CEC Exhibit – 8 Fire Calculations

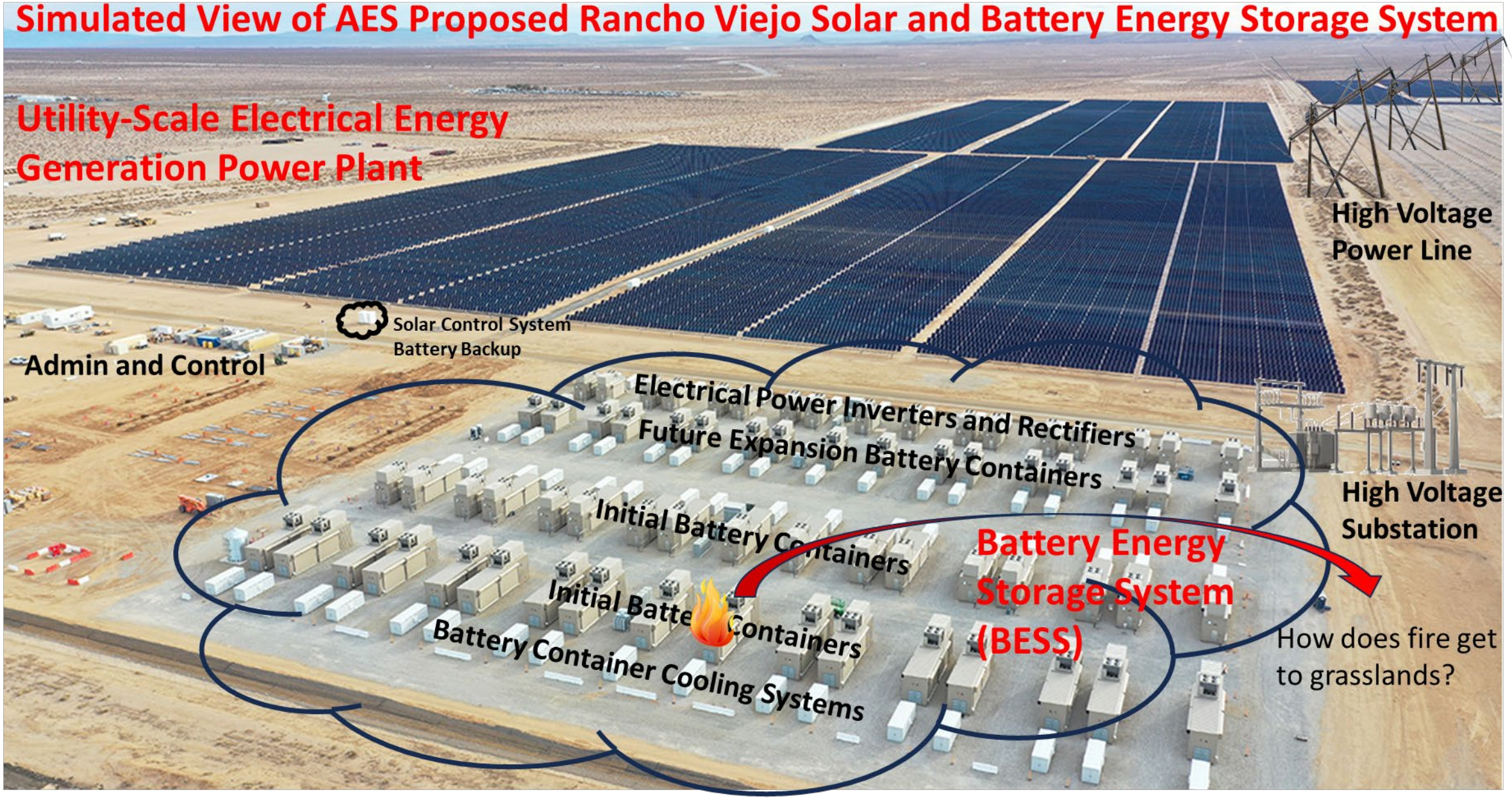


Image Source: https://www.mortenson.com/newsroom/battery-energy-storage-solutions

2017-03-28

Vehicle Fires Resulting from Hot Surface Ignition of Grass and Leaves 2017-01-1354

