are two outstanding issues which the command needs to be made knowledgeable of: first, the Florida City water authority has contacted the State and EPA officials concerning the status of distribution system and expressed a concern for the personality conflicts with the HRS District Engineer; second, the HRS is investigating the potability of the water systems in the Leisure City and Cutler Ridge areas. The Army is not involved in either of these issues nor should they be involved in these issues. The state authorities have the capability to resolve these problems and should be resolved by the local and state authorities.

TIMOTHY G. BOSETTI
1LT, MS
Sanitary Engineer

MEMORANDUM FOR RECORD 15 September 1992

SUBJECT: Sanitary Engineering Support in Support of Operation Andrew and Hurricane Disaster Relief

1. My mission as a sanitary engineer in support of Hurricane Andrew Disaster Relief was primarily as a liaison officer between the city and state authorities to coordinate and expedite repair of the water distribution systems in South Dade County. My secondary function was to provide technical engineering recommendations to flush and disinfect water distribution systems, and to assist the local water authorities in bringing the water distribution systems back on line producing potable water to the communities. The end goal was to return water sampling and coordination back to the Department of Health and Rehabilitative Services (HRS) and the civilian authorities when the systems were at pre-hurricane status.

2. Prior to Hurricane Andrew there were four operational water distribution systems in South Dace County: the Miami-Dade Water and Sewer Authority (WASA), the REX system-Everglades Migrant Worker Camp (owned by WASA), City of Homestead, and Florida City water distribution systems. All systems were rendered non-potable by the hurricane. Fortunately, there was no structural damage to the water treatment facilities and all well heads were intact and not damaged during the storm. All systems lost commercial power and some lost emergency generator power for a few days. After the hurricane, all water systems relied solely upon the use of emergency generator power. The distribution systems were disrupted by the loss of pressure in the distribution system and broken service connections. This lead to contaminated water mains. A boil water notice was placed on all of South Dace County.

3. When I arrived on site, 3 September 1992, there were several parties involved in the reconstruction of the water distribution systems: the Department of Health and Rehabilitative Services (HRS), city water authorities, county officials, Army Corps of Engineers, the Armed Forces, and other Federal Agencies. The incoming assistance of surrounding water authorities and governmental agencies all operating independently of each other, created a lot of duplication of efforts and confusion. The confusion resulted primarily from the lack of coordination between the different groups. On the Army side, the Preventive Medicine Task Force (155th Medical Detachment) was conducting an immense, wide spread water sampling program to characterize and identify positive coliform results throughout the disaster area. All samples collected by the 155th Medical Detachment were sent to the HRS certified lab for analysis, therefore all samples results collected by the 155th Medical Detachment were valid and legal samples.

4. My first priority was to meet and coordinate with the key players to learn what efforts had occurred and what was planned to get the water systems back on line. My second priority was to learn and get acquainted with what assets were on the ground and what was scheduled to come. After getting up to speed on the water issues, I formulated a plan to coordinate efforts and assets to facilitate the reestablishment of the water distribution systems. This also involved prioritizing engineering projects to focus on what was needed to get the systems back on line. After coordination with HRS personnel, the following criteria was established and required to be meet by the individual water systems prior to release of the boil water order:

a. Two sources of power had to be in place. This includes having commercial power and at least one emergency generator with the power capacity to run the entire water treatment plant.

b. Water pressure in the distribution system must be maintained at 25 pounds per square inch (psi) or greater. It was recommended that pressures be maintained at 50-55 psi with only a 5 psi fluctuation. This was to prevent backflow in the distribution system and maintain fire protection.

c. Water storage capability must be maintained. This included a structurally sound water tower capable of storing potable water without the possibility of contamination of the chlorinated water.

d. Chlorine residuals need to be maintained at 1 milligram per liter (mg/L) of free available chlorine or higher at the tap. The emphasis behind this was to suppress bacterial growth and disinfection of the water distribution system.

