

ANNEX K

PUBLIC WORKS & ENGINEERING

City Of Navasota

State Planning Standards Checklist for Annex K, Public Works & Engineering


Jurisdiction: City of Navasota

Annex Date: May 18, 2006 **Date of most recent change, if any:** May 4, 2011
 (The date which appears on the signature page)

Note: The annex will be considered Deficient if the *italicized* standards are not met.

This Annex shall:	Section/paragraph
<i>I. Authority</i>	
K-1. Identify local, state, and federal legal authorities pertinent to the subject of the annex in addition to those cited in the basic Plan.	I
<i>II. Purpose</i>	
K-2. Include a purpose statement that describes the reason for development of the annex.	II
<i>III. Explanation of Terms</i>	
K-3. Explain and/or define terms and acronyms used in the annex.	III
<i>IV. Situation & Assumptions</i>	
<i>K-4. Include a situation statement related to the subject of the annex.</i>	IV.A
<i>K-5. Include a list of assumptions used in planning for emergency public works & engineering operations.</i>	IV.B
<i>V. Concept of Operations</i>	
<i>K-6. Describe the local concept of operations for emergency public works & engineering operations.</i>	V.A
<i>K-7. Explain the role of public works & engineering elements in pre-emergency resource protection.</i>	V.B
<i>K-8. Explain the role of public works & engineering elements in post-emergency damage assessment.</i>	V.D
<i>K-9. Describe the role of public works & engineering elements in debris management.</i>	Appendix 2
<i>K-10. Explain the role of public works & engineering elements in repairing and restoring government facilities and infrastructure.</i>	V.F
<i>K-11. Include a list of actions by phases of emergency management to be taken to insure an adequate public works & engineering capability during emergency situations</i>	V.G
<i>VI. Organization & Assignment of Responsibilities</i>	
<i>K-12. Describe the emergency organization that will carry out the public works & engineering function, in accordance with NIMS/NRF, during emergencies.</i>	VI.A
<i>K-13. Include a listing by organization and/or position of the responsibilities for public works & engineering tasks during emergencies.</i>	VI.B
<i>VII. Direction & Control</i>	
<i>K-14. Describe how public works & engineering efforts in support of emergency operations will be directed and controlled, all in accordance with NIMS.</i>	VII.A-G
<i>K-15. Indicate the line of succession for key public works & engineering personnel.</i>	VII.H
<i>VIII. Readiness Levels</i>	

K-16. Describe emergency actions relating to public works & engineering to be taken at various readiness levels.	VIII
IX. Administration & Support	
K-17. Outline policies relating to management of public works & engineering resources.	IX.A
K-18. Describe public works & engineering communication systems.	IX.B & Appendix 1
K-19. Make reference to a list of key local facilities having general priority for protection, repair, and restoration	IX.C
K-20. Outline policies relating to reporting and record keeping.	IX.D & E
X. Annex Development & Maintenance	
K-21. Specify the individual(s) by position responsible for developing and maintaining the annex.	X.A
K-22. Make reference to the schedule for review and update of annexes contained in Section X of the Basic Plan.	X.B
XI. References	
K-23. List references pertinent to the content of the annex not listed in the Basic Plan.	XI
Other	
K-24. Describe the general concept of operations for debris management.	Appendix 2, Section 4
K-25. Describe the local organization for debris management.	Appendix 2, Section 5
K-26. Include a sample debris removal access agreement.	Appendix 2, Atch 1
K-27. List local landfills and potential temporary debris storage and reduction sites.	Appendix 2, Atch 2
K-28. Include methods for estimating debris or make reference to methodologies located in another document.	Appendix 2, Atch 3

FOR LOCAL GOVERNMENT USE	Signature	Date
This Checklist Completed By		5/4/2011

FOR DEM USE	Initials	Date
TDEM Regional Liaison Officer Review		
TDEM Preparedness Section Processing		

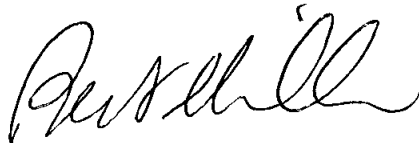
APPROVAL & IMPLEMENTATION

**Annex K
PUBLIC WORKS
&
ENGINEERING**



Signature, City of Navasota EM Coordinator

May 4, 2011
Date



Signature, City of Navasota Mayor

May 4, 2011
Date

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 530-06 provides for emergency purchasing or contracting.

