

**ANNEX K**

**PUBLIC SERVICES**

**CITY OF SHERMAN, TEXAS**

**January 17, 2007**

**APPROVAL & IMPLEMENTATION**

**Annex K**

**PUBLIC WORKS  
&  
ENGINEERING**

\_\_\_\_\_  
Director of Public Works & Engineering

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Date

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EMC

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Date



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# ANNEX K

## Public Works & Engineering

### I. AUTHORITY

See Section I of the Basic Plan for general authorities.

Texas Government Code, Section 418.023, Clearance of Debris.

City Ordinance #4144, dated February, 26, 1990

City Ordinance #4637, dated September, 8, 1997

### II. PURPOSE

The purpose of this annex is to outline the local organization, operational concepts, responsibilities, and procedures to accomplish coordinated public works and engineering activities during emergency situations.

### III. EXPLANATION OF TERMS

#### A. Acronyms

|       |   |
|-------|---|
| DPS   | Texas Department of Public Safety           |
| EOC   | Emergency Operations Center                 |
| EMC   | Emergency Management Coordinator            |
| FEMA  | Federal Emergency Management Agency         |
| GDEM  | Governor's Division of Emergency Management |
| IC    | Incident Commander                          |
| ICP   | Incident Command Post                       |
| ICS   | Incident Command System                     |
| NIMS  | National Incident Management System         |
| NRP   | National Response Plan                      |
| SAR   | Search and Rescue                           |
| SOP   | Standard Operating Procedures               |
| TAHC  | Texas Animal Health Commission              |
| DSHS  | Texas Department of State Health Services   |
| TCEQ  | Texas Commission on Environmental Quality   |
| TDSR  | Temporary Debris Storage and Reduction      |
| TRRN  | Texas Regional Resource Network             |
| TxDOT | Texas Department of Transportation          |

#### B. Definitions

1. Debris Clearance. Clearing roads of debris by pushing debris to the roadside.

2. Debris Disposal. Placing mixed debris and or the residue of debris volume reduction operations into an approved landfill.
3. Debris Removal. Picking up debris and taking it to a temporary storage site for sorting and/or volume reduction or to a permanent disposal site. Debris removal also includes demolishing damaged structures and removing the remains of such structures.

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| <b>IV. SITUATION &amp; ASSUMPTIONS</b> |
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**A. Situation**

1. See the general situation statement and hazard summary in Section IV.A of the Basic Plan.
2. This jurisdiction can expect to experience emergency situations that could threaten public health and safety, as well as public and private property. This will necessitate the need for emergency public services.

**B. Assumptions**

1. Public Works equipment and personnel may be employed prior to a disaster in an attempt to reduce its severity or in the aftermath of a disaster to restore government facilities and infrastructure.
2. Local departments and agencies responsible for the public works function may have insufficient resources to remove the debris created by a major emergency or disaster and accomplish other recovery tasks.
3. Public Works departments and agencies are expected to accomplish expedient repair and restoration of essential services and vital facilities. Dependent on the scale of the operation(s), major reconstruction initiatives will likely require contract assistance.
4. Public Works will be able to organize and carry out debris clearance in the aftermath of an emergency. Large scale debris and/or hazardous material operations, however, will likely require external assistance.
5. Private construction companies, engineering firms, and equipment rental contractors have staff and equipment resources that may be contracted to carry out public works and engineering activities during emergency situations. However, local government may have to compete with businesses and individuals seeking those resources for repairs or rebuilding.
6. Assistance may be available from other jurisdictions through inter-local agreements and from commercial firms through contingency contracts. Some types of emergency situations, including earthquakes, hurricanes, and floods may affect large areas, making it difficult to obtain assistance from usual sources.

7. Damage to chemical plants, power lines, sewer and water distribution systems, and secondary hazards, such as fires, may result in health and safety hazards that may pose a threat to Public Works personnel.
8. Local landfills and waster disposal facilities may be inadequate to deal with large amounts of debris and it may be necessary to use alternate methods and facilities for disposal.
9. If local capabilities prove inadequate to deal with a major emergency or disaster, state, and/or federal resources will be available to assist in debris removal and restoration of essential services.

## V. CONCEPT OF OPERATIONS

### A. General

The general Public Works tasks to be performed during emergency situations include:

1. For slowly developing emergency situations, take actions to protect government facilities, equipment, and supplies prior to the onset of hazardous conditions.
2. Provide heavy equipment support for search and rescue operations.
3. Conduct damage-assessment surveys of public facilities, roads, bridges, and other infrastructure.
4. Clear debris from roadways and make repairs to reopen transportation arteries.
5. Remove debris from public property and manage debris disposal operations for public and private property.
6. Assist in controlling public access to hazardous areas.

### B. Protecting Resources and Preserving Capabilities

1. For slowly developing emergency situation, it may be possible to employ Public Works resources to protect and limit damage to government facilities, equipment, and essential utilities. This will prevent or reduce damage. Protective actions may include sandbagging, building protective levees, ditching, installing protective window coverings, or removing vital equipment. Public Works elements are expected to identify buildings and other infrastructure that will benefit from protective measures and, in coordination with the departments or agencies that occupy those facilities, carry out necessary protective actions.
2. If time permits, Public Works elements are also expected to take action in advance of an emergency situation to preserve response and recovery capabilities by protecting vital equipment and supplies, either in place or by relocating them to a safe location. It is desirable for agencies to enter into advanced agreements with other agencies or jurisdictions to ensure the safety and security of vital equipment and resources.

### C. Search & Rescue (SAR) Support

Public works and engineering crews may be required to provide heavy equipment support for search and rescue operations, particularly support for search operations in collapsed buildings.

#### **D. Damage Assessment**

1. As the primary local government expertise in the maintenance of roads, bridges, culverts, and drainage ditches, Public Works & Engineering personnel are expected to play a primary role in the damage assessment of these elements of the City's infrastructure. Damage assessment procedures and the forms to be used in that process are discussed in Annex J, Recovery.

#### **E. Debris Clearance and Removal**

See Appendix 2, Debris Management.

#### **F. Temporary Repairs and Restoration**

1. The public works and engineering staff, assisted by staff from the Building Maintenance department, when necessary is expected to make timely temporary repairs to government-owned buildings and other infrastructure essential to emergency response and recovery operations. Building contents should be removed or restricted until the restoration process is complete. In order to protect some equipment and records, it may be necessary to relocate them from damaged structures. Personnel should coordinate with building occupants to determine which areas and equipment have the highest priority for protection.
2. Hazardous situations may result in damage to computers storing vital government records and/or hard copy records, such as building plans, legal documents, tax records, and other documents. When computers or paper records are damaged, it is essential to obtain professional technical assistance for restoration as soon as possible.
3. It is generally impractical to restore buildings sustaining major damage during the emergency response phase. Major repairs will normally be postponed until recovery operations commence and will typically be performed by contract personnel.