e. A program to flush the service mains, through the use of fire hydrants, to remove contaminated water, debris, and sediment which may have collected in the distribution system.

f. A program to sweep the water distribution system to detect, repair, and shut off service and customer connections. This is a labor intensive project to find and repair leaks in the distribution system to return water to areas of high population. It also involved shutting off those connections to areas which were completely destroyed, such as mobile home parks, or areas which there was no population, such as warehouse areas. This was important to regain the integrity of the distribution system and prevent further contamination after the water has entered the service mains.

g. A sampling scheme, approved by HRS, which has samples taken from areas in the distribution system where dead ends are located, areas which serve highly populated communities, and the major service lines.

5. During the first three days on the ground I kept in constant coordination with the water plant operators, city engineers, and State and Federal Agencies. It was important to be a good liaison and maintain a good relationship with the different authorities. By doing this I was able to assist them in directing relief efforts to those cities which needed the most help. After the work orders were issued and assistance directed to troubled areas, I followed up on the work to make sure that it was what the city water authority needed and if it was enough. This was particularly important for Florida City, which was the hardest hit area in South Dace County. Through coordination with Florida City, USPHS, and Army assets, I was able to direct some of the incoming aide to Florida City to bring them on line and operational.

6. I also coordinated with HRS personnel to set up a joint sampling program between HRS lab personnel, city water authorities, and the 155th Medical Detachment. This worked out very well and greatly assisted HRS in compliance sampling of the City of Homestead. This program also identified areas which still required flushing, but did not go over well with city officials. As a result of this confrontation, the Army Preventive Medicine Task Force began to disengage from all compliance and certification sampling of city water systems. On 13 September 1992, the Army Preventive Medicine Task Force returned this function to the civilian authorities, specifically HRS who is the approving authority of water systems in the State of Florida (enclosure 1).

7. Water Line to Homestead Hospital.

a. After coordination with Major Dale Brown, Health Care Facilities Planner, I was made aware of the urgency to restore potable water to the Homestead Hospital (John Archer Smith Hospital). This was required so that the hospital could return to pre-hurricane patient care rather than just triage and emergency care. I coordinated primarily with MAJ Brown and proposed a design of an isolated water line which connected the City of Homestead Wittcop water plant directly with the Homestead Hospital. After extensive coordination with HRS, the U.S. Public Health Service (USPHS), the City of Homestead Water Authority, and the Hospital engineers. The proposal was submitted to HRS and the civilian chain of command would initiate construction. My proposed plan (enclosure 2) had only one modification. This

modification was to make it an underground, permanent water line rather than an aboveground, temporary line.

b. After the paperwork was handed over to the civilian authorities, my job was complete. It was latter brought to my attention that HRS personnel were holding submittal of my proposal, waiting for the boil water order notice to be removed from the City of Homestead. Therefore the proposal would never leave HRS and construction would never commence.

8. City of Homestead.

a. The City of Homestead did not require much engineering support. However, technical engineering assistance such as identification of broken service lines, location of total coliform results, and specific areas which required flushing was important.

b. To accomplish this task I coordinated with 1LT Arron Silver, Commander of the 155th Medical Detachment. Members of the 155th Medical Detachment conducted an extensive sampling program and collected over 500 samples. I took those results and with the help of 1LT Silver, plotted the positive results on map of the area of operation. The plot clearly showed areas where there was problems. These problem areas were either lines which required flushing or broken mains. This information was given to the local water authorities and for the most part followed my recommendations. This information greatly assisted the local water authorities to clear contaminated and broken service lines.

c. The City of Homestead conducted a two day flushing program and had compliance sampling done by HRS personnel on 14-15 September 1992. As of 15 September 1992, the City of Homestead water distribution system was removed from the boil water order. This system was released after compliance testing done by HRS personnel showed no coliform growth on the samples collected.

