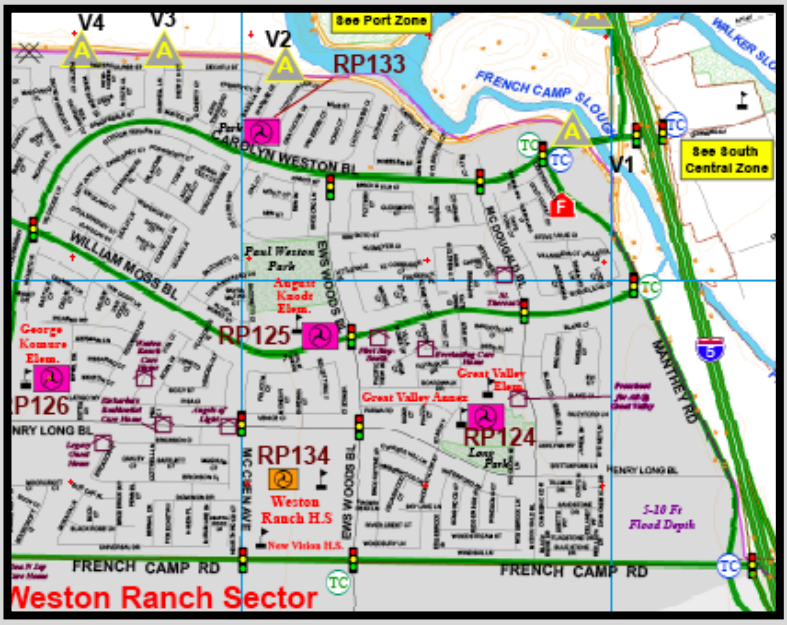
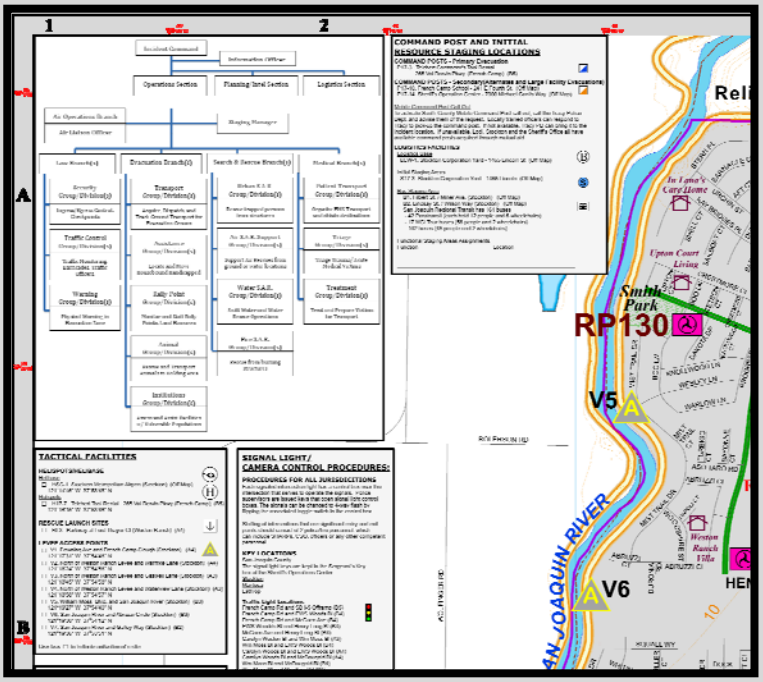
Guide to Urban Evacuation Mapping, 2nd Edition





Federal Emergency Management Agency
Region IX RiskMAP
September 2012

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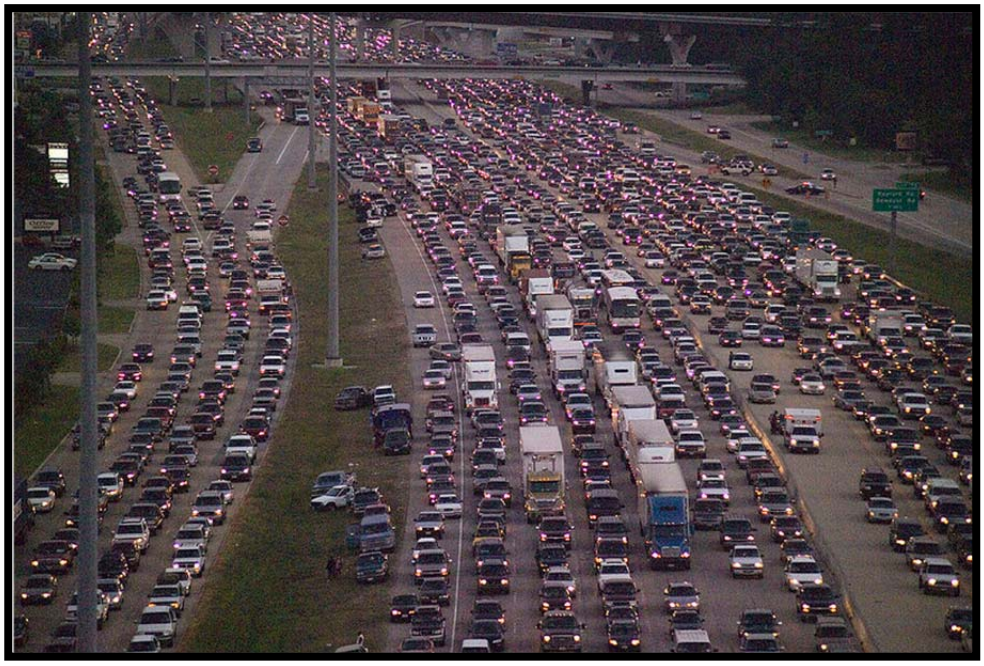

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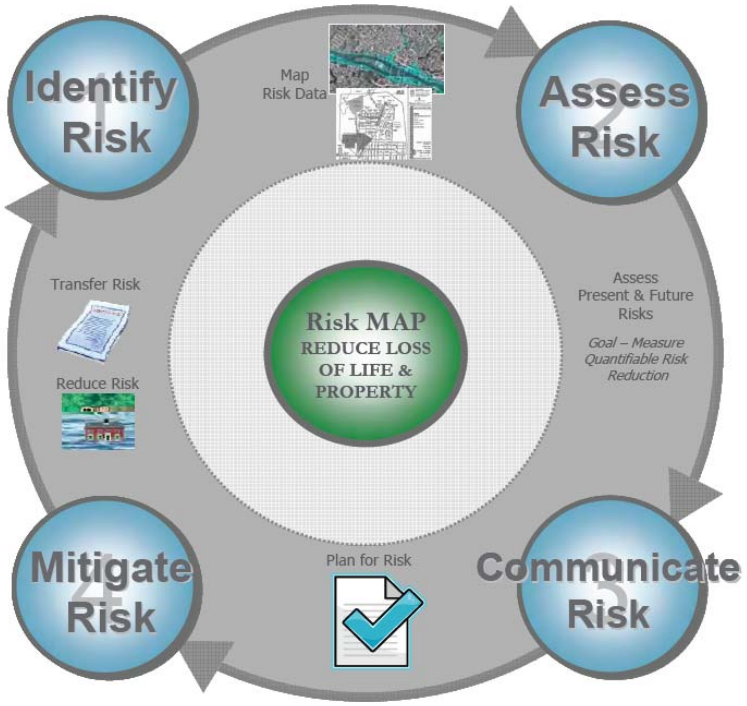