#### **G. Actions by Phases of Emergency Management:**

1. Prevention
  - a. Identify vulnerabilities of existing public buildings, roads, bridges, water systems, and sewer systems to known hazards and take steps to lessen vulnerabilities.
  - b. Develop plans to protect facilities and equipment at risk from known hazards.
  - c. Install emergency generators in key facilities and have portable generators available to meet unexpected needs. Ensure procedures are in place to maintain and periodically test back-up sources of power, such as generators and fuel, in the event of an emergency power loss.
2. Preparedness
  - a. Ensure government buildings, roads and bridges, and public works equipment are in good repair.

- b. Ensure an adequate number of personnel are trained to operate heavy equipment and other specialized equipment.
  - c. Stockpile materials needed to protect and repair structures, roads, bridges, and other infrastructure.
  - d. Develop general priorities for clearing debris from roads.
  - e. Maintain an adequate quantity of barricades and temporary fencing.
  - f. Maintain current maps and plans of government facilities, roads, bridges, and utilities.
  - g. Review plans, evaluate emergency staffing needs in light of potential requirements, and make tentative emergency task assignments.
  - h. Execute contingency contracts for emergency equipment and services with local contractors and execute agreements with individuals and businesses to borrow equipment.
  - i. Develop procedures to support or accomplish the tasks outlined in this annex.
3. Response
- a. If warning is available, take actions to protect government facilities and equipment.
  - b. Survey areas affected by a hazard, assess damage, and determine the need and priority for expedient repair or protection to prevent further damage. Report damage assessments to the EOC.
  - c. Upon request, provide heavy equipment support for SAR operations. See Annex R, Search and Rescue.
  - d. Clear roads of debris. See Appendix 2.
  - e. Inspect damaged buildings to determine if they are safe for occupancy.
  - f. Remove debris from public property and manage proper debris disposal. See Appendix 2.
  - g. Assist the Utilities Department in making emergency repairs to government-owned utility systems, as necessary. See Annex L, Utilities & Engineering.
  - h. Restrict access to hazardous areas, using barricades and temporary fencing, upon request.
4. Recovery
- a. Repair or contract repairs to roads, bridges, and other infrastructure.
  - b. Support community clean up efforts, as necessary.

- c. Participate in compiling estimates of damage to the City's public services and of response and recovery costs.
- d. Participate in post-incident review of emergency operations and make necessary changes to improve emergency plans and procedures.

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| <b>VI. ORGANIZATION &amp; ASSIGNMENT OF RESPONSIBILITIES</b> |
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**A. Organization**

- 1. The function of Public Works & Engineering during emergency situations shall be carried out in the framework of our normal emergency organization described in Section VI.A of the Basic Plan, and in accordance with National Incident Management System (NIMS)/National Response Plan (NRP) protocols. Preplanning for emergency Public Works and Engineering tasks shall be conducted to ensure staff and procedures needed to manage resources in an emergency situation are in place.
- 2. The Director of Public Works & Engineering shall serve as the Public Services Officer during emergencies. The Public Services Officer is assigned primary responsibility for planning, organizing, and carrying out, with the support of those departments and agencies described below, the Public Services tasks outlined in this annex during emergencies.

**B. Assignment of Responsibilities**

- 1. The Director of Public Works & Engineering will serve as the Public Services Officer during emergencies and will:
  - a. Coordinate certain pre-emergency programs to reduce the vulnerability of local facilities and other infrastructure to known hazards. See Annex P, Hazard Mitigation.
  - b. Manage the Public Works & Engineering function during emergency situations in accordance with the NIMS.
  - c. Oversee the restoration of key facilities and systems and debris removal following a disaster.
  - d. Develop procedures for coordinating the efforts of the various local departments and agencies that perform the Public Works & Engineering functions and arrange for appropriate emergency training for local personnel.
  - e. Identify contractors who can provide heavy and specialized equipment support during emergencies and individuals and businesses that may be willing to lend equipment to local government during emergencies.
  - f. Assist the Resource Manager in maintaining a current list of Public Works & Engineering resources. See Annex M, Resource Management. In an effort to facilitate assistance pursuant to mutual aid agreements, our available resources are typed according to NIMS and a part of the Texas Regional Response Network (TRRN).

- g. Maintain this annex.
2. The Public Works & Engineering Department will:
- a. Carry out pre-disaster protective actions for impending hazards, including identifying possible facilities for debris storage and reduction.
  - b. Make emergency repairs of roads, bridges, culverts, and drainage systems and protect them from further damage, if possible.
  - c. Provide heavy and specialized equipment support for SAR operations.
  - d. Carry out debris clearance and removal. See Appendix 2.
  - e. With the assistance of the Legal Officer, negotiate inter-local agreements for Public Works support.
  - f. Maintain stockpiles of disaster supplies such as sandbags, plastic sheeting, and plywood.
  - g. Maintain reasonable stockpiles of emergency paving materials.
  - h. Supervise debris clearance from the public right-of-way and support debris removal operations.
  - i. Place barricades where needed for safety.
  - j. Provide personnel and equipment to aid in SAR operations as needed
  - k. Provide heavy equipment support for protective actions taken prior to an emergency and for response and recovery operations.
  - l. Provide communications support for emergency operations with spare equipment
  - m. Collect and properly dispose of refuse
  - n. Support emergency operations with available resources, if necessary

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| <b>VII. DIRECTION &amp; CONTROL</b> |
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- A.** The City Manager shall, pursuant to NIMS, provide general guidance for the Public Works activities during emergencies and shall be responsible for approving any request for state or federal resources.
- B.** The Incident Commander (IC) will manage Public Works & Engineering resources committed to an incident site and shall be assisted by a staff commensurate with the tasks to be performed and resources committed to the operation. If the EOC is not activated, the IC may request additional resources from local departments and agencies. The IC may also

request authorized officials to activate mutual aid agreements or emergency response contracts to obtain additional resources.

- C. The EOC will be activated for major emergencies and disasters. When the EOC is activated, the Public Services Officer will manage the emergency public works function from the EOC. The IC shall direct resources committed to the incident site and coordinate resource requests through the Public Services Officer. The Public Services Officer shall manage resources not committed to the incident site and coordinate the provision of additional resources from external sources.
- D. The Public Services Officer will respond to mission priorities established by the IC or the EOC Supervisor, direct departments and agencies with public works and engineering resources to accomplish specific tasks, and coordinate task assignments to achieve overall objectives.
- E. The Public Services Officer will identify public and private sources from which needed resources can be obtained during an emergency and coordinate with the Resource Manager to originate emergency procurements or to obtain such resources by lease, rental, borrowing, donation, or other means.
- F. A major emergency or disaster may produce substantial property damage and debris requiring a lengthy recovery operation. In such incidents, it may be desirable to establish a Debris Removal Task Force to manage debris removal and disposal. The task force may continue to operate even after the EOC deactivates. See Appendix 2 for the organization and responsibilities of this element.
- G. Normal supervisors of public works & engineering personnel participating in emergency operations will exercise their usual supervisory responsibilities over assigned personnel, subject to NIMS span of control guidelines. Organized crews from other jurisdictions responding pursuant to inter-local agreements will normally operate under the direct supervision of their own supervisors. Individual volunteers will work under the supervision of the individual heading the team or crew to which they are assigned.
- H. The line of succession for the Public Works Officer is:
  - 1. City Engineer
  - 2. Street Department Superintendent.
  - 3. Solid Waste Supervisor.
  - 4. Assistant Street Department Superintendent.