9. Miami-Dade Water and Sewer Authority System.

a. The WASA system north of the City of Homestead and south of State road 104th Street was primarily handled by WASA authorities. The Army Preventive Medicine Task Force conducted sampling in this area and identified the location of positive coliform results to Mr. Tom Seegers. From the 155th Medical Detachment's results, the hot spots appeared to be clustered around the Leisure City and Cutler Ridge areas. This information was also relayed to Mr. Seegers. On 10 September 1992, the Boil

water order for all of South Dace County less the City of Homestead and Florida City was released from the boil water order and the Army instructed to cease all sampling in those areas. This information was provided to me by Mr. Walter Livingstone, Environmental Administrator, District XI, HRS.

b. Following the release of the boil water notice for the WASA system, sample results taken by the 155th Medical Detachment just days prior to the release, where positive for total coliform bacteria in the Leisure City and Cutler Ridge areas. Personnel from HRS resampled the sites where the Army had positives and came up with the same results. This issue is presently being addressed by HRS personnel and WASA authorities. The Army has no part in this issue other than the initial identification.

10. Everglades Migrant Worker Camp Water System. The Everglades Migrant Worker Camp has a water treatment plant which consists of three wells and an inline chlorination unit. This facility provided water to the Migrant Camp and to the surrounding area. All connections to the camp were shut off by WASA personnel because of the numerous service connection leaks to the devastated mobile home park. The Migrant Camp also has permanent structures (HUD housing) with occupants which needed potable water. I coordinated with Mr. Seegers on the possibility of restoring potable water to the HUD housing area by isolating the 10 inch service main which feed water to that area. He agreed with my proposal and initiated work that afternoon to isolate the service main (enclosure 3). The next afternoon running water was restored to the Migrant Camp.

11. Florida City Water System.

a. The Florida City water distribution system required extensive coordination to make sure that the water authority was getting the assistance they needed to restore the integrity of the system. I coordinated with Mr. Richard Coates, Professional Engineer from the City of North Miami Beach, who was the onsite coordinator for the Florida City water system.

b. Within a week the Florida City water system had met all criteria for coming on line except for the storage requirement. The top hatch on the Florida City water tower was open and needed to be shut, but the access ladder was torn off by the hurricane. I coordinated with Major Abner and the 57th Medical Detachment (Air Ambulance) and did an aerial recon of the water tower by helicopter. With the assistance of the flight crew and a rake the top hatch of the water tower was closed as much as possible without causing damage to the hatch, the water tower, crew, or the Blackhawk helicopter. I made the observation that the hatch

was rusted open and may have been open for several months. This raised question as to what has accumulated in the tank before and during the hurricane.

b. At the present time, Florida City system is back on line but has not been released from the boil water order because of the following: the questions concerning how long the top hatch of the water tower was open and what debris may have accumulated in the tower need to be resolved, the inspection report of the water tower from three months ago needs to be forwarded to HRS, a follow up inspection may be required, well head number 1 needs to be shut down due to total coliform contamination, the ten sampling points chosen by Florida City needs to be increase to thirty sampling points, and the system needs to be flushed to remove any contamination in the service mains. This information was provided to me by Mr. Alonso (enclosure 4).

b. Several problems developed in bringing Florida City back on line. The problems were primarily the result of the lack of communication between HRS and Florida City. These problems were what was required of Florida City to be brought back on line and questions concerning the sanitary conditions of the water tower. These issues became very political and involved the State Authorities from Tallahassee and the Environmental Protection Agency (EPA) Region IV. The Army was not involved with this issue, we disengaged prior to the State and EPA getting involved.

