ANNEX K

Public Works and Engineering

Fort Bend County

09/06/2018 Original sent to Alan Spears, Emergency Management office

APPROVAL & IMPLEMENTATION

Annex K

Public Works & Engineering

This annex is hereby accepted for implementation and supersedes all previous editions.

Approved:

Robert E. Hebert
County Judge
Fort Bend County

9-4-2018
Date

Reviewed by:

Marc Grant
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8/24/18
Date

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RECORD OF CHANGES

Annex K

Public Works
&
Engineering

Change #	Date of Change	Entered By	Date Entered
1	8/2006	NIMS – Jill Boehm	8/2006
2	2/2011	Update – Judy Lefevers	2/2011
3	8/2013	Add Appendix 3-Alan Spears	8/2013
4	9/2013	Update Appendix 3- Alan Spears	09/2013
5	8/2018	Updated Appendix 4-Alan Spears	8/2018

ANNEX K
Public Works & Engineering

I. AUTHORITY

See Basic Plan Section I.

Texas Government Code, Section 418.023, Clearance of Debris.

Fort Bend County Debris Management Plan

Fort Bend County Levee Emergency Action Plan

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	Department of Public Safety
EOC	Emergency Operations Center
EMC	Emergency Management Coordinator
FEMA	Federal Emergency Management Agency
IC	Incident Commander
ICP	Incident Command Post
ICS	Incident Command System
LID	Levee Improvement District
MUD	Municipal Utility District
NIMS	National Incident Management System
NRF	National Response Framework
SAR	Search and Rescue
SOP	Standard Operating Procedures
TAHC	Texas Animal Health Commission
TCEQ	Texas Commission on Environmental Quality
TDEM	Texas Division of Emergency Management
TDSHS	Texas Department of State Health Services
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.

IV. SITUATION & ASSUMPTIONS

A. Situation

1. See the general situation statement and hazard summary in Section IV.A of the Basic Plan.

2. Fort Bend County can expect to experience emergency situations that could threaten public health and safety and private and public property and necessitate the need for emergency public works and engineering services.

3. Fort Bend County can expect to experience emergency situations that could compromise the levee systems within the county. The failure of levees within FBC could expose the community to potentially hazardous situations, both natural and man-made warrant the need for a comprehensive emergency plan related to critical infrastructure and engineering.

B. Assumptions

1. Public Works and Engineering 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 and Engineering function probably do not have sufficient resources to cope with a major disaster.

3. Public Works and Engineering departments and agencies can reasonably be expected to accomplish expedient repair and restoration of essential services and vital facilities, but it will probably be necessary to contract for major reconstruction.

4. Private construction and engineering firms and equipment rental contractors have staff and equipment resources that may be contracted for to carry out Public Works and Engineering activities during emergency situations. However, local governmental units, including MUDs and LIDs may have to compete with businesses and individuals seeking those resources for repairs or rebuilding.

5. Assistance may be available from other jurisdictions through inter-local agreements and from commercial firms through contingency contracts. Some types of emergency situations, including hurricanes and floods may affect large areas, making it difficult to obtain assistance from usual sources.

6. Damage to chemical plants, power lines, sewer and water distribution systems, and secondary hazards, such as fires, could result in health and safety hazards that may pose a threat to Public Works and Engineering personnel.

7. 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.

8. Levee operators, engineers, or appropriate personnel and equipment may be utilized prior to disaster in an attempt to reduce the severity or aftermath of a disaster and to restore critical equipment and infrastructure to the levee systems.

9. During any levee emergency, all available equipment and appropriate personnel associated with affected levees will assist in coping with any anticipated disaster with the coordination of resources.

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, taking actions to protect government facilities, equipment and supplies prior to the onset of hazardous conditions.
2. Providing heavy equipment support for search and rescue operations.
3. Providing maintenance and fuel for vehicles and equipment.
4. Surveying damage to public facilities, roads, bridges, and other infrastructure.
5. Inspecting damaged structures.
6. Clearing debris from streets and roads and making repairs to reopen transportation arteries.
7. Making expedient repairs to essential public facilities to restore them to operation or protect them from further damage.
8. Removing debris from public property and managing disposal of debris from public and private property.
9. Taking actions to prevent/remove the accumulation of ice and snow on transportation arteries.
10. Assisting in controlling public access to hazardous areas.

B. Protecting Resources and Preserving Capabilities

1. For slowly developing emergency situations, it may be possible to employ Public Works and Engineering resources to protect government facilities and equipment and essential utilities and thus prevent or reduce damage. 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 would benefit from protection and, in coordination with the departments or agencies that occupy those facilities, carry out such 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 temporarily evacuating it to safer locations. It is desirable that agreements with other jurisdictions to host local resources at risk be developed in advance of an emergency.

C. Search & Rescue (SAR) Support

Public Works and Engineering crews may be required to provide heavy equipment support for search and rescue (SAR) operations, particularly support for search operations in collapsed buildings.

D. Damage Assessment

1. As the primary local government expertise in construction and maintenance of buildings and other infrastructure resides with Public Works and Engineering departments and agencies, Public Works, Road & Bridge, Facilities Management and Planning, and Engineering personnel are expected to play a primary role in leading the local teams that will make preliminary assessments of damage to public buildings, homes, businesses, roads, bridges, levees, and other infrastructure. Damage assessment procedures and the forms to be used in that process are discussed in Annex J, Recovery.

2. Public Works and Engineering personnel, in conjunction with Risk Management personnel, shall inspect damaged structures. The purpose of such inspections is to identify unsafe structures, post signs, and, if necessary, take other actions to restrict entry to and occupancy of such structures.

3. Damaged buildings that pose an immediate threat to public health and safety should be demolished. Fort Bend County regulations and Joint Resolution Jurisdictions local ordinances provide for expedited demolition of structures that pose a threat to public health during emergency situations.

E. Debris Clearance and Removal

The Fort Bend County Debris Management Plan has been developed to provide the framework for the County, Joint Resolution Jurisdictions, and other entities to clear, remove and dispose of debris generated during a public emergency throughout the County. Refer to Appendix 3, Fort Bend County Disaster Debris Management Plan.

F. Levee Operations

1. The FBC Levee Emergency Action Plan (refer to Appendix 4) has been developed to provide the framework for the County, Joint Resolution Jurisdictions, Levee Improvement Districts (LIDs), and other entities to identify emergency situations involving levees that could threaten FBC and to coordinate a response to a levee emergency.

G. The Board of Directors for a LID or MUD is responsible for all levee operation's and maintenance. The designated appropriate personnel from the LID or MUD are responsible for notifying the FBC SO in the event of a levee watch, warning, or failure conditions.

Temporary Repairs and Restoration

1. In Fort Bend County, Road & Bridge Department and Facilities Management and Planning Department staff are expected to make timely temporary repairs to government-owned buildings and other infrastructure that is essential for emergency response and recovery and take action to protect all government buildings and their contents from further damage until they can be repaired. 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 that hold vital government records as well as to 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 to restore them as soon as possible.

3. It is generally infeasible to restore buildings that have suffered major damage during the emergency response. Major repairs will normally have to be postponed until recovery operations commence; such repairs will typically be contracted.

Activities by Phases of Management:

1. Prevention

    a. Identify vulnerabilities in existing public buildings, roads, bridges, water systems, and sewer systems to known hazards and take steps to lessen vulnerabilities.

    b. Reduce vulnerabilities in 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 there are an adequate number of personnel trained to operate heavy equipment and other specialized equipment.

    c. Stockpile materials needed to protect and repair structures, roads, bridges, levees, and other infrastructure.

    d. Maintain an adequate quantity of barricades and temporary fencing.

e. Maintain current maps and plans of government facilities, roads, bridges, levees, and utilities.

f. Review plans, evaluate emergency staffing needs in light of potential requirements, and make tentative emergency task assignments.

g. In conjunction with Tax Office personnel, establish and train damage survey teams.

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 accomplish the tasks outlined in this Annex.

j. Ensure that 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 Emergency Operations Center (EOC).

c. Upon request, provide heavy equipment support for SAR operations. See Annex R, Search and Rescue.

d. Inspect damaged buildings to determine if they are safe for occupancy.

e. Clear roads of debris, remove debris from public property, and manage proper disposal of all debris. See Appendix 3.

f. In coordination with Inspection, Fire, and Environmental Health Departments, make repairs to damaged government facilities and equipment, as needed.

g. Coordinate with the Utilities staff to arrange for emergency electrical service, if required to support emergency operations.

h. Assist the Fort Bend County Utility Coordinator and Joint Resolution Jurisdiction Utility Departments in making emergency repairs to government-owned utility systems, as necessary. See Annex L, Utilities.

i. Restrict access to hazardous areas, using barricades and temporary fencing, upon request.

j. Coordinate with Levee Improvement Districts to ensure that any damages have been addressed and assess the need for debris removal assistance. See Appendix 3.

4. Recovery

a. Repair or contract for 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 of 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 functions 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 Systems (NIMS)/National Response Framework (NRF) protocols. Pre-planning for emergency Public Works and Engineering tasks shall be conducted to ensure that 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 Fort Bend County Road Commissioner and/or the Joint Resolution Jurisdiction Public Works Directors 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 NIMS.

   c. Oversee the repair and restoration of key facilities and systems and removal of debris in the aftermath of an emergency.

   d. Develop procedures for coordinating the efforts of the various local departments and agencies that perform the Public Works and 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 governments 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).

g. Maintain this Annex.