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| <b>VIII. READINESS LEVELS</b> |
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**A. Readiness Level 4 - Normal Conditions**

See the mitigation and preparedness activities in Section V.G.

**B. Readiness Level 3 - Increased Readiness**

- 1. Review plans and procedures.

2. Inform key public works and engineering personnel.
3. Monitor the situation.
4. Check equipment readiness and correct deficiencies.
5. Check emergency supply status and fill shortfalls.

**C. Readiness Level 2 - High Readiness**

1. Monitor the situation.
2. Alert personnel for possible emergency duty.
3. Increase short-term readiness of equipment if possible.
4. Review inter-local agreements and contracts for resource support and alert potential resource providers of possible emergency operations.
5. Identify personnel to staff the ICP and EOC.

**D. Readiness Level 1 - Maximum Readiness.**

1. Mobilize selected public works and engineering personnel.
2. Implement plans to protect government facilities and equipment.
3. Ensure equipment is loaded and fueled; consider precautionary deployment of resources.
4. Dispatch personnel to the ICP and EOC when activated.
5. Advise resource suppliers of situation.
6. Continue to monitor the situation.

|   |
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| <b>IX. ADMINISTRATION &amp; SUPPORT</b> |
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**A. Resource Support**

1. A listing of local public works and engineering equipment is provided in Annex M, Resource Management.
2. Should our local resources prove to be inadequate during an emergency; requests will be made for assistance from other local jurisdictions, other agencies, and industry in accordance with existing mutual-aid agreements and contracts.
3. If the public works & engineering resources available locally, from other jurisdictions, and from businesses pursuant to contracts are insufficient to deal the emergency situation, assistance may be requested from the State. The Mayor should approve requests for

state aid, which should be forwarded to the Disaster District Committee (DDC) Chair in Garland. Cities must request resource support from their county before requesting assistance from the State.

## **B. Resource Readiness**

1. During period of increased readiness, work should be undertaken to keep operational equipment at full readiness (full on-board equipment and fuel) and restore equipment out-of-service due to minor problems to operating condition.
2. To the extent possible, shortages in stocks of emergency supplies should be filled during periods of increased readiness. It is desirable to have sufficient supplies to sustain emergency operations without assistance for at least two days.

## **C. Communications**

The public works & engineering communications network is depicted in Appendix 1.

## **D. Key Facilities**

A listing of key local facilities, providing a general priority for damage assessment, debris clearance, and repair, is contained in Annex G, Law Enforcement. The EMC and the directors of the appropriate departments shall determine the specific priority for restoration of city services and facilities in the aftermath of an emergency.

## **E. Reporting**

In addition to reports that may be required by their parent organization, public works and engineering departments and agencies participating in emergency operations should provide appropriate situation reports to the IC, or if an incident command operation has not been established, to the EOC. The IC will forward periodic reports to the EOC. Pertinent information will be incorporated into the Initial Emergency Report and periodic Situation Reports. The essential elements of information for the Initial Emergency Report and the Situation Report are outlined in Appendices 2 and 3 to Annex N (Direction and Control).

## **F. Records**

Expenses incurred in carrying out emergency response and recovery operations for certain hazards may be recoverable from the responsible party, insurers, or as a basis for requesting reimbursement for certain allowable costs from the state and/or federal government. Hence, all public works elements will maintain detailed records of labor, materials, equipment, contract services, and supplies consumed during large-scale emergency operations.

## **G. Post Incident Review**

For large-scale emergency operations, the EMC shall organize and conduct an after action critique of emergency operations in accordance with the guidance provided in Section IX.F of the Basic Plan. The After Action Report will serve as the basis for an Improvement Plan.

**X. ANNEX DEVELOPMENT & MAINTENANCE**

- A. The City Public Services Officer is responsible for developing and maintaining this annex with the support from organizations specified in Section VI.
- B. This annex will be reviewed annually and updated in accordance with the schedule outlined in Section X of the Basic Plan.
- C. Departments and agencies assigned responsibilities in this annex will develop and maintain SOPs covering those responsibilities.

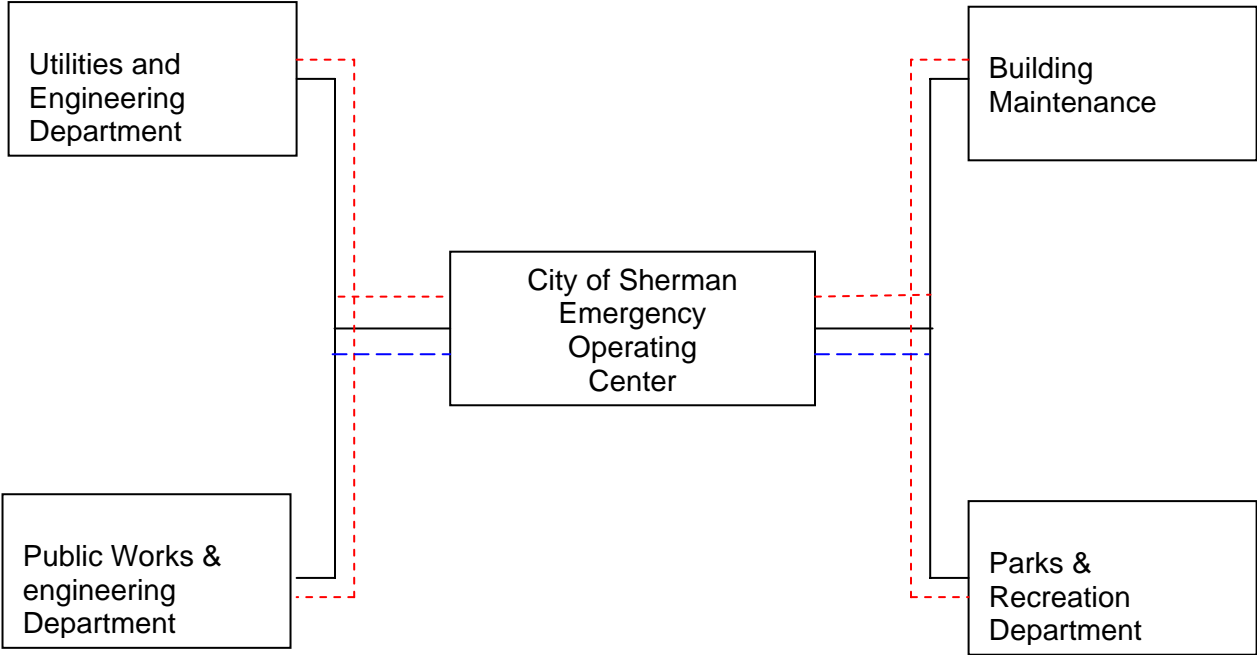
**XI. REFERENCES**

- A. DEM, Texas Disaster Recovery Manual.
- B. FEMA, Public Assistance Debris Management Guide (FEMA-325).
- C. FEMA, State and Local Guide for All-Hazard Emergency Operations Planning (SLG-101).
- D. FEMA, Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials (FEMA-116).