12. Hand Off to Civilian Authorities.

a. On 14 September 1992, I reached a stagnation point. All water system had come on line or were going to come on line. Florida City has to correct the deficiencies with its water tower and have HRS sample the City distribution system for certification. My job and role as a liaison officer and technical advisor has been completed.

b. The Army Preventive Medicine Task Force has handed over compliance and certification sampling of Florida City and other water distribution systems in South Dace County back to HRS personnel. I have also made coordination with HRS, USPHS, and Florida City that further coordination between HRS and Florida City should be made directly rather than through the liaison officer (1LT Bosetti) (enclosure 5). This was also part of the handoff of military assistance back to civilian authorities.

13. Lessons Learned.

a. Coordination between governmental agencies is crucial and a liaison officer is extremely useful. Its also extremely

useful to have someone on the ground looking and talking to the people onsite. Its also very important to coordinate efforts of other governmental agencies. For example coordinating the data from the sampling of the 155th Medical Detachment and making use of that data to identify hot spots in the distribution system.

b. One of the biggest problems with getting water systems back on line after a hurricane is flushing and disinfection of the water distribution system. Increasing the chlorine levels to 5 mg/L free available chlorine is adequate but takes a lot of time. I recommend bulk chlorination of the water systems using calcium hypochlorite and increasing the chlorine residual to 50 mg/L for twenty-four hours, then extensively flushing the system, block by block.

c. Backup power and the ability to restore commercial power is another factor in getting water distribution systems back on line. Emergency generators are only designed to last for short periods of time, then they fatigue and loose their capability to meet the electrical demands to operate a water plant. In the future it would be prudent to supply the water plants with an extra generator to run the system and keep emergency generator use to a minimum. Eventhough it did not occur during the relief effort, if an emergency generator had failed, the city would have suffered a severe setback.

d. Another key was the availability of certain public works assets such as; sweeper crews to locate and fix broken lines, plumbers, meter technicians, and a crew to inspect water towers for sanitation and structural integrity. The availability and placement of these assets impact greatly on how fast a water distributing system can come back on line and provide potable water to the servicing community.

14. Key Personnel Contacted:

a. BG Peake, Commander, 44th Medical Brigade.

b. Colonel Dale Carroll, Preventive Medicine Doctor, Joint Task Force Andrew.

c. Colonel Kim, Commander, 55th Medical Group.

d. Captain Gorham, USPHS.

e. Major Dale Brown, Health Care Facilities Planner, Joint Task Force Andrew.

f. Major Steve Jones, Environmental Science Officer, XVIII

Airborne Corps.

g. CPT Abner, Aviator, 55th Medical Group

h. CPT Jeff Ryan, Commander, 714th Medical Detachment.

i. 1LT Arron Silver, Commander, 155th Medical Detachment.

j. SFC Robert Herald, NCOIC, 714th Medical Detachment.

k. SFC David Hughes, NCOIC, 155th Medical Detachment.

l. Mr. Raul Alonso, District Engineer, HRS.

m. Mr. Tom Seegers, Superintendent, WASA.

n. Mr. Richard Coates, City of North Miami Beach, Florida City water plant coordinator.

o. Mr. Richard Waters, Florida City, City Engineer.

p. Mr. J. Henry Stalvey, City of Homestead, City Engineer.

q. Mr. Robert Slayton, USPHS.

r. Mr. Walter Livingstone, Environmental Administrator, District XI, HRS.

s. Mr. Venkatasen, Florida City, City Engineer.

t. Mr. Larry Angle, Homestead Hospital Engineer.

u. Mr. Bob Charro, Homestead Hospital Engineer.

15. The point of contact for this information is 1LT Bosetti, Sanitary Engineer, U.S. Army Environmental Hygiene Activity-North, (410) 677-6205.

TIMOTHY G. BOSETTI
1LT, MS
Sanitary Engineer

13 September 1992

Memorandum for record

Subject: Water inspections in Homestead City

1. I was contacted today by LTC Dressel, 10th Mtn Div Surgeon, who informed me that the 10th Mtn's ADCS had told LTC Dressel to call me and to instruct me to "keep hands off Homestead City's" water supply.