2. The Fort Bend County Road & Bridge Department and Joint Resolution Jurisdiction Public Works and Construction Departments 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 disasters.

   c. Repair damaged government facilities and/or protect such facilities from further damage.

   d. Provide heavy and specialized equipment support for SAR operations.

   e. Carry out debris clearance and removal. See Fort Bend County Disaster Debris Management Plan

   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 Fort Bend County and Joint Resolution Jurisdictions Engineers 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. The Fort Bend County Road & Bridge Department, and the Joint Resolution Jurisdictions Public Works and Transportation Departments will:

   a. Maintain reasonable stockpiles of emergency paving materials.

   b. Make emergency repairs to Fort Bend County and Joint Resolution Jurisdictions city roads, bridges, culverts, and drainage systems.

c. Supervise debris clearance from the public right-of-way and support debris removal operations. See Fort Bend County Disaster Debris Removal Plan

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 Fort Bend County Health and Human Services Department and Joint Resolution Jurisdictions Public Works Departments, Environmental Services Departments, and other related departments will:

   a. Collect and properly disposal of refuse.

   b. Support emergency Public Works and Engineering operations with available resources.

6. The Fort Bend County Road and Bridge Department, Joint Resolution Jurisdictions Inspection Departments, and other similar departments 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. Fort Bend County Parks and Recreation Department and Joint Resolution Jurisdictions Parks and Recreation Departments 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 Fort Bend County Judge and Joint Resolution Jurisdictions Mayors or City Managers, pursuant to NIMS, shall provide general guidance on the management of Public Works and Engineering 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 and Engineering resources committed to an incident. If the Fort Bend County Office of Emergency Management EOC has not been activated, the IC may request additional resources from local departments and agencies and may request those local officials authorized to activate mutual aid agreements or emergency response contracts do so to obtain additional resources.

C. When the Fort Bend County Office of Emergency Management EOC is activated, the Fort Bend County Road Commissioner, or his designee, will manage the emergency Public Works and Engineering function from the EOC. The IC shall direct resources committed to the incident site and coordinate through the Road and Bridge and/or Public Works Officer to obtain additional resources. The Road & Bridge and/or Public Works Officers shall manage resources not committed to the incident site and coordinate the provision of additional resources from external sources.

D. The Road & Bridge/Public Works Officers will respond to mission priorities established by the Incident Commander or the Emergency Management Coordinator, direct the various departments and agencies with Public Works and Engineering resources to accomplish specific tasks, and coordinate the efforts of those departments and agencies in order to achieve overall objectives.

E. The Fort Bend County Road & Bridge and/or Joint Resolution Jurisdictions Public Works Officers 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. Normal Fort Bend County Road & Bridge and Public Works supervisors and engineering personnel participating in emergency operations will exercise their usual supervisory responsibilities over such personnel. 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.

G. The line of succession for Road & Bridge is:
1. Road Commissioner
2. Superintendent – North Zone
3. Superintendent – South Zone

H. The line of succession for Public Works is:
1. Public Works Director
2. Public Works Assistant Director
3. Public Works Supervisor

VIII. READINESS LEVELS

A. Readiness Level IV - Normal Conditions

See the prevention 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 Road & Bridge and 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 Road & Bridge and 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 Fort Bend County Judge and Joint Resolution Jurisdictions Mayors and/or City Managers should approve requests for state aid, which should be forwarded to the Disaster District Committee (DDC) Chair in Pierce, Texas. Cities must request resource support from the County before requesting assistance from the State.

B. Resource Readiness

1. During periods of increased readiness, work should be undertaken to keep operational equipment at full readiness (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 three days.

C. Communications

The Fort Bend County Road & Bridge and Joint Resolution Jurisdictions Public Works and Engineering communications network is depicted in Appendix 1.

D. Key Facilities

A listing of key local facilities that have general priority for damage assessment, debris clearance, and repair is provided in Annex G, Law Enforcement.

E. Reporting

In addition to reports that may be required by their parent organization, Road & Bridge and 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 Fort Bend County Office of Emergency Management EOC. The IC will forward periodic reports to the EOC. Pertinent information will be incorporated into the Initial Emergency Report and the periodic Situation Report that is prepared and disseminated to key officials, other affected jurisdictions, and state agencies during major emergency operations. 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 or, in the event a Presidential disaster declaration is issued, partially reimbursed by the federal government. Hence, all Public Works and Engineering elements will maintain records of labor, materials, and equipment used and goods and services contracted for during large-scale emergency operations.

G. Post Incident Review

For large-scale emergency operations, the Fort Bend County Judge and Mayors and/or City Managers who are a part of the Joint Resolution Jurisdictions shall organize and conduct a review of emergency operations in accordance with the guidance provided in Section IX.E of the Basic Plan. The After Action Report will serve as the basis for an Improvement Plan.

X. ANNEX DEVELOPMENT & MAINTENANCE

A. The Fort Bend County Road Commissioner is responsible for developing and maintaining this annex with the support from organizations specified in Section VI.

B. This annex will be reviewed and updated in accordance with the schedule outlined in Section X of the Basic Plan.

C. Departments and agencies tasked in this Annex will develop SOPs that address assigned tasks.

XI. REFERENCES

A. DEM, Texas Disaster Recovery Manual (DEM-62).

B. FEMA, Debris Management Guide (FEMA-325).

C. FEMA, 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).

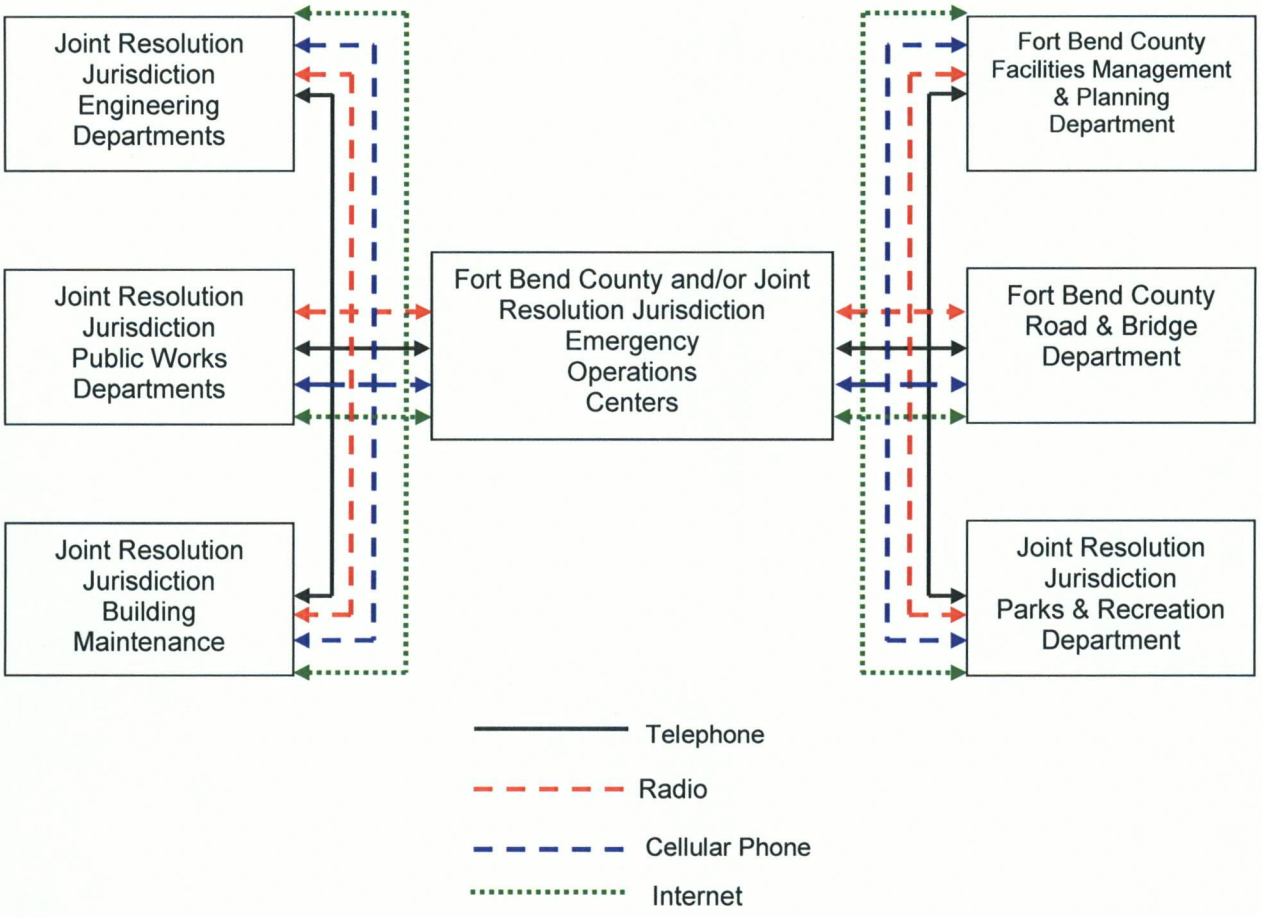
E. Fort Bend County Disaster Debris Management Plan

APPENDICES:

Appendix 1.....Public Works & Engineering Communications Network
Appendix 2.....Debris Estimation
Appendix 3.....Fort Bend County Disaster Debris Management Plan
Appendix 4..... ..Fort Bend County Levee Emergency Action Plan

Appendix 1

PUBLIC WORKS & ENGINEERING COMMUNICATIONS NETWORK



Appendix 2

DEBRIS ESTIMATION

Although frequently calculated with software programs, this appendix contains information necessary for estimating debris long-hand.

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. This tab include one worksheet (Worksheet 5) that 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 that within the sector, this method will be inaccurate.

