“An Analysis of Injury Risks Associated with the Trinity River Corridor Project in Dallas, Texas”

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CERTIFICATION STATEMENT

I hereby certify that this paper constitutes my own product, that where language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

Signed: _____

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ABSTRACT

The problem is that the Dallas Fire-Rescue Department has not performed an all hazards injury/safety risk analysis of the area known as the Trinity River Corridor Project-10,000 acres of land encompassing the area adjacent to the Trinity River within the City of Dallas. The lack of an all hazards injury risk analysis leaves emergency responders without a proactive means to prepare for responses to this diverse geographic region. The purpose of this research is to analyze the injury risks associated with the Trinity River Corridor Project (TRCP) and provide responders with an initial template/foundation for emergency response preparation in this diverse topographical region. Internal and external subject matter experts were contacted to gain valuable feedback about injury risks associated with the project. Site visits and computer aided dispatch data were reviewed and analyzed to answer the following research questions utilizing descriptive research as a tool to answer the following research questions: (a) How many injuries occurred within the TRCP during 2011-2012? (b) What activities contribute to escalating injury risks? (c) What environmental factors contribute to injury risks? (d) Future changes that contribute to injury risk? (e) What types of technologies exist that could help mitigate risk in these types of areas? DFR responded to over 5681 incidents within the TRCP during 2011-2012. Findings conclude that four major activities contribute to escalating injury risks and responses in the area; water activities associated with the Trinity River, recreational parks, equestrian activities and hiking trails. In addition, environmental factors such as flooding/erosion cause extensive hazards related to injuries. Recommendations include establishing an internal system of partnering with the organizers of large scale developments, enhancing the trail marking system, purchasing Polaris type vehicles to assist in response activities and expanding/decentralizing the DFR Swiftwater Team.

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INTRODUCTION

The Trinity River Corridor is a 10,000 acre region containing wetlands, river front plains, and a wildland interface. There is roughly 12.2 billion dollars of investment property within the floodplain and an estimated 200,000 people that live/work within the vicinity according to the Dallas County Appraisal District. Consequently, the infrastructure for this project focuses on flood risk reduction and is funded by a combination of public funds and private citizen donations. Funding has not been specifically designated to address response issues related to this area; therefore, Dallas Fire-Rescue Department has/will respond to incidents with the TRC with existing resources and without an influx of additional equipment or personnel.

The problem is that the Dallas Fire-Rescue Department (DFR) has not performed an all hazards injury/safety analysis of the area known as the Trinity River Corridor Project. The purpose of this research is to analyze the injury risks associated with the Trinity River Corridor Project and provide responders with a template to be utilized as an initial foundation for emergency response preparation and the development of standard operating procedures to this diverse topographical region. The lack of a definitive, specific plan for this region is an area of vulnerability and weakness due to the fact emergency responses into this area are low frequency/high risk events. Descriptive research (surveys, structured interviews, and literary reviews) were utilized to answer the following research questions: (a) How many injuries occurred within the TRCP during 2011-2012? (b) What activities contribute to escalating injury risks? (c) What environmental factors contribute to injury risks? (d) Future changes that contribute to injury risk? (e) What types of technologies exist that could help mitigate risk in these types of areas?

BACKGROUND AND SIGNIFICANCE

The City of Dallas is located in the North Central Texas Region and the Trinity River flows directly through the metroplex. The City of Dallas has a population of 1.25 million and has a land area of 340 square miles according to the United States Census Bureau. The history of Dallas is directly related to the Trinity River, as the City's founder, John Dealy, understood that a vibrant community could thrive along the banks of the great river. However, the Trinity River was a constant source of flooding and many residents were injured and killed due to the lack of flood protection features. The great flood of May 1908 resulted in the reformation of the City of Dallas. The height of the river reached 52.6 feet and the width of the river was over 1.5 miles. Fatalities were minimal; however property damage was estimated at a record 2.5 million dollars which was an astronomical amount for that time period. Lives were lost and the property damage caused by the disaster was unprecedented. City Management reacted to this event by contracting experts to develop plans to address the flooding and also identify methods to grow the Dallas economy. George Kessler presented a 20 year plan to Dallas community leaders that involved improving critical infrastructure such as flood control and transforming the City of Dallas into a hub for industry. These plans were not fully implemented as the plans were considered extravagant and expensive. However, facets of the plan have been implemented over the years such as constructing a levee system to address the flooding issues. The first levee system was constructed in 1928 with a major upgrade in 1958, additional components have been included to the point that the City of Dallas flood protection system now contains over 30 miles of levees (with an average height of approximately 30 feet) and a complex drainage system (with six strategically positioned pump stations) to provide supplemental protection from flooding (see Appendix I). These protection systems are the conduit that directs the river away from

downtown and allows areas within the floodplain to be further developed for businesses and commerce. Portions of this area is now known as the “Stemmons Corridor” and has expanded and morphed into the extensive Trinity River Corridor Project ("Levees in Texas-A historical perspective", 2007).

The Trinity River Corridor Project (see Appendix J & K) is an urban park development plan along the Trinity River. It also includes an urban natural habitat, the 6,000 acre Great Trinity Forest. Due to flooding, the majority of the land was considered untenable for development. In 2008, the Trinity Audubon Center (see Appendix L) was constructed within the TRC to successfully provide environmental education and awareness training to both students and adults. The desired outcomes of the project include several components such as additional protection from flooding, identifying recreational areas, opportunities to advance/improve transportation in the metroplex, reduce adverse impacts on the environment and also to provide a means of further developing the City of Dallas economy.

The City of Dallas has partnered with the following local, state, federal, corporate and non-profit entities to ensure the project is a success:

- US Army Corps of Engineers
- Texas Department of Transportation
- Federal Highway Administration
- Environmental Protection Agency
- North Texas Tollway Authority
- Scottish Rite Hospital
- Audubon Society

- Texas Horse Park Foundation
- Downtown Dallas
- AT&T
- CVS
- Dallas Morning News
- Methodist Hospital
- Oncor
- Wells Fargo
- Southwest Airlines
- Sprint

These relationships allow the City of Dallas to utilize the input of stakeholders as a tool in making the TRCP representative of the ideals of the community.

The Dallas Fire-Rescue (DFR) Department is an approximately 2,000 member all hazards emergency response provider. The mission of DFR is to prevent and suppress fire, educate and rescue citizens, provide emergency medical services, promote public safety and foster community relations. Our organization is configured into six uniformed bureaus to ensure proper service delivery is provided, best practices are utilized, and innovative ideas are on the horizon. The total annual budget for DFR is over 180 million dollars. The six bureaus are as follows: Emergency Response, Training & Support Services, Homeland Security, Emergency Medical Service, Technology/Personnel Support, and Fire Prevention. These bureaus are all managed by Assistant Chiefs who report directly to the Chief of the Department. The Assistant

Chiefs all have managers and supervisors who provide oversight in various divisions and sections within their area of responsibility.

The Emergency Response Bureau is the operational core of the department. This bureau contains all of the personnel assigned to fire stations. DFR has multiple resources allowing effective response to structure fires, aircraft emergencies, hazardous material spills, wildland fire conflagration, request for advanced/basic medical assistance, and response to both swift and static water situations. Fifty-seven fire stations are strategically located to stage 56 fire engines, 40 Advanced Life Support Units, 22 aerials (ladder trucks), 9 boat cars, 9 Battalion Chiefs, 2 Deputy Chiefs, 11 Boosters, 3 HazMat Units, and two heavy rescue rigs (USAR). The daily staffing level is constantly maintained with 425 personnel each day. Four firefighters staff each heavy apparatus (engine or truck/aerial) and two firefighter/paramedics respond on ambulance units.

Training and Support Services provides the mechanical support and preventive maintenance for the entire DFR fleet. A Clothing and Supply division keeps an inventory of protective clothing, uniforms, and necessary emergency and station supplies. This Bureau also contains the recruit academy and incumbent Fire/EMS training sections.

Special Operations Bureau is the homeland security hub of the department. This bureau is also responsible for managing community outreach programs/marketing, ISO certification, mutual aid/automatic assistance agreements, and strategic planning. In addition, administrative support is provided to specialty teams (ARFF, HAZMAT, USAR).

Fire Prevention and Investigations targets fire prevention and education services to our external customers. These services include inspections of new construction, fire alarm/sprinkler installation, fire safety training, night detail teams, and the installation of smoke detectors.

The Technology and Personnel Support Bureau involves Fire Dispatch and provides ancillary support to our internal customers. Human Resources and Workers Compensation sections are all within this bureau. Research Analysis provides essential services necessary to ensure that the department has the necessary tools to progress towards our defined future goals.