2. I asked LTC Dressel if he and the ADCS knew that we were finding positive coliforms in the Homestead system and that we had coordinated our testing with HRS and the state lab. He answered that he knew of the positives in the Homestead system as did the ADCS and I was to "call off my people"!

3. I discussed the issue with Mr. Walter Livingston of HRS who informed me that he had been called by Mr. Spivey of the Homestead Water Department who had told him (Mr. Livingstone) that he beleived that "the Army people didn't know what they were doing". Mr. Spivey related that he had or would talk to MG Arnold if our PM techs continued to test his system. Mr. Livingstone believes that Mr. Spivey is concerned about the positives we are finding which could delay the "all clear" for the Homestead system.

4. This afternoon LTC Dressel left me a message to call Mr. Muxo the Homestead City Manager, "per Col Hennessey". I attempted to call Mr. Muxo but he was out of the office. His secretary said she would have him call me back. As of 2030 hr he had not returned the call.

5. My recommendation is that we cease to sample the Homestead water system except at points of troop concentrations. This recommendation has been coordinated with Mr. Livingston of HRS and he has offered the continued services of the State water lab to run our samples.

Dale A. Carroll
COL, USA
JTF Andrew Prev Med Off

7 September 1992

MEMORANDUM FOR RECORD

SUBJECT: Above Ground Water Line to Homestead Hospital

1. In coordination with the Department of Health and Rehabilitative Services (HRS) and Major Dale Brown, I have developed the following plan to supply the Homestead Hospital (John Archer Smith Hospital) with potable water.

2. Problem. Homestead Hospital needs constant, steady flow of potable water within the hospital.

3. Facts Bearing on the Problem.

a. The City of Homestead's water distribution system has not been declared potable by HRS personnel; however, HRS personnel have declared the water produced by the Homestead water treatment works is potable.

b. Homestead Hospital's patient load is increasing and so is their demand for potable water. Therefore, Homestead Hospital needs a constant, steady supply of potable water.

4. Impact on Local Population. The lack of a potable water supply within the Homestead Hospital significantly hinders patient treatment and the number of patients which can been seen by medical personnel. This has an adverse affect on the local population and the hospital's mission to provide patient care.

5. Proposed Above Ground Water Supply System.

a. The proposed aboveground water system will connect the City of Homestead water treatment works directly to the Homestead Hospital, the 28th Combat Support Hospital, and the Physician/Clinic Towers (Enclosure 1).

b. A tap will be placed into the City of Homestead's 18 inch main coming from the water tower. Its recommended this tap be placed after the main shut off valve.

c. The line will be approximately a half mile of pipe. Its recommended that the pipe and all connections and attachments are galvanized steel to prevent tampering and accommodate the water pressure. In addition, this system may require pressure release valves and backflow prevention devices due to pressure fluctuations in the City of Homestead's water distribution system. This line will have to be of adequate size to distribute water to Homestead Hospital, the 28th Combat Support Hospital, the Physician/Clinic Towers, and the Physicians/Clinic Building.

SUBJECT: Above Ground Water Line to Homestead Hospital

d. The line will be placed 13 feet above ground at a minimum. This is required so that traffic patterns are not interrupted. See enclosure for above ground conception.

e. The line will also be constructed with a T-valve so that future expansion of the above ground system can be made to supply potable water to the Physician/Clinic Building on Krome Avenue.

f. The connection to Homestead Hospital will be made through the installation of a Y-valve. The purpose of the Y-valve is to provide Homestead Hospital with water from both the City of Homestead's distribution system and the above ground water system. This duplication will provide the hospital with two separate sources of water. If the City of Homestead's water distribution system should come on line in the days near completion of the above ground system, then the hospital will have a backup potable water supply. The intent of this connection is to give the hospital a potable water source in the event that the distribution became contaminated in the future.

g. Upon completion, the above ground system would be disinfected by the addition of a calcium hypochlorite solution (no less than 3,000 milligrams per liter (mg/L) of free available chlorine) allowed to stay within the system for no less than 3 hours. After the 3 hour period the line will be flushed until the chlorine levels are reduced to normal (approximately 3-5 mg/L). The system will then be tested for total coliforms using an approved State lab and sampling method.