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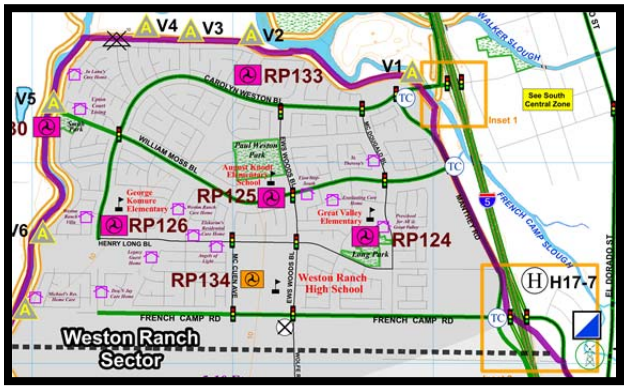
INTRODUCTION TO URBAN EVACUATION MAPPING

PROGRAM OBJECTIVE

The objective of an urban evacuation mapping program is to facilitate the organization of large evacuation operations in highly populated areas of the Country. This objective is accomplished through the use of advanced mapping as the primary means for displaying organizational cues and critical community information that responders will need in the initial stages of such complex operations.

A NEW APPROACH TO EMERGENCY PLANS - MAPPING

Clearly, even good emergency plans cannot benefit responders if they cannot be quickly accessed and understood in the difficult field response environment. Thus a major challenge in emergency planning has been finding the display format that is most easily accessed and assimilated by responders in the initial stages of a major emergency. Traditional written plans have proven an awkward tool for providing information in such fast moving and potentially chaotic field environments. If one adds the prudent assumption that initial responders will not have had recent training on the complex operation they must now organize, then this challenge becomes even more urgent.



Modern mapping software offers this new needed approach to displaying emergency procedures and information. Maps can integrate pre-plans, organizational cues and community information with a visual view of the geographical area in which operations will take place. Cartographic tools provide the means to display information more economically than in written narrative. In this approach, maps move from a supplementary tool of emergency response to a primary organizational tool for field responders.

The use of maps to display urban evacuation plans does not necessarily replace all needed plans and protocols. Urban evacuation maps are a command level organizational tool and serve as a summary center piece of a well-organized evacuation system around which other plans and procedures will be understood and implemented.

This Guide describes the process for implementing an urban evacuation mapping program developed over the period of several years in a model program that can be adapted to local circumstances.

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MAPPING AND THE EMERGENCY PLANNING PROCESS

The basic product of an urban evacuation mapping program is a set of hard copy maps covering pre-identified evacuation "zones" within the targeted planning area. Each map displays command, tactical, and logistical response cues together with critical community information needed to organize an evacuation of that area. The number of individual maps in a set will depend on factors to be discussed below. Completed map products are subsequently placed in a central repository for rapid access and sharing in a crisis.

This basic set of maps can be supplemented with additional planning to address specific response functions shown on the maps in summary form. If geographical information systems (GIS) or computer aided drawing programs (CADD) are used to create the maps, then the digital map files can also be organized to allow for real-time modification of maps to meet specific response needs during the emergency.

ESTABLISHING A MAPPING PROGRAM

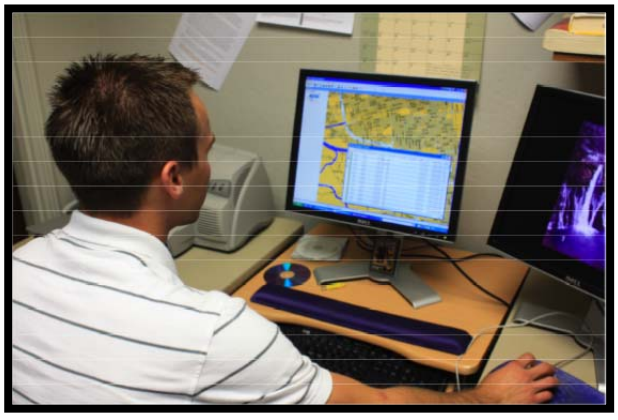
As with any emergency planning program, there are key first steps to a successful effort. Completion of these initial steps will help establish realistic program objectives.

Step 1: Identify Program Manager and Staff Resources

An urban evacuation mapping program will involve numerous agencies and personnel working together over an extended period of time. A sound management structure is critical for the management of such a complex process. The following two resources are particularly important.

Program Staff

A program manager should be appointed to handle overall coordination of program activities. Staff available to assist the program manager should also be clearly identified along with a program budget. The number of dedicated project staff will be a key determinate of how rapidly maps can be completed.



Technical Resources

A variety of software and techniques are available for creating high quality maps. Decisions on what mapping technology will be used, and how the mapping technicians to use it will be provided, should be

made early in the program. An adequate budget for this resource should be established since mapping technicians may need to attend key discussions and possibly conduct some independent research.

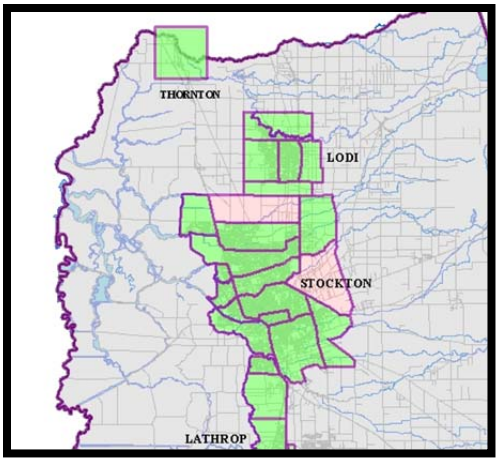
Once program resources are identified, realistic program objectives and timelines can be set. Implementation decisions, such as whether to complete individual maps sequentially or in groups, can be made.

Step 2: Determine Map Specifications

Program staff and public safety responders now identify the specifications for the evacuation maps. These written specifications describe in a clear and complete manner what will be displayed on each map and how. Map specifications include at least a list of the map data elements, the methodology for displaying each data element, the symbol set, scale guidelines, the map intellectual hierarchy, and file technical requirements. The complexity of such specifications will depend on the software being used, the level of expertise of mapping technicians, and whether a dynamic mapping capability is desired.