Dallas Fire-Rescue Department is the authority having jurisdiction to respond to emergency incidents within the TRCP. All members assigned to the Emergency Response Bureau are required to complete 784 hours of training to become certified by the Texas Commission on Fire Protection as a structural firefighter. Eight hundred one members assigned to the Emergency Response Bureau are also certified paramedics capable of performing advanced life support interventions to patients. Additional training is provided to members fulfilling roles on specialty teams:

ARFF

- ARFF Basic - 120 hours
- Movement training - 8 hours
- CE – quarterly movement testing
- CE – quarterly night driving
- CE – annual hot drill
- CE – three (3) agent discharge drills
- CE – annual driver certification

BOAT STATIONS

- Initial certification – 8 hours
- CE – 16 hours annually

HAZMAT

- HazMat certification class - 97 hours
- CE – 20 hours annually

MARINE 1-Lake Ray Hubbard

- Initial certification – 8 hours
- CE – 16 hours annually

SWIFTWATER

- Rope certification – 60 hours
- Swiftwater technician class – 40 hours
- CE – 16 hours annually

USAR

- Rope certification – 60 hours
- Structural Collapse – 80 hours
- Technical search – 40 hours
- Trench – 40 hours
- Confined Space – 24 hours
- Wide Area search – 24 hours
- CE – 40 hours annually

WILDLAND

- S130 (Wildland Firefighter Training) class – 40 hours
- G131 (Wildland Training for Structural Firefighters) class – 8 hours
- S290 (Intermediate Wildland Fire Behavior) class – 32 hours
- CE - 4 hours annually

These diverse training backgrounds provide DFR with an invaluable resource in our mission to successfully mitigate the most complex of emergencies. However, very few of the members with specialty training are familiar with the specific hazards associated with the TRCP.

This issue is significant as the development of this region will lead to increasing number of people and potentially additional responses. In the past, this area was basically undeveloped land without any significant hazards; however the development of the TRCP causes present and future concern. According to the statistics maintained by DFR and the National Reporting System (NFIRS), our resources responded to over 250K requests for emergency service in 2012. The sheer number of responses stretches the capabilities of our system to effectively respond in a manner consistent with our internal objectives (response time benchmarks, unit utilization percentages, responses per unit, etc.). Therefore, it is critical that DFR utilize a proactive, defined approach when becoming aware of potential hazards, otherwise there will certainly be adverse outcomes.

The Executive Analysis of Community Risk Reduction Course provided a precursory insight of the associated challenges related to large scale projects and the importance of emergency service organizations partnering with other city departments/stakeholders in the **initial** stages to ensure the needs of the community are kept in perspective. This research project focuses on the course goal of applying a strategic process of addressing risks within the local community. The Trinity River Corridor includes both human (recreational injuries) and natural risks (flooding) that could have devastating outcomes for the Dallas community. The research also utilizes the following United States Fire Administration's Goals as a foundation:

- Reduce risk at the local level (Prevention and Mitigation)
- Improve local planning/preparedness

- Improve emergency services capability to respond to all hazards
- Improve the fire and emergency services' professional status
- Lead the Nation's fire and emergency services by establishing and sustaining USFA as a dynamic organization.

LITERATURE REVIEW

Literature review was first conducted to gain clarity and guidance related to how to conduct an injury/safety risk analysis. Additionally it was necessary to gather details about the history/development of urban parks, and investigate information about specific types of threats/vulnerabilities within the TRC. This information is critical to answering each of the following research questions: (a) How many injuries occurred within the TRCP during 2011-2012? (b) What activities contribute to escalating injury risks? (c) What environmental factors contribute to injury risks? (d) Future changes that contribute to injury risk? (e) What types of technologies exist that could help mitigate risk in these types of areas? The National Fire Academy Learning Resource Center, the Dallas Public Library, and various web search engines were utilized as invaluable resources in identifying articles, books, and publications related to this specific research.

Risk assessment/analysis should begin with a preparatory stage followed by actual risk identification. This research paper will focus on the assessment component but it is critical to acknowledge and provide an overview of the entire risk management process. Risk assessments can be conducted by following a detailed process including hazard identification, recognizing those who could be injured and the mechanism, evaluating specific risks and methods to lessen/stop the impact, as well as capturing the results and applying solutions while updating as

necessary. Identifying hazards is accomplished by personal observation and physically scouting the area. Issues should be captured by photographs, sketches or video. This will serve as evidence that a gross hazard exists. The population group that could be injured is identified by census information and land/building use. Finally, all results should be documented in a report and recommended solutions should be provided, shared, and updated with the appropriate stakeholders and decision makers (Great Britain. Health and Safety Executive, 2003)

Risk can be easily defined as the anticipation of some type of loss. Risk assessments give communities the foundation for ensuring appropriate planning is performed to mitigate potential problems and issues. Hazard/risk assessment instruments provide a method of identifying hazards, by looking at the probability of occurrence, severity and potential consequences. The assessment instrument should basically be utilized to determine if the amount of loss can be managed by the community resources (UCLA Center for Public Health and Disasters, 2006)

The format utilized to conduct a risk assessment is solely the discretion of the organization or authority having jurisdiction. Flexibility is encouraged to ensure that the basic process can be applied and utilized by organizations of various sizes and complexities. It is critical to maintain awareness that a risk assessment is simply a tool to identify, forecast, and place the appropriate priority on specific threats. Stakeholders can take information from a risk assessment and make informed decisions related to resource allocation and management. Risk assessments should begin with a preparatory stage and then actual risk identification. This research paper will focus on the assessment portion but it is critical to acknowledge and provide an overview of the entire risk management process. The assessment tool is only a portion of the risk management process as the other components include framing, monitoring, and response to risk (United States Joint Task Force Transformation Initiative, 2012).

Pre-Incident planning assists emergency responders by improving their capability to manage situations and effectively protect lives, property and even the environment. The individual developing the pre-incident plan should make site visits to familiarize themselves with the features and particulars of the location. Ease of use, training, and standardization are critical components of a pre-incident plan. In addition, it is imperative to develop an evaluation mechanism after an event to ensure the pre-incident plan is fulfilling its purpose as a management tool for the incident commander. Special hazards should be thoroughly documented on the pre-incident plan to ensure hazardous materials are identified and any extensive life safety considerations are noted. Pre-incident plans are a proactive means of addressing specific incident management issues and will directly lead to desired outcomes if they are developed appropriately, utilized as a supplemental source of information (not all inclusive), and are updated as needed (National Fire Protection Association. American National Standards Institute, 2010)

Urban parks are a relatively new phenomenon. European cities such as Paris, France and London, England began carving out natural habitats within the city limits in the 19th Century to add and embrace a pleasurable aesthetic tone for their community. Seattle, Chicago, Minneapolis and New York all have urban parks with similar components of the Trinity River Corridor Project. Seattle's Freeway Park is similar to the TRCP in that transportation routes pass directly through its epicenter. Chicago's Grant Park is located along Lake Michigan and the great park development for Dallas is along the Trinity River. The Minneapolis Park System is 6500 acres which is relatively close in size to the TRCP but is still almost 3500 acres smaller. In addition, the reserve is along the Mississippi River similar to the TRCP's proximity to the Trinity River. Finally, New York's Central Park similarities to the TRCP include its development from

an “uninhabitable swampland” to an area of constant development and thriving recreational opportunities and amenities (Tate, 2001).

New York’s Central Park is the oldest urban/public park in the United States but is not the largest or even most scenic. Its distinction as a renown location begins with the fact that from its inception it was developed for use for all people both rich and poor. Cities throughout the country followed this example and now most large municipalities have dedicated acreage for parks and public use. In fact the architect of the park Frederick Law Olmstead said,” the purpose of the park is to give workers who don’t have the opportunity to spend summers in the mountains a specimen of GOD’s handiwork.” Olmstead’s vision allowed the conversion of swampland to its current state as a true work of art and science. Arches and bridges were developed with an artistic approach to accentuate the beauty of the park; however, the delivery of clean fresh water is what truly placed the location on the map as a work of science and ingenuity (Miller, 2003).

There are specific injury types that are precipitated by activities common in urban parks. Musculoskeletal injuries to the lower extremities often occur on hiking trails. These injuries are usually due to uneven terrain, poor conditioning, and weather changes (heat and humidity). Other injuries common to these venues include insect/snake bites, near drowning events, and animal attacks. Most of these adverse events are preventable with proper education and safety awareness (Parent, 1996).

Kayaking on rivers is a physically demanding activity as it requires constant paddling. This can lead to injuries if the individual is not in good physical condition. Individuals also must be sound swimmers and should have a thorough knowledge of water safety prior to attempting to navigate rivers in a kayak, otherwise injuries or even death will result. Texas has rivers, streams, and lakes that are consistently utilized for recreational purposes (Kramer & Kruvand, 2010).

Firefighters can become injured attempting to rescue citizens. Most injuries to firefighters are associated with cardiac/medical issues. However, it is critical to have an awareness that increased physical stress will result in a higher proportion of injuries. Structural firefighters have limited expertise/experience combating emergencies in wooded environments. This lack of familiarity can lead to an increase propensity for injuries to occur (Houser, Ari N, 2004).

PROCEDURES

Internal (City of Dallas and Dallas Fire-Rescue Department members) and external (Seattle, New York, Chicago, and Minneapolis) subject matter experts were contacted to gain valuable feedback about injury risks associated with the project. The internal subject matter experts were sampled from individuals whose job responsibilities are directly related to planning, fire dispatch, and response. In addition, the external subject matter experts were selected based upon the similarities of a geographic region within their response district and the Trinity River Corridor Project.

Internal SME's (SMEs) were asked the following questions:

1. What is your level of involvement with the Trinity River Corridor Project?
2. What current/future activities place citizens and visitors at the highest risk?
3. Are there any current or future environmental factors that contribute to placing lives in jeopardy?
4. How could the Dallas Fire-Rescue Department improve overall safety or reduce risk in these specific geographical areas?