**APPENDICES:**

Appendix 1 .....Public Works Communications Network  
Appendix 2 .....Debris Management

**APPENDIX 1 TO ANNEX K  
PUBLIC WORKS COMMUNICATIONS NETWORK**



**LEGEND:**

- TELEPHONE
- - - RADIO

## **APPENDIX 2 TO ANNEX K DEBRIS MANAGEMENT**

### **1. Objectives**

The objectives of debris management in the aftermath of an emergency are to:

- A. Reopen roads and provide access to facilities that provide essential government and population support services.
- B. Remove debris from public property.
- C. Assist citizens in removing debris from private property.
- D. Reduce the volume of debris going to disposal facilities to extend the life of those facilities and reduce costs.
- E. Ensure hazardous materials are segregated from other debris and properly disposed of.

### **2. Explanation of Terms**

- A. Debris is the remains of things destroyed or damaged as a result of natural or technological disasters. Disaster debris may include yard waste, building materials, household items, personal property, hazardous household products, batteries, automobiles, boats, hazardous chemicals, spoiled food, dead animals, and other materials. Some types of debris pose a threat to health, safety, and the environment.
- B. Categorization of Debris. There are a variety of schemes for categorizing debris. In this appendix, the following categorization is used:
  - 1) Burnable Materials, which include:
    - a) Burnable Natural Debris – generally trees, shrubs, and vegetation
    - b) Burnable Construction and Demolition (C&D) Debris – wooden structural members and other wood products such as roof decking, siding, doors
  - 2) Non-burnable Debris – plastic, glass, metal, sheet rock, roofing shingles, carpet, tires, treated lumber, bricks, concrete, soil, and similar items. Household waste is a type of non-burnable debris.
  - 3) Hazardous Debris – industrial and household hazardous waste, paint, materials containing asbestos, batteries, petroleum products, agricultural chemicals, dead animals, and similar products.

### **3. Situation & Assumptions**

#### **A. Situation**

- 1) The type and quantity of debris generated by an emergency situation is a function of the type of event, the location of impact, and the magnitude, intensity, and duration.
- 2) The quantity and type of debris generated, its location, and the size of the area over which it is spread affect the choice of removal and disposal methods, the costs incurred in doing so, and the time it will take to accomplish the task.

## B. Assumptions

- 1) Emergency situations requiring debris removal may occur at any time.
- 2) Local government may have insufficient resources to remove debris created by a major emergency or disaster and accomplish other recovery tasks.
- 3) If local debris removal capabilities are insufficient, the chief elected official may issue a local disaster declaration and request State assistance in debris removal. If the local emergency situation is of such magnitude that the Governor requests a Presidential Disaster Declaration and such a declaration is approved, federal resources could become available.
- 4) For major emergencies or disasters, private contractors may be needed to collect, reduce the volume of, and dispose of debris.
- 5) Citizens should assist in removing debris from the immediate area of their homes and businesses, but will generally need government assistance in removing it for disposal.
- 6) Citizens are often willing to help their neighbors in removing debris. Proper public information can encourage such cooperative action, speeding up the process and reducing costs.

## 4. Concept of Operations

### A. Phased Approach. Debris management shall be conducted in phases, including:

- 1) Phase 1 - Emergency Roadway Clearance
  - a) Following a disaster, the top priority is to clear major roads and routes providing access to key population support facilities such as hospitals, to allow for the movement of emergency vehicles, resumption of critical services, and damage assessment. Emergency roadway clearance also facilitates the deployment of external response elements and delivery of emergency equipment and supplies. In initial roadway debris clearance, debris is normally pushed to the side of the road with no attempt to remove or dispose of it.
  - b) Local government is responsible for clearing city streets, county roads, and their rights of way. The Texas Department of Transportation (TxDOT) is responsible for clearing state and federal highways and the rights of way for such highways along with debris disposal resulting from the clearing process.
  - c) In this phase, crews equipped with chain saws will generally be required to cut up downed trees and heavy equipment will be needed to move the remains. If possible, heavy equipment used for moving debris should be equipped with protective cabs and all personnel should wear protective equipment. Fire hydrants, driveway cutouts, and utility valves should be left unobstructed.

- d) Electrical systems are often damaged by the same hazards that create substantial debris, public works and engineering crews may need to coordinate their efforts to remove debris with utility crews.

## 2) Phase 2 – Debris Removal and Disposal

### a) Debris Removal from Public Property.

- (1) In the aftermath of a disaster, it may be necessary to remove debris from a variety of public property, including:

- (a) Roads and rights of way.
- (b) Government buildings, grounds, and parking lots.
- (c) Parks and recreation facilities.
- (d) Storm drainage systems and reservoirs.

- (2) If the emergency situation resulted in a Presidential Disaster Declaration, the expense of debris removal from public property may be partially reimbursed by the federal government if the debris must be removed to:

- (a) Eliminate immediate threats to life, public health and safety.
- (b) Eliminate immediate threats of significant damage to improved public or private property.
- (c) Ensure economic recovery of the affected community.

Large-scale debris removal and disposal operations can be extremely costly. It is vital to determine if federal assistance will be provided and the rules that apply to such assistance before commencing debris removal operations. See the DEM *Texas Disaster Recovery Manual* for further information.

- (3) State law provides that state resources may not be used to clear or remove debris from local public property unless the local government presents the State an unconditional authorization for removal.

### b) Debris Removal from Private Property.

- (1) Debris removal from private property, including demolishing condemned structures, is generally the responsibility of the property owner, and the cost may be wholly or partly covered by insurance. If there has been a Presidential Disaster Declaration and debris on private property is so widespread that public health, safety, or the economic recovery is threatened, local government may be partially reimbursed for the cost of debris removal from private property. Local government normally has responsibility for picking up and disposing of debris from private property placed at the curb and bears the cost of that effort.

- (2) When the Governor has issued a disaster declaration for an emergency situation, § 418.023 of the Government Code law provides that state resources may be used to remove debris from private property. As a general rule, the property owner must authorize removal of debris, grant unrestricted access, and indemnify the state against any claim resulting from the removal.