Step 3: Identify Evacuation Zones

The area targeted for mapping can now be divided into the individual map products. Each map will cover one or more evacuation "zones" which program staff will define in cooperation with public safety agencies. The boundaries of these zones are based on the characteristics of the community and the nature of its hazards. These characteristics also include any predictable specific hazards, such as floods, or the organizational structure of the community's public safety agencies. Transportation, access, and mutual aid issues may also be considerations in this process.



There will also be practical considerations such as effective map scale and the benefit of minimizing the number of individual maps needed. More than one evacuation zone may be shown on a map if the zones are small in area and optimum map scales can be met. The bottom line is that the coverage of individual maps must be operationally sound and all maps must be easy to read, understand, and use at the physical size that they will be printed.

Establishing evacuation "zones" can be a somewhat arbitrary process when hazards to a community are general and the size and exact nature of potential evacuations cannot be determined in advance. There will also be cases where a geographically extensive evacuation zone is called for by the characteristics of the area. In order to deal with such situations, planners can add additional operational flexibility by further subdividing each evacuation zone into sectors or other sub-divisions.

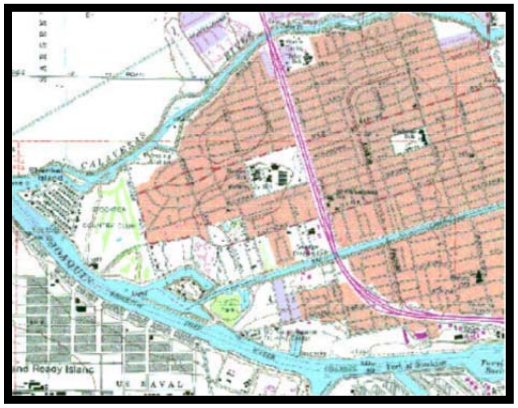
If such sub-divisions are established, a less detailed small-scale map of the entire evacuation zone can be created and then complemented with larger-scale maps of each sub-division for actual operational use. These sub-division maps would show portions of the overall evacuation zone at a scale more easily used by responders while still displaying all of the relevant information for that zone.

Regardless of how evacuation zones, and potential sub-divisions of those zones, are identified, most mapping software provides the flexibility to quickly modify maps to correspond with an actual area of evacuation in an emergency. But development of these tentative zones and individual map coverage early in the program will allow draft maps to be created for initial planning discussions.

Model maps that come with this Guide include an example map for an urban evacuation zone where sub-divisions are not needed and a map of a geographically extended evacuation zone where "sectors" were established. One sector map for the extended evacuation zone is provided for comparison.

Step 4: Determine the Background for the Maps

An early program decision will be the selection of the background for the maps. Information and procedures subsequently developed by public safety agencies will be displayed against this background. The United States Geological Survey (USGS) topographical maps series may be used if that older data still adequately portrays the area being mapped. Aerial photos, if they are available, may be used in lieu of the USGS map background, or as an alternate background. The model maps provided with this Guide use a custom background created with GIS software showing up-to-date streets and highways and topographical features.



Creation of a custom map background allows planners to only show community and topographical information important for evacuation operations. Unneeded information that may clutter the map can be left off. A custom map background is more costly than using existing data sets so an intermediate option may be to have mapping technicians modify digital versions of the older USGS topographical background to correct out-of-date map details critical to evacuation operations.

Step 5: Confirm Commitment of Public Safety Agencies

Once evacuation zones and individual map products are defined, project staff can determine which public safety agencies, or individuals within those agencies, need to be involved in the development of each individual map. Agency participation and level of commitment should be confirmed and time and other constraints to participation identified.

Step 6: Identify a Standard Evacuation Organization

A major evacuation operation can be organized in any number of ways while still complying with the standards and procedures of the National Incident Management System (NIMS). It is a major benefit, therefore, if a standard incident command organizational structure can be agreed upon by all public safety agencies operating in the area covered by the mapping program. This will simplify the map development process as well as subsequent training activities and operations. A common organizational structure will also make mutual aid operations more effective.

If a standard evacuation organization is established, a chart showing this organization can be placed on the evacuation maps as a cue for initial responders. If a standard organizational structure cannot be agreed upon then the specific incident command organization for each evacuation zone will need to be determined and placed on the map. Once emergency operations begin, the organizational structure can be modified if necessary by responders based on the actual situation.

Step 7: Establish a Mapping Schedule and Process

Program funding, the number of individual map products identified, and the commitment of involved agencies will determine the schedule for map development. Most individual maps will require several meetings and several map drafts to complete. A map completion schedule should be developed and provided to participating agencies for planning purposes. The schedule may change over time but its existence will help maintain program momentum.

Step 8: Develop Individual Evacuation Zone Maps

The development of individual maps will follow a similar process. An initial draft map is created prior to the involvement of the public safety agencies that will provide the input for its completion. The availability of a draft map at initial meetings will facilitate discussion and improve results. This initial work will also allow program and technical staff to resolve technical issues such as best map scale, exact map orientation, and best placement of planned text boxes.

Standard information not requiring decisions or input from the public safety agencies can also be added to the initial draft map (See Table 1, Map Data Elements). This standard information, such as locations of schools or care homes, is generally obtained from the same sources for all maps. Blank text boxes that will contain information generated in the planning sessions can also be placed on the draft map in order to determine best placement and facilitate subsequent discussions.

With an initial draft map in hand, project staff now schedule joint meetings with the different agencies and/or individuals responsible for evacuation operations within that evacuation zone. Technical staff adds information to the map as it is developed through this collaborative planning process until a complete draft is ready for review and approval. There are several common types of decisions that will be made during this process.

Command Post and Resource Staging Sites

Pre-planned locations for establishing field command posts and resource staging areas can be identified. Alternate sites for each of these facilities can be selected but these should be limited to prevent confusion and to avoid map clutter. Physical visits to the evacuation zone may be necessary to confirm these locations. If sites for staging areas for specific response functions cannot be determined in advance, then a text box for recording these locations at the time of the emergency can be added to the map.

Tactical Facilities

Tactical facilities to support response activities are also be pre-identified. These would include emergency helispots, watercraft launch sites (into potentially flooded areas), and other specialized response facilities. Again, alternate sites can be selected and surveyed if desired to provide pre-planned options to responders. Other key locations, such as access points to levees, can also be added to the map. All these facilities and their locations are also listed in a text box on the map for rapid reference.

Command and Tactical Communications Frequencies

Command and tactical communications frequencies are worked out and added to the map. If security of this information is of concern, then the map can merely reference where the communications plan is located. Communications is usually a major issue in a large response so this planning should be thorough and detailed.

