

EA Project Summaries and Findings Report Project

Project 8 – Edwards Aquifer Water Quality Protection from Catastrophic and Low to Mid-Level Effects of Discharge of Hazardous and Polluting Materials from Contaminated Water Runoff during Emergency Response

Project Summary

Author: UTSA

By Walter Den, Mark Black, and Rudolph Rosen

Funding Amount

\$218,937

Stated objectives of the study – *This Texas A&M University – San Antonio project will eliminate or reduce risks of pollution discharge from occasional potentially catastrophic and low to mid-level effects of response to emergencies such as fire, flood, high wind, and explosion in structures and along transportation corridors in the Edwards Aquifer Recharge Zone in Bexar County by enabling and equipping First Responders with Best Management Practices (BMPs) and training, and by helping to reduce or eliminate impact to water quality from emergency response runoff during emergency events in locations where threats exist due to on-site storage, production, or transport exchanges of polluting or hazardous materials.*

Justification for the study – *In 2007 the Texas Legislature directed the Edwards Aquifer Authority to protect the water quality of the Edwards Aquifer from the impact of fire control in the Edwards Aquifer's recharge zone. The event that prompted legislative action was a fire called "Mulchie" that burned for three months in an eight-story high mulch and debris pile on the edge of the Edwards Aquifer recharge zone near Helotes. The legislative mandate covered reducing impacts on aquifer water quality of catastrophic and mid- to low-level pollution of the aquifer from day-to-day fire control activities in the presence of hazardous and other polluting materials in the recharge zone. The project will accomplish the mandate of the legislature to address both catastrophic and low- to mid-level pollution of the aquifer due to fire response, by leveraging multiple collaborators, funding sources, and in-kind contributions to address the deficiencies in current programs intended to protect the aquifer.*

1 Summary

Risks from runoff associated with spills of hazardous materials, sanitary sewer overflows, and firefighting activity contain pollutants detrimental to public health and groundwater. In areas with karst features, such as the Edwards Aquifer recharge zone (EARZ) where this project was focused, the risks of contamination are even greater. Polluted runoff and spilled material can rapidly enter the subsurface through recharge features and contaminate the groundwater in the aquifer. Due to rapid and variable groundwater velocities it can take only a few hours or days for these contaminants to move into a public or private water supply. It is critical for runoff from spills and firefighting activities to be managed during and after emergency response to help minimize potential risks to public health and safety.

The project team's goal was to develop best management practices (BMPs) and other resources to improve responses to spills, releases, and fires over the EARZ, and then distribute these strategies to first responders and the public. Outcomes of the project included a training curriculum for first responders, BMPs specific to first responder actions for minimizing aquifer contamination, a risk assessment framework for aquifer contamination, instructional aids and videos to support training efforts, and a collaborative workshop attended by key stakeholders.

1.1 Methods

To achieve their objective of protecting water quality within the Edwards Aquifer recharge zone, the

project team produced and shared several resources with multiple stakeholder groups. They developed a training curriculum, program, and educational materials to instruct first responders and the public on how to properly reduce or eliminate runoff in the EARZ during emergency firefighting situations. The supporting documents include four PowerPoint presentations for live instructional delivery and two manuals for instructors and participants. The curriculum goes into detail on actions that first responders should take during an emergency event split out into three categories: pre-event site planning, emergency event mitigation, and post-emergency firefighting activities. They provide context on why it is important to prevent hazardous materials from reaching the aquifer, how to identify karst features, and sources of potentially harmful runoff. The strategy also breaks down response objectives into three additional categories, offensive, defensive, and non-intervention, with a description of action options and techniques based on the strategy selected.

They also provided information and encouraged communication between the San Antonio Fire Department, Bexar County Fire Department, and Edwards Aquifer Authority to maximize the use and accuracy of the Edwards Aquifer Water Quality Protection Information Base and Mobile Interface. This GIS interface is accessible from the cab of each fire response vehicle and command cars and provides real time data on existing hazardous material storage locations, previously identified karst features, and other relevant site information overlaid on a map. This helps responders develop an effective strategy prior to arriving at the site saving valuable time. The final training presentation discusses how to apply risk-frequency analysis to types of emergency response events based on potential consequences and site conditions.

As an additional tool to provide first responders and the public with information about aquifer protection during emergency response, the team produced two educational videos. One video introduces karst features, demonstrates how easily runoff can enter the aquifer through surface openings, and discusses detention structures as a strategy for containing runoff. The second video acts as a brief summary of the training efforts and response strategies to serve as a resource for those unable to attend an in-person training seminar.