6. HRS Taskings.

a. HRS will be responsible for the overall coordination of the submittal of the proposal and be the overall coordinating authority for the installation, construction, testing, and certification of the line prior to use by the hospital.

b. It is also suggested that HRS personnel coordinate with the local police departments to provide security for the system during and after construction.

TIMOTHY G. BOSETTI
1LT, MS
Sanitary Engineer

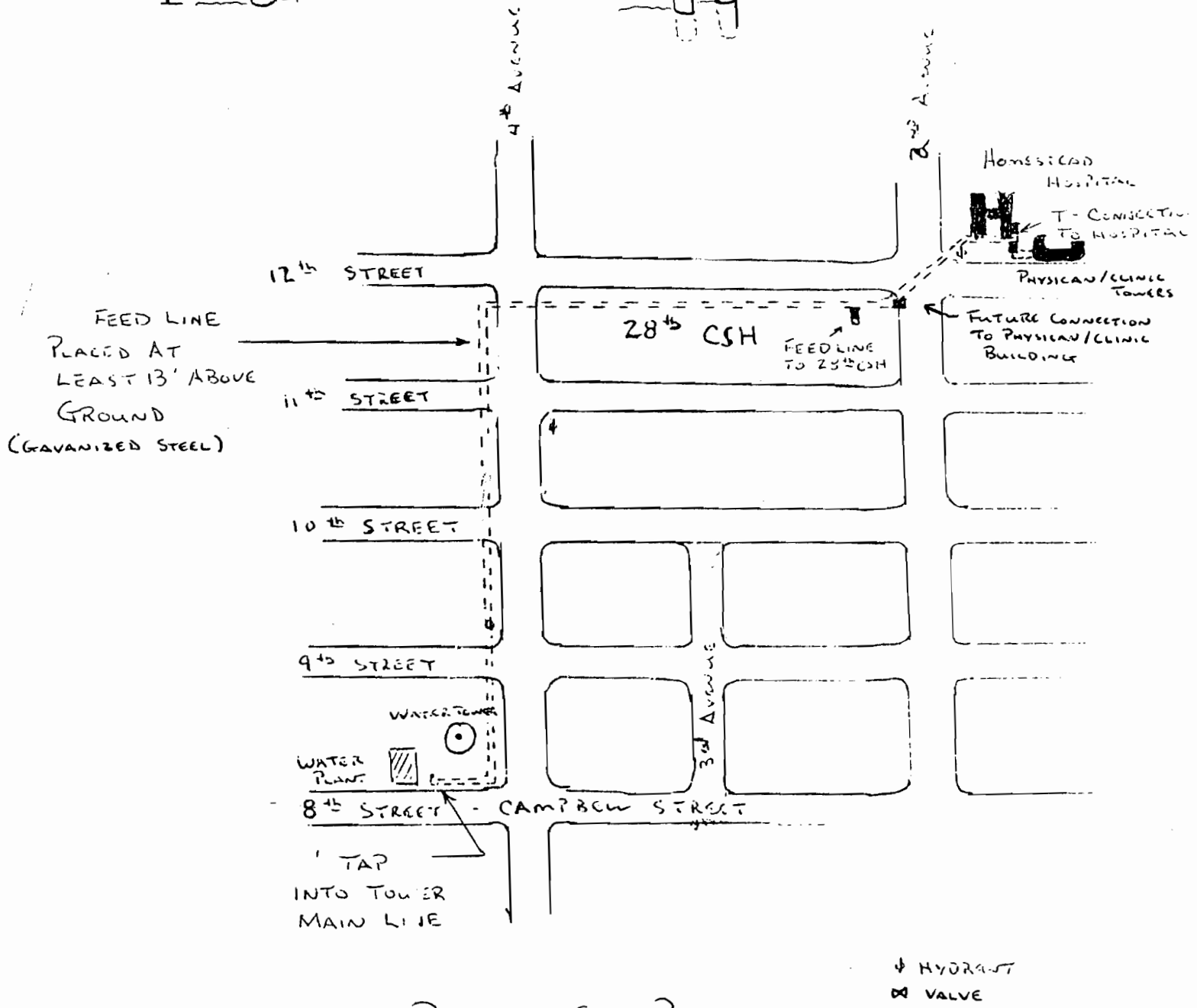
SUBJECT: Above Ground Water Line to Homestead Hospital