Evacuation Routes, Traffic Control, and Security Checkpoints

Primary evacuation routes and sites for traffic control, ingress/egress, and other control points are determined and placed on the map. Different symbols can be used to discriminate between sites where unstaffed barricades or staffed vehicles will be used. Enlarged insets of key or complex intersections can be placed on the map to assist with displaying or recording the traffic control plan for these locations.

Where multiple different evacuation scenarios are possible within an evacuation zone, planners may not identify specific evacuation directions. In this case, traffic control points may be left off of the map and recorded on the map at the time of the emergency. Or, the traffic control point symbols can be color-coded to indicate which points would be staffed for each movement direction. In this case, a text box can be added to the map to record evacuation direction once it is determined at the time of the emergency. Mapping technicians can then remove the unneeded symbols by turning off that "layer" of the digital map file.

Rally Points

Any evacuation plan needs to make provisions for people who cannot leave the evacuation zone on their own. Some people will not be able to leave their house due to a medical or physical handicap while others may be physically mobile but not able to expeditiously leave the area due to lack of a vehicle or other problem. In the case of those evacuees who are physically mobile, public safety agencies will need to establish locations where they can obtain transportation assistance. There is no standard term for such locations so "Rally Point" is used in this Guide to designate such gathering places. Rally points should be locations with adequate space for loading operations and which are familiar to residents of the area.

Additional procedures will need to be developed to assist individuals who are house bound due to handicaps or medical conditions and cannot even reach a rally point. The field incident command organization should include a function and procedures for providing this assistance.

Summaries of Other Concurrent Operations in the Evacuation Zone

Evacuation operations are rarely conducted in total isolation from other emergency operations taking place at the same time. For example, in a flood there may be engineering efforts to prevent levee failure or reduce the impact of flood flows proceeding simultaneously with evacuation operations. Key elements of the pre-plans for such concurrent emergency operations which might affect evacuation and rescue operations are placed on the maps to help with coordination.

Other Map Elements

Review of the map should continue until all desired map data elements are addressed and the results of discussions and planning posted on the final draft map. Any general information, such as locations of facilities with vulnerable populations, that has not already been added should be collected at this time and placed on the map.

REVIEW AND APPROVAL OF FINAL MAP

Once the draft zone map is complete, involved agencies should provide final approval. This approval process should be established at the beginning of the map development process and should include a formal sign off by all agencies. If lower level personnel are assigned to perform the initial work, the formal approval process must ensure that higher levels of command in each participating agency are aware of the plan details and have approved them for operations.

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DEVELOPING MAP SPECIFICATIONS

MAP CONTENT

Program staff and public safety responders first define the map content. The primary criterion for putting specific information on the map is, of course, usefulness to the responders. There may be, however, an initial tendency by responders to identify a large amount of information for display on the map. Placing too much information on a map can make it difficult to use so balancing the need for information and the need to keep the map usable will be a critical part of determining map content.

Map content may be divided into objective and subjective data elements. Objective data elements just need to be collected and verified. Examples would include locations of hospitals or acute-care facilities, operational radio frequencies, or street systems. Subjective data elements result from decisions made in the collaborative planning process. Examples of subjective data elements would include the pre-planned location for a command post or staging area, the evacuation organization that will be used, or the siting of emergency helispots.

Once map content is determined, each data element of that content is further defined. For example, it may be decided that pre-planned field command post locations will be placed on the map. This decision would be further defined by describing how many alternate sites can also be selected and the guidelines that will be used to choose appropriate sites.

Table 1 shows the data elements of the model maps that come with this Guide. This list was developed over a period of time as experience was gained in the use of the maps.

DISPLAY METHODOLOGY

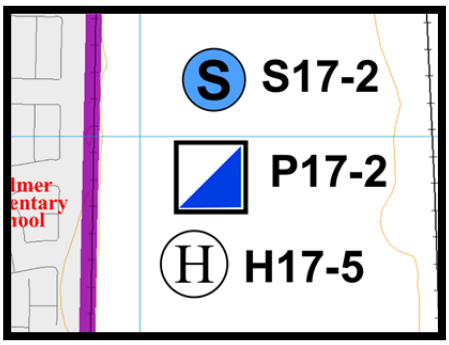
Planners now determine how each data element will be displayed on the map. The basic cartographic options are as a symbol with or without a label, within a text box, or as part of the general map background. It may be decided to show some information in more than one form. For example, hospitals could be shown as a symbol on the map to assist with locating each facility and also as part of a list of hospitals within a text box to assist with tracking hospital evacuation status.

Symbols

Table 2 shows standard symbols used for the model maps. NIMS symbols are used where they exist but for many of the symbols there is no national standard. Any symbols used in a similar program should, however, comply with two key principals. Symbols must be easily distinguished from each other while being simple enough in design to be drawn by freehand. Adherence to these principals will facilitate understanding of the maps and also allow improvised updating of the maps during emergency

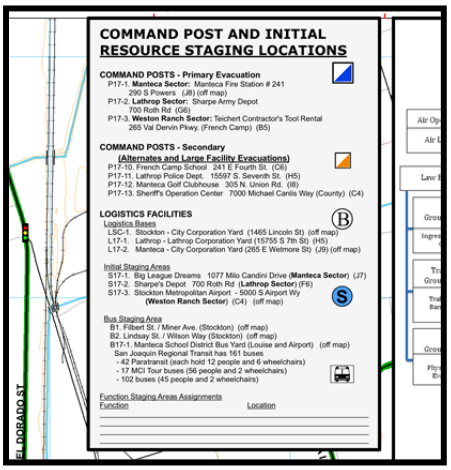
operations. Symbols may have an accompanying descriptive or identifying label such as a name or designation.

Keeping symbol design simple will also help ensure that their appearance is consistent if they are created with different types of mapping software. The key in the use of symbols is standardization and consistency to facilitate understanding by users. Sizing of the symbols on the map is also important. Symbols should be large enough to be easily recognized and should stand out boldly in the map background (see discussion on visual hierarchy). Examples of proper use of symbols can be seen on the model maps provided with this Guide.



Text Boxes

All map text should be placed in text boxes except for labels for symbols or prominent features within the map background. This practice keeps the map organized and easier to read. Text box borders can be color coded in accordance with the type of information that they contain to assist with locating desired information. Table 3 shows the color scheme for text borders used on the model maps.



Text boxes should be placed in peripheral portions of the map where they do not obstruct critical geography, symbols, or infrastructure. Text boxes with related information are grouped together if possible. For example, text boxes showing tactical facilities and communications plans are placed as close to the organizational chart as possible since they have related information.

As noted before, some facilities or structures, such as command posts, rally points, or schools, may be shown as a point symbol at their specific location and also within a text box as part of a list of similar facilities. Such text boxes can include check boxes, lines, and/or space for recording actions and information next to each facility name.