Several documents containing emergency response best management practices were developed with focuses on responses to spills over the Edwards Aquifer and as tools to increase resilience during emergency fire control activities. They break down best management practices into the same three categories discussed in the training, shown in Figure 1. Additional BMPs are included to improve aquifer resilience, including surface-water flow and aquifer vulnerability modeling and considerations of the transport and fate potential of hazardous materials. The BMP documents provide information on developing, staging, and deploying tools first responders can use to predict and mitigate the consequences of specific contaminants suspected of entering the aquifer. A third guidance document provides recommendations on integrating the relevant BMPs into the Edwards Aquifer Alliance's existing sampling and monitoring program.

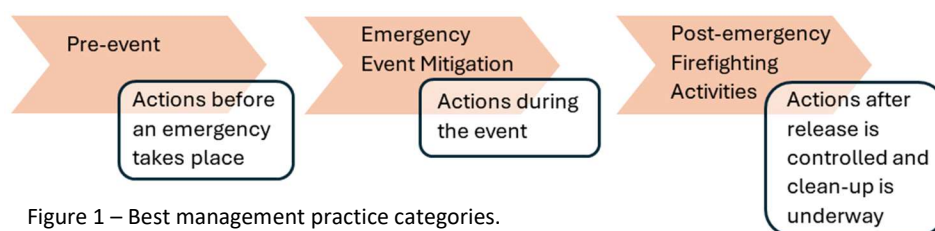


Figure 1 – Best management practice categories.

To better understand the pollutant transport processes of the aquifer, the project team conducted a literature review of existing research pertaining to karst aquifer contamination pathways via surface runoff within various karst aquifers throughout the U.S. and the world. The findings were utilized to develop a risk assessment framework for the Edwards Aquifer.

1.2 Findings

As a result of the training resources and best management practices published throughout this project, the team was able to impact and educate the community and emergency responders working within the Edwards Aquifer recharge zone in Bexar County and San Antonio. The team conveyed their findings and strategies at conferences and training classes, with a combined audience estimated to be a minimum of 227 professionals. Training resources were also posted to a website to further increase the accessibility of the information.

To further ensure that the best management practices and other tools continue to be implemented beyond the life of the project, there was a decision-making roundtable workshop held with representatives from several departments within the City of San Antonio, the Edwards Aquifer Authority, the San Antonio River Authority, and others. The workshop discussed the overall objectives of the project, and four key program areas which could benefit from additional stakeholder coordination.

1. Governance of a coordinated emergency response system to effectively and appropriately respond to fire emergencies occurring in the sensitive Edwards Aquifer recharge and contributing zones.
2. Deployment of fire runoff control barriers to shorten response time and enhance response efficiency.
3. Continue coordination of the interactive GIS tools that map sensitive karst features, structures, runoff containment facilities, and hazardous material storage areas.
4. Feasibility of applying dye-tracing techniques to aid in predicting the impact of contaminants that have entered the aquifer.

The project team gathered feedback and outlined next steps to ensure the program continues after the project closes, and to ensure the BMPs are utilized far into the future. The team is hopeful that the training will be utilized by other emergency response groups outside of Bexar County and San Antonio to create a regional approach to minimizing the impacts of runoff from spills and firefighting activities over the Edwards Aquifer recharge zone.

1.3 Challenges and Limitations

This project required the coordination of several public agencies and stakeholders to develop and implement a unified strategy. This requires continued cooperation to ensure the messaging and response techniques are cohesive and necessitates frequent check-ins to exchange information and data. For example, the GIS layer being utilized by first responders must be synced quarterly with the data being gathered by the Edwards Aquifer Alliance otherwise it may lack accuracy and be a less useful tool. For the findings from this project to maximize their effectiveness, it is imperative that stakeholders continue to collaborate.

Another limitation involves the reach of the program's funding. This project is aimed at improving water quality within the EARZ within Bexar County and San Antonio. There are six additional counties with land over the recharge zone who could benefit from the emergency response training and best management practices. Without the principal investigator driving

this coordination, it may be difficult to continue the implementation of the developed strategies. Figure 2 shows all of the entities involved with protecting water quality of the EARZ.