4. Tab D – Estimating Requirements for Debris Processing. This tab provides a worksheet (Worksheet 6) that 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. This tab provides a worksheet (Worksheet 7) that can be used to estimate the quantity of debris produced by a hurricane. This worksheet is based on a US Army Corps of Engineers methodology.

Tab A
Appendix 2

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
Debris Volume Estimate (cubic yards/CY)				
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:

Vegetative Cover	V =
None	1
Light	1.1
Medium	1.3
Heavy	1.5

Tab B
Appendix 2

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		
Removal Cycle (all times in hours)				
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		
Removal Time				
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)
Equipment			
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
Appendix 2

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
Sample Debris Characteristics				
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		
Disposal Volume (cubic yards)				
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:
1. 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.
2. 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.
3. 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
Appendix 2

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:**

   CY = (stack height in feet / 3) x 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
Appendix 2

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 x C x V x B x S, where:

Q = the quantity of debris in cubic yards (CY)
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
Debris Volume Estimate - Hurricane				
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

Category	C =
1	2
2	8
3	26
4	50
5	80

3. V= Vegetative Multiplier

Vegetative Cover	V =
None	1
Light	1.1
Medium	1.3
Heavy	1.5

4. B = Business/Commercial Density Multiplier

Density	B =
Light	1.0
Medium	1.2
Heavy	1.3

5. S = Storm Precipitation Multiplier

Precipitation	S =
None to Light	1.0
Medium to Heavy	1.3

Appendix 3

Fort Bend County
Debris Management Plan
(May 2012 version)

To reference this plan, contact the Fort Bend County Office of Emergency Management

Appendix 4

Fort Bend County
Levee Emergency Action Plan

RECORD OF CHANGES

# of Changes	Date of Change	Entered By (Name)	Date Entered
10	09/13/2012	Alan Spears, Doug Barnes, Zahra Rizvi	09/13/2012
15	10/02/2012	Alan Spears, Jeff Janecek, Zahra Rizvi	10/03/2012
12	11/02/2012	Alan Spears, Jeff Braun, Marc Grant, Mark Vogler, Rita Anderson, Zahra Rizvi	11/04/2012
25	11/15/2012	Rita Anderson, Zahra Rizvi	11/16/2012
25	01/10/2013	Alan Spears, Caroline Egan, Doug Barnes, Lach Mullen, Zahra Rizvi	01/14/2013
1	02/20/2013	Zahra Rizvi	02/20/2013
5	08/29/2013	Alan Spears, Zahra Rizvi	08/29/2013

I. EXPLANATION OF TERMS

A. Acronyms

BOD	Board of Directors
DD	Drainage District
DPS	Texas Department of Public Safety
EAP	Emergency Action Plan
EOC	Emergency Operations Center
EMC	Emergency Management Coordinator
FBC	Fort Bend County
FEMA	Federal Emergency Management Agency
HHS	Fort Bend County Health and Human Services
IC	Incident Commander
ICP	Incident Command Post
ICS	Incident Command System
LID	Levee Improvement District
MOU	Memorandum of Understanding
MUD	Municipal Utility District
NIMS	National Incident Management System
NRF	National Response Framework
NWS	National Weather Service
OEM	Office of Emergency Management
R&B	Road & Bridge
SAR	Search and Rescue
SO	Sheriff's Office
TCEQ	Texas Commission on Environmental Quality
TDEM	Texas Division of Emergency Management (under DPS)
TxDOT	Texas Department of Transportation
USACE	U.S. Army Corps of Engineers

B. Definitions

1. 1-Percent-Annual-Chance Flood: The flood that has 1-percent chance of being equaled or exceeded in any given year. Also known as the 100-year flood.

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.

4. Dike: A ditch; a causeway or a bank of earth formed of material being excavated.

5. Distress: To subject to pressure, stress or strain to a building or structure.

6. Embankment: The bank, mound, dike, or the similar structures that are raised to hold back water.

7. Emergency: A situation involving a natural or non-natural disaster that would result in an unacceptable hazard to human life, a significant loss of property, or significant economic hardship.

8. Emergency Preparedness: All those activities and measures designed or undertaken to prepare for or minimize the effects of a hazard upon the civilian population, to deal with the immediate emergency conditions that would be created by the hazard, and to effectuate emergency repairs to, or the emergency restoration of, vital utilities and facilities destroyed or damaged by the hazard.

9. Flood: Abnormally high water flow or water level that overtops the natural or artificial confining boundaries of a waterway. A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of river and/or tidal waters and/or the unusual accumulations of waters from any sources.

10. Flood Fighting: Actions taken immediately before or during a flood to protect human life and to reduce flood damages, such as evacuation, emergency sandbagging, and providing assistance to flood victims.

11. Flood Plain: Any normally dry land area that is susceptible to being inundated by any natural source, such as a stream, during floods.

12. Hundred Year Flood (100-Year Flood): More accurately referred to as a "one percent chance flood," a flood of a magnitude that, according to historical statistics, has one chance in one hundred of occurring in any given year. Also known as 1-Percent-Annual-Chance Flood.

13. Imminent Threat: A subjective, statistically supported evaluation of how quickly a threat scenario can develop, how likely that threat is to develop in a given geographical location, and how likely the threat will produce catastrophic consequences to life and improved property. Implicit in the timing aspect can be considerations of time (e.g. a storm front's predicted path) or of known cyclical activities (e.g., rising water levels after storm) or season (the typical summer months in Texas experience increased rainfall).

14. Levee: A structure, normally of earth or stone, built generally parallel to a river to protect land from flooding. A levee is a complete unit, designed and intended for flood control. A levee (excluding a ring levee) is always tied to high ground at both ends.

15. Joint Resolution Jurisdictions: Any jurisdiction, both political and administrative (i.e. city, MUD, LID, Fort Bend ISD or likewise) that have signed and formalized into agreement FBC's EAP.

16. Piping: A subsurface form of erosion which involves the removal of subsurface soils in pipe-like erosional channels to a free or escape exit. Although it develops in different types of soils and under a wide range of conditions, erosion of piping materials is common.

17. Rehabilitation and Inspection Program: A component of the Civil Emergency Management Program concerned with the inspection and rehabilitation of Federal Control Work(s).

18. Repair and Rehabilitation: The terms "repair," "rehabilitation," or "repair and rehabilitation" mean the repair or rebuilding of a flood control structure, after the structure has been

damaged by a flood, hurricane, or coastal storm. The terms do not include improvements (betterments) to the structure, nor does "repair and rehabilitation" include any repair, course of usage, has become structurally unsound and is no longer fit to provide the level of protection for which it was designed.

19. Sand Boil: A symptom of seepage in the levee structure. When water from seepage forces its way into and under a levee embankment it pushes its way through weakened regions out to the landward side of the structure. The end-opening of the seepage is called a sand boil.

20. Seepage: As river rises, hydrostatic pressure against a levee slope increases significantly and can force water into and under levee embankment. Even when a levee is properly constructed and of such mass to resist the destructive action of flood water, this seepage tends to push its way through regions of least resistance (i.e. sandy layers under levee or animal burrows) then out to the surface on the the landward side of the structure. Lack of sufficient pressure on landward side to hold back the seepage may result in breakthrough in the form of bubbling springs. These bubbling springs erode and carry soil particles from under the levee.

21. Sliding: Frictional resistance to relative movement of surfaces on loaded contact.

22. Stream: A body of water flowing in a definite natural or manmade course that has the potential flood. The term stream refers to river, streams, creeks, brooks, etc., and includes intermittent streams that are subject to flooding.

23. Toe: The bottom most point of a levee structure that is often used in measurements.

II. PURPOSE

The purpose of this Emergency Action Plan (EAP) is to identify emergency situations that could threaten FBC; and to plan for an expedited, effective response and warn surrounding residents.

III. SITUATION & ASSUMPTIONS

A. Situation

1. This plan defines the notification procedures to be followed in the event of an emergency situation that affects public safety, public health, public and private property and necessitates the need for emergency critical infrastructure and engineering services.

2. The procedures are intended to protect lives and prevent property damage from failure of FBC Levees.

3. The failure of levees within FBC could expose the community to potentially hazardous situations, both natural and man-made warrant the need for a comprehensive emergency plan related to critical infrastructure and engineering.

B. Assumptions

1. The levee operators, engineers, or appropriate personnel and equipment may be utilized prior to disaster in an attempt to reduce the severity or aftermath of a disaster and to restore critical equipment and infrastructure.

2. All available equipment and appropriate personnel associated with affected Levees will assist in coping with any anticipated disaster with the coordination of resources.

3. Local departments and agencies responsible for the engineering function may not have sufficient resources to cope with a major disaster (refer to Tab 6, Emergency Response Resource List).

4. Appropriate personnel that have been designated can be expected to accomplish expedient repair and restoration of essential services and vital facilities; however the need may arise to contract for major reconstruction.

5. Debris removal, refer to Annex J, Recovery of the Basic Plan.

6. Damage to chemical plants, power lines, sewer and water distribution systems, and secondary hazards such as fires, could result in health and safety hazards that may pose a threat to on-site personnel.

IV. RESPONSIBILITIES

A. Responsibilities

1. The BOD for a LID or MUD is responsible for all levee operations and maintenance.

2. The LID, or designated appropriate personnel, is responsible for notifying the FBC SO in the event of levee watch, warning, or failure conditions.