As the Executive Order of the Governor Relating to Emergency Management provides that county judges and mayors who have issued a local disaster declaration may exercise the emergency powers of the Governor on an appropriate local scale, local governments may remove debris from private property subject to the same conditions cited above. Attachment 1 to this appendix provides a sample Debris Removal Access Agreement that should be used to meet statutory requirements.

#### B. Preparation for Debris Removal

Considerable time and labor can be saved in the debris removal process by sorting debris from public property and encouraging the public to sort debris from private property before it is picked up. A proactive public outreach program should advise the public of the actions they can take to facilitate pickup, including:

- 1) Sorting debris into categories – burnable natural debris, burnable construction and demolition debris, non-burnable debris, and potentially hazardous debris.
- 2) Placing sorted debris piles at curbside.
- 3) Keeping debris off roadways and away from fire hydrants and utility valves.
- 4) Disposing of household waste in normal refuse containers.

#### C. Estimating the Amount of Debris

In determining the means to be used to remove and dispose of debris, it is essential that local officials have a reasonable estimate of the amount of debris that must be removed and eventually disposed of. Attachment 3 to this appendix provides a methodology that may be used to estimate the amount of debris that must be removed.

#### D. Determining Debris Removal Strategy

- 1) After an estimate of the amount of debris that needs to be removed is made, options for removing the debris should be evaluated in terms of their cost and timeliness.
- 2) The general strategies for debris removal and processing are:
  - a) Removal and processing of debris by local government.
    - (1) Advantages:
      - Direct government control.
    - (2) Disadvantages:
      - Normally requires diversion of significant government resources from regular functions and makes them unavailable for other recovery tasks.
      - Speed of debris removal may be constrained by the government equipment and personnel available.
      - Local government may lack specialized equipment and skills needed to carry out all aspects of debris removal.
  - b) Removal and processing of debris by contractors.

- (1) Advantages:
  - Speed of debris removal may be increased by contracting for additional resources.
  - If local contractors are used, may provide local economic benefit.
- (2) Disadvantages:
  - Requires detailed contracts.
  - Requires extensive oversight and inspection.

c) Removal and processing of debris by a combination of local government and contractors.

- 3) If contractors are used, the disaster area should be divided into geographic sectors for control purposes and bids solicited based on the estimated quantity of debris in each sector. In defining sectors, it is desirable to group properties of like type, construction, and with similar vegetation together. This will also facilitate estimating the quantity of debris that needs to be removed.
- 4) Debris may be removed by one time collection of all debris at each property or using multiple passes to collect different types of material that have been pre-sorted by the property owner.

#### E. Establishing Temporary Debris Storage and Reduction (TDSR) Facilities.

- 1) The effective disposal of large quantities of disaster debris requires that suitable temporary storage and volume reduction facilities be established. Such facilities hold debris until it can be sorted, reduced in volume, and dispatched to an appropriate disposal facility. Sorting and volume reduction can significantly reduce the costs of disposing of debris and prevent potentially serious environmental problems.
- 2) Sorting. TDSR facilities sort debris and send it to the most appropriate facility for treatment or disposal. Sorting is needed to separate burnable from non-burnable materials and segregate hazardous products for disposal at authorized facilities and identify debris that can be burned, chipped or ground, recycled, or simply disposed of at a landfill without treatment.
- 3) The volume of debris can be greatly reduced by a variety of methods, including:
  - a) Incineration. This method includes open burning, use of air curtain pit incineration (trench burners), or use of portable air curtain incinerators. Incineration of burnable debris typically reduces its volume by 95 percent.
  - b) Chipping and grinding. Chipping and grinding is appropriate for clean, woody debris and typically reduces its volume by 75 percent. However, chipping and grinding normally costs as much as incineration and unless the resulting mulch can be disposed of without cost or at a profit, local government may incur additional costs to have the residual material hauled to a landfill.
  - c) Recycling. Recycling debris may present an opportunity to reduce the overall cost of disposal. Metals, lumber, and soil are the most likely candidates for

recycling. Before local government attempts to operate a recycling operation, it is essential to determine if there is, in fact, a market for the materials sorted out in the recycling process; otherwise the output may simply have to be hauled to a landfill. Specialized contractors may be willing to undertake recycling, particularly if it involves large amounts of well sorted debris.

#### 4) Site Selection

##### a) Criteria pertinent to selecting TDSR facilities are:

- (1) Preferably government-owned.
- (2) Large enough to accommodate a storage area, a sorting area, and volume reduction operations area(s).
- (3) Reasonable proximity to disaster areas and debris disposal sites.
- (4) Good road access.
- (5) Not in a residential area or in the vicinity of schools, churches, or other facilities with concentrations of population.
- (6) Not in an environmentally sensitive area, such as wetlands or a water well field.

##### b) Local landfills and possible local sites for TDSR facilities are described in Attachment 2 to this appendix. The selection of specific sites to be used for TDSR facilities will normally be made by a team of local, state, and, where appropriate, federal personnel, who are familiar with the local area and the specific environmental regulations governing such facilities. Attachment 3 to this appendix provides methods for determining space requirements for TDSR sites and estimating the quantity of debris that must be disposed of after processing.

#### F. Public Information and Instructions

- 1) In the aftermath of an emergency situation, the Public Information staff should provide the public detailed information on debris removal and disposal plans and procedures. Providing appropriate instructions to the public concerning debris removal can significantly reduce the time and costs involved. Public information on debris removal must start as soon as possible after the disaster – before people start moving and stacking large amounts of debris.
- 2) Public instructions should encourage citizens to:
  - a) Assist their neighbors, particularly the elderly or infirm, in removing debris.
  - b) Move debris to curbside for pickup.
  - c) Separate debris into the categories determined by local officials.
  - d) Keep debris piles away from fire hydrant and utility valves.
- 3) Public information should keep citizens advised of:
  - a) Debris pickup schedules and the system of pickup, if various types of debris will be picked up on different days.
  - b) Self help disposal guidelines for citizens and businesses that wish to haul their own debris to a debris storage area or landfill.

- 4) The normal methods of public information dissemination through the media should be used to provide information to the public. If loss of electric power has occurred, extra effort must be made to reach those without power using door hangers, flyers, signs, and, if necessary, door-to-door outreach.

#### G. Regulatory Issues and Technical Assistance

- 1) The Texas Commission on Environmental Quality (TCEQ) regulates the disposal of waste, including hazardous waste. TCEQ also issues emergency permits for debris incineration. Hence, the advice and assistance of TCEQ should be obtained in developing and implementing plans for debris disposal.
- 2) The Texas Department of State Health Services (DSHS) is the state agency responsible for ensuring food safety. The assistance of DSHS should be sought when there are questions regarding the safety of foodstuffs in damaged retail stores, warehouses, and processing facilities. DSHS has the authority to condemn unsafe foodstuffs so that they can be disposed of.
- 3) The Texas Animal Health Commission (TAHC) can provide advice and assistance regarding the disposition of dead animals. TAHC may also help identify stray live animals so they can be returned to their owners.