Projected Equipment List*

1/2 Mile of galvanized steel pipe
brass tap and tapping machine
backhoe
materials to support above ground line
Y-valves
T-sections
elbows
water valves
pressure release valves
backflow preventions devices

* This is not an inclusive listing, more equipment may be required upon further site assessment.

ABOVE GROUND WATER SYSTEM - CONCEPTION DRAWING



PROPOSED SITE PLAN

MEMORANDUM FOR RECORD 10 September 1992

SUBJECT: Water System at Everglades Migrant Worker Camp

1. Coordination with was made with Mr. Tom Seegers, Metro-Dade Water and Sewer Authority (WASA), to restore water to the HUD housing projects at the Everglades Migrant Worker Camp on 9 September 1992.

2. Work was initiated on that same day by workers from WASA and completed on 10 September 1992. The project involved isolating the 10 inch water main in the Camp by capping all service lines to the mobile home parks.

3. The system will come on-line when an additional generator is brought onsite, repairs are made to the existing generator, and power is restored to the plant by Florida Power and Light.

4. Once the system comes on-line it will require boosting the chlorine feed to properly disinfect the system and adequate flushing of the system. Upon completion of disinfecting and flushing, the system will need to be tested by the Department of Health and Rehabilitative Services (HRS) to verify that the water from the water treatment is potable.

5. This system should be on-line and ready for confirmation testing on Monday, 14 September 1992, provided that the system is properly chlorinated and flushed for at least two days.

6. Mr. Walter Livingstone, HRS, also informed me that the county authorities want the Preventive Medicine Task Force to hand over water compliance testing and monitoring back to the civilian authorities in all cities less the City of Homestead and Florida City. The Preventive Medicine Task Force will discontinue compliance and monitoring of the water system in these areas; however, the Preventive Medicine Task Force will continue to monitor those sites where troops are located.

TIMOTHY G. BOSETTI
1LT, MS
Sanitary Engineer

MEMORANDUM FOR RECORD 14 September 1992

SUBJECT: Handoff of Water Systems to Civilian Authorities

1. The purpose of my mission was to coordinate with the local and state authorities and facilitate the reestablishment of the potable water systems within South Dade County. I was a liaison between the Department of Health and Rehabilitate Services (HRS), Joint Task Force Andrew, and the City water authorities.

2. To date, the coordination that I have made has facilitated the engineering aspects of the water distribution systems in the City of Homestead, Florida City, and the Everglades Migrant Worker Camp. The potable water systems of the City of Homestead and Florida City have not been cleared by HRS as potable. The Army (specifically the 155th Medical Detachment) has discontinued compliance sampling of the water distribution systems in South Dade County and has returned this function to HRS personnel.

3. The City of Homestead is presently undergoing compliance sampling done by personnel from HRS. The Army has completely disengaged its assistance in bringing the City of Homestead potable water system off the boil water order. This responsibility falls solely upon HRS.