3. The FBC SO is responsible for notifying FBC OEM if the need arises to activate the EOC to better manage an incident.

4. Local law enforcement is responsible for contacting FBC SO in the event of emergency.

5. FBC OEM will establish a JIC together with FBC SO and appropriate stakeholders (i.e. LID)

B. Assignment of Responsibilities

1. FBC has no statutory or regulatory authority over levees and LIDs, and will not responsible for incident-appropriate actions, such as:

   a. Opening or closing water intakes

   b. Remedial construction activities, such as dirt moving, etc.

   c. Other preventative emergency measures

2. Levee operators and engineers are the first line of levee observers and responsible for initiating the implementation of their EAP.

3. The levee operating company or engineering firm is responsible for routine levee maintenance, annual brush control, levee integrity inspections, and communicating with LID BOD members, LID attorneys and/or any other appropriate personnel.

4. The LIDs' Board of Directors or their designee is responsible for updating the EAP and conducting an annual review to ensure that contact names and numbers are up to date on Notification Flowcharts in their own EAPs. LIDs are encouraged to provide their EAPs to FBC OEM.

5. FBC OEM is responsible for updating this EAP and conducting an annual review to ensure that contact names and numbers are up to date on the Notification Flowchart see page 35.

6. It is the responsibility of the LID to provide FBC OEM with a main point of contact for emergencies.

C. Responsibilities of Notification

1. The LID BOD will contact the FBC SO or local law enforcement in the event of an emergency.

2. In the event of an emergency, FBC or Joint Resolution Jurisdictions will establish and activate a JIC as outlined in the FBC JIC Plan. The JIC will be responsible for notifying affected individuals and communicating with media outlets as deemed necessary.

D. Responsibilities for Evacuation

1. The FBC or Joint Resolution Jurisdictions are responsible for contacting members of the public directly in order to carry out evacuations.

E. Responsibilities for Duration, Security, Termination, and Follow-up

1. The LID is responsible for monitoring of emergency situations at the levee and keeping authorities informed.

2. The County Judge, and/or City Mayor are responsible for declaring an emergency at the levee is terminated.

V. HAZARD AND VULNERABILITY ANALYSIS

A. Emergency Detection

1. Situations

   a. Many levee conditions can lead to emergency situations, not all of which will necessitate the implementation of the EAP.

b. Hurricanes and Storms: Severe storms and other inclement weather conditions are not in themselves a threat to the levee. However, they can contribute to an existing problem and hinder any remediation efforts. Severe storms also cause the uncontrolled release of floodwater, and increase flow in already rain-swollen areas.

c. Tornadoes: Tornadoes do occur in the area have the potential for structural damage to the levee, possibly resulting in its failure. If a tornado has struck in the area, an inspection of the levee and facilities for any signs of seepage will be conducted.

d. Sabotage: A threat to damage the levee has been made. The LID will work with local law enforcement to protect against sabotage (or terrorism). The LID operators or designated appropriate personnel are responsible for notifying local law enforcement.

2. However, if any of these situations occur, the appropriate actions must be taken:

   a. Preventing Failure

      i. The LID/MUD is responsible for conducting routine inspections and identifying conditions that could indicate the onset of problems leading to a levee failure.

      ii. The early identification of potentially dangerous conditions can allow time for the implementation of EAPs.

3. Signs of Failure

   a. It is important to understand how distress can develop into failure. With appropriate action, distress need not lead to a catastrophic failure of the levee.

   b. This section describes only some of the different types of situations which could lead to a levee failure. Besides the scenarios listed in this section, there is a possibility of other situations which could threaten levees.

   c. There are four levels of distress conditions: Watch, Warning, Possible Failure and Failure. See Tab 4 for detailed information.

   d. Seepage Failure:

      i. Although all earthen embankments allow some minor seepage through the levee or the foundations, excessive, uncontrolled seepage can result in piping (the movement of embankment material in the seepage flow) and lead to failure.

      ii. Piping can occur for years at a slow rate. If the piping has progressed to a dangerous level, it will be evident by increased flow or the discharge of muddy water (or both).

      iii. At that stage, immediate action to stop the piping is needed. Fully developed piping is difficult to control and is very likely to result in failure.

      iv. A whirlpool maybe a sign of uncontrollable piping and necessitates immediate inspection.

e. Embankment or Foundation Sliding: Sliding is usually the first apparent when cracks or bulges in the embankment appear. Slides with progressive movement can cause failure of the embankment.

f. Structural Failure: The structural failure or collapse in any portion could result in within the levee district. A structural failure of a portion of the spillway could cause piping and possibly embankment failure.

g. Overtopping Failure: Overtopping of the embankment results in erosion of the levee crest. Once erosion begins, it is very difficult to stop.

B. Emergency Evaluation and Classification

1. The USACE Levee Owner's Manual lists the conditions and actions which may be used to classify the graduated level of emergency response: Watch, Warning, Possible Failure and Failure. See page 28, Evidence of Distress table, Tab 4.

2. Specific levee observations and corresponding emergency classification levels can be found in Tab 4.

3. Warning Condition: A problem has been detected at the levee which requires constant monitoring or immediate action to repair or correct. At this time, the distress condition is manageable by levee personnel.

   a. Cloudy or dirty seepage or seepage with an increase in flow, boils, piping, or bogs.

   b. Seepage around conduits.

   c. Large sinkholes with corresponding seepage anywhere on the embankment or surrounding from the toe.

   d. Any slide that degrades the crest of the embankment or that is progressively increasing in size.

   e. Cracking or moving of any concrete structure.

   f. The engagement of the emergency spillway.

   g. The designated appropriate LID personnel, City personnel, FBC SO or FBC OEM will receive regular update notifications during the warning condition of the levee.

   h. Any situation where flood waters reach base of the levee.

   i. See Evidence of Distress, Tab 4.

4. Possible Failure Condition: A "possible failure" condition that is progressively getting worse. A situation is developing that will cause the levee to break. Efforts to correct the situation will continue. At this time, the distress condition is being managed by levee personnel and possibly some FBC departments (SO, R&B, DD, and OEM). If the situation worsens any further then an IC will be set up and run by FBC SO. After establishing IC,

the FBC SO will be responsible for managing the incident in coordination with relevant stakeholders, and will contact FBC OEM as needed.

a. For detailed information, see Evidence of Distress, Tab 4. If conditions continue to deteriorate, the levee could fail that may include:

   i. Rapidly increasing boils or the presence of new, significantly flowing boils, particularly muddy ones near previously identified ones

   ii. Rapidly increasing seepage, especially flowing muddy water

   iii. Slides involving a large mass of material or which have degraded the crest of the embankment to a level that approaches the water surface level, or if significant seepage is observed through the slide area

   iv. Settlement that is predicted to degrade.

   v. Cracks that expand.

   vi. Significant movement or failure of any structure that forms an integral part of the levee

   vii. Overtopping of an earthen levee

   viii. Uncontrollable release of water

b. A situation can develop where there is presence of immediate danger to first responders, levee personnel and surrounding residents.

5. Failure Condition: A "failure" condition is one where controlling the situation has surpassed the Watch, Warning and Possible Failure conditions. All efforts to contain and prevent an emergency situation have proven ineffective by levee personnel. Multiple agencies will coordinate response actions and coordinate resources.

   a. Though there may be a multitude of reasons; damage to the levee structure is causing an uncontrolled release of water.

   b. Containing the water overflow is committing multiple resources.

      i. Coordination of resources includes activation of the EOC (at FBC SO, FBC OEM, or both locations).

      ii. Communication between the LID BOD, designated appropriate LID personnel, FBC SO, DD, R&B and OEM are crucial at this point.

VI. EMERGENCY PREPAREDNESS & PREVENTION

A. General

1. Preparedness actions are to be taken both before and following the development of emergency conditions and should identify ways of preparing for an emergency, increasing response readiness in a uniform and coordinated manner, and helping reduce the effects of a levee failure.

B. Preventative Actions

1. Surveillance:

    a. The designated appropriate personnel of a levee are responsible for monitoring monitor the levee during emergency situations such as a high flood event.

2. Response during weekends and holidays:

    a. The designated appropriate personnel of a levee will be available for emergency response during weekends and holidays and can be present at the levee site as soon as possible.

3. Response during periods of darkness and adverse weather:

    a. The designated appropriate personnel of a levee will arrange for access to generators and lights to adequately monitor the situation.

    b. The designated appropriate personnel of a levee will be able to access the site during adverse weather conditions and will be the first in the line of observers to monitor levee conditions and will be the first to contact FBC SO as they deem necessary.

4. Access to the site:

    a. Alternate access routes should be planned in the event of an emergency at the levee.

5. Preventative measures can be taken in an emergency to prevent catastrophic failure of the levee, but such repairs should be undertaken with extreme caution.

    a. The repairs are only temporary, and a permanent repair should be designed by an engineer as soon as possible.

    b. The following actions should only be undertaken under the direction of a professional engineer or contractor. In all cases, the appropriate Notification Flowchart must be implemented and the LID Board of Directors must be notified, see page 5, Notification Flowchart.

6. Consider the following preparedness actions if the levee's integrity is threatened by:

    a. Overtopping:

i. Plug the flow of water with whatever material is available (hay, bentonite, or plastic).

ii. Lower the water level by using the low flow outlet and pumping if necessary, until the flow decreases to a non-erosive velocity or until it stops. Place an inverted filter (a protective layer of sand and gravel) on the exit area to hold the material in place.

iii. Continue operating at a lower level until a repair is made.

b. Seepage:

i. Lower the water level by pumping if necessary at a rate and to an elevation considered safe, given the slide condition.

ii. Stabilize the slide, if on the surrounding slope, by weighting the toe area below the slide with soil, rock, or gravel.

iii. Continue operating at a lower level until repair is made.

c. Erosion:

i. Implement temporary measures to protect the levee structure, such as placing rock riprap in the damaged area.

ii. Lower the water level to a safe elevation through the low flow release valve and by pumping if necessary.