One potential fire ignition source in a motor vehicle is the hot surfaces on the engine exhaust system. These hot surfaces can come into contact with combustible and flammable liquids (such as engine oil, transmission fluid, brake fluid, gasoline, or Diesel fuel) due to a fluid leak, or during a vehicle collision. If the surface temperature is higher than the hot surface ignition temperature of the combustible or flammable liquid in a given geometry, a fire can potentially ignite and propagate. In addition to automotive fluids, another potential fuel in post-collision vehicle fires is grass, leaves, or other vegetation. Studies of hot surface ignition of dried vegetation have found that ignition depends on the type of vegetation, surface temperature, duration of contact, and ambient conditions such as temperature and wind speed. Ignition can occur at surface temperatures as low as 300 °C, if the vegetation is in contact with the surface for 10 minutes or longer. At surface temperatures of 400 °C, ignition can occur in 3 minutes, and at surface temperatures of 500 °C, ignition can occur in a few seconds. We made measurements of the surface temperature at various locations along the exhaust system of a passenger vehicle, including on the catalytic converter, under different transient conditions. The temperatures were measured using thermocouples welded to the exhaust system. The tests show that the maximum external surfaces temperatures occur under transient conditions after the vehicle comes to a sudden stop. Thus, testing that only measures steady-state temperatures or temperatures while the vehicle is moving will not necessarily capture the worst-case temperatures. For the vehicle tested, exhaust system components can reach temperatures of 400 °C and these temperatures can be sustained for minutes after the vehicle stops, and thus are capable of igniting dried vegetation.

Hiller Report, page 4/5 states Theoretical complete fire engagement of enclosure would result in external wall temperature of approximately 1241-degree C. This represents an external distance to grass fuel of 0 feet. With a design basis wind of 9 mph, the surface temperature of a first responder at 6.5 feet would intermittently be 1110-degree C. A reasonable assumption is that the decrease in resulting surface temperature would be proportional to the gradient of the Heat Flux. The Heat Flux gradient can be plotted from the data in the Hiller Report, page 34, Table 2. Once the data is plotted the gradient plot is used to plot a similar linear gradient for temperature over distance. The estimated intermittent temperature at 30 feet from the radiating enclosure is on the order of 500-degree C or less.

Distance (feet)	Heat Flux (Kw/m2)	Temperature
0		1241
6.5	1148	1110
10	939	
20	589	
30	348	500
40	235	
50	170	