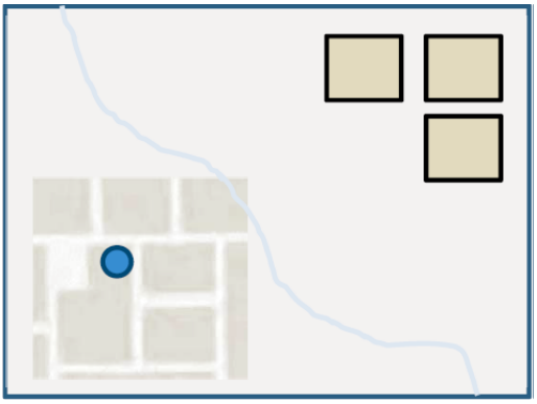
Map Background

Many desired data elements may be shown as part of this standard map background, particularly generalized linear information such as elevated highways, elongated topographic features important for evacuation operations, and sub-division street schemes of populated areas

INTELLECTUAL AND VISUAL HIERARCHY

An important concept in cartography is figure-ground. This element of map design involves giving a map visual depth so that its intended message is clearly communicated to users. Techniques for developing good figure-ground include differentiation, use of enclosed forms or figures, centrality, and smoothing of outlines or contours. These techniques are used to convert a pre-planned map "intellectual hierarchy" to a corresponding map "visual hierarchy".

The "intellectual hierarchy" of a map is the relative importance of map contents for communicating the map's purpose as determined by the potential map users. An intellectual hierarchy, or scale of concepts, should be consciously defined when map content is first identified. Intellectual hierarchy, by ordering the importance of map data elements, drives how each will be visually presented.



Good Visual Hierarchy makes the most important map elements *stand out* to better communicate the information that responders need to see and focus on

Proper intellectual hierarchy also includes a clear and logical separation of information needed by distinctly different emergency functions into separate map products. This last is an important consideration because combining different information used by different responders with distinctly different missions (e.g. engineers flood fighting a levee and responders conducting an evacuation) on one map risks making the map difficult to read by all of them.

The "visual hierarchy" of the map contents will be developed to reflect the intellectual hierarchy established by users. Again, visual hierarchy is the planned differentiation in appearance of map information to draw initial attention to relatively more important information, to assist with locating needed information, and to allow more rapid distinction between different kinds of information. Visual hierarchy techniques include sizing, placement, closed forms, and other visual qualities that give map content a planned visual "order" and clarity. For example, use of easily distinguishable symbols and their relative sizing can help bring more important information to the forefront. Use of enclosed forms or figures such as boxes can help draw initial attention to key information by taking advantage of the tendency of users' eyes to be drawn to real or perceived forms. Placement of information closer to central parts of the map can make that information more prominent. These, and other techniques such as color-coding and orientation, are the means for creating visual hierarchy.

Intellectual and visual hierarchy may well be the most important element of conscious map design since good information poorly displayed undermines the key advantage of the map format. This visual "depth" will be the key to rapid comprehension of the map in difficult operational circumstances.

TACTICAL FACILITY DESIGNATIONS

Public safety agencies will inevitably identify multiple tactical facilities with the same function within individual maps and throughout the set of maps. These tactical facilities, such as command posts or emergency helispots, should be assigned unique designators to prevent confusion and assist with communication. The use of unique designators will shorten tactical communications and allow quicker identification of a tactical facility on a map.

The designator for each tactical facility should be unique for the entire area being mapped and not just for the specific map where it is placed. The model maps use a simple designator system that combines an initial letter indicating the type of facility with two letters from the name of the zone map in which it is found and a unique number. Other designation systems can be created as appropriate to local circumstances. The chosen designation scheme becomes part of the map specifications.

GEOGRAPHIC FRAMEWORK

The geographic framework of a map includes the projection and coordinate system and the range of map scales that will be used for the map set.

Projection and Coordinate Systems

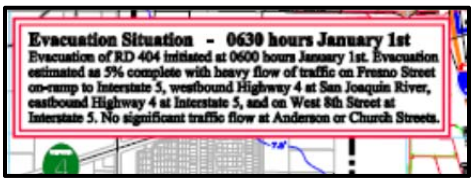
The projection standard and coordinate system to be used for the maps will need to be defined. Most states and engineering firms use the State Plane Coordinate System (SPCS). This standard should be clearly set and the same projection and coordinate system used on all maps in a set.

Scale

There will be almost certainly an initial desire to create and print all the maps in the set at the same scale. In practice this is hard to accomplish. Printing hard copy maps at a common physical size to facilitate their use in the field will, therefore, require that different scales be used for individual map products. But limits to potential map scales should be set to ensure that the maps have optimum visual qualities. Map designers should identify a range of optimum scales to keep differences within reason.

CREATING DYNAMIC MAPS

The objective of an urban evacuation mapping program can remain limited to the creation of a set of hard copy maps displaying information developed prior to an emergency. But advancements in modern geographical information systems (GIS) and computer aided drawing programs (CADD) offer improved ability to quickly modify digital map products to meet real-time response needs.



Such enhanced mapping capabilities have obvious advantages for timely, effective, emergency response. Real-time information such as road-closures, location of resources, a new traffic control point, and status of the evacuation can be quickly added to maps created before the emergency. Information on the original evacuation map that is no longer needed can be dropped off. The desire to take these types of actions will be an inevitable result of having the maps in the first place. But to effectively add this dynamic capability, a mapping program must be more carefully thought out and designed.

In the case of static map products, how the GIS or CADD technician creates the maps is not highly important. The only criterion of success is that a map is visually correct. However, if responders want to be able to rapidly and efficiently modify the evacuation maps, then exactly how the map files are structured and the maps created becomes highly important.

In a more dynamic mapping program the initial process of defining map contents is supplemented with a description, based on knowledge and experience, of how the maps may need to be modified in an emergency. Anticipated modifications of the standard map content to meet special needs may include a logistics map, situation maps, or other products. While all potential needed modifications cannot be anticipated, this initial effort to identify types of modifications will help mapping technicians structure the digital map files.