VII. RESOURCE READINESS

A. Contracts

1. Should the designated personnel and resources of LIDs prove to be inadequate during an emergency; requests will be made for assistance from other local jurisdictions, other agencies, and industry, as needed.

   a. Assistance may include equipment, supplies or personnel.

2. It is highly encouraged to enter all agreements, pre-existing or otherwise, in writing and signed by the appropriate parties.

B. Equipment and Supplies

1. Equipment that is available for use and local contractors that can be contracted to provide equipment during an emergency event, refer to Annex M, Resource Management.

C. Reports

1. Technical Data

a. Period inspections of the levee will be made to evaluate its structural safety, stability, and operational adequacy.

b. In the event of an abnormal occurrence, reference to these reports, particularly the photographs, can be beneficial in the evaluation of a potential problem.

c. Technical drawings and inspection reports should be stored and carefully maintained with the designated appropriate personnel site offices and in compliance with LID document retention policy.

    i. Alternate personnel should be familiar with the location of the documents in the event of an emergency situation.

2. LID Emergency Operations Center Activity Log

    a. Any unusual or emergency condition should be documented, including the following:

        i. Activation or deactivation of emergency facilities

        ii. Emergency notifications to other local governments and to state and federal agencies

        iii. Significant changes in the emergency

        iv. Major commitments of resources or requests for additional resources from external sources

        v. Telephone calls should be recorded in chronological order

        vi. Issuance of protective action recommendations to the public

        vii. Evacuations

        viii. Casualties

        ix. Termination of the incident

3. Costs of the Emergency Operations Center

    a. For major emergencies, the emergency operations center should maintain detailed records of costs expended.

    b. These records may be used to recover costs from the responsible party or insurers, or as a basis for requesting financial assistance for certain allowable response and recovery costs from the state and federal government.

    c. Documented costs include:

        i. Personnel costs esp. overtime

        ii. Equipment operation

iii. Equipment leasing and rental

iv. Contract services to support emergency operations

v. Specialized supplies expended in emergency operations

VIII. INUNDATION MAPS

A. Inundation Maps: The inundation map(s) illustrates the areas subject to flooding from a failure of the levee. Refer to Inundation or Floodplain Maps in Tab 2.

B. Local Evacuation Plan

1. If the imminent failure of the levee with uncontrolled increasing flooding is anticipated, elected officials and law enforcement exercise the responsibility of notifying surrounding residents of evacuation and conducting it in the most expedient manner possible.

2. The organizations and personnel on the Notification Flowchart should be contacted immediately.

   a. Local law enforcement officials utilize the best and most wide-reaching methods of public notification depending on the incident dynamics.

   b. Local law enforcement can use any means necessary, i.e. red alert, reverse 911, or AM alert trailer, and if possible, push text messages (not all jurisdictions have this capacity or permissions) to conduct an evacuation.

   c. For flood breaches, the following actions should be taken:

      i. The LID or city has the responsibility of providing barricading, otherwise FBC Road & Bridge will be contacted to provide barricading, if they are able to.

      ii. These bridges include the Brazos River Bend crossings of Highway 90 Alternate.

      iii. See Inundation Map in Tab 2 to determine appropriate barricade locations.

   d. The LIDs' City Police Dept., FBC SO, FBC OEM, or the City OEM has the authority of public notification of all persons, with the possibility of requesting additional support

   e. City and FBC officials are generally familiar with developed areas in their LID. Such knowledge, coupled with the requirements of state law that they respond to disasters make them logical officials to be notified and to spread the warning message to all areas subject to flooding.

IX. IMPLEMENTATION PROCEDURES

A. Development

1. It is highly encouraged for LIDs to send their EAPs to FBC OEM (Richmond), and their respective city, if applicable to keep a copy on file.

B. Updating

1. This plan is recommended to be reviewed and updated no fewer than once every 3 years by FBC OEM with the suggestions and input from FBC Drainage District, FBC Road & Bridge, FBC Purchasing departments, local EMCs, and private consultant firms.

C. Testing

1. A table top exercise should be conducted at least once every 3 years.

    a. The table top exercise involves a meeting of all designated appropriate LID personnel (BOD, attorneys, operators, engineers, etc.) with local and state emergency management officials in a conference room.

    b. The exercise begins with a description of a simulated event and proceeds with discussions by the participants to evaluate the EAP and response procedures, and to resolve concerns regarding coordination and responsibilities.

    c. Any problems identified during an exercise should be included in revisions to the EAP.

D. Training

1. Drainage District, R&B, and OEM staff will ensure that they provide sufficient and appropriate training to personnel, as well as provide training opportunities for LIDs personnel.

2. Personnel will be trained in problem detection, evaluation, and appropriate corrective measures.

3. The training is essential for proper evaluation of developing situations at all levels of responsibility.

X. EMERGENCY ACTION PLAN DEVELOPMENT & MAINTAINENCE

A. FBC OEM is responsible for reviewing and maintaining this EAP.

1. The recommended cycle for review is every 3 years.
2. To keep track of changes see page 5, Record of Changes.
3. OEM as well as other FBC departments will maintain and file training records of FBC personnel as deemed necessary.

XI. AUTHORITIES AND REFERENCES

FEDERAL

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2. Fort Bend County Drainage District (2011). *Drainage Criteria Manual.* "Section 7: Leveed Areas."
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4. Personal communication, October 2012. Mark Vogler, FBC Drainage District.
5. Personal communication, October 2012. Marc Grant, FBC Road & Bridge.
6. Personal communication, November 2012. Rita Anderson, Freese & Nichols.
7. Santa Clara County Fire Dept. (2012). *Joint Stevens Creek Dam Failure Plan.* 1-28.

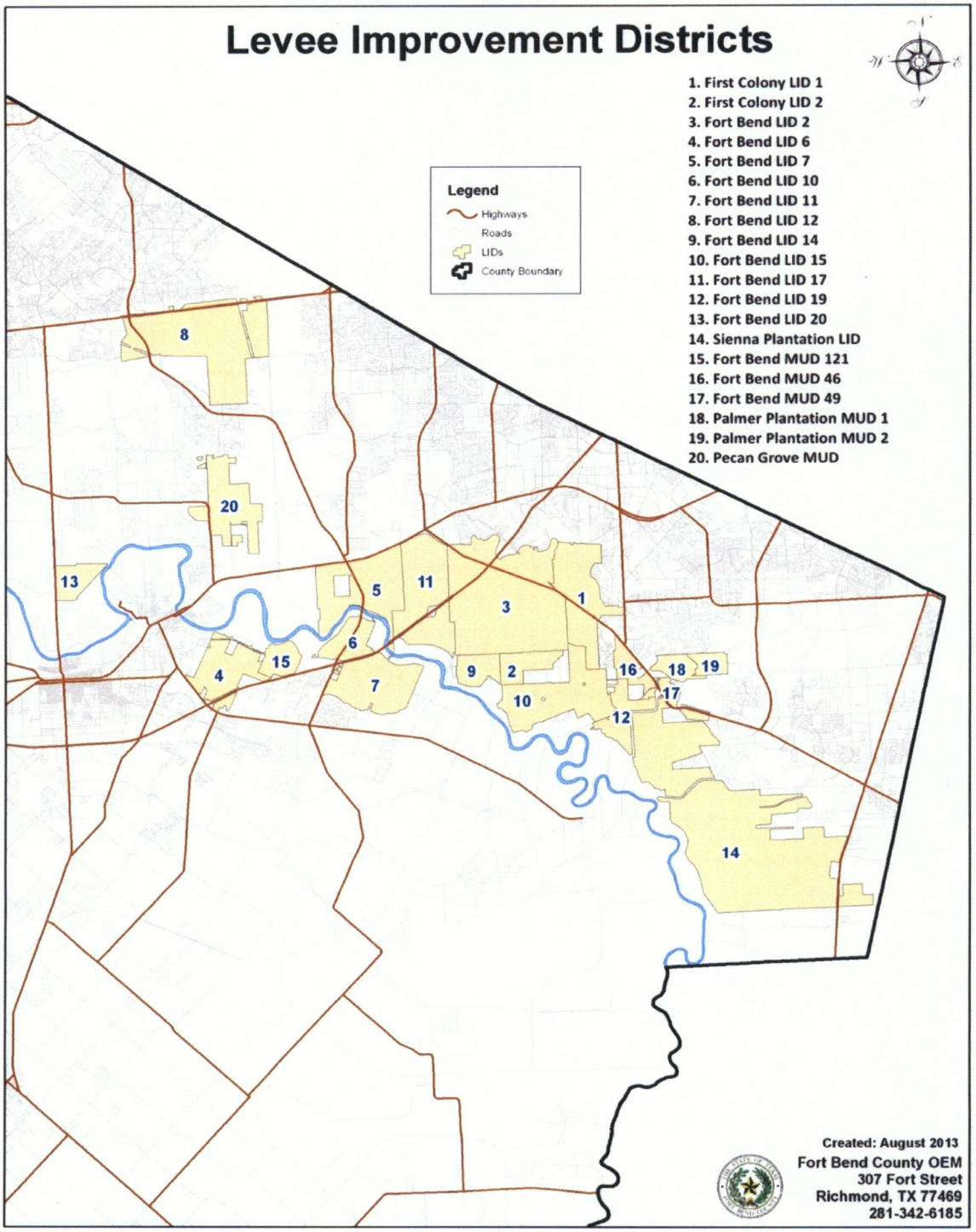
OTHER

1. Y. M. Masannat (1980). "Development of piping erosion conditions in the Benson area, Arizona, U.S.A." *Quarterly Journal of Engineering Geology and Hydrogeology.* © The Geological Society, London. http://qjegh.lyellcollection.org/content/13/1/53.abstract [Accessed January 2013]