5. Are you aware of any technology, equipment, tools or programs that could potentially produce positive effects in relation to risk aversion in the area known as the Trinity River Corridor?

External SME's were asked the following questions:

1. Does your department respond to incidents within **(venue specific to their jurisdiction)**?

2. What are the most common types of responses?

3. What type of training do you provide to members to ensure they are prepared to respond to this geographic area?

4. Do you have an existing SOP, Risk Mgmt Plan or MOP specifically related to the park area? If so, can you send a copy via email or fax?

5. Are there any technologies that you are aware of that could be utilized to mitigate risk to responders/visitors?

Descriptive research was performed to answer the following research questions:

(a) How many injuries occurred within the TRCP during 2011-2012?

The Dallas Fire-Rescue Department Computer Aided Dispatch (CAD) administrator assisted in providing the raw data necessary to calculate the current response information related to this specific area. A query was performed generating a list of emergency responses within the geographic region. The next step involved identifying the types of responses. A map (see Appendix M) was developed with the assistance of the City of Dallas GIS Staff to provide a visual reference of the type and location of the emergency request for services.

(b)What activities will contribute to escalating injury risks?

The Trinity River Corridor Project Assistant Director, Sarah Standifer, was contacted and an interview scheduled to gain insight/information related to the current status of the project and also determine the progress of additional phases of construction. In addition, all of the Dallas Fire-Rescue Department Special Operations Specialty Team Coordinators were polled to determine if they had an awareness of the project and also gain input about response issues related to their specific disciplines. The researcher conducted site visits in conjunction with the Dallas Fire-Rescue Department Special Operations Division. This included exploring the Great Trinity Forest, utilizing a small off-road vehicle to maneuver the trail systems, and visiting the Audubon Center.

(c) What environmental factors contribute to injury risks?

Literature review related to similar venues was performed to determine which specific factors would have a direct impact on injury risks. In addition, the feedback from the internal and external subject matter experts was utilized to capture potential environmental risks.

(d) What future changes will contribute to injury risk?

The first step in understanding future risks associated with the project was to gain insight on the timeline for the project. This involved attending the Trinity River Corridor Project Partner Agency Executive Team meeting (with the assistance and support of Ms. Standifer) to determine if the proposed times would be accomplished as scheduled or if there would be delays or even fast-track components of the project. Departments with comparable, completed parks were contacted to determine what types of issues are attached to the venues in their respective jurisdictions.

(e) What types of technologies exist that could help mitigate risk in these types of areas?

Literature review was performed to capture any potential mechanisms that would assist in the reduction of injury risks associated with the TRCP. Internal and external subject matter experts were also contacted to determine if they could potentially provide valid options that would assist in successfully mitigating emergency incidents within the Trinity River Corridor Project.

RESULTS

(a) How many injuries occurred within the TRCP during 2011-2012?

The Trinity River Corridor Project (TRCP) is an extensive development that contains an urban park, a system of trails, a kayak park, multiple recreational fields, wetlands and bridge systems designed to ensure the region's most readily available resource, the Trinity River, is at the forefront. Each of these activities has their own inherent risks. However, the simple injection of additional people into the vicinity will increase the likelihood of additional injuries due to motor vehicle collisions and medical emergencies.

Based upon the information from the external SMEs the prevalent types of responses to Grant Park-Chicago, Freeway Park-Seattle, Minnesota Park System-Minneapolis, and New York Central Park-New York City are medical emergencies/injured persons. This does not appear to be inordinate considering the information is from four separate geographical regions. Therefore, it is highly practical that medical emergencies/injured person will be the most common request for service in the TRCP.

In addition, the Dallas Fire-Rescue Department Computer Aided Dispatch system was utilized to extract response data related to the Trinity River Corridor. The results have been tabulated from the raw numbers. The table below summarizes the information.

TRINITY RIVER CORRIDOR RESPONSES

YEAR	INJURED PERSONS/MEDICAL	GRASS FIRES	WATER RESCUE (NO BOAT)	WATER RESCUE (WITH BOAT)	SWIFT WATER RESCUE	UNDERWATER RECOVERY
2011	3037	213	4	3	3	2
2012	2644	178	3	5	7	1
TOTAL	5681	391	7	8	10	3

These statistics provide empirical evidence of the resulting injuries and subsequent requests for service within the Trinity River Corridor.

(b)What activities will contribute to escalating injury risks?

Based upon the feedback from the internal SMEs there are four major activities that will cause injury risks to increase:

a) Water activities associated with the Trinity River (see Appendix N)

b) Recreational Parks / soccer complexes

c) Horse (equestrian) trails

d) Hiking Trails (see Appendix O, P, and Q)

It is estimated that all of these activities will see an ample increase as people begin to utilize these amenities more due to increased advertisement. A kayak area was developed as an attraction for outdoor enthusiast. However, the area is unsupervised and will definitely result in injuries and possible deaths when traversed by novice kayakers. The sports complex is logically an area that will see a climb in requests for service due to the nature of injuries associated with

the most common game, soccer. Soccer players tend to have a predisposal of injuries to the lower extremities. The risks associated with the horse and hiking trails are mainly related to the difficulties that emergency responders have responding to the heavily wooded areas. In addition, the bridges along the trails are not capable of sustaining the weight of an ambulance or brush vehicles (booster). This fact will cause responders to travel an extensive distance on foot to reach patients/extinguish a fire which could exacerbate the situation due to the subsequent delay.

(c) What environmental factors contribute to injury risks?

Surprisingly, all types of wildlife occupy this area including bobcats, cougars, poisonous snakes, coyotes, wild dogs, and even an infestation of feral hogs. The City of Dallas has made a concerted effort to maintain an ecological balance in this vicinity with zoning standards that limit destruction of trees, partnering with conservation organizations and assisting in the development/maintenance of the Audubon Center. However, human contact with the wildlife can result in injuries such as bites, animal mauling, and the spread of infectious diseases such as rabies.

The river itself is a huge factor related to risk. The Trinity River Levees are being refortified; however flooding can occur in this region. As mentioned earlier in this research, previous floods Erosion and rain can lead to substantial fall injuries to individuals utilizing the trails along the river or even those who fish in the Trinity, as there are many overlooks in the area (see Appendix R). In addition, there are definitely difficulties locating victims due to the fact that there are minimal landmarks for victims to provide to responders. The City of Dallas does utilize a trail marking system (see Appendix S) but this location defining tool has not extended to the actual river banks.

(d) What future changes will contribute to injury risk?

An oral interview with Sarah Standifer revealed the complexity of the Trinity River Corridor Project. The current trail system is extensive but will be expanded over the next five years. Recreational amenities such as an athletic complex containing over 20 soccer fields soccer fields, equestrian Texas Horse Park, Trinity Forest Golf Course, Four urban lakes (approximately 20 acres each), a myriad of new thoroughfares, pedestrian bridges, gateways, and beltways to accommodate additional traffic in the general region will increase the propensity of injuries in the TRC. Simple reasoning suggests more people in the area will directly lead to additional injuries and requests for service.

The City of Dallas identified this area as a premium means of developing a vast urban park setting and developing recreational space for citizens in otherwise underdeveloped locations. Currently, the use of these facilities/areas is not being maximized; however as the City of Dallas continues to advertise and encourage the use of these amenities it is easy to project that the number of emergencies/responses into the Trinity Corridor will increase.

(e) What types of technologies exist that could help mitigate risk in these types of areas?

Internal subject matter experts provided some outstanding concepts/ideas that could potentially reduce the level of risk in the area. These suggestions include the following:

- Web based applications for capturing and displaying geographical locations
- Identifiable area and trail maps (with distinguishing location markers) to provide advance warning to visitors o the region and a landmark for citizens in distress

- GPS ready digital cameras to assist in the marking and identification of the trails and forest areas
- A compliment of all terrain vehicles configured with medical, extrication, and brush fire equipment to ensure the appropriate level of equipment is available.
- Portable pumps to ensure a patent water supply can be established
- Boat ramp upstream of the Kayak Park to ensure rescues can launch into the river in a timely manner in the vicinity of a know hazard

External subject matter experts did not refer to or provide any details related to data that will reduce risks.

DISCUSSION

The biggest challenge in performing the research was to develop a general knowledge of the project quickly and subsequently identify hazards without a concise template. NFPA 1620 was developed to provide the fire service with guidance related to pre-plans for buildings/structures but was not intended to assess vast geographic regions like the Trinity River Corridor Project. The foundation and merits of providing first responders with some type of proactive means of prevention and response planning was established in the early 1970's with the America Burning publication. Most fire departments have established specific standard operating procedures/guidelines for low frequency/high risk events (hazmat, high rise, tunnel/subway emergencies, etc.). Dallas Fire-Rescue Department has embraced this philosophy and detailed pre-incident response plans exist for target hazards such as Love Field Airport, the Dallas Area Rapid Transit Tunnel, and emergencies at Lake Ray Hubbard. Based upon this research DFR should definitely include the TRCP as a target hazard and develop a pre-incident plan. The information gathered during the site visits, literary review, structured interviews, and

contacts with external subject matter experts revealed that there are a myriad of injury/safety hazards associated with the TRCP.