Figure 1: Process for Designing Dynamic Maps

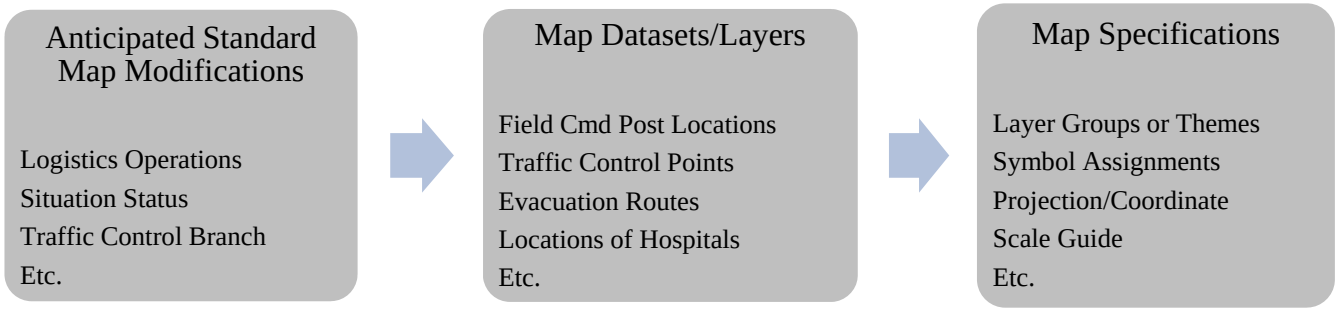


Figure 1 shows this more sophisticated process. First, anticipated modifications of the standard evacuation map for special purposes are identified. Each data element of the standard evacuation map is then structured as a distinct "layer" within the digital map file linked to the relevant dataset for each map. In this way, each layer can be easily turned on or off by the mapping technician as needed. These distinct map layers are then assigned to "groups" or "themes" by the mapping technician based on the anticipated types of modifications identified by the map users. Themes could be "critical facilities" or "air operations" or "command/logistics facilities". This file structure becomes part of the detailed "map specifications" which mapping technicians use to create all maps and their digital files.

This system of organizing the map data in the mapping software becomes a "model" which can be followed for all individual map products to ensure consistency and meet anticipated operational needs. If geographical information systems (GIS) software is used to create the maps then each symbol on the map can also be intelligently populated. Using GIS field types such as MapName, PointType, Location, etc. can aid the technician's efforts in selecting the desired symbols for each map as well as in hiding map symbols on adjoining maps. This is especially useful when working with multiple maps that border each other.

FOLLOW-ON PLANNING OPPORTUNITIES

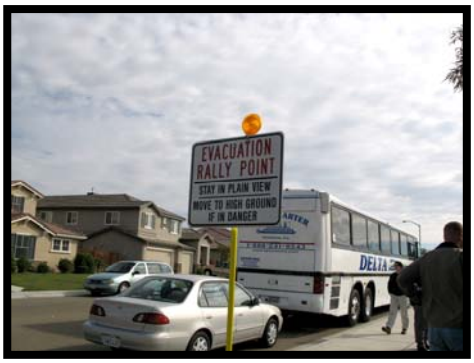
The process of developing the urban evacuation maps will generate additional opportunities for follow-on planning. These additional response tools can be used in conjunction with the maps to further improve response efficiency. The following are a few examples of such follow-on planning.

Field Operations Guides, Checklists, and Specific Procedures

The development of a standard evacuation organizational scheme can be the stimulus for additional planning to develop specific procedures and forms for each specialized function. Such specialized field guides can be then used in conjunction with generic incident command system guides. These specialized guides can be posted with the evacuation maps for easy access.

Tactical Facility Surveys

Tactical facilities identified in the mapping process can be surveyed and planned in more detail. Some facilities may only need a brief survey while other facilities may benefit from more detailed planning. An example would be emergency helispot sites. Pilots, or other staff knowledgeable with helicopter operations, can survey sites tentatively identified by public safety agencies and confirm the suitability of each location and classify it by the size of aircraft it can safely support. The result of these surveys would confirm the suitability of sites and also provide a pilot advisory which can be posted on the map repository for use by responding aircrew.



Acquisition of Equipment and Supplies

The effectiveness of any major response will depend on the availability of specialized equipment needed to effectively implement pre-plans shown on the map. Custom signage for traffic control points and rally points can improve the quality and effectiveness of those operations. The process of developing the evacuation maps will serve to focus attention on the equipment needed to effectively implement the response plan displayed. The existence

of this equipment, and how to access it, can be posted on the map to ensure that there is no delay in mobilizing it.

USING THE MAPS IN AN EMERGENCY

Even without developing a dynamic mapping capability, the hard copy urban evacuation maps are a highly effective tool for situation analysis, initial response organization, and tracking of key evacuation decisions and information. But there are some considerations for ensuring that the maps will be effectively used in a crisis.

HARD COPY MAPS

In an emergency, hard copy maps will be requested for discussions and planning sessions. Field operations in particular may rely on hard copy maps. There are several issues to keep in mind to prevent confusion with the use of hard copy maps.

Confirming Use of Current Versions

Numerous copies of the maps will have been printed before an emergency for training, exercise, or planning purposes. Once actual emergency operations begin, it is important to ensure that only current versions of maps are being used. Protocols should be established to ensure that all hard copies printed prior to the beginning of the incident are destroyed and new copies downloaded and printed from the central repository. Technicians maintaining the website can confirm that all files posted to the central repository are the most current versions and can then modify file names to include the event name or current date. This will help agencies to confirm that they are downloading or printing the most current map file.

Ensuring Map Durability

A key problem with using hard copy maps in harsh field conditions is ensuring their durability. More durable plotting paper is now available which is difficult to tear and resists excessive creasing. The use of waterproof ink to print maps provides additional durability in wet weather. The special plotting paper can be used with any plotter but printing the maps in waterproof ink requires a specialized plotter. Other methods of ensuring map durability, such as the use of acetate coverings, can also be explored.

MAKING MAPS EASILY ACCESSIBLE

A major advantage of maps is the ease and speed with which their digital files can be shared over great distances and among many different agencies. The key to exploiting this advantage is a properly maintained central map repository.

Dedicated Map Website

A very efficient method for establishing a central map repository is through the use of a dedicated website. Figure 2 displays a website page used to post evacuation maps of a model program. In the example shown, users can identify the map they need from a graphic of the overall jurisdiction or from a tabular list. Users download the map file to their local computer where it can be viewed on screen or printed using a map plotter. The example website is secure and provides copies of completed maps in a non-modifiable format to prevent unauthorized changes before the emergency.

A single agency should be assigned to maintain the central repository. That agency will receive and post original files received from the technicians who created them. Protocols should be developed for accessing the central repository and for using and distributing downloaded maps. Other planning or operational documents that complement the evacuation maps can also be posted on the central repository for access along with the maps. If a dynamic mapping capability is developed then custom maps created at the time of the emergency can also be posted to this site for easy access.

USE OF DIGITAL MAP FILES IN OTHER EMERGENCY MANAGEMENT SYSTEMS

Digital map files can be easily used for computer, audio-visual, and other electronic displays. Their digital nature makes it easy to isolate, enlarge, and print or display key portions of a map. The maps also lend themselves to use with video-conferencing systems because of their single page format and easy transmissibility. In some cases, digital map files can be imported into existing incident management software systems for use with the other features of those systems. This capability, and the procedures involved, can be confirmed and practiced prior to the emergency.