4. The Florida City water system still requires some coordination to bring the system on line and off the boil water notice. However this coordination has been returned to HRS personnel and the Florida City water authorities. Florida City still requires documentation of a water tank inspection conducted three months ago, identification of the twenty additional sampling points for compliance, the removal of well number one from operation until the coliform contamination is cleared, and possibly a reinspection of the water tank based on the findings of the previous report. This information was provided to me in a meeting with Mr. Raul Alonso, District Engineer, for HRS on 14 September 1992. Florida City is presently seeking assistance from the Corps of Engineers to do design specifications on the water tower and to reinspect the water tower within the next 30 to 60 days.

5. Coordination was made with Mr. Richard Coates (Florida City Representative), Mr. Raul Alonso (HRS), Captain Gorham (U.S. Public Health Service), and Mr. Ray Collins (HRS) to hand off my coordination efforts back to the respective officials and disengage from further interactions between those officials.

TIMOTHY G. BOSETTI
1LT, MS
Sanitary Engineer

MEMORANDUM FOR RECORD 15 September 1992

SUBJECT: Meeting With Raul Alonso on 14 September 1992

1. The purpose of this meeting was to discuss the status of the water distribution systems in South Dade County and the Army Preventive Medicine Task Force's role in returning water sampling and coordination back to the Department of Health and Rehabilitative Services (HRS) and the civilian authorities. The meeting was also to reiterate that the Army Preventive Medicine Task Force's original mission to assist HRS in sampling and locating broken service lines.

2. Personnel who attended this meeting were the following:

a. Mr. Raul Alonso, District Engineer, HRS.

b. 1LT Arron Silver, Commander, 155th Medical Detachment.

c. 1LT Timothy Bosetti, Sanitary Engineer.

d. SFC David Hughes, NCIOC, 155th Medical Detatchment.

3. Mr. Alonso is preparing a memorandum for the State Engineer, which describes the status of the water distribution systems in South Dade County and what HRS is doing to resolve outstanding issues with the Miami-Dade Water and Sewer Authority (WASA), City of Homestead, and Florida City water distribution systems.

4. I gave Mr. Alonso a water distribution system diagram of Florida City marked with the ten sample points chosen by Florida City Water Authority. Mr. Alonso added twenty sampling points in addition to the ten chosen by Florida City which must be sampled for the compliance and certification testing. Mr. Alonso requested that I hand carry the diagram back to Florida City representative, Mr. Richard Coates, and relay the sampling point information to Mr. Coates and return the diagram to Mr. Alonso.

5. 1LT Silver and I explained to Mr. Alonso that the Army Preventive Medicine Task Force will not participate in compliance sampling of Florida City, because of the political climate and HRS has the assets to do the compliance sampling. We also explained to Mr. Alonso that further coordination between HRS and Florida City should be made directly rather than through the liaison officer (1LT Bosetti). This is also part of the handoff of military assistance back to civilian authorities.

MEMORANDUM FOR RECORD
SUBJECT: Meeting With Raul Alonso on 14 September 1992

6. Mr. Alonso also stated that Florida City was not ready for compliance testing to remove the boil water order. His reasons were as follows: the questions concerning how long the top hatch of the water tower was open and what debris may have accumulated in the tower need to be resolved, the inspection report of the water tower from three months ago needs to be forwarded to HRS, a follow up inspection may be required, well head number 1 needs to be shut down due to total coliform contamination, the ten sampling points chosen by Florida City needs to be increase to thirty sampling points, and the system needs to be flushed to remove any contamination in the service mains.

7. Mr. Alonso is also aware of the notice given to the Army Preventive Medicine Task Force which states that the Army will not sample the City of Homestead's water distribution system. Mr. Alonso is using HRS personnel to sample the City of Homestead for compliance and certification to remove the boil water order.

8. The point of contact for this information is 1LT Bosetti, Sanitary Engineer, U.S. Army Environmental Hygiene Activity-North, (410) 677-6205.

TIMOTHY G. BOSETTI
1LT, MS
Sanitary Engineer

AARON J. SILVER
1LT, MS
Commander, 155th MED DET