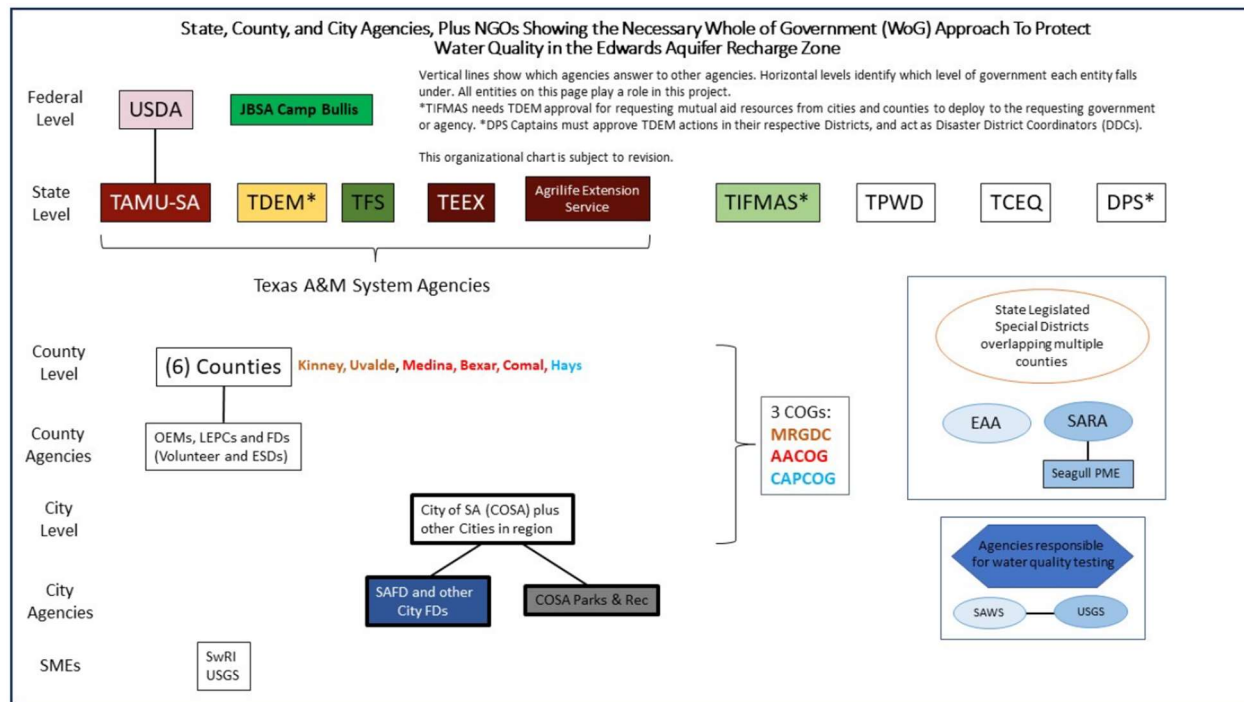


Figure 2 – Whole of Government Approach to EARZ protection.

There are also challenges from the public's perception of the emergency response strategies chosen, such as the "let it burn" approach. Business owners may have a difficult time understanding why it is the better decision to let their property burn to minimize contaminated runoff, as opposed to trying to exterminate the fire. The responders will have to weigh the costs of rebuilding infrastructure against the potential impacts of aquifer contamination by firefighting runoff. New and emerging sources of contaminants also pose a threat, such as electric vehicle fires, which require creative strategies to exterminate efficiently.

2 Benefits

This project provides water quality benefits and public education / outreach for emergency response efforts in the Edwards Aquifer recharge zone. In addition, the project provides the resources necessary for stakeholders interested in improving their protocols both before, during, and after spills and firefighting activities to minimize potential risks to public health and safety.

The benefits of the project include:

- The training and best management practices developed by the project team provide guidance to facilitate streamlined and consistent responses for a set of specific situations. This reduces time spent on decision making and increases responder confidence.
- The project team established communication pathways between local agencies and stakeholders.

- The project serves as a local example to generate interest for other counties over the EARZ. Additional local agencies may consider adopting these practices as operational policies.
- The project has provided a strong foundation for emergency planning and response with the potential for continued improvement.

Project Deliverables:

Den, W. (2024). Executive Summary Report. Texas A&M University-San Antonio.

Rosen, R., Den, W., and Black, M. (2021-2022). Deliverable A: Training curriculum, program, and educational materials for 12-hour, 2-day course for first responders on reducing or eliminating emergency runoff into the Edwards Aquifer recharge zone. Texas A&M University-San Antonio.

Den, W., and Black, M. (2023). Deliverable B: Delivery of said training course to first responders. Texas A&M University-San Antonio.

Schindel, G. M. (2019). Deliverable C1: Recommended Best-Management Practices for Response to Spills in the Edwards Aquifer of South-Central Texas. Edwards Aquifer Authority.

Rosen, R. (2023). Deliverable C2: Best Management Practices for Firefighting in the Karstic Edwards (Balcones Fault Zone) Aquifer. Texas A&M University-San Antonio.

Den, W. and Black, M. (2023). Deliverable S1: Risk Assessment of Urban Development in the Recharge Zone of the Karstic Edwards Aquifer – A Literature Survey and Analysis. Texas A&M University-San Antonio.

Rosen, R. and Gary, M. (2020). Deliverable E: Emergency Responder's Guide to Protecting the Edwards Aquifer: Instructional Enhancements. Texas A&M University-San Antonio.

Den, W., and Black, M. (2024). Deliverable E: BMP Training Instructional Aid for Protection of Edwards Aquifer Water Quality from Firefighting Runoff. Texas A&M University-San Antonio.