City Ordinances 436-00 and 514-05 provides for demolition of damaged structures during emergency situations.

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
TDEM	Texas Division of Emergency Management
IC	Incident Commander
ICP	Incident Command Post
ICS	Incident Command System
NIMS	National Incident Management System
NRF	National Response Framework
SAR	Search and Rescue
SOG	Standard Operating Guidelines
TAHC	Texas Animal Health Commission
TDH	Texas Department of Health
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. Debris collection and transport to a temporary storage site for sorting and/or volume reduction or to a permanent disposal site. Debris removal also includes damaged structure demolition and removal.

IV. SITUATION & ASSUMPTIONS
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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 anticipates emergency situations may occur which threaten public health, safety, and property. An emergency situation of this nature may require emergency public works and engineering services.

B. Assumptions

1. Employing public works and engineering personnel and equipment during pre-disaster operations should minimize disaster damage. Advance preparation of personnel and equipment may also hasten restoration efforts.
2. Local departments and agencies responsible for the public works and engineering function may have insufficient resources to remove the debris created by a major emergency or disaster and accomplish other recovery tasks.
3. Public works & engineering 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 and engineering 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. 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. These hazards could pose a threat to public works and engineering personnel and impede operational capabilities.
8. Alternate disposal methods and facilities may be needed as local landfills and waste disposal facilities may prove inadequate to deal with large amounts of debris. Special considerations must be made if the debris has been contaminated with chemicals or petroleum products.
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 and engineering 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. Inspect damaged structures.
5. Clear debris from roadways and make repairs to reopen transportation arteries.
6. Make expedient repairs to essential public facilities to restore operations or protect them from further damage.
7. Remove debris from public property and manage debris disposal operations for public and private property.
8. Assist in controlling public access to hazardous areas.

B. Protecting Resources and Preserving Capabilities

1. Public works and engineering resources may be employed during slow developing emergency situations to protect and limit damage to government facilities, equipment, and essential utilities. Protective actions may include sandbagging, building protective levees, ditching, installing protective window coverings, or removing vital equipment. Public works and engineering 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 and engineering 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. Public works and engineering departments will lead preliminary damage assessments of public buildings, homes, businesses, roads, bridges, and other infrastructure following a disaster. Damage assessment procedures and forms used in the assessment processes are discussed in Annex J, Recovery.
2. Public works and engineering personnel shall inspect damaged structures. Inspections are conducted to identify unsafe structures and, if necessary, take actions to restrict entry and occupancy until the structures can be made safe.
3. Damaged buildings posing an immediate threat to public health and safety should be appropriately posted to restrict public access pending repairs or demolition. Local ordinance or regulation provides for demolition of structures that pose a threat to public health during emergency situations.

E. Debris Clearance and Removal

See Appendix 2, Debris Management.

F. Temporary Repairs and Restoration

1. The public works and engineering staff 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. 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. Reduce vulnerability of new public facilities to known hazards through proper design and site selection.
- c. Develop plans to protect facilities and equipment at risk from known hazards.
- d. 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. Establish and train damage survey teams.
- i. Execute contingency contracts for emergency equipment and services with local contractors and execute agreements with individuals and businesses to borrow equipment.
- j. Develop procedures to support or accomplish the tasks outlined in this annex.
- k. Ensure government-owned vehicles and other equipment can be fueled during an electrical outage.

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. Make repairs to damaged government facilities and equipment, as needed.
- h. Coordinate with the Energy & Utilities staff to arrange for emergency electrical service, if required, to support emergency operations.
- i. Assist Utility Department in making emergency repairs to government-owned utility systems, as necessary. See Annex L, Utilities.
- j. Restrict access to hazardous areas, using barricades and temporary fencing, upon request.