### 5. Organization

#### A. Phase 1 - Emergency Roadway Clearance

During Phase 1, our normal emergency organization as outlined in the Section VI.A of the Basic Plan and this annex should coordinate debris clearance operations. Debris clearance will normally be managed from the EOC. However, if debris is localized, an incident command operation may be established at the incident site to manage debris clearance.

#### B. Phase 2 - Debris Removal and Disposal

- 1) For small-scale debris removal and disposal operations, our normal emergency organization as outlined in the Basic Plan and this annex may coordinate debris removal and disposal.
- 2) For major emergencies or disasters that result in large volumes of debris, removal and disposal may have to continue for an extended period. For these situations, a Debris Management Task Force, consisting of personnel from those departments and agencies having the required expertise, shall be formed to manage debris removal and disposal operations. The Task Force should be comprised of personnel to perform the following functions:
  - a) Operations: Plan debris removal and processing, manage the use of government resources, and monitor the use of contract resources committed to the task.
  - b) Contracting & Procurement: Develop contracts for services and/or equipment, obtain bids, and award contracts.

- c) Legal: Contract review, manage authorizations for debris removal, and prepare legal documents for building condemnation and land acquisition.
- d) Administration: Provide supply, administrative, and accounting support.
- e) Engineering: Damage assessment, develop scopes of work and specifications for contracts, and prepare cost estimates.
- f) Public Information: Provide information and instructions relating to debris removal to the public.

It may be desirable to organize the Debris Management Task Force as an ICS operation under an Incident Commander.

- 3) If the government uses its own resources to remove debris, the primary role of the operations staff is to plan and supervise debris removal. If contractors will be removing debris, then the primary role of the operations staff is to monitor contractor work and ensure contract provisions are followed.

## 6. Task Assignments

### A. Phase 1 - Emergency Roadway Clearance

Task assignments shall be as stated in Section VI.B of this annex.

### B. Phase 2 - Debris Removal and Disposal Phase

Task assignments shall be determined by the Debris Management Task Force leader. General tasks of the various components of the Task Force are described in the Chapter 3 of the *FEMA Debris Management Guide* (FEMA-325).



**Attachment 2 of Appendix 2  
For ANNEX K**

**Landfills  
&  
Potential Temporary Debris Storage and Reduction (TDSR) Sites**

**1. Landfills**

- a. TASWA Landfill (903) 564-4749
  - 1) 25090 State Highway 56, Whitesboro, TX 76273
  - 2) Operated by: Texoma Area Solid Waste Authority
  - 3) Estimated capacity remaining: 26 million cy
  - 4) Estimated daily processing capacity: 700 tons/day
  - 5) Normal operating schedule: M-F 07:00 – 16:30  
Sat 07:00 – 13:00
  - 6) Restrictions: Any non-hazardous materials accepted
  - 7) Fees: \$24 / ton
  - 8) Other factors: None
  
- b. Name: Hillside Sanitary Landfill (903.868.0310)
  - 1) Address: 1100 Nelson Rd. Sherman, TX 75090
  - 2) Operated by: Waste Management of Texas
  - 3) Estimated capacity remaining (cubic yards): 2.9 million cy
  - 4) Estimated daily processing capacity: Unlimited
  - 5) Normal operating schedule: M-F 6am-5pm  
Sat. 7am – 12pm
  - 6) Restrictions: Any non-hazardous materials accepted
  - 7) Fees: Loose - \$ 8.55/cy Compacted - \$10.00/cy Non-compacted - \$25.55/cy  
Roofing Material - \$19.00/cy
  - 8) Other Factors: None

**2. Possible TDSR Facilities**

- a. Name: Ida Road Storage Facility
  - 1) Address: 1800 E. Ida Road
  - 2) Owner: City of Sherman
  - 3) Site size: 96 acres
  - 4) Fenced? Partially
  - 5) Road access: Off of Ida Road in Sherman TX.
  - 6) Neighbors: City of Sherman Animal Control Office
  - 7) Environmental concerns: Adjacent to Flood Plain

**Attachment 3 of Appendix 2  
For ANNEX K**

**Debris Estimation**

This attachment contains the following tabs:

1. Tab A – Estimating Debris Quantity.

This tab includes two worksheets (Worksheet 1 and Worksheet 2) which outline a methodology that can be used to estimate the quantity of debris produced by a disaster. The methodology allows the user to estimate the debris in various geographic areas (sectors) and then sum the amount of debris in each sector to determine the overall volume of debris that must be dealt with. The sectors developed in this process can be used in operational planning and contracting. To the extent possible, sectors should be drawn to encompass areas with buildings of similar construction and vegetative cover.

[The methodology in this tab should not be used for hurricane debris; use the methodology in Tab E instead.]

2. Tab B – Estimating Debris Removal Time. This tab includes two worksheets (Worksheet 3 and Worksheet 4). The worksheets provide a methodology that can be used to estimate the time in days that it will take to remove specific quantities of debris given a known set of hauling resources and a reasonable estimate of the cycle time for those resources (time spent in pickup, hauling, unloading, and, waiting on one trip).
3. Tab C – Estimating Debris Disposal Quantity. Worksheet 5 outlines a method to determine the volume of debris that will have to be disposed of after sorting and volume reduction, given information on the composition of debris that must be disposed of. To utilize this methodology, you must remove a sample of debris in each sector and sort it to determine the characteristics of the debris from that sector. If the sample of debris is not representative of debris in the sector, this method will be inaccurate.
4. Tab D – Estimating Requirements for Debris Processing. Worksheet 6 can be used to estimate how much space will be required for temporary debris storage and reduction facilities. This worksheet is based on a US Army Corps of Engineers methodology.
5. Tab E – Estimating Hurricane Debris Quantity. Worksheet 7 can be used to estimate the quantity of debris produced by a hurricane. This worksheet is based on US Army Corps of Engineers methodology.