DYNAMIC MAPPING AND DATA MANAGEMENT

If a dynamic mapping capability is developed where real-time modifications of the initial evacuation map are made during the emergency, then a system for managing incoming new data or requests for modified maps and outgoing new map products needs to be established. This could be as simple as designing a custom map order form that responders in the field can use to order modified maps. Figure 3 shows an example of such a special use form.

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EVACUATION MAPS FOR THE GENERAL PUBLIC

Some elements of the evacuation plan displayed on the public safety evacuation maps, such as evacuation routes and rally points, need to be communicated to the general public in a timely manner to be effective. The map format can be used to assist with this education process. As with responders, the development of maps designed for use by residents will allow the general public to more quickly access evacuation information in relation to their location or home. A model general public map developed from one of the model public safety evacuation maps is included with this Guide as an example of the following discussion.

Development of the General Public Map

A general public map can be developed for each evacuation zone by extracting the information that the public needs to know from the respective public safety agency map. This will usually include at least evacuation routes, rally points and the means for obtaining evacuation information. Information that the general public does not need to know, such as the location of command posts, is not transferred.

General public maps should use different symbols that are more intuitively understood by the layman. Short and concise definitions of symbols can be included on the map to help with understanding. Additional safety information or instructions for the public can be added to the map if desired but these maps should be kept as simple as possible providing only critical information residents need to evacuate the area.

Making Maps Available to the General Public - Websites and Hard Copies

As with the public safety agencies, a separate dedicated website can be established for the use by the general public to view their maps. Hard copies of the maps can be made available in libraries and other public locations and within the evacuation zones themselves by preparing framed hard copies for posting at schools, malls, or parks. This latter action would be particularly important where there would only be very short notice to residents of a potential evacuation.

TECHNICAL ISSUES

FILE NAMING PROTOCOLS

Since final maps will be maintained and accessed from digital files it is important to establish a set of rules or protocols for naming the electronic files and the maps they contain. Naming protocols will help ensure that files are properly maintained and that the most recent map is accessed in an emergency.

Names and dates can be used in combination in the file name to identify the map and the version. Figure 3 shows an example of a file naming protocol.

SOFTWARE AND STANDARD GIS MODELS

Different types and versions of geographical information system software are now widely used. Software standards will need to be set to minimize the problem of conversion or incompatible files if more than one agency is creating evacuation maps. A standard model for maps should also be worked out between local, state, and federal agencies to ensure that the data of other related mapping programs can be easily integrated with the evacuation map data.

STANDARD FOR REPORTING MAP LOCATIONS

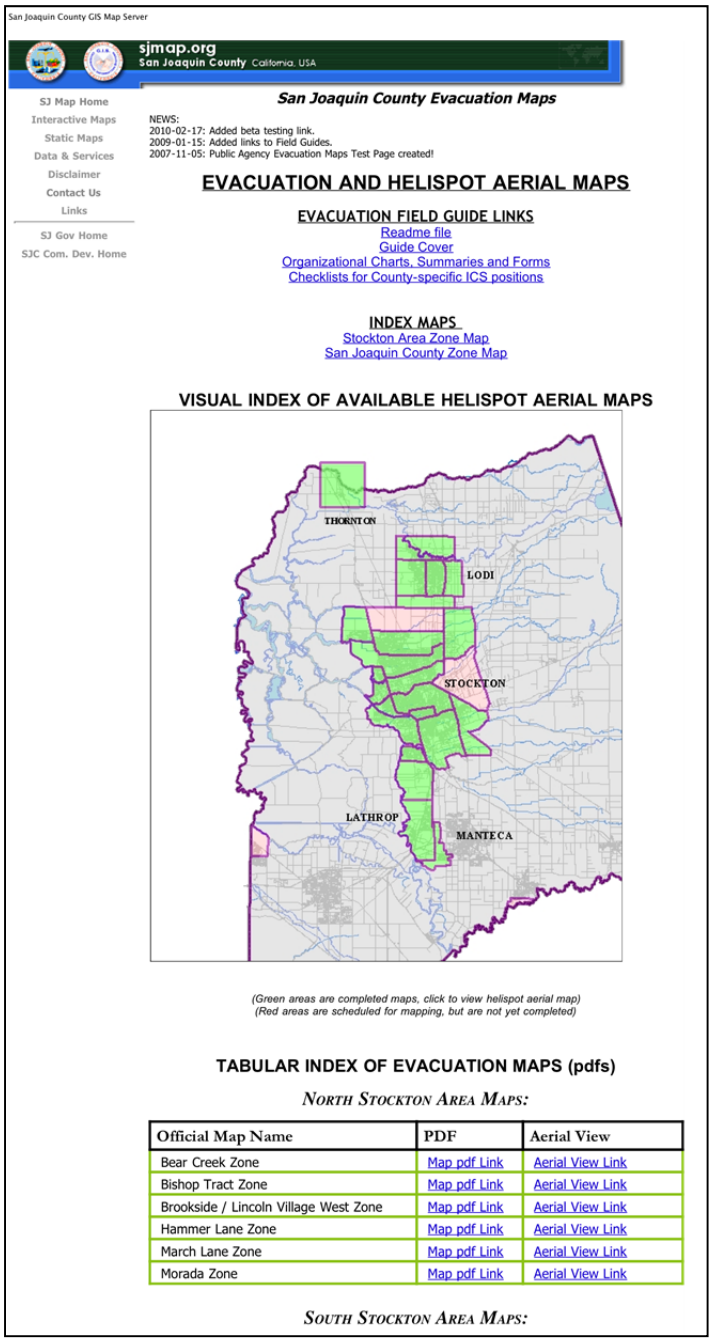
In the actual world one finds a wide range of methods used for reporting a location from the field. A standard should be established for reporting locations on the evacuation maps. Such a standard will help ensure that the maps are developed to facilitate the use of this standard reporting protocol.

A universal standard for reporting location is the use of longitude/latitude coordinates. The increasing use of GPS technology in the field makes the use of the longitude/latitude system imminently practicable. Provision for use by field personnel of this reporting standard can be incorporated into the maps by adding longitude and latitude markings to the maps.

DATA COLLECTION/METADATA

Metadata should be maintained for any technical data shown on each map. Metadata should be created and maintained in accordance with the Federal Geographic Data Committee Standard (FGDCS). Metadata for GIS files will be maintained within the files while metadata for other non-GIS electronic files will be maintained in a WORD text document.

Figure 2: Example of Flood Contingency Map Website



San Joaquin County GIS Map Server

sjmap.org
San Joaquin County California, USA

SJ Map Home
Interactive Maps
Static Maps
Data & Services
Disclaimer
Contact Us
Links
SJ Gov Home
SJC Com. Dev. Home

San Joaquin County Evacuation Maps

NEWS:
2010-02-17: Added beta testing link.
2009-01-15: Added links to Field Guides.
2007-11-05: Public Agency Evacuation Maps Test Page created!