Preparation to analyze the risks began at the National Fire Academy Learning Resource Center. It quickly became evident that there was limited information about injury/risk analysis associated with geographic regions such as urban parks; therefore the focus became to identify specific activities that could result in injuries to citizens and first responders. The actual identification of hazards at the TRCP began with an initial site visit in April 2013. This visit caused quite a bit of personal concern, as the observed hazards would definitely require the use of specialized training and equipment. For example, the wave park is at the northern part of the TRCP and if an actual emergency occurred the DFR Swift Water Team would have to launch into the river a considerable distance from this water amenity. In addition, the bridges within the trail system are not capable of sustaining the weight loads of any current DFR emergency response vehicles. These types of issues were captured for discussion with stakeholders (emergency response personnel, specialty team support staff, and the Trinity River Corridor Project Planning Team). The most valuable tool in the subsequent meetings were the photographs and all parties are working together to make the TRCP a safer environment. This means of gathering buy-in would not have been utilized if I had not referred to the 5 Steps to Risk Assessment guide.

Identifying hazards/activities was only the initial step to the actual research. A data source was needed to determine the current risks status associated with project. There was difficulty attaching specific responses to the TRCP using conventional queries. Many methods were discussed with the CAD administrator to extract the necessary information, as there is not a singular address that defines the TRCP; therefore gathering the information by geographic

vicinity became the most viable solution. The responses from 2011 and 2012 were plotted on a map to provide a visual aid and also provide verification of target hazards within the project. The map and supporting documents indicate that DFR should strongly consider performing a definitive risk assessment of the TRC as it was unclear if current resources could accommodate the demands for service similar to the recommendations from the UCLA Hazard Risk Assessment instrument.

The response information acquired from the CAD data and the hazards identified by personal observation and feedback from SMEs was utilized somewhat as an assessment tool to analyze and provide the City of Dallas community with a snapshot of our current deployment of resources to the TRC, but more importantly can be the fulcrum to assist in forecasting future emergency response needs. Based upon the assessment tool, definitive priorities related to the TRC were developed and discussions with the TRCP management have been productive by following an approach suggested in the NIST guide for conducting risk assessments.

There were several special hazards noted during the site visits and all were captured by photographs and in a narrative format. This information should be reviewed and incorporated into a DFR Standard Operating Procedure to ensure responding personnel have a “game plan” when dispatched to the TRC. Additionally, the Dallas Fire-Rescue Department After Action Report template was revised to ensure that challenges associated with responses into the TRC were posted on the Dallas Fire-Rescue Department Internal Document System and disseminated to all members of the department as a learning tool. These modifications support the philosophy of ensuring an evaluation method is available for target hazards and a process is available for monitoring the effectiveness of the pre-incident plan as mentioned in NFPA 1620.

The long-term desired outcome for the Trinity River Corridor Project is to become the epitome of an urban park. Wildlife has been undisturbed, for the most part, to ensure that the ecological and environmental impacts associated with being in the proximity of the ninth largest city in the United States. Four urban parks were determined to be similar to the TRCP based upon the information from the Tate's Great City Parks book: Seattle's Freeway Park, Chicago's Grant Park, the Minneapolis Park System, and New York City's Central Park. Representatives from the entities that provide emergency response to the respective areas advised that the majority of the requests for service are related to medical/injured person incidents. In addition, these departments did not have specific response plans to the geographic areas but they did require event action plans upon receipt of notification that a special event would occur. These statistics mirror the current metrics for the TRCP. It is estimated that responses will increase as the City of Dallas advertising and promotional efforts raise awareness related to the activities associated with the TRCP.

The activities and amenities associated with the TRCP are intended for use by all citizens of Dallas from every socioeconomic group, age classification and ethnic background similar to New York's Central Park. The recently opened suspension bridge (see Appendix T) placed the area in the spotlight and has generated publicity that will entice people to visit the area. This fact is similar to the opening of Central Park, according to the Miller's Central Park an American Masterpiece, as bridges and arches were the conduit that initially attracted the citizens of New York to enjoy the amenities of the park.

Certain activities such as the opening of the soccer fields and additional hiking trails will directly lead to additional request for service due to several factors. The trails within the TRC are mostly natural, although some have concrete pavement, which leads to soft tissue

sprains/strains to lower extremities. Sprains and strains are the most common type of injury to hikers according to Hiking Texas by L. Parent. These types of injuries are also the most common request for service within the TRC and the number of incidents will increase without any type of direct intervention. In addition, the water amenities specifically the kayak wave park will result in injuries due to the inherent risks associated with the activity. According to the Ken Kramer and Charles Kruvland's Living water of Texas book, the efforts to protect the environment and specifically the Trinity river will lead to a new generation of water enthusiasts visiting the area.

The focus of the research has been on citizens; however the health and safety of emergency responders must be considered as well. Unfortunately, a limitation of this research is that injuries to responders were not included. This should be addressed in any subsequent research related to the TRCP. An average of 100 firefighters within the United States die each year and countless others are injured responding to emergencies; therefore it is critical that every organization prepare their personnel to respond to known target hazards and provide some semblance of familiarity when possible. Injury information should be captured and proactive methods to reduce adverse outcomes can be developed from this data as suggested by the technical report related to emergency responder injuries and fatalities.

RECOMMENDATIONS

During the lecture based portion of the EACRR course, the instructors impressed the need to ensure that public safety secure a role in the development of large scale projects. This would have been a great opportunity to partner with conversationalist organizations and produce proactive injury prevention programs related to safe practices while biking, hiking, kayaking, and any other recreational activities. The Dallas Fire-Rescue Department should consider

establishing a section that focuses on research and plans for future development. This would allow the department to have a proactive approach to managing risks associated with large scale developments and projects. Future bridges along the trail system should be capable of withholding the weight of DFR and increasing the number of access points to address the inevitable responses near the wave park. A Polaris style vehicle equipped for brush fire responses and patient transportation is needed as well.

Dallas Fire-Rescue's GIS section should continue to develop and enhance the 911 pole marker system. This system allows citizens in distress to notify emergency responders of their whereabouts utilizing a specific location within the trail system as a benchmark. Additional staff should potentially be directed towards ensuring the proposed trails are marked prior to opening. All of the current trails should be reconciled to ensure there is not any duplication regarding the names (some of the names are very similar) this can cause confusion and extend response times. The pole markers should also extend to the actual river. Currently, guess work is the only method utilized to guide responders to the actual section of the river where the person in distress is actually located. Individuals in distress could receive assistance quicker if there was some type of landmarks along the river.

The Dallas Fire-Rescue Department Swift Water Team is currently located quite a distance away from the main hazard associated the river, the Kayak Park. Therefore, DFR should strongly consider expanding the Swiftwater Team and staging the group at a fire station closer to the central hazard.

In conclusion, this research project has truly revealed that public safety organizations should be proactive in their approach to large scale projects. Many of the amenities and recreational activities are sponsored by private means and it is highly likely that these supporters

would have been able to provide funding to address some of the public safety issues. It is imperative that we continue to develop relationships and partner with stakeholders to make new developments safer for the customers we serve.

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Appendix A

INTERVIEW QUESTIONS BEN THORNTON

1. What is your level of involvement with the Trinity River Corridor Project?

I am the current CAD administrator for the Dallas Fire Rescue Department Communications Technology Division. As the CAD admin. I am intimately involved in the technology and software that allows DFR to dispatch throughout the city, including surrounding municipalities. My actual involvement with the project would be a technical supportive role, concerning communications/dispatch, to the DFR command staff. Providing subject matter expertise as communications/technology relates to DFR response w/in the Corridor.

2. What current/future activities place citizens and visitors at the highest risk?

Current activities w/in the corridor that impose the most risk would be the natural water hazards that exist within the Trinity River itself. Currently there is not a large volume of use of the river as a recreational feature but with the expansion/development of the corridor into a multi-use recreational area the volume of participants will increase. With this comes accidents and while a broke leg on a soccer field is not small, it does pale in comparison to a rescue involving water both in resources required and risk to live. For example there is a whitewater feature build by the city that currently has limited access via DFR, and w/in this feature exists true swift water risk. Logic would hold that with increase in use there will be a proportional increase in the likelihood of a swift water rescue incident. In relation to the swift water feature considerations of multiple access points to the river should be explored both upstream and downstream. While I have mentioned the specific white water feature, which exists everyday, there should also be consideration given to the entire river under normal or storm flow conditions.

3. Are there any current or future environmental factors that contribute to placing lives in jeopardy?

Risks to lives would could be evaluated as a function two factors access to the incident and locating the incident, and for arguments sake the risk area could be divide in two as the area from Irving to the white water feature and the the region below the feature. Concerning the area from Irving to the feature, for the most part, DFR has the ability to access about 50% of the river bottom from the levee system that runs from the Irving boundary to just south of Downtown. This area is largely devoid of trees and obstacles that would limit locating a victim and accessing them. The caller would even be able to geo locate themselves based on large visible landmarks thus decreasing the time required for responders to render aid. Access to his area, namely the river itself, is still not easy but nothing compared to downstream of the feature.