Den, W., and Black, M. (2023). Deliverable F: Emergency response BMPs tailored for the Edwards Aquifer recharge zone evaluation of course curriculum, BMPs, and associated materials. Texas A&M University-San Antonio.

Rosen, R., and Maxwell, R. (2020). Deliverable G1: Video – Emergency Responder's Guide to Protecting the Edwards Aquifer. Texas A&M University-San Antonio.

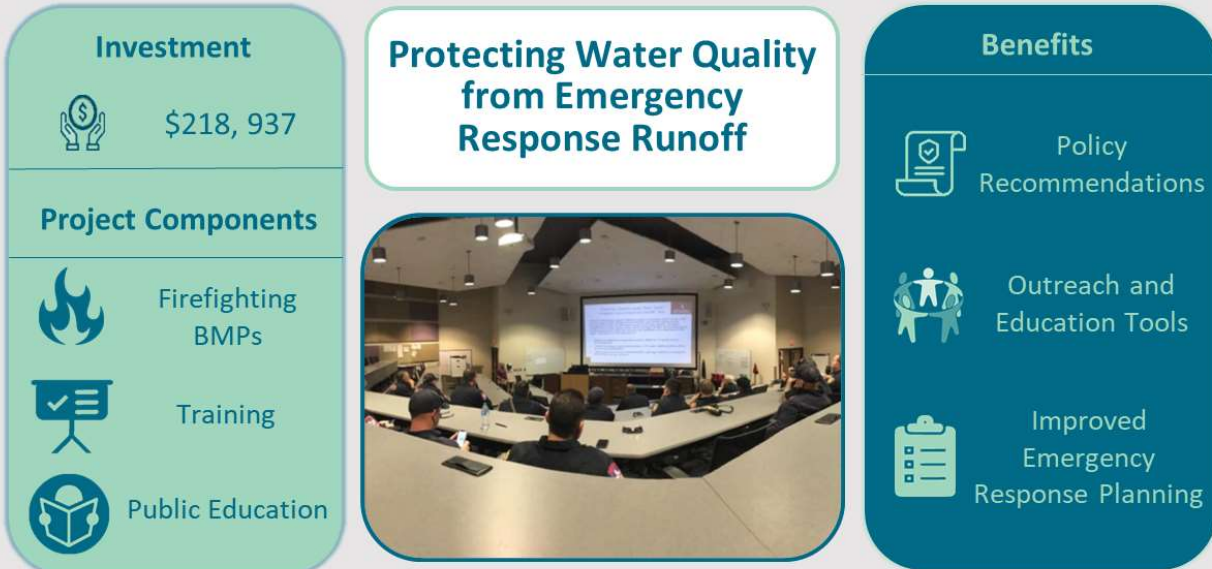
Den, W., Black, M., and Cantu, E. (2024). Deliverable G2: Video- Edwards Aquifer Water Quality Protection from Contaminated Firefighting Runoff. Texas A&M University-San Antonio.

Den, W., and Black, M. (2024). Deliverable H: General outreach and education. Texas A&M University-San Antonio.

Den, W., and Black, M. (2024). Deliverable I: Stakeholders Decision-Making Roundtable Workshop. Texas A&M University-San Antonio.

EA Project Summaries and Findings Report Project
Project 8 – Edwards Aquifer Water Quality Protection from
Catastrophic and Low to Mid-Level Effects of Discharge of
Hazardous and Polluting Materials from Contaminated Water Runoff
during Emergency Response
Fact Sheet

Project 8: Edwards Aquifer Water Quality Protection from Catastrophic and Low to Mid-Level Effects of Discharge of Hazardous and Polluting Materials from Contaminated Water Runoff during Emergency Response



UTSA
The University of Texas at San Antonio

Benefits

- The training and best management practices developed by the project team provide guidance to facilitate streamlined and consistent responses for a set of specific situations. This reduces time spent on decision making and increases responder confidence.
- The project team established communication pathways between local agencies and stakeholders.
- The project serves as a local example to generate interest for other counties over the EARZ. Additional local agencies may consider adopting these practices as operational policies.
- The project has provided a strong foundation for emergency planning and response with the potential for continued improvement.

EA Project Summaries and Findings Report Project
Project 8 – Edwards Aquifer Water Quality Protection from
Catastrophic and Low to Mid-Level Effects of Discharge of
Hazardous and Polluting Materials from Contaminated Water Runoff
during Emergency Response
Project Graphic

Project 8 – Edwards Aquifer Water Quality Protection from Catastrophic and Low to Mid-Level Effects of Discharge of Hazardous and Polluting Materials from Contaminated Water Runoff during Emergency Response

Protecting water quality from emergency response runoff