XII. TABS

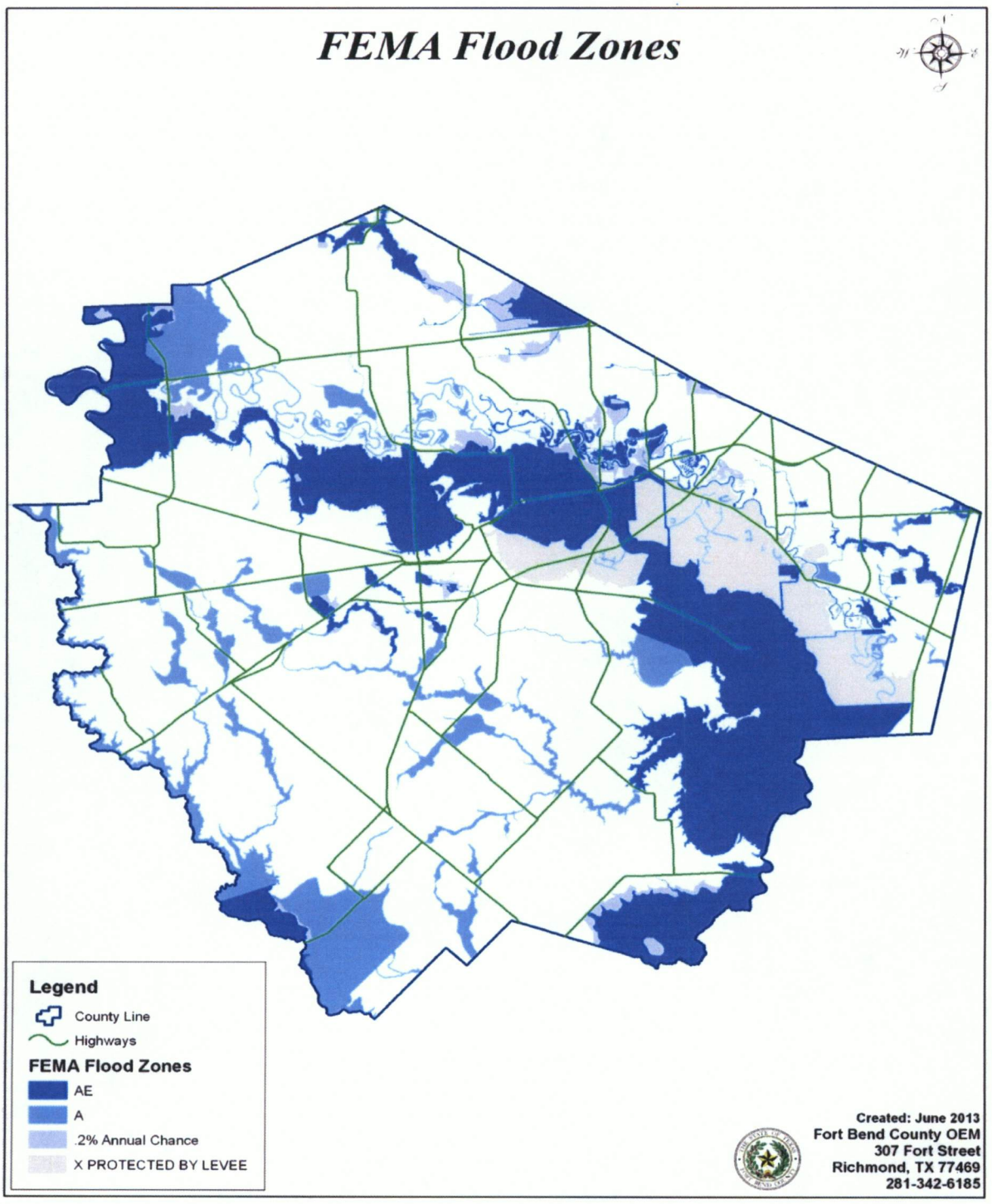
Map Tab A
Appendix 4

VICINITY MAP



Map Tab B
Appendix 4

INUNDATION or FLOODPLAIN MAP



Tab C
Appendix 4

CRITICAL ACTIONS CHECKLIST

Stage	Location	Action
Example: *(47.00')*	*(SH90A @ Richmond)*	*(Close all sluice gates at Pump Station No. 1)*

Tab D
Appendix 4

EVIDENCE OF DISTRESS:

PROGRESSION OF EVENTS from Watch to Failure

General Observation	Specific Observation	Emergency Action	Equipment, Material and Supplies	Data to Record	Condition
BOILS	Small boils, no increase of water flow, flowing clear water	1. Closely check all surrounding toe, especially in vicinity of boil for additional boils, wet spots, sinkholes, or seepage. 2. Closely monitor entire area for changes or flow rate increases.	• None	▪ Site ▪ Location ▪ Approximate flow	WATCH
	Large or additional boils near previously identified ones, without increasing flow rate, but carrying small amount of soil particles	1. Initiate 24-hour surveillance. 2. Construct sandbag ring dikes around boils, to cover them with water to retard the movement of soil particles. 3. Filter cloth may be used to retard soil movement, but do **not** retard the flow of water.	• Sandbags • Filter cloth	▪ Site ▪ Location ▪ Approximate flow	WARNING
	Large or additional boils near previously identified ones, increasing flow rate, carrying soil particles	1. Continue 24-hour surveillance. 2. Continue monitoring and remedial action as described above. 3. Initiate emergency. 4. Issue a warning to surrounding residents.	• Sandbags • Pump	▪ Site ▪ Location ▪ Approximate flow	POSSIBLE FAILURE
	Rapidly increasing size of boils and flow increasing and muddy water	5. Surrounding evacuation. 6. Employ all available equipment to attempt to construct a large ring dike around the boil area.	• Dozer • Shovels • Source of earthfill	▪ Site ▪ Location ▪ Approximate flow	FAILURE

General Observation	Specific Observation	Emergency Action	Equipment, Material and Supplies	Data to Record	Condition
BROKEN GATE	Structural member of a gate or gate operator broken or severely damaged so as to prevent operation of the gate	1. Initiate 24-hour surveillance 2. Immediately place stop logs in front of gate and initiate necessary actions to get gate repaired.	• Crane and welder	Type of problem Location	WATCH

General Observation	Specific Observation	Emergency Action	Equipment, Material and Supplies	Data to Record	Condition
CRACKING	Cracks in the embankment crest or on slopes	Walk on entire crest and slope and check for additional cracking	Stakes Tape measure	Size Location	WATCH
	Numerous cracks in crest that are enlarging, especially those perpendicular to the centerline of the levee	Initiate 24-hour surveillance. Carefully monitor and measure cracking to determine the speed and extent of the problem. Mobilize to fill cracks Cracks parallel to the centerline indicate a slide. Follow remedial action for slides.	Stakes Tape measure Dozer Shovels Source of earthfill	Size Location	WARNING
	Large cracks in the crest that are rapidly enlarging, especially those perpendicular to the centerline of the levee	Continue monitoring and remedial action as described above	Dozer Shovels Source of earthfill	Size Location	**POSSIBLE FAILURE**
	Cracking that extends to pool elevation	Surrounding evacuation. Continue remedial actions as described above.	Dozer Shovels Source of earthfill	Size Location	**FAILURE**

General Observation	Specific Observation	Emergency Action	Equipment, Material and Supplies	Data to Record	Condition
CRACKING OR MOVEMENT OF CONCRETE STRUCTURE	Minor cracking and/or movement	1. Immediately install measuring device to monitor movement	• Crack monitors • Stakes • Tape measure	Size Location	WATCH
	Significant cracking and/or movement	1. Initiate 24-hour surveillance 2. Lower burlap on upstream face of crack to reduce flow of soil particles. 3. Dump rockfill surrounding of moving concrete structure monolith to resist the movement.	• Burlap • Rockfill • Dozer • Shovels	Size Location Flow rate	WARNING
	Serious cracking and/or movement	1. Continue monitoring and remedial action as described above.	• Dozer • Rockfill • Burlap • Crack monitors	Size Movement Flow rate	POSSIBLE FAILURE
	Major cracking and/or movement	1. Surrounding evacuation. 2. Continue monitoring and remedial actions as described above.	• Dozer • Shovels • Rockfill	Size Location Flow rate	FAILURE

General Observation	Specific Observation	Emergency Action	Equipment, Material and Supplies	Data to Record	Condition
SEEPAGE	Minor seepage of clear water at toe, on slope of embankment, or at the abutments	1. Closely check entire embankment for other seepage areas. 2. Use wooden stakes or flagging to delineate seepage area 3. Try to channel and measure flow 4. Look for upstream whirlpools	• Wooden stakes • Flagging	▪ Site ▪ Location ▪ Approximate flow	WATCH
	Additional seepage areas observed flowing clear water and/or increasing flow rate	1. Initiate 24-hour surveillance 2. Monitor as described above 3. Construct measuring weir and channel all seepage through weir. 4. Attempt to determine source of seepage.	• Dozer • Shovels	▪ Site ▪ Location ▪ Approximate flow	WARNING
	Seriously or rapidly increasing seepage, under seepage, or drain flow	1. Continue 24-hour monitoring and remedial action as described above 2. Initiate emergency 3. Construct a large ring dike around the seepage area	• Dozer • Shovels • Source of earthfill	▪ Site ▪ Location ▪ Approximate flow	POSSIBLE FAILURE
	Additional seepage areas with rapid increase in flow and muddy water.	4. Surrounding evacuation. 5. Employ all available equipment to attempt to construct a large ring dike around the seepage area.	• Dozer • Shovels • Source of earthfill	▪ Site ▪ Location ▪ Approximate flow	FAILURE