4. Recovery

- a. Repair or contract repairs to government-owned buildings, roads, bridges, and other infrastructure.
- b. Support community clean up efforts, as necessary.
- c. Participate in compiling estimates of damage and response and recovery costs.
- d. Participate in post-incident review of emergency operations and make necessary changes to improve emergency plans and procedures.

VI. ORGANIZATION & ASSIGNMENT OF RESPONSIBILITIES

A. Organization

1. The function of public works and 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 Framework (NRF) 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. During an Incident of National Significance or Disaster Declaration under the Stafford Act Public Assistance Program, Public Works and Engineering may integrate, as required, with the National Response Framework (NRF), Emergency Support Function (ESF) #3 activities. The Federal ESF #3 will develop work priorities in cooperation with state, local, and/or tribal governments and in coordination with the Federal Coordinating Officer and/or the Federal Resource Coordinator. (See Annex 3, Public Works and Engineering – National Response Framework).

B. Assignment of Responsibilities

1. The City Public Works Director will serve as the Public Works 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 and 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 and implement procedures to ensure a coordinated effort between the various local departments and agencies that perform the public works and engineering functions. Ensure appropriate emergency response training for assigned personnel in accordance with Section IX.D of the Basic Plan.
 - 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 and 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).
2. The Public Works Department will:
 - a. Carry out pre-disaster protective actions for impending hazards, including identifying possible facilities for debris storage and reduction.
 - b. Conduct damage assessments in the aftermath of disaster.
 - c. Repair and protect damaged government facilities.

- d. Provide heavy and specialized equipment support for SAR operations.
 - e. Carry out debris clearance and removal. See Appendix 2.
 - f. With the assistance of the Legal Officer, negotiate inter-local agreements for public works and engineering support.
 - g. Maintain stockpiles of disaster supplies such as sandbags, plastic sheeting, and plywood.
3. The Public Works Director/Building Official will:
- a. Develop damage assessment procedures and provide training for damage survey teams.
 - b. Provide engineering services and advice to the Incident Commander and EOC staff.
 - c. Assist in conducting damage assessments in the aftermath of an emergency. See Annex J, Recovery.
 - d. Safeguard vital engineering records.
4. Public Works Department/Streets and Drainage will:
- a. Maintain reasonable stockpiles of emergency paving materials.
 - b. Make emergency repairs to city roads, bridges, culverts, and drainage systems.
 - c. Supervise debris clearance from the public right-of-way and support debris removal operations.
 - d. Emplace barricades where needed for safety.
 - e. Provide personnel and equipment to aid in SAR operations as needed.
 - f. Provide heavy equipment support for protective actions taken prior to an emergency and for response and recovery operations.
 - g. Assist in repairs to government-owned utilities and drainage systems.
5. The Public Works/Sanitation Departments will:
- a. Collect and properly dispose of refuse.
 - b. Support emergency public works and engineering operations with available resources.

6. The Inspection Department will:
 - a. Support damage assessment operations.
 - b. Determine if access to damaged structures should be restricted or if they should be condemned and demolished.
 - c. Inspect expedient shelter and mass care facilities for safety.
7. Embarq Communications will:
 - a. Restore damaged communications systems.
 - b. Provide communications technical and equipment support for emergency operations.
8. Parks and Recreation Department will:
 - a. Assess damage to parks and recreation facilities and assist in assessing damage to other facilities.
 - b. Provide personnel and light equipment support for public works and engineering operations.
 - c. Upon request, establish and staff a facility to sort and catalog property removed from damaged government-owned facilities.