As we move below the whitewater feature the game changes considerably in concerns to life risk. Largely this increase will be a function of the inability to rapidly locate the victim, and this increasing the risk to life. The concept of "backcountry" is not often associated with an urban environment, but as I have personal experience with this river from the Irving boarder to below I20 I can firmly state this: The region of the river and the surrounding forests below the feature should be considered true wilderness and be approached with far more regard as to the risk of life. As this developmental project increases thus will the number of people accessing and exploring this new found wilderness. This region has been largely untouched due to limited access points, and really people just do not want to go there. But both of these points will change and thus the risk to life will also increase. While do I not believe that there will be numerous people flocking to this new found wilderness there will be an increase in use, and thus an increase in risk to life. The river itself below this area is largely placid and beautiful and is easily paddled by even the

least experienced boater. There are a few older structures down there that could present some risk in times of increased CFM. Really the issue in this region would be an inability of a victim to accurately determine their location as they communicate with DFR communications, that coupled with DFR responders also having difficulty locating them on land or water.

4. How could the Dallas Fire-Rescue Department improve overall safety or reduce risk in these specific geographical areas?

Here are some initial thoughts and will report further:

Decentralization of the swift water program or expansion there of it to incorporate a more regional response coverage w/in the city. Lobbying for multiple access points where the design of emergency services access has been of major importance. A terrible example is the access the to whitewater feature and the inability of DFR SW teams to access it with current equipment. Increased awareness of wilderness response factors, and a greater understanding of the actual region departmentally and especially by the stations/districts that boarder the region south of the whitewater feature.

5. Are you aware of any technology, equipment, tools or programs that could potentially produce positive effects in relation to risk aversion in the area known as the Trinity River Corridor?

Technology:

To be reported back on as an ongoing investigation. I do have some ideas on how do geo-locate someone in an wilderness environment, but I feel I have not vetted the concepts far enough to report on them. Generally I feel that Technology can be the crutch the department will fall upon,

while it is great to enhance our abilities it falls apart when the basics are left out. Ie. .... actually knowing the layout of the land that you are responding to... The corridor is no different than any other piece of your response district having an great understanding of the lay and shape of the wilderness portion will always be prime. A piece of tech in hand is useless if you yourself have no idea where you are.

Equipment:

Much the same issues as above...

Programs:

Expansion on training for wilderness response and for the districts that are south of the whitewater feature. Maybe looking at other cities that have response responsibilities that cover a wilderness area, and looking into their training practices and SOP's in regard these regions.

PSA/educational practices (more on this later)

Appendix B

Interview Questions (Sam Friar-Dallas Fire-Rescue Department Wildland Coordinator)

1. What is your level of involvement with the Trinity River Corridor Project?

Our current level of involvement from a wildfire perspective is minimal; however, we plan to engage very soon. We are sending a member of our team to the National Fire Academy this month to learn how to develop a Wildfire Protection Plan that will significantly include the Trinity River Project.

2. What current/future activities place citizens and visitors at the highest risk?

The general increase in activities in previously undeveloped areas significantly increases the likelihood of a wildfire event especially during drought cycles.

3. Are there any current or future environmental factors that contribute to placing lives in jeopardy?

The accessibility to certain areas is a major concern from both a firefighting and medical response perspective.

4. How could the Dallas Fire-Rescue Department improve overall safety or reduce risk in these specific geographical areas?

A Wildfire Protection Plan that incorporates all stakeholders is the primary tool that can be utilized in order to mitigate risk in the area.

5. Are you aware of any technology, equipment, tools or programs that could potentially produce positive effects in relation to risk aversion in the area known as the Trinity River Corridor?

There are a number of equipment items that have already been identified such as medium-weight four wheel drive vehicles that have the capability to carry water for firefighting as well as a litter

that could transport incapacitated citizens. These type vehicles are critical since there are trail bridges that cross the river that cannot support the weight of our current firefighting or EMS vehicles. Another needed item is a marking system for the trails. This would help medical and rescue personnel locate citizens in need. A third critical need is portable pumps. These pumps can be utilized to draft water from the Trinity River itself for firefighting purposes. This may be the most expedient way to maintain a constant water supply if needed.

Appendix C

Interview Questions Chad Smith Dallas Fire-Rescue Swiftwater Coordinator

1. What is your level of involvement with the Trinity River Corridor Project?

First Responder, Swiftwater Coordinator, Wildland Training Coordinator

2. What current/future activities place citizens and visitors at the highest risk?

The Kayak Park is an unsupervised water feature and as such could cause some serious risk to individuals who believe they are up to the challenge and yet have no business in moving water. The manner in which the trails on the south end of the park are setup make it extremely difficult for DFR to access a patient given our current equipment allotment. The load-zoned bridges on the trails are rated at 10,000lbs and will not support any of our current equipment. DFR members may have to walk up to two miles to access a patient. We have no way of getting Booster equipment into the Forrest should we have a fire.

3. Are there any current or future environmental factors that contribute to placing lives in jeopardy?

There are currently several overlooks on the river that are not barricaded and anyone getting too close to the edge could potentially fall 30+ft.

The Kayak Park listed above will always be a life safety risk.

4. How could the Dallas Fire-Rescue Department improve overall safety or reduce risk in these specific geographical areas?

DFR could improve our risk response with the equipment listed below

5. Are you aware of any technology, equipment, tools or programs that could potentially produce positive effects in relation to risk aversion in the area known as the Trinity River Corridor?

The Trinity River Corridor must install a workable boat ramp upstream of the Kayak Park. The current ramp is unusable and was put in as an afterthought by TRC. The ramp should be in a straight line and not turn 90 degrees as it currently does. DFR members must utilize a minimum 5 man team to cart the boat to the water at this location. This is dangerous to our members and delays our response to an emergency at this location. The only other workable boat ramp in the city limits currently is at Loop 12. Putting in at that location and driving upstream to the patient takes 28 minutes if river flow allows access.

Purchase a Polaris type 6X6 vehicle equipped with a wildland pack and an EMS pack. This dual purpose vehicle can be used to combat grass fires in the Trinity Forrest as well as respond to EMS related emergencies in the myriad of trails surrounding the TRC.

Appendix D

Interview Questions Lieutenant Nelson Ross, City of Dallas GIS

1. What is your level of involvement with the Trinity River Corridor Project?

As of August 2013, DFR's GIS involvement with the TRCP has been very minimal. We are aware of upcoming plans, especially with the addition of more City trails, and foresee an increase of time and manpower resources needed to address such projects as with the identifying locations for 911 pole markers on the trails and parks.

Public Safety is vital to be included in the pre planning phase of major projects such as the Trinity River Project.

2. What current/future activities place citizens and visitors at the highest risk?

Any citizen activity in which they are out in a public facility presents the possibility of risk. Some of our main concerns are:

a) Wave Park – any water feature and this one in particular could place citizens (all levels of experience) at high risk. Boat ramps for DFR along the project are not the easiest to access or deploy a rescue boat from and can delay our response

b) Horse Trails – these trails have not been marked (911 pole marker project) and in case of an accident location at any point along these trails will be extremely difficult, once again delaying response

c) Recreation Parks / Sports Complexes – large concentration of citizens and children in one location

d) Walking / Running Trails – DFR's accessibility to many of these trails is extremely difficult either to location, lack of proper equipment and/or geographically difficult access points.

3. Are there any current or future environmental factors that contribute to placing lives in jeopardy?

Some of our City trails are in very remote, heavily wooded and with geographical adverse terrain hard to access areas. With the possibility throughout the year of rain, natural erosion, flooding, etc. it becomes virtually impossible to predict from a first responder standpoint what could happen at any given point in time. We always hope for the best scenario but prepare for the worst. So, the answer is yes!

4. How could the Dallas Fire-Rescue Department improve overall safety or reduce risk in these specific geographical areas?

DFR's GIS biggest involvement alongside Parks & Recreation has been the implementation of the 911 pole marker project. These markers allow the citizens to call from a specific point along the trails with their location making it easier for DFR to respond (this does not necessarily mean an easy way to remove a citizen from a specific area but rather a way to identify their location, gives us access points to assess the situation better).

Another way to help reduce risk to all of these locations is to have a standardized way of addressing for each park, complex and trail, along with maps and signage for the citizens to be informed of the area/terrain as well as for first responders. There are currently parks with duplicate names or very similar names which need to be looked at and corrected before these become an issue, once again delaying first responder response due to lack of proper accurate information.

Another way for DFR to improve response would be to update their communication inside the CAD system by being able to provide area/trail maps into apparatus computers for first responders.

5. Are you aware of any technology, equipment, tools or programs that could potentially produce positive effects in relation to risk aversion in the area known as the Trinity River Corridor?

There are many new web based applications that can help record and display geographical locations. Of course with new technology and applications would be a matter of finding one that would be best suited for the City of Dallas and DFR's specific needs.

We believe that the better informed the citizen is regarding to their specific location the easier it will be for them to convey and communicate that information to the emergency call takers. Large, well identified area/trail maps, address signage and any warning precautions need to be made available and fully visible at these locations.

GPS ready digital cameras make the process of marking and identifying these areas/trails easier and more accurately (DFR GIS was approved the purchase of such an item about two months ago but at this time we are unaware of where we are in the process).

There are terrain areas that are simply impossible to reach with our current bigger and heavier 911 equipment. Smaller, more agile and lighter vehicles such as 4x4 ATV's (Polaris), outfitted with basic emergency medical and extrication equipment are a necessity for adequate response into some areas. There are many access bridges throughout the City trails that cannot be currently accessed due to weight restrictions.