General Observation	Specific Observation	Emergency Action	Equipment, Material and Supplies	Data to Record	Condition
SETTLEMENT	Obvious settlement of the crest of the embankment, especially adjacent to concrete structures.	Look for bulges on slope or changes in crest alignment	None	Size Location	WATCH
	Settlement of crest of embankment that is progressing, especially adjacent to concrete structures or if any corresponding seepage is present.	Initiate 24-hour surveillance. Mobilize all available resources for repair operations to increase freeboard. Fill and stockpile sandbags. Identify any boils near settlement points for flowing material and pursue action for boils.	Sandbags Dozer Shovels Source of earthfill	Size Location	WARNING
	Settlement of crest of embankment that is rapidly progressing especially adjacent to concrete structures or if any corresponding seepage is flowing muddy water or increasing flow.	Continue monitoring and remedial actions as described above. Use sandbags to increase the freeboard on the levee if necessary.	Sandbags Shovels Dozer Source of earthfill	Size Location	POSSIBLE FAILURE
	Progressing settlement that is expected to degrade the embankment.	Surrounding evacuation. Utilize all available equipment and personnel to build up the crest in the area that is settling Identify any boils near settlement points for flowing material and pursue action for boils.	Dozer Shovels Source of earthfill Sandbags	Size Location	FAILURE

General Observation	Specific Observation	Emergency Action	Equipment, Material and Supplies	Data to Record	Condition
SINKHOLES	Sinkholes anywhere on the embankment or within 500 feet surrounding the toe.	Carefully walk the entire embankment and surrounding area looking for additional sinkholes, movement, or seepage.	Stakes Flagging	Size Location	WATCH
	Sinkholes with corresponding seepage anywhere on the embankment or surrounding from the toe.	Initiate 24-hour surveillance. Monitor as above. Construct sandbag dike around the seepage exit point to reduce the flow rate Start filling sandbags and stockpile near sinkhole.	Dozer Shovels Pump	Size Location	WARNING
	Large sinkholes with corresponding seepage anywhere on the embankment or surrounding from the toe.	Continue monitoring and remedial action as described above. Utilize sandbags to increase the freeboard on the levee if necessary.	Sandbags Dozer Pump	Size Location	POSSIBLE FAILURE
	Sinkholes rapidly getting worse Seepage flowing muddy water and increasing flow	Surrounding evacuation. Utilize all available equipment and personnel to attempt to construct a large ring dike around the area.	Dozer Shovels Pump	Size Location	FAILURE

General Observation	Specific Observation	Emergency Action	Equipment, Material and Supplies	Data to Record	Condition
SLIDES OR SEVERE EROSION	Skin slide or slough on slope of embankment. No further movement of slide and embankment crest not degraded.	1. Examine reset of embankment for other slides. 2. Place stakes in slide material and adjacent to it for determining if further movement is taking place.	Stakes Tape measure	Distance between stakes	WATCH
	Slide or erosion involving large mass of material, crest of embankment is degraded, no movement or very slow continuing movement	1. Initiate 24-hour surveillance. 2. Mobilize all available resources and equipment for repair operations to increase freeboard and to protect the exposed embankment material. 3. Start filling sandbags and stockpile near slide area			WARNING
	Slide or erosion involving large mass of material, crest of embankment is degraded, progressively increasing in size	1. Continue monitoring and remedial actions as described above. 2. Place additional material at the toe of the slope to stop the slide.	Dozer Shovels Source of earthfill Pump	Distance between stakes	POSSIBLE FAILURE
	Slide or erosion involving large mass of material, crest of embankment is severely degraded, movement of slide is continuing and may reach pool level.	1. Surrounding evacuation. 2. Utilize all available equipment and personnel to sandbag the degraded slide area to prevent it from overtopping	Dozer Shovels Sandbags Pump	Distance between stakes	FAILURE

Tab E
Appendix 4

LEVEE CONTACTS DIRECTORY

	LID No.	Operator	Engineer	Attorney	Directors		PCT.	Affected by Brazos?	City Limits
1	Fort Bend	Storm Water Solutions, L.P.	Costello, Inc.	Allen Boone Humphries Robinson	Andre McDonald	macandre@hal-pc.org	4	YES	SUGAR LAND
	LID No. 2	Mike Thelen	Greg Frank, P.E.	David Oliver	Glen Gill	glen@glengill.com			
	1st/3rd Wed.	(713) 907-6162	(713) 783-7788	(713) 860-6465	Bryan K. Chapline	bchapline@municipaldistrictse rvices.com			
	at 8:30am	mthelen@stormwatersolutions.com	gfrank@coseng.com	doliver@abhr.com					
2	Fort Bend	Levee Management Services	Costello, Inc.	Allen Boone Humphries Robinson	Gary Pochyla	oldsouth@sbcglobal.net	1	YES	NONE
	LID No. 6	Jeff Perry / Clark Carruth	Greg Frank, P.E.	Angie Lutz	EE"Gene" Reed	genereed@eereed.com			
	4th Mon. at noon	(281) 240-6454	(713) 783-7788	(713) 860-6470	Linda Jacks	thejacksfamily@comcast.net			
	Not Monthly	c.carruth@leveemanagementservice.com	gfrank@coseng.com	alutz@abhr.com					
3		Levee Management Services	Costello, Inc.	Schwartz, Page & Harding	Karen Mawyer	kmawyer@prodigy.net	4	YES	SUGAR LAND/ NONE
	Fort Bend	Jeff Perry / Clark Carruth	Jon Vanderwilt/ Greg Frank	Chris Skinner	Epi Salazar	epi.salazar@seshorizon.com			
	LID No. 7	(281) 240-6454	(713) 783-7788	(713) 623-4531\(713)443-2122	Jim Hicks	jjhicks@tmhs.org			
		j.perry@leveemanagementservice.com	jvanderwilt@coseng.com	cskinner@sphllp.com					
4	Fort Bend	Levee Management Services	Brown & Gay Engineers, Inc.	Allen Boone Humphries Robinson	Don Burns	don@donburns.com	1	YES	SUGAR LAND
	LID No. 10	Jeff Perry / Clark Carruth	Paul Dodd, P.E.	Steve Robinson	Michael Ross	mross@westutx.gov			
	1st Wednesday	(281) 240-6454	(281) 558-8700	(713) 860-6400	Rodney Vannerson	rvannerson@aol.com			
	at 11:30am	c.carruth@leveemanagementservice.com	pdodd@browngay.com	srobinson@abhr.com					
5	Fort Bend	Levee Management Services	LJA Engineering, Inc.	Allen Boone Humphries Robinson	Stuart Rimes	srimes@comcast.net	1	YES	SUGAR LAND/ NONE
	LID No. 11	Jeff Perry / Clark Carruth	Michael Rusk, P.E.	Lynne Humphries	Jared Jameson	jaredj@wjinterests.com			
	1st Tuesday	(281) 240-6454	(713) 953-5200	(713) 860-6400	Justin R. Ring	jring@ehrainc.com			
	at 5:00pm	j.perry@leveemanagementservices.com	mrusk@ljaengineering.com	lhumphries@abhr.com					
6	Fort Bend		Brown & Gay Engineers, Inc.	Smith, Murdaugh, Little & Bonham,LLP	Valerie Meyer	valann425@aol.com	3 & 4	NO	HOUSTON/ NONE
	LID No. 12		Lee Lennard	James D. Bonham	Sondra Salchak	ssalchak@comcast.net			
			(281)558-8700	(713)652-6500	Bobby Bullis	bobbybullis@gmail.com			
			llennard@browngay.com	jbonham@smithmur.com					