VII. DIRECTION & CONTROL

- A.** The Mayor shall, pursuant to NIMS, provide general guidance for the public works and engineering function and, when necessary, approve requests for state or federal resources.
- B.** The Incident Commander (IC) will manage public works and engineering emergency 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 Works Officer will manage the emergency public works and engineering function from the EOC. The IC shall direct resources committed to the incident site and coordinate resource requests through the Public Works Officer. The Public Works Officer shall manage resources not committed to the incident site and coordinate the provision of additional resources from external sources.
- D.** The Public Works Officer will respond to mission priorities established by the IC or the EMC/City Manager, 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 Works 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 and 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. Building Official
 - 2. Utility Superintendent

VIII. READINESS LEVELS

A. Readiness Level IV - Normal Conditions

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

B. Readiness Level III - 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 II - 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 I - 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.

IX. ADMINISTRATION & SUPPORT

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 and 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 Bryan. Cities must request resource support from their county before requesting assistance from the State in accordance with Section V.F of the Basic Plan.

B. Communications

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

C. 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 shall determine the specific priority for public works and engineering work on each of these facilities in the aftermath of an emergency.

D. 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).

E. 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 and engineering elements will maintain detailed records of labor, materials, equipment, contract services, and supplies consumed during large-scale emergency operations.

F. Post Incident Review

For large-scale emergency operations, the City Manager/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 EMC is responsible for developing and maintaining this annex.
- 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 SOGs covering those responsibilities.

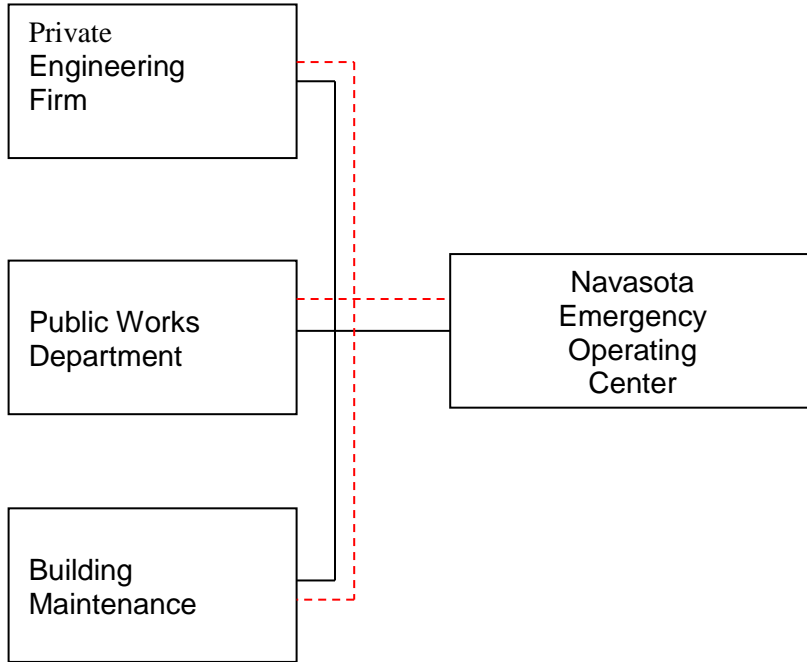
XI. REFERENCES

- 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 1Public Works & Engineering Communications Network
Appendix 2 Debris Management

PUBLIC WORKS & ENGINEERING COMMUNICATIONS NETWORK



LEGEND:

- TELEPHONE
- - - RADIO

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 down 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 Health (TDH) is the state agency responsible for ensuring food safety. The assistance of TDH should be sought when there are questions regarding the safety of foodstuffs in damaged retail stores, warehouses, and processing facilities. TDH 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 1

Debris Removal Access Agreement

I/We _____, the owner(s) of the property
commonly identified as _____,
(street address)
_____, State of Texas
(city/town) _____ (county)

do hereby grant and give freely and without coercion, the right of access and entry to said property to the [County/City] of _____, its agencies, contractors, and subcontractors thereof, for the purpose of removing and cleaning any or all storm-generated debris of whatever nature from the above described property.

