

A Five-Year Project

Rural Emergency Firefighting Water Supply
and Delivery Systems:
Dependency of Firefighting Success on Adequate Access,
Timely Delivery, and Effective Application of Water

West Lake Limestone Volunteer Fire Department (WLLVFD)
And
Limestone County Emergency Services District #2 (ESD#2)

Presentation Content

- Limestone County
 - Geography & Demographics
- Emergency Services District #2
- ESD-WLLVFD Challenges:
 - Fire risks in the district
 - Firefighting water supply
 - Water delivery to the fire scene
- West Lake Limestone VFD
 - Firefighting Challenges
- Five-Year Project
 - Fire Station locations
 - Firefighting water tank options
 - Main tank locations
 - Satellite tank storage
- Tender Selection Issues
- Tender Shuttle Operations
- Funding Opportunities

Limestone County

- Population: 23,480 in 933 sq. mi.
 - 8,100 households
 - median income \$43,356
 - 20.7% below poverty level
 - Population density: 24/sq. mi.
 - Housing density: 11/sq. mi.
- Cities: Mexia (7,394), Groesbeck (4,318), Thornton (528), & Kosse (466)
- 2,764 miles of roads in the County;
 - 238 mi. of city streets.
- 1-Paid FD (Mexia) & 11-Rural VFDs
 - 2-ESDs: (East Lake & West Lake)



- Lake impoundment - 1978
 - 13,378 acres
 - Max. depth 43 ft.
 - Avg. depth: 16 ft.

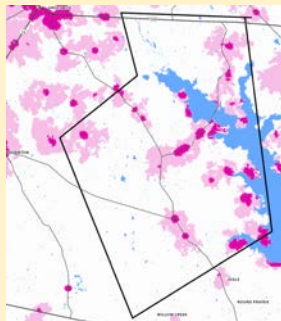
ESD#2 and WLLVFD: Primary First Response Area

- Rural county: 96 sq. mi.
- South east corner
- Population: nominally 2800;
 - Holidays, weekends & summers: 4000-5000
 - 1150 homes
 - Significant number of retirees
- Majority on the lake shoreline
- SW corner a lignite strip mine



ESD-VFD Challenges

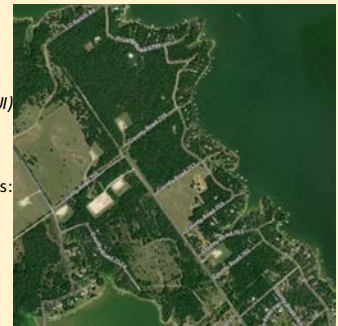
- Community Protection Zones
 - Dark and light pink areas
- Primary Risks
 - structure fires
 - wildfires
- Primary Challenge
 - No fire hydrants
 - FIREFIGHTING WATER



- From: Texas A&M Forest Services Risk Assessment Report

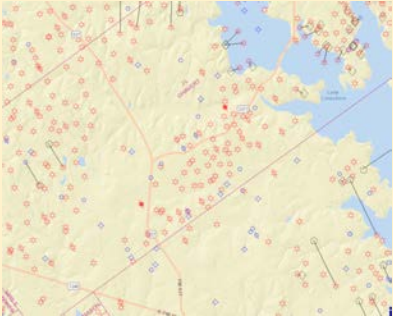
ESD/VFD Challenges

- Growth along the lakeshore
- *Isolated communities*
- *Wildland Urban Interface (WUI)*
 - Interface between woodlands, brush, pastures, and homes
- Residential Structure fire issues:
 - Exposure protection
 - WUI
 - Lack of defensible space
 - Wildfire prevention



ESD/VFD Challenges

- Operational Gas wells:
 - open 6x red circles
- Operational Oil wells:
 - closed 8x red circles
- Closed wells:
 - open 4x blue circles
- Planned wells:
 - open blue circles
- Fire Safety Issues
 - Well sites w/tanks
 - Gas pipelines (6")
 - Transmission lines (36")




Ref.: Railroad Commission of Texas, Oil & Gas Production Data 36



ESD-VFD Challenges

- Wildfire Potential
 - Woodlands (Green)
 - Pastures, hay meadows, fields and brush (Yellow)
- Fire Suppression Risk
 - Surface fuels
 - Wildfires

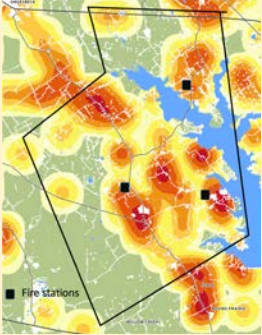


From Texas A&M Forest Services Risk Assessment Report

Fire Risks in Our District

Wildfire Ignition Density

- Non-Burnable
- 1 (Low)
- 2
- 3 (Moderate)
- 4
- 5 (High)
- 6
- 7 (Very High)



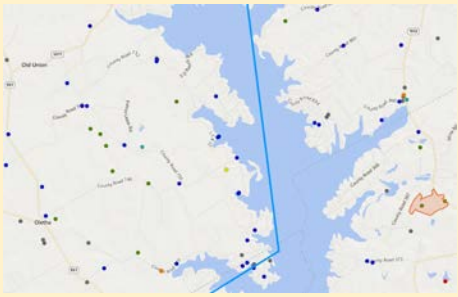
Fire stations

- Amazing and Challenging!