Appendix E

Interview Questions Seattle Fire Department

1. Does your dept. respond to incidents within Freeway Park?

Yes. We respond. However, in the past 10 years we've only responded to 55 incidents at Freeway Park.

2. What are the most common types of responses?

Most of the responses are medical: 24 BLS, 15 ALS. The rest were auto fire alarm, investigations, etc.

3. What type of training do you provide to members to ensure they are prepared to respond to this geographic area?

There is no special training for this area.

4. Do you have an existing SOP, Risk Mgmt Plan or MOP specifically related to the park area? If so, can you send a copy via email or fax?

There are no SOPs, response plans or similar material specific to the Freeway Park

5. Are there any technologies that you are aware of that could be utilized to mitigate risk to responders/visitors?

AEDs strategically placed in the Freeway Park Garage and near building egress points that open to the park area would reduce risks associated with cardiac arrest. Many businesses in the downtown area are putting AEDs in their buildings and letting us know where they are located so our dispatchers can factor that in their instructions to callers.

Appendix F

Interview Questions Fire Department New York

1. What are the most common types of responses?

For the most part most responses are a medical issue in which an ambulance and possibly a CFR-D engine would respond. We sometimes may have a minor brush fire, but this is not much of an issue.

2. What type of training do you provide to members to ensure they are prepared to respond to this geographic area?

Any building structures are inspected to insure compliance with NYC fire codes and are covered in our general SOP's for building fires.

FDNY trains in ice rescues and has rescue units with scuba ability.

3. Do you have an existing SOP, Risk Mgmt Plan or MOP specifically related to the park area? If so, can you send a copy via email or fax?

Central Park has many special events that require their own Incident Action Plan. Examples: Concerts, Road races (NYC Marathon), Fireworks ect....

FDNY does not have a specific SOP for park incidents.

4. Are there any technologies that you are aware of that could be utilized to mitigate risk to responders/visitors?

No

Appendix G

Interview Questions Minneapolis

1. What are the most common types of responses?

We respond to all areas of the City, including: parks, recreational and green areas, and waterways. Most of these calls would be categorized as EMS; however, we routinely (meaning, a few annually) respond to fires and technical rescues, especially along the river bank.

2. What type of training do you provide to members to ensure they are prepared to respond to this geographic area?

No additional training.

3. Do you have an existing SOP, Risk Mgmt Plan or MOP specifically related to the park area? If so, can you send a copy via email or fax?

No

4. Are there any technologies that you are aware of that could be utilized to mitigate risk to responders/visitors?

No

Appendix H

Interview Questions Chicago Fire Department

1. What are the most common types of responses?

The park is normally open to the public other when it is occupied by private venues which does happen several times a year. There are also times the city will sponsor events.

During city events we along with other city services set up command posts and work with our office of emergency management to prevent any duplicate responses.

Private events pretty much take care of the zone occupied and we meet to discuss their plans and there is an understanding and approvals for city services outside the area.

2. What type of training do you provide to members to ensure they are prepared to respond to this geographic area?

No additional training.

3. Do you have an existing SOP, Risk Mgmt Plan or MOP specifically related to the park area? If so, can you send a copy via email or fax?

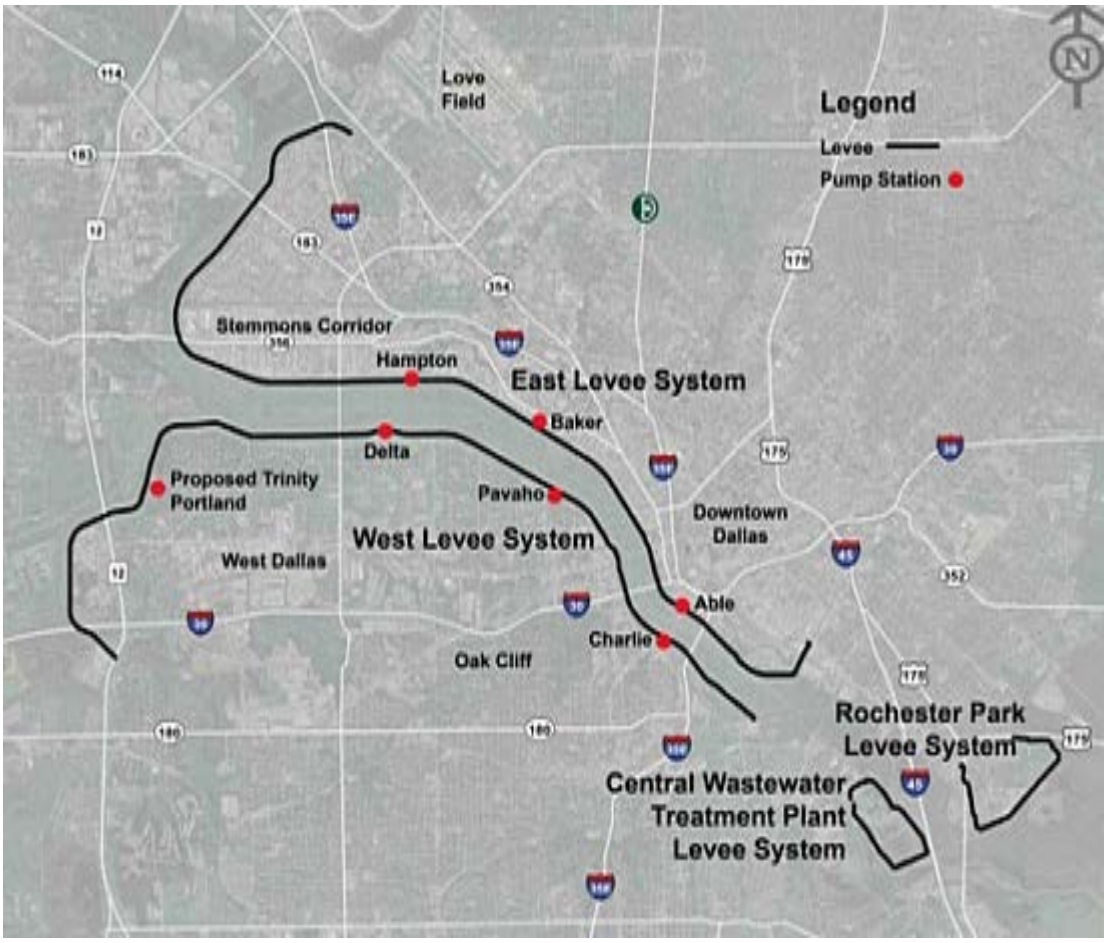
Each events calls for a separate plan. We do have a grid system set up that assists the first responder that may have to respond to areas of the park.