It is fully understood that this agreement is not an obligation to perform debris clearance. The undersigned agrees and warrants to hold harmless the [City/County] of _____, State of Texas, its agencies, contractors, and subcontractors, for damage of any type, whatsoever, either to the above described property or persons situated thereon and hereby release, discharge, and waiver any action, either legal or equitable that might arise out of any activities on the above described property. The property owner(s) will mark any storm damaged sewer lines, water lines, and other utility lines located on the described property.

I/We (have _____, have not _____)(will _____, will not _____) received any compensation for debris removal from any other source including Small Business Administration (SBA), National Resource Conservation Service (NRCS), private insurance, individual and family grant program or any other public assistance program. I will report for this property any insurance settlements to me or my family for debris removal that has been performed at government expense. For the considerations and purposes set forth herein, I set my hand this _____ day of _____ 20____.

Owner

Owner

Telephone No. _____ Address _____

Witness

Attachment 2

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

1. Landfills

- a. Name: Rock Prairie Road Landfill
 - 1) Address: 7600 E. Rock Prairie Rd., College Station, TX 77845
 - 2) Operated by: City of College Station
 - 3) Estimated capacity remaining (cubic yards): 2,360,000
 - 4) Estimated daily processing capacity: 1,000 tons
 - 5) Normal operating schedule: M-F, 7am to 5pm; Sat, 7am to 1pm
 - 6) Restrictions: All loads must be secured. \$10 per ton charge
 - 7) Fees: \$23.50 per ton; \$10 disposal fee for Freon containing units – refrigerators, freezers, and A/C units
 - 8) Other Factors: N/A

2. Possible TDSR Facilities

- a. Name: City of Navasota Abandoned Landfill Property
 - 1) Address: CR 415, Navasota, TX (outside of city limits in Grimes County)
 - 2) Owner: City of Navasota
 - 3) Site size (acres): 31 acres
 - 4) Fenced? Yes
 - 5) Road access: Yes (asphalt) – Located 1.5 miles SE of Navasota, 2.0 miles SE of SH 6 & SH 105 and .25 miles S of CR 415
 - 6) Neighbors: Yes – within 2,000 feet of site
 - 7) Environmental concerns: N/A
- b. Name: City of Navasota Recycle Station (Compost Facility)
 - 1) Address: 501 Fifth St., Navasota, TX (within city limits)
 - 2) Owner: City of Navasota
 - 3) Site size (acres): 5.42 acres
 - 4) Fenced? Yes
 - 5) Road access: Yes (asphalt) – Located 2 mi W of SH 6 & SH 90 and .25 mi. NW of SH 105 W
 - 6) Neighbors: Yes – within 1,000 feet site
 - 7) Environmental concerns: Located near Cedar Creek, Flows West outside of the City

Attachment 3

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

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

C. Other Buildings	L = Length/ft	W = Width/ft	H = Height/ft	CF = (LxWxH)	CY = (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 = Length/ft	W = Width/ft	H = Height/ft	CF = (LxWxH)	CY (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

WORKSHEET 2	Sector A	Sector B	Sector C	Sector D
<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.

WORKSHEET 3	Sector A	Sector B	Sector C	Sector D
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 [add entries in Row K above]	58.8			

WORKSHEET 4	A. Truck Capacity (CY)	B. Units Available	C. Group Capacity (AxB)
<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) [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.

Worksheet 5	Sector 1	Sector 2	Sector 3	Sector 4
<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 ¹	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 ²	5400	767		
M. Volume of Non-Burnables for Disposal (K - L)	15510	2300		
N. Volume (Non-hazardous) for Landfill Disposal (I + J + M) ³	17401	5693		
N. Total for Landfill Disposal [add quantities in row N above]	23094			
O. Volume for Hazmat Disposal (A x E)	1792	191		
P. Total for Hazmat Disposal [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

WORKSHEET 6		
A. Debris Volume in cubic yards (CY) [From Worksheet 2 or 7]		69325
B. CY per acre assuming 10' stack height ¹		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 ²		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

WORKSHEET 7	Sector A	Sector B	Sector C	Sector D
<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		
TOTAL (add columns in item 6 above)	364581			

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