Ref.: Texas A&M Forest Services Risk Assessment Report

Wildfires Do Happen

- Recorded Wildfires:
 - (2011-15)
- Leon County:
 - 3650 acres
- Tehuacana Hills:
 - 3000 acres
- Robertson County:
 - Pipeline Explosion



Ref.: Texas A&M Forest Services Data

ESD#2 & WLVFD

- ESD Board Commissioners (5)
- Fire stations (3)
- Vehicles (7)
- VFD personnel (20)
- Mutual aid agreements
- Goals and measures



ESD-VFD's Principal Challenge: Firefighting Water

- To attack a fire, apply water!
- Rural area: no fire hydrants
- Only 3 drafting locations.
- WLLVFD must bring water
- Brush trucks: 400 gallons
- Fire engines: 1000 gallons
- Future Tender: 3500 gallons

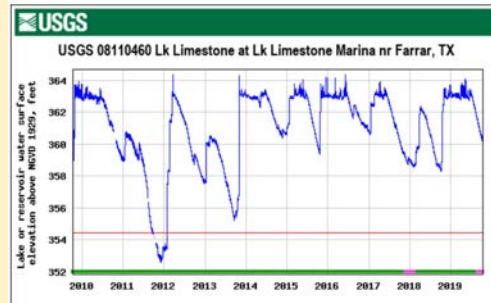


Rural ESD-VFD's Need: Lots of accessible water & efficient transport/delivery

ESD-VFD Challenge

Not a Constant Level/Lake!

Consequence of this deviation?



Ref.: WaterData.usgs.gov

ESD/VFD Challenges: Firefighting Water for a House Fire

- To put out the fire, apply water!
- How much water ?
- NFPA 1142 fire flow calculation: light construction/ wood frame
 - 27,000 cu ft, 2-story home
 - 8,775 gal at 500 gpm
 - Initial Attack
- Insurance Services Organization
 - 30,000 gal. for 2-hr. at 250 gpm



Our Plan to Address Challenges: Five-Year Project

- New Station-3
- Third ISO engine
- Storage & Fill Station locations
 - ISO 5-road mile access
- Firefighting Water Tank Selection
 - NFPA 1142: Water Supplies for Suburban and Rural Firefighting
 - NFPA 22: Standard for Water Tanks for Private Fire Protection
- Tender Acquisition
- Tender Shuttle Operations
 - Mutual Aid Agreements
 - SOPs
 - Training Exercises
- Funding Issues
 - Project Costs
 - Funding Sources

Tank Option: Bolted Steel Storage Tanks

- Typically Larger Water Storage as in Municipal Applications
 - A single centrally located tank of over 30,000 gallons
- Site Preparation: concrete slab
- Shipping
- Site Installation and Assembly
- Labor cost
- Unit Price



Tank Option: Corrugated Galvanized Metal

- Commonly used
- Often Commercial Applications
 - Several >15,000 gallon tanks distributed within the district
- Site Preparation: concrete slab
- Transportation cost
- Site Installation & Assembly
- Labor cost
- Unit Price



Tank Option: Fiberglass Cistern Storage Tanks

- Dry Hydrant - Below Ground
 - NFPA1142 Cistern
- ~30,000 gal. Tankage
 - 10' dia. x 26' length
- Installation complexity
 - Excavation; bedding
 - Ballast/Dead men
 - Graded Gravel Fill
- Labor & Equipment Cost
- Unit Price



Tank Option: Plastic HDPE Storage Tanks

- Dry or Wet Hydrant - Above Ground
- Suction or High Capacity Pump
- Installation simplicity
 - Level area
 - Road base
- Unit price



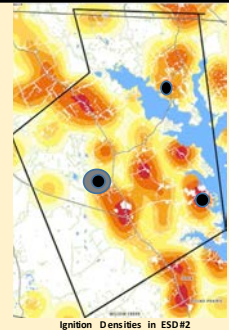
Tank Options: Comparing Costs

Concept	Tank Type	Capacity	Size (D - H)	Cost	Freight	Total
One Centrally Located	Steel Bolted / Epoxy Coated	50,000 gal.	21' - 20'	\$67,782	\$1,783	\$69,565
Three Distributed Locations						
Single Tank / Location	Corrugated Galvanized	16,000 gal.	21' - 7.3'	\$21,207	\$1,215	
		3x 16,000 gal.		\$63,621	\$3,645	\$67,266
Multiple Tanks / Location	Plastic - HDPE	8,000 gal.	12' - 12'	\$5,410	\$700	
		6x 8,000 gal.		\$32,460	\$4,200	\$36,660
Three Below Ground Cisterns						
Single Tank / Location	Fiberglass	15,000 gal.	10' - 25.5'	\$28,201	included	
		3x 15,000 gal.		\$84,603	included	\$84,603

Note: Quotations do not include site preparations, installation materials and labor.
 Steel and corrugated tanks require a concrete pad; the plastic tanks only require road base or similar material.
 Fiberglass cistern requires excavation, concrete deadmen, pea gravel base and backfilling.