EVACUATION AND HELISPOT AERIAL MAPS

EVACUATION FIELD GUIDE LINKS
Readme file
Guide Cover
Organizational Charts, Summaries and Forms
Checklists for County-specific ICS positions

INDEX MAPS
Stockton Area Zone Map
San Joaquin County Zone Map

VISUAL INDEX OF AVAILABLE HELISPOT AERIAL MAPS

(Green areas are completed maps, click to view helispot aerial map)
(Red areas are scheduled for mapping, but are not yet completed)

TABULAR INDEX OF EVACUATION MAPS (pdfs)

North Stockton Area Maps:

Official Map Name	PDF	Aerial View
Bear Creek Zone	Map pdf Link	Aerial View Link
Bishop Tract Zone	Map pdf Link	Aerial View Link
Brookside / Lincoln Village West Zone	Map pdf Link	Aerial View Link
Hammer Lane Zone	Map pdf Link	Aerial View Link
March Lane Zone	Map pdf Link	Aerial View Link
Morada Zone	Map pdf Link	Aerial View Link

South Stockton Area Maps:

Figure 3: Custom Map Order Form

Custom Map Order Form

Instructions: Indicate Layer(s) desired. Forward to EOC Planning/Intelligence Section.

Background: __ Topo/Street __ Street Only __ Aerial __ Other: _____

Changes to Current Data Attached: __ YES __ NO New Data Attached: __ YES __ NO

Documents/Maps Attached with new/changed data:_____

Copies Needed: ___ Size: __ 8.5"x11" __ 11"x17" __ 17"x22" __ 22"x34" __ 34"x44"

Include	Layer#	Map Elements	Type
_____	1	Command Posts/Initial Staging Locations	Symbols
_____	2	Command Posts/Initial Staging Locations List	Text Box
_____	3	Tactical Facilities List	Text Box
_____	4	Emergency Broadcasts to Public	Text Box
_____	5	Radio Transmitter Locations	Symbols
_____	6	Communications – Key Command and Tactical	Text Box
_____	7	State/Federal SAR Resources and Assignments	Text Box
_____	8	Incident Command Organization	Chart
_____	9	Evacuation Ingress Controls	Text/Symbols
_____	10	Exit Controls (Staffed)	Symbols
_____	11	Special Considerations	Text Box
_____	12	Signal Light/Camera Control Procedures	Text Box
_____	13	Locations of Controllable Signal Lights	Symbols
_____	14	Evacuation Routes	Symbol
_____	15	Intersection Insets	Graphic Inset
_____	16	Flood Depths	Graphic w/Key
_____	17	Command Post Inset(s)	Graphic Inset
_____	18	School/Group Quarter/Care Facility Locations	Symbols
_____	19	School/Group Quarter/Care Facility List	Text Box
_____	20	Specialized Evacuation Equipment/Supplies	Text Box
_____	21	Rally Point Locations	Symbols
_____	22	Rally Points for Public List	Text Box
_____	23	Mass Care Shelters/Reception Centers Tracking	Text box
_____	24	_____	_____

Figure 4: Map/File Naming Protocol

URBAN EVACUATION MAPPING PROJECT
PUBLISHED MAP FILE FORMAT AND NAMING CONVENTIONS
Rev: 2006-12-13 DB/GIS/SJC

PURPOSE:
In order to assure that subsequent revisions of a given map are consistently identified as such for posting to website and use in an emergency.

USAGE:
Each agency developing base maps will use the official map name within the map product and in the digital file name.

FORMAT:
Published maps shall be delivered to the Central Repository in Adobe Portable Document Format (PDF).

DATES:
All maps are required to contain an accurate revision date within the marginalia of the map.

DIGITAL FILENAMES:
Published maps shall be delivered with filenames according to this convention:

`OfficialMapName_Variation.pdf`

Explanation of Convention:

"`OfficialMapName`" - The recognized official map name as shown on Map Index without spaces in proper case

"`_Variation`" - Some zones include multiple maps with different background imagery. The variation portion of the filename is used to distinguish those maps from each other. The values are:

`_None`	*(No background to GIS data layers)*
`_Quad`	*(USGS DRG Quads Background)*
`_Aerial`	*(Aerial photography Background)*
`_GIS Vector`	*(Custom GIS Background)*

Figure 4: Map/File Naming Protocol, Continued

".pdf" - Extension expected of documents in PDF format

CURRENT OFFICIAL MAP NAMES:
See Urban Evacuation Zone Map Index.

```
Bear Creek
Bishop Tract
Brookside/Lincoln Village
Hammer Lane
March Lane
Morada
Country Club
Harding Way
    Downtown Sector
    North Sector
Port
South Central
Southeast
Reclamation District 17
    Weston Ranch Sector
    Lathrop Sector
    Manteca Sector
River (Lodi)
Acampo (Lodi)
Ham Lane (Lodi)
Central (Lodi)
Beckman Lane (Lodi)
Harney Lane (Lodi)
Thornton
```

Table 1: Map Data Elements

Data Element	Method of Display
Topographic	
Waterways and key physical features	Graphic or GIS data
Flood Depths and potential extent, if appropriate	Graphic or GIS data
Streets, Highways, Road Systems	Graphic or GIS data
Critical Community and Infrastructure Information	
Care Facilities, Hospitals, Group Homes, Schools	Point Symbol and Text Box
Controllable Signal Lights, Cameras	Point Symbol and Text Box
Enlarged Map Inserts of Key Intersections	Map Insert
Emergency Response	
ICS Organizational Chart for Evacuation Operations	Graphic in Text Box
Pre-Planned Tactical Facilities	Point Symbol and Text Box
Command Post/Initial Resource Staging Locations	Point Symbol and Text Box
Communications - Command and Tactical	Text Box
Rally Points	Point Symbol and Text Box
Traffic Control Points - Staffed and Unstaffed Barricade	Point Symbols

Table 1: Map Data Elements, Continued

Data Element	Method of Display
Specialized Evacuation Equipment - Summary of Type/Location	Text Box
Warning and Information Systems	Text Box
Special Considerations or Information	Text Box
Summaries of Expected Concurrent Operations in Evacuation Zone	Text Box
Display of Real-Time Decisions	
Direction of Evacuation	Text Box
Evacuation Ingress Controls	Text Box
Mass Care Shelters, Reception Centers	Text Box
State/Federal Resources and Assignments	Text Box

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Table 2: Map Symbols

Table 3: Text Box Borders

Text Box Content	Border Color	
Command Post, Tactical Facilities, Organizational Chart	Black	
Infrastructure, Evacuation Equipment	Black	
Communications	Green	
Mass Care, Ingress Controls	Green	
Mutual Aid Resources Tracking	Green	
Rally Points	Brown	
Schools	Red	
Care Homes, Group Homes, etc.	Purple	
Legend, Special Considerations	Black