**Tab A**

**ESTIMATING DEBRIS QUANTITY**

Complete a separate Worksheet 1 for each Sector.  
 Transfer results from each Worksheet 1 to Worksheet 2.  
 CF = cubic feet & CY = cubic yards

**Use Tab E for Estimating Hurricane Debris**

| <b>WORKSHEET 1</b>               |  |               |                   |               |
|----------------------------------|--|---------------|-------------------|---------------|
| <b>Sector:</b>                   |  |               |                   |               |
| Description:                     |  | N =<br>Number | M =<br>Multiplier | CY =<br>(NxM) |
| A. Homes (1800-2000 square feet) |  | 100           | 300               | 30000         |
| B. Mobile Homes                  |  | 130           | 80                | 10400         |
|                                  |  |               |                   |               |

| C. Other Buildings              | L =<br>Length/ft | W =<br>Width/ft | H =<br>Height/ft | CF =<br>(LxWxH) | CY =<br>(CF/27) x.33 |
|---------------------------------|------------------|-----------------|------------------|-----------------|----------------------|
| Apex Center                     | 250              | 60              | 10               | 150000          | 1833                 |
| Anchor Fire Station             | 100              | 100             | 12               | 120000          | 1467                 |
| Teasdale School                 | 125              | 100             | 10               | 125000          | 1527                 |
|                                 |                  |                 |                  |                 |                      |
|                                 |                  |                 |                  |                 |                      |
|                                 |                  |                 |                  |                 |                      |
|                                 |                  |                 |                  |                 |                      |
|                                 |                  |                 |                  |                 |                      |
| Subtotal [sum the right column] |                  |                 |                  |                 | 4827                 |

| D. Debris Piles                 | L =<br>Length/ft | W =<br>Width/ft | H =<br>Height/ft | CF =<br>(LxWxH) | CY<br>(CF/27) |
|---------------------------------|------------------|-----------------|------------------|-----------------|---------------|
| Crystal Creek @ Compton         | 150              | 8               | 4                | 4800            | 177           |
| Hungry Hollow Bridge            | 80               | 20              | 8                | 12800           | 474           |
| Willow Road @ Newton            | 100              | 16              | 5                | 8000            | 296           |
|                                 |                  |                 |                  |                 |               |
|                                 |                  |                 |                  |                 |               |
|                                 |                  |                 |                  |                 |               |
|                                 |                  |                 |                  |                 |               |
|                                 |                  |                 |                  |                 |               |
| Subtotal [sum the right column] |                  |                 |                  |                 | 947           |

| <b>WORKSHEET 2</b>                             | <b>Sector A</b> | <b>Sector B</b> | <b>Sector C</b> | <b>Sector D</b> |
|--|-----------------|-----------------|-----------------|-----------------|
| <i>Debris Volume Estimate (cubic yards/CY)</i> |                 |                 |                 |                 |
| A. Homes [from Worksheet 1]                    | 30000           | 4200            |                 |                 |
| B. Mobile Homes [from Worksheet 1]             | 10400           | 2400            |                 |                 |
| C. Other Buildings [from Worksheet 1]          | 4827            | 1021            |                 |                 |
| SD = Structural debris (A + B + C)             | 45227           | 7621            |                 |                 |
| V = Vegetation Multiplier [see note]           | 1.3             | 1.1             |                 |                 |
| ST = Subtotal (SD x V)                         | 58795           | 8383            |                 |                 |
| D. Debris Piles [from Worksheet 1]             | 947             | 1200            |                 |                 |
| E. SV = Sector Volume (ST + D)                 | 59742           | 9583            |                 |                 |
| TOTAL [add entries in row E above]             | 69325           |                 |                 |                 |

Note:

|                           |                         |            |
|---------------------------|-------------------------|------------|
| V= Vegetative Multiplier: | <u>Vegetative Cover</u> | <u>V =</u> |
|                           | None                    | 1          |
|                           | Light                   | 1.1        |
|                           | Medium                  | 1.3        |
|                           | Heavy                   | 1.5        |

**Tab B**  
**ESTIMATING DEBRIS REMOVAL TIME**

Worksheets 3 and 4 may be used to estimate the time it will take to remove a quantity of debris given information on the quantity and capacity of the hauling resources available and estimates of the cycle time for those resources. Cycle time is the time it takes a cargo truck to complete a round trip. Cycle time is computed by adding the time it takes to load a truck, the round-trip travel time between the loading point and the off-load point, unloading time, and any unproductive waiting time. This methodology will be most accurate if you use times observed during actual operations, not theoretical numbers.

| <b>WORKSHEET 3</b>  | <b>Sector A</b> | <b>Sector B</b> | <b>Sector C</b> | <b>Sector D</b> |
|---|-----------------|-----------------|-----------------|-----------------|
| A. Debris to be Removed in cubic yards (CY) from Worksheet 2 or 7 | 59742           | 9583            |                 |                 |
| <i>Removal Cycle (all times in hours)</i>                         |                 |                 |                 |                 |
| B. Estimated loading time   | .2              | .2              |                 |                 |
| C. Estimated travel time (roundtrip)                              | .4              | .6              |                 |                 |
| D. Estimated unload time  | .1              | .1              |                 |                 |
| E. Estimated waiting time   | .1              | .1              |                 |                 |
| F. Cycle time (B+C+D+E)   | .8              | 1.0             |                 |                 |
| G. Daily work period  | 7.5             | 7.5             |                 |                 |
| H. Cycles per day (G / F)   | 9               | 7               |                 |                 |
| <i>Removal Time</i>   |                 |                 |                 |                 |
| I. Capacity (CY) per cycle [ Worksheet 4]                         | 136             | 136             |                 |                 |
| J. Capacity (CY) per day [H x I]                                  | 1224            | 952             |                 |                 |
| K. Days to Clear Sector [A / J]                                   | 48.8            | 10.0            |                 |                 |
| L. Days to Clear All Sectors<br>[add entries in Row K above]      | 58.8            |                 |                 |                 |

| <b>WORKSHEET 4</b>                                | <b>A.<br/>Truck Capacity<br/>(CY)</b> | <b>B.<br/>Units<br/>Available</b> | <b>C.<br/>Group Capacity<br/>(AxB)</b> |
|---|---------------------------------------|-----------------------------------|--|
| <i>Equipment</i>                                  |                                       |                                   |  |
| Dump Truck, Light                                 | 6                                     | 4                                 | 24                                     |
| Dump Truck, Medium                                | 8                                     | 4                                 | 32                                     |
| Dump Truck, Heavy                                 | 10                                    | 8                                 | 80                                     |
| Capacity Per Cycle (CY)<br>[sum the right column] |                                       |                                   | 136                                    |

Note: In estimating units available, it is essential to consider that some equipment may not operationally ready each day. Hence, an out-of-service factor based on local experience should be applied to obtain a realistic estimate of equipment available for use on a daily basis.