4. Are there any technologies that you are aware of that could be utilized to mitigate risk to responders/visitors?

No

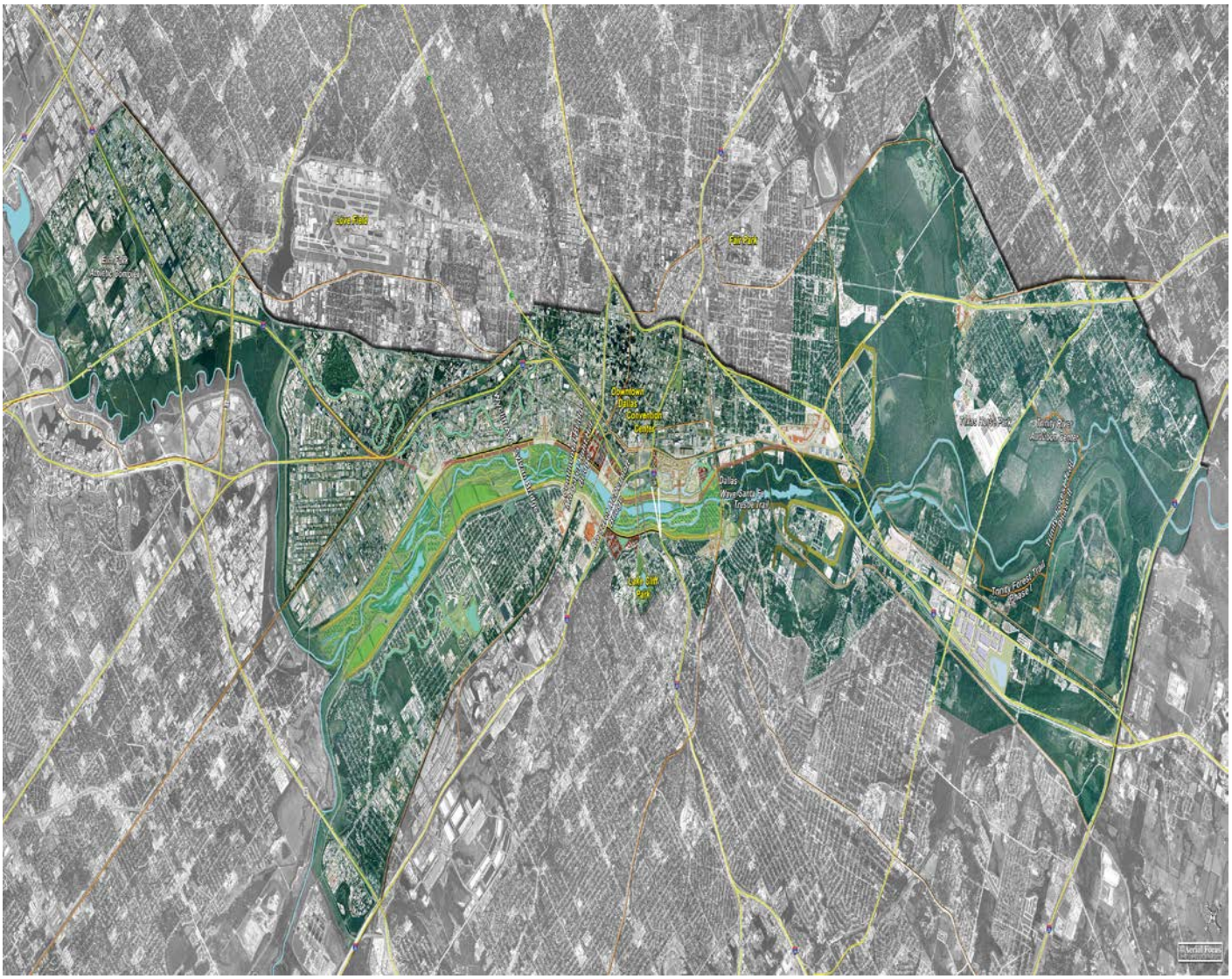
Appendix I

CITY OF DALLAS LEVEE SYSTEM

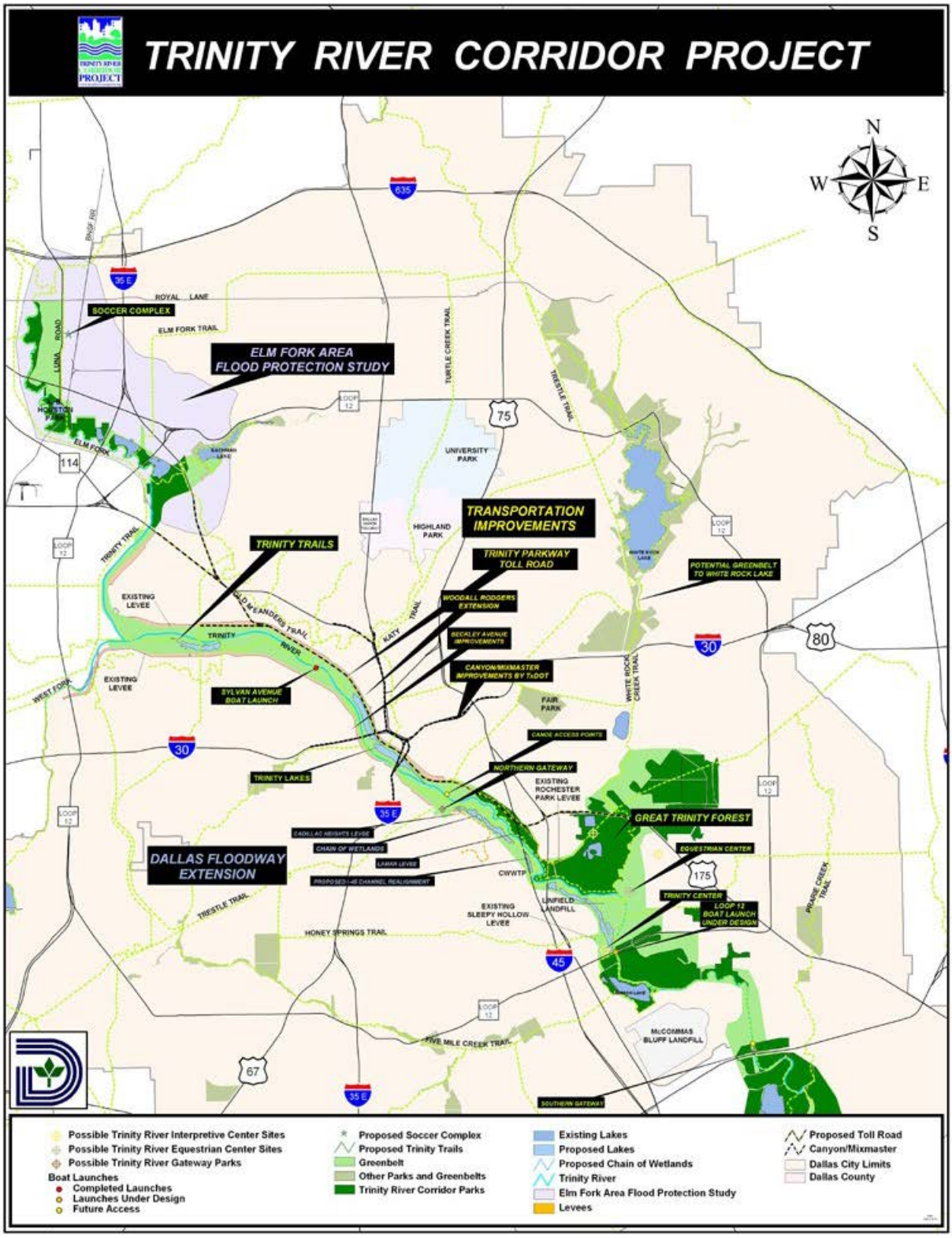


Appendix J

Aerial View of the Trinity River Corridor



Appendix K


TRINITY RIVER CORRIDOR PROJECT
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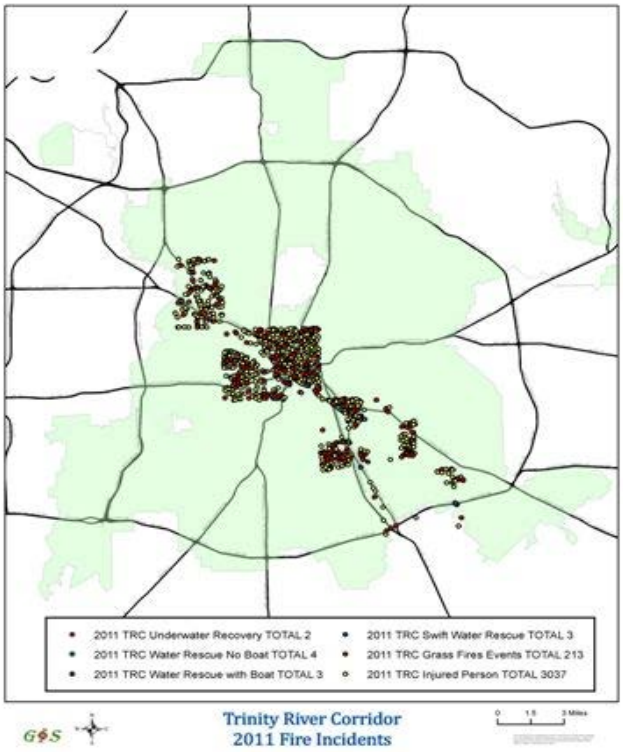
TRANSPORTATION IMPROVEMENTS
TRINITY TRAILS
TRINITY PARKWAY TOLL ROAD
WOODALL RODGERS EXTENSION
BECKLEY AVENUE IMPROVEMENTS
CANYON/MIXMASTER IMPROVEMENTS BY TxDOT
POTENTIAL GREENBELT TO WHITE ROCK LAKE
SYLVAN AVENUE BOAT LAUNCH
DALLAS FLOODWAY EXTENSION
GREAT TRINITY FOREST
TRINITY LAKES
NORTHERN GATEWAY
SOUTHERN GATEWAY
CANOE ACCESS POINTS
EQUESTRIAN CENTER
TRINITY CENTER
LOOP 12 BOAT LAUNCH UNDER DESIGN
SOCCER COMPLEX
ELM FORK TRAIL
ROYAL LANE
LUNA ROAD
TURTLE CREEK TRAIL
TRESTLE TRAIL
UNIVERSITY PARK
HIGHLAND PARK
FAIR PARK
TRINITY TRAIL
OLD MEANDERS TRAIL
KATY TRAIL
WHITE ROCK CREEK TRAIL
PRAIRIE CREEK TRAIL
HONEY SPRINGS TRAIL
FIVE MILE CREEK TRAIL
EXISTING LEVEE
EXISTING ROCHESTER PARK LEVEE
EXISTING SLEEPY HOLLOW LEVEE
CADILLAC HEIGHTS LEVEE
CHAIN OF WETLANDS
LAMAR LEVEE
PROPOSED HE CHANNEL REALIGNMENT
CWWTP
UNFIELD LANDFILL
McCOMMAS BLUFF LANDFILL
TRINITY
WEST FORK
635
35 E
75
114
30
80
45
67
175
LOOP 12
Possible Trinity River Interpretive Center Sites
Possible Trinity River Equestrian Center Sites
Possible Trinity River Gateway Parks
Boat Launches
Completed Launches
Launches Under Design
Future Access
Proposed Soccer Complex
Proposed Trinity Trails
Greenbelt
Other Parks and Greenbelts
Trinity River Corridor Parks
Existing Lakes
Proposed Lakes
Proposed Chain of Wetlands
Trinity River
Elm Fork Area Flood Protection Study
Levees
Proposed Toll Road
Canyon/Mixmaster
Dallas City Limits
Dallas County