Project Decision: Fill Site Locations

- Selected Plastic HDPE Tanks
- Distributed toward High Fire Risks
- At our Fire Station Locations
- Three, 16,000 gallon water plants
 - 5-Road mile accessibility



ESD-VFD Funding Challenges

- Poor, Rural County
- Modest ESD
 - Tax rate: \$0.04 of the \$0.10 allowed
 - Annual budget: ~\$100,000
- Small VFD
 - All volunteer
 - Annual budget: ~\$30,000
 - ESD#2: direct and indirect support
- Grants for small VFDs
 - Numbers game



ESD-VFD Water Storage Plan

- Water plants at three fire stations
- 16,000 gal. capacity with water well and high capacity fire pump
- Main fire station
 - ESD#2 funded the construction to include pump and tank installation
 - 16,000-gal tank was "donated"
- Stations-2 & -3
- Two 8,000-gal HDPE tanks with water well and high capacity fire pump
- 2018 Grant Proposal Effort
 - To several major foundations
 - \$84,000 Grant from a Texas foundation for Two Water Plants



- **HDPE Tanks**
- Delivery
- Site Prep
- Installation
- Plumbing
- **Water Well**
- Drilling
- **Fire Pump**
- Testing

Next in our Five-Year Plan

- Satellite Water Storage Tanks
 - 16,000-gal. water plants at stations (black squares)
 - 6,000-gal. dry-hydrant tanks in communities (blue circles)
 - 8,000-gal. dry-hydrant tanks on primary access roads (red circles)
- Tender Acquisition
- Tender Shuttle Program

Dry Hydrants

NFPA 1142: Alternative Water Supply
Minimum requirements for water supply source:

- ≥ 30,000 gallons usable year-round
- ≥ 250 gpm flow rate for two hours
- Lift ≤ 15 feet (≤ 12 feet desirable)
- All at 50-yr drought condition (2% chance in given year)
- Certified by hydrologist, engineer, or "similarly qualified person"
- Ref: NFPA 1142

Mobile Water Supply Apparatus

- "Water Mover"
- Pumper Tender
- 3500 gallon
- 750 gpm pump
- Pressure tank
- Large dump valve
- Folding tank

Tender Shuttle Operation

- Well choreographed dance
- Mutual Aid Agreements
- SOPs; training & practice
- On-site attack engines & folding tanks
 - Drafting and water delivery
- Tender shuttle cycle:
 - Travel, fill, return, dump
 - Goal: execute few TFRD cycles
 - Transport >33,000 gallons

In this scenario two WLLVFD engines, a brush truck (BTK) and a tender (TDR) deploy to a residential fire. Mutual aid tenders are deployed from Groesbeck (Gbk), Thornton(Thr), and East Lake (EL) VFDs. The travel-fill-return-dump (TFRD) cycles occur at the major 16,000 gallon storage tanks (STO). The sequencing of TFRDs occurs to minimize traffic and utilize available all water at STO-1 and STO-2. It is further assumed that within the first 30-35 min. a our portable tank can be deployed on-site.

Capacity:	Wl-BTK (400 gal)	Wl-Eng (1,000 gal)	Wl-TDR (3,000 gal)	Gbk-TDR (3,000 gal)	Thr-TDR (1,500 gal)	EL-TDR (3,500 gal)																																						
time (min)	0	5	10	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	78	81	84	87	90	93	96	99	102	105	108	111	114	117	120				
Brush Truck-1																																												
Engine-1																																												
Engine-2																																												
WL-TDR																																												
Gbk-TDR																																												
Thr-TDR																																												
EL-TDR																																												
Delivered (gallons)																																												
Accumulated (gallons)																																												

Grant Funding Needed
The Proposal Writing Process

- Preparation: Internal
 - ESD & VFD: Strategic Plan
 - ESD & VFD: Risk Assessment Reports
 - ESD & VFD: Budgets & Audit Reports
 - ESD & VFD: "Large" Project Vision
- Research: External
 - Funding agencies & funded awards
- Proposal: Project's "Small" Place
 - Letters of inquiry; a pre-proposal
 - Technical & Cost: "THE" proposal
 - Appendices: documents & presentations
 - Web site and follow-on communication



What Makes this Work?
The People

- The Board members at the ESD
- The Volunteers at the VFD
 - Officers
 - Firefighters
 - Medical First Responders
 - Associate members
- The Community
 - Those at your community events



Today's Presenters

- | | |
|---|---|
| <ul style="list-style-type: none"> • Chief Allen McWhirter, WLLVFD <ul style="list-style-type: none"> • Member (8-yrs) • Serving as the Fire Chief (2-yrs) • Retired as Senior Captain Texas City Fire Department (25-yrs) | <ul style="list-style-type: none"> • Commissioner Paul Loeffler, ESD#2 <ul style="list-style-type: none"> • Grants Administrator, WLLVFD & ESD#2 • Water Supply Officer for WLLVFD • Retired as a Professor of Chemistry Sam Houston State University (40-yrs) |
|---|---|