**Tab C**  
**ESTIMATING DEBRIS DISPOSAL QUANTITY**

Worksheet 5 provides a method of estimating the volume of debris that will have to be disposed of after volume reduction. It requires taking a **sample of the debris in each sector** to determine the percent of burnable debris (B below), the percent of burnable C&D debris (C below), the percent of non-burnable debris (D below) broken down by recyclable materials (D-1) and other material (D-2), and the percent of hazardous debris. In taking a sample, it is desirable to include debris from at least 10 properties.

| <b>Worksheet 5</b>   | <b>Sector 1</b> | <b>Sector 2</b> | <b>Sector 3</b> | <b>Sector 4</b> |
|--|-----------------|-----------------|-----------------|-----------------|
| <i>Sample Debris Characteristics</i>                                     |                 |                 |                 |                 |
| A. Debris volume [from Worksheet 2]                                      | 59742           | 9583            |                 |                 |
| B. % Burnable Natural Debris   | .30             | .40             |                 |                 |
| C. % Burnable C&D Debris   | .32             | .28             |                 |                 |
| D. % Non-Burnable Debris   | .35             | .32             |                 |                 |
| D-1. Potentially Recyclable  | .07             | .10             |                 |                 |
| D-2. Landfill  | .28             | .20             |                 |                 |
| E. % Hazardous Debris  | .03             | .02             |                 |                 |
| <i>Disposal Volume (cubic yards)</i>                                     |                 |                 |                 |                 |
| F. Burnable Natural Debris (A x B)                                       | 17922           | 3833            |                 |                 |
| F-1. Amount to be chipped/ground <sup>1</sup>                            | 200             | 0               |                 |                 |
| F-2. Amount to be burned   | 17722           | 3833            |                 |                 |
| G. Burnable C&D Debris (A x C)   | 19117           | 2683            |                 |                 |
| H. Total Burnable (F-2 + G)  | 36839           | 6516            |                 |                 |
| I. Volume for disposal after burning (H x .05)                           | 1841            | 326             |                 |                 |
| J. Volume for disposal after chipping or shredding (F-1 x .25)           | 50              | 0               |                 |                 |
| K. Non-Burnable Debris (A x D)   | 20910           | 3067            |                 |                 |
| L. Less Non-Burnables to be Recycled <sup>2</sup>                        | 5400            | 767             |                 |                 |
| M. Volume of Non-Burnables for Disposal (K - L)                          | 15510           | 2300            |                 |                 |
| N. Volume (Non-hazardous) for Landfill Disposal (I + J + M) <sup>3</sup> | 17401           | 5693            |                 |                 |
| N. Total for Landfill Disposal<br>[add quantities in row N above]        | 23094           |                 |                 |                 |
| O. Volume for Hazmat Disposal (A x E)                                    | 1792            | 191             |                 |                 |
| P. Total for Hazmat Disposal<br>[add quantities in row O above]          | 1983            |                 |                 |                 |

Notes:

- Local officials need to decide how much debris to chip or grind instead of burning. The quantity should be based on a) the amount of chipped/ground wood that local government wants to retain for use as mulch and b) the amount that can be disposed of without cost or at some profit to landscape products firms. Since chipping and grinding costs approximately the same as burning and produces a higher volume of residue, there is little reason to chip and grind instead of burning if you also have to pay to have the resulting mulch hauled away.
- This number should be based on the proportion of recyclable materials for which you can determine there is a ready market. Recycling materials for which there is no market simply leaves you sorted debris to haul to the landfill.
- If mulch produced in the chipping and grinding operation is hauled away without cost, do not include it (Item J) in the equation because disposal of that material is no longer your problem.

**Tab D**  
**ESTIMATING REQUIREMENTS FOR DEBRIS STORAGE & PROCESSING SITES**

This methodology may be used to determine the space required for debris storage and processing sites.

It assumes that:

1. Debris will be stacked 10 feet high.
2. 40 percent of a site will be used for storage; 60 percent will be used for sorting areas, separation between debris piles, roads, site buffers, and burn pits

| <b>WORKSHEET 6</b>  |  |       |
|---|--|-------|
| A. Debris Volume in cubic yards (CY)<br>[From Worksheet 2 or 7] |  | 69325 |
| B. CY per acre assuming 10' stack height <sup>1</sup>           |  | 16117 |
| C. Acres for debris storage only (A/B)                          |  | 4.3   |
| D. Multiplier for processing, roads, & buffers                  |  | 1.66  |
| E. Required facility area in acres <sup>2</sup>                 |  | 7.1   |
|   |  |       |
|   |  |       |

Notes:

1. **If you plan to use a stack height other than the typical 10 feet, use the following formula to compute CY per acre:**

$$\text{CY} = (\text{stack height in feet} / 3) \times 4840$$

2. Where the area requirement is large, the requirement is generally satisfied by establishing several sites that, taken collectively, provided the needed area.

**Tab E**  
**ESTIMATING HURRICANE DEBRIS QUANTITY**

Worksheet 7 may be used to estimate the quantity of debris that must be removed. This worksheet uses the formula  $Q = H \times C \times V \times B \times S$ , where:

- Q = the quantity of debris in cubic yards (CF)
- H = the number of households
- C = the storm factor in CY:
- V = the vegetation characteristic multiplier:
- B = the business/commercial use multiplier
- S = the storm precipitation characteristic multiplier

| <b>WORKSHEET 7</b>                         | <b>Sector A</b> | <b>Sector B</b> | <b>Sector C</b> | <b>Sector D</b> |
|--|-----------------|-----------------|-----------------|-----------------|
| <i>Debris Volume Estimate - Hurricane</i>  |                 |                 |                 |                 |
| 1. H = households                          | 5167            | 2100            |                 |                 |
| 2. C = Storm category                      | 26              | 8               |                 |                 |
| 3. V = Vegetation multiplier               | 1.5             | 1.1             |                 |                 |
| 4. B = Business/commercial multiplier      | 1.3             | 1.0             |                 |                 |
| 5. S = Storm precipitation multiplier      | 1.3             | 1.3             |                 |                 |
| 6. Q = H x C x V x B x S                   | 340557          | 24024           |                 |                 |
| <b>TOTAL (add columns in item 6 above)</b> | <b>364581</b>   |                 |                 |                 |

Notes:

1. H = Households. If you do not know the number of households, estimate the number by dividing the population of the area by 3.

|                           |                 |            |
|---------------------------|-----------------|------------|
| 2. C = Hurricane Category | <u>Category</u> | <u>C =</u> |
|                           | 1               | 2          |
|                           | 2               | 8          |
|                           | 3               | 26         |
|                           | 4               | 50         |
|                           | 5               | 80         |

|                             |                         |            |
|-----------------------------|-------------------------|------------|
| 3. V= Vegetative Multiplier | <u>Vegetative Cover</u> | <u>V =</u> |
|                             | None                    | 1          |
|                             | Light                   | 1.1        |
|                             | Medium                  | 1.3        |
|                             | Heavy                   | 1.5        |

|   |                |            |
|---|----------------|------------|
| 4. B = Business/Commercial Density Multiplier | <u>Density</u> | <u>B =</u> |
|   | Light          | 1.0        |
|   | Medium         | 1.2        |
|   | Heavy          | 1.3        |

|                                       |                      |            |
|---------------------------------------|----------------------|------------|
| 5. S = Storm Precipitation Multiplier | <u>Precipitation</u> | <u>S =</u> |
|                                       | None to Light        | 1.0        |
|                                       | Medium to Heavy      | 1.3        |