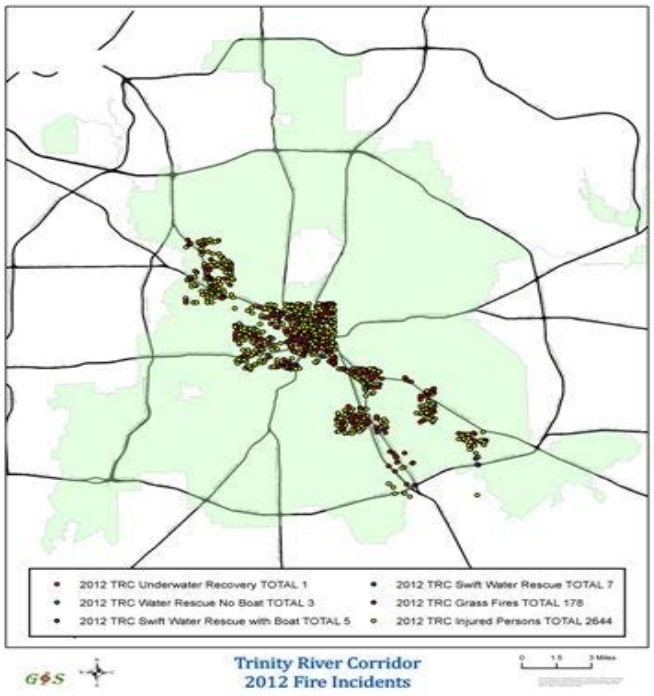
Appendix L

Trinity Audubon

Appendix M

Response Data Maps



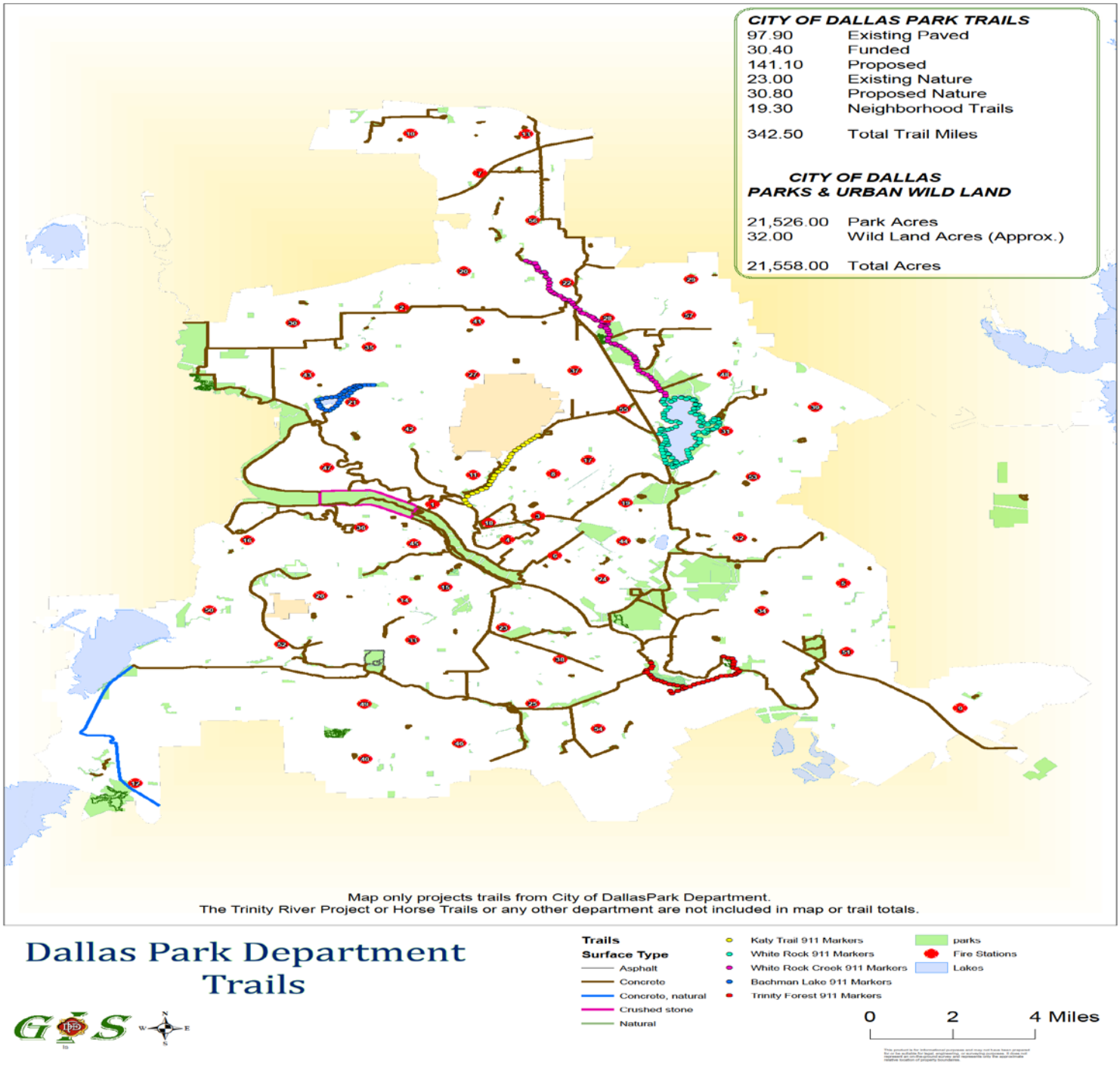


Appendix N

Wave Park

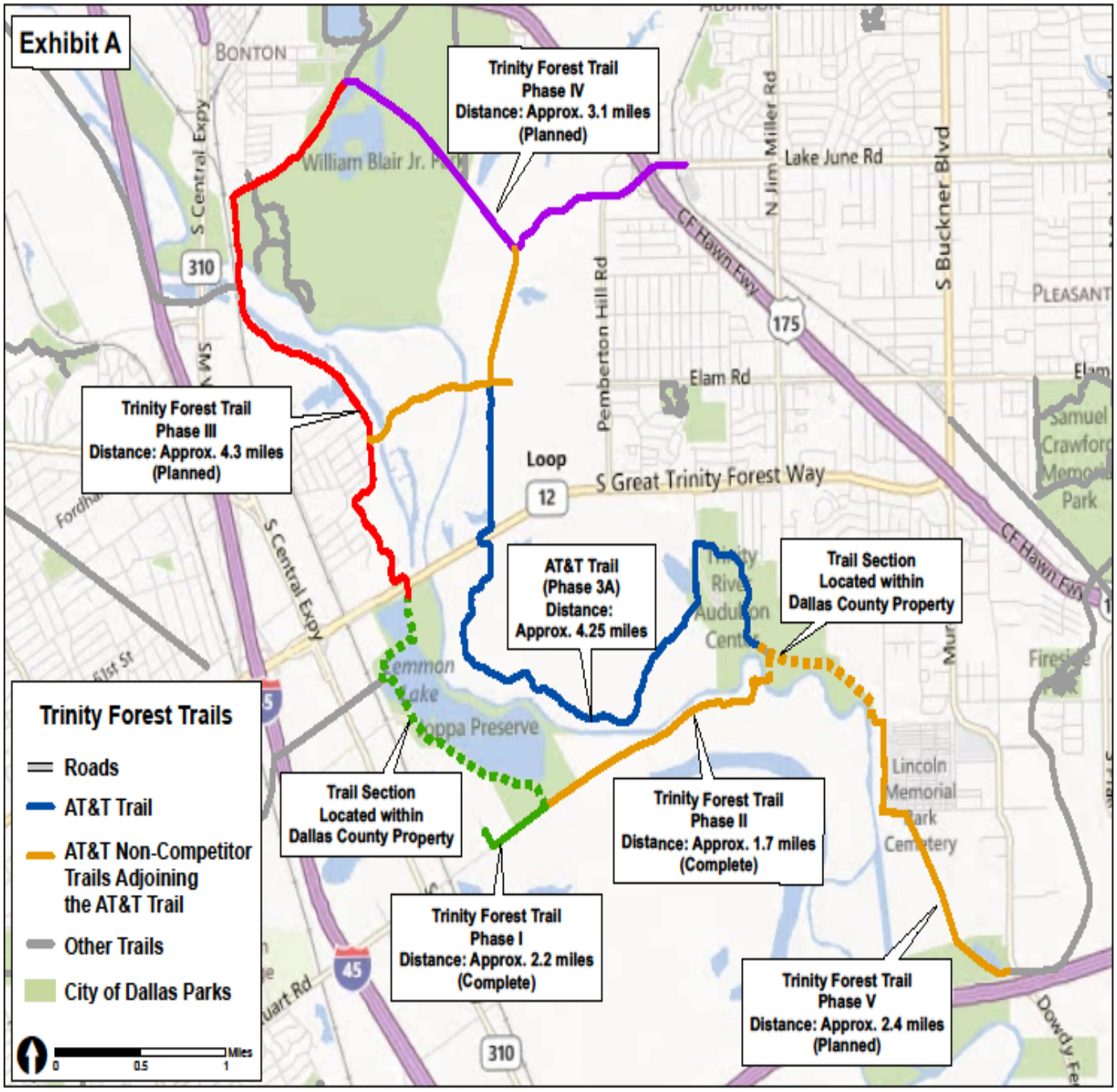
Appendix O

Trail Maps



Appendix P

Sections of New Trails



Appendix Q

Proposed Trails

Appendix R

Environmental Hazard

Appendix S

Trail Markers

Appendix T

Margret Hunt Hill Bridge