	LID No.	Operator	Engineer	Attorney	Directors		PCT.	Affected by [illegible]?	City Limits
7	Fort Bend	Levee Management Services	LJA Engineering, Inc.	Allen Boone Humphries Robinson	Jeffrey A. Anderson	jeff_anderson@windstream.net	4	YES	SUGAR LAND
	LID No. 14	Jeff Perry	Jason Kelly, P.E.	Lynne Humphries	David Shaw	davidleeshaw@gmail.com			
	3rd Friday	(281) 240-6454	(713) 953-5200	(713) 860-6400	Herb Krog	kro4g6@windsream.net			
	at Noon	j.perry@leveemanagementservices.com	jkelly@ljaengineering.com	lhumphries@abhr.com					
8	Fort Bend	Levee Management Services	Costello, Inc.	Allen Boone Humphries Robinson	Dana Lered Koy	legsdk@prodigy.net	4	YES	SUGAR LAND/ NONE
	LID No. 15	Jeff Perry / Clark Carruth	Chad Hablinski, P.E.	Rich Muller/Susan Edwards	Allan Harris	aharris12@comcast.net			
	4th Monday	(281) 240-6454	(713) 783-7788	(713) 860-6400	Frank Yonish	fyonish@hotmail.com			
	at 11:00am	j.perry@leveemanagementservice.com	chablinski@coseng.com	rmuller@abhr.com / sedwards@abhr.com		fyonish@bankoftexas.com			
9	Fort Bend	Levee Management Services	LJA Engineering, Inc.	Allen Boone Humphries Robinson	David Lawrence	dlawrence@dcindustrial.com	4	YES	SUGAR LAND
	LID No. 17	Jeff Perry / Clark Carruth	Jason Kelly, P.E.	Lynne Humphries	Jeff Scarborough	jeffs@sre-texas.com			
	2nd Thursday	(281) 240-6454	(713) 953-5200	(713) 860-6400	David Gornet	dgornet@gmail.com			
	at 11:30 am	c.carruth@leveemanagementservice.com	jkelly@ljaengineering.com	lhumphries@abhr.com					
10	Fort Bend	Levee Management Services	Costello, Inc.	Allen Boone Humphries Robinson	J. Michael Dinges	mdinges@lowerybank.com	2	YES	MISSOURI CITY/NONE
	LID No. 19	Jeff Perry / Clark Carruth	Chad Hablinski, P.E.	Rich Muller/ Susan Edwards	Kolbe M. Curtice	kolbe.curtice@colliers.com			
	4th Monday	(281) 240-6454	(713) 783-7788	(713) 860-6400	Robert Walters	rwwalters@windstream.net			
	at 9:30 am	j.perry@leveemanagementservice.com	chablinski@coseng.com	rmuller@abhr.com/ sedwards@abhr.com		robert_w@robertwaltersarchitect.com			
11		Municipal District Services	Sherrington, Inc.	Allen Boone Humphries Robinson	S.Scott West	scott@westfirm.com	1	YES	NONE
	Fort Bend	Rebecca Marcucci	Sean Humble, P.E.	Steve Robinson		emily@westfirm.com			
	LID No. 20	(281) 290-6500	(281) 758-1531	(713) 860-4500	David Hunter	david@davidhunterlawfirm.com			
		rmarcucci@municipaldistrictservices.com	sean@sherringtoninc.com	srobinson@abhr.com	Jeffrey R. Singer	jsinger@triallawyers.net			
12	First Colony	Storm Water Solutions, L.P.	Costello, Inc.	Allen Boone Humphries Robinson	Debby Coffman	debbycoffman@earthlink.net	4	YES	SUGAR LAND/ MISSOURI CITY
	LID	Mike Thelen	Greg Frank, P.E.	Angie Lutz	Scott Jacobson	scotthjacobson@comcast.net			
	2nd Monday	(713) 907-6162	(713) 783-7788	(713) 860-6470	Richard Sherrill	resherrill@aol.com			
	at 9:00 am	mthelen@stormwatersolutions.com	gfrank@coseng.com	alutz@abhr.com					
13		Storm Water Solutions, L.P.	Jones & Carter, Inc.	Coats Rose	Ron Frerich	rjfrerich@earthlink.net	4	YES	SUGAR LAND
	First Colony	Jason Klump	Craig Kalkomey, P.E.	John Cannon	Carl Mazzo	cmazzo@windstream.net			
	LID No. 2	(832)250-0987	(281)342-2033	(713) 653-5735		carl_masso@oky.com			
		jklump@stormwatersolutions.com	cwkalkomey@jonescarter.com	jcannon@coatsrose.com	Christine Lukin	clukin@gmail.com			
14	Sienna Plantation	Levee Management Services	LJA Engineering, Inc.	Allen Boone Humphries Robinson	Kendall Beckman	ken.beckman@cbre.com	1 & 2	YES	MISSOURI CITY/NONE
	LID	Jeff Perry / Clark Carruth	Michael Rusk, P.E.	Rich Muller/ Angie Lutz	Michael Johnson	mike.johnson2020@yahoo.com			
	1st Wednesday	(281) 240-6454	(713) 953-5200	(713) 860-6470	John P. "Bucky" Richardson	bucky@ei2hou.com			
	at 11:30 am	c.carruth@leveemanagementservices.com	mrusk@ljaengineering.com	rmuller@abhr.com/ alutz@abhr.com					
15	Palmer Plantation	Quail Valley Utility District	LJA Engineering, Inc.	Paul A. Philbin & Assoc. P.C.	Tara Wagner	waggolf@att.net	4	YES	MISSOURI CITY
		Joe Taylor	Gary Mensik, P.E.	Paul Philbin	Mike Ware	mware@alliancegp.net			
	MUD No. 1	(281)499-5539	(713) 953-5200	(713) 783-4120	Terri Ellis	tmach41@earthlink.net			
					Lynn Macko	smacko44@yahoo.com			
		jtaylor@quailvalleyud.org	gmensik@ljaengineering.com	pphilbin@cypressmail.com	Doug Roberts	Robertsdoug@sbcglobal.net			

	LID No.	Operator	Engineer	Attorney	Directors		PCT.	Affected by [illegible]	City Limits
16	Palmer Plantation	Quail Valley Utility District	LJA Engineering, Inc.	Paul A. Philbin & Assoc. P.C.	Jim Wagner	waggolf@att.net	4	YES	MISSOURI CITY
		Joe Taylor	Gary Mensik, P.E.	Paul Philbin	Elizabeth Layman	ewlayman@att.net			
	MUD No. 2	(281)499-5539	(713)953-5200	(713) 783-4120	Jim Gasper	JaGaspe@aol.com			
					Larry Eaton	larryeaton46@yahoo.com			
		jtaylor@quailvalleyud.org	gmensik@ljaengineering.com	pphilbin@cypressmail.com	Bob Butzke	butzke@att.net			
17		Environmental Development Partners, LLC	Jones & Carter, Inc.	Allen Boone Humphries Robinson	Chad Howard	howardcgroup@yahoo.com	3	YES	NONE
	Pecan Grove	Mike Ammel	Bryan Jordan/ Bethany Miller	Lynne Humphries	John Minchew	jminchew@secure1one.com			
	MUD	(832) 467-1599	(713) 777-5337	(713) 860-6400	Buddy Kluppel	buddy_kluppel@msn.com			
	Last Tuesday		bjordan@jonescarter.com		Raymond Kirkwood Boyd	rboyd1213@sbcglobal.net			
	at 5:30 pm	mammel@edpwater.com	bmiller@jonescarter.com	lhumphries@abhr.com	James Randall Vance	vanceairconditioning@gmail.com			
18		Si Environmental, LLC	Century Engineering, Inc.	Coats Rose	Charles Lusk, III	cmlusk@luskproperties.com	4	YES	MISSOURI CITY
	Fort Bend	Brian Bare	Bernard Johnson	Timothy Green	Jojo Tharayil	jojotharayil@yahoo.com			
	MUD No. 46	(832) 490-1500	(713) 780-8871	(713) 653-5735	Ketan Imandar	ketanshilpa@comcast.net			
	4th Tuesday				Timothy P. Williamson	tim.williamson@cadencebank.com			
	at noon	bbare@sienv.com	bj@centuryengineering.com	tgreen@coatsrose.com	Nick A. Hernandez	nick.hernandez@transwestern.net			
19		Quail Valley Utility District	LJA Engineering, Inc.	Strawn & Richardson, P.C.	Bill Quinn	Billquinn34@aol.com	2	YES	NONE
	Fort Bend	Hector Acevedo	Gary Mensik, P.E.	Christopher B. Richardson	Terry Sparks	terrysparks@earthlink.net			
	MUD No. 49	281-499-5539	(713)953-5200	(713)864-5466	Donna Kottwitz	donna.kottwitz@enipetroleum.com			
					Dennis Hurta	DHurta@bbgres.com			
		hacevedo@quailvalleyud.org	gmensik@ljaengineering.com	chris@srlegal.com					
20		Si Environmental, LLC	RG Miller	Allen Boone Humphries Robinson	Chad Millis	chad@millisdevelopment.com	1	YES	MISSOURI CITY
	Fort Bend	Jason Demel	Angela Hallimore	Lynne Humphries	Charles K.Friday	Friday.kevin@gmail.com			
	MUD No. 116	(832) 490-1500	(713)461-9600	(713) 860-6400	Angela Wood	aws2693@yahoo.com			
	1st Tuesday				Thomas J. Shirley	tshirley@newfirst.com			
	at Noon	jdemel@sienv.com	ahallimore@rgmiller.com	lhumpries@abhr.com	Kafi Dalcour	tuere2@yahoo.com			
21		Levee Management Services	LJA Engineering, Inc.	Allen Boone Humphries Robinson	William Lowry	bill.lowry@dot.gov	1	YES	NONE
	Fort Bend	Jeff Perry \ Wade Wendt	Wallace Trochesset, P.E.	Jim Boone	Paul Schaub	jespws7@aol.com			
	MUD No. 121	(281) 240-6454	(713) 953-5200	(713) 860-6400	Edmund Dumas	adumas9582@aol.com			
	2nd Tuesday	j.perry@leveemanagementservice.com			Sharon Boehck				
	at 10:00 am	wwendt@ci.richmond.tx.us	wtrochesset@ljaengineering.com	jboone@abhr.com	Pat Baker	pattybaker930@gmail.com			
22		Severn Trent	AECOM	Allen Boone Humphries Robinson	Richard Ward	dward@tetratec.com	3	NO	HOUSTON/ NONE
	Willow Fork	Rich Rankin	Robert Wempe	Steve Robinson	Dan Smith	dan.smith@mustangeng.com			
	Drainage District	(281)578-4200	(713) 956-4100	(713) 860-6400	Joseph Robinson	jrobinson1@juno.com			
	2nd Tuesday				John Poulter	jcpoulter@gmail.com			
	at 11:30 am	rrankin@stes.com	bob.wempe@aecom.com	srobinson@abhr.com	April Renberh	alrenberg@yahoo.com			

Tab F
Appendix 4

NOTIFICATION FLOWCHART