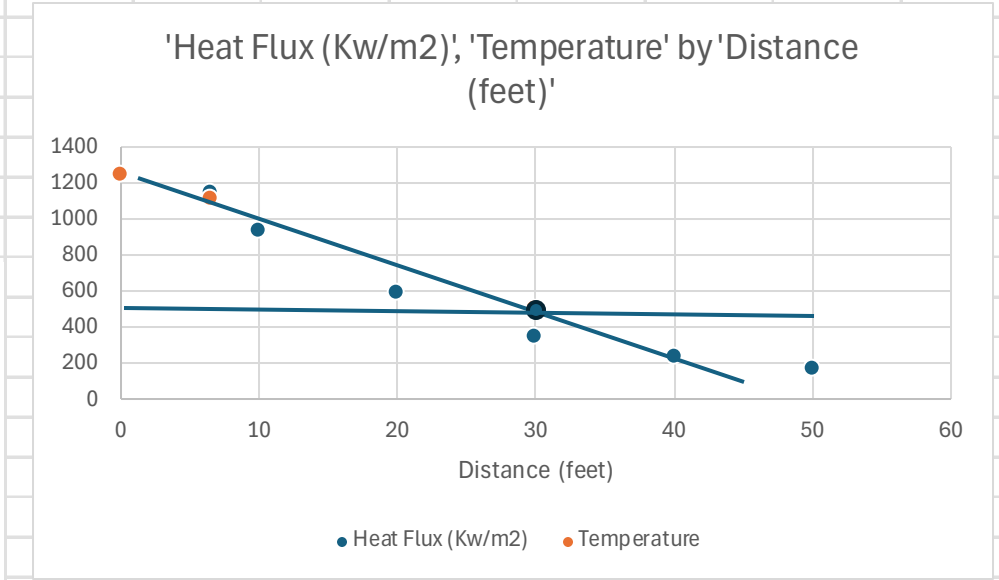
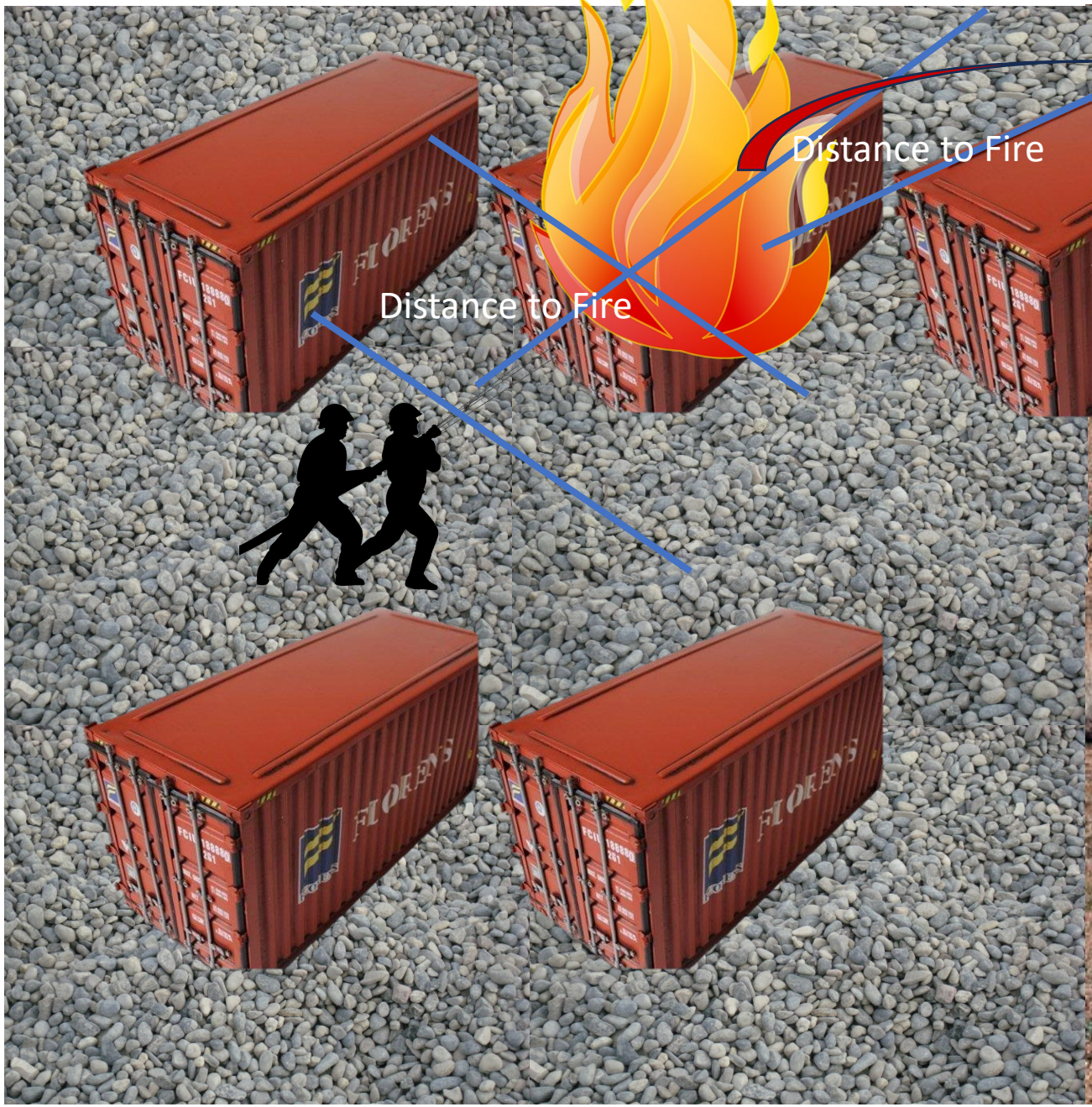


Table 2: Theoretical Momentary Heat Flux as a Function of Distance

Distance	Momentary Maximum Theoretical Heat Flux (kW/m²)
10’	939
20’	589
30’	348
40’	235
50’	170
60’	127
70’	98
80’	77
90’	62
100’	51

The estimated intermittent temperature at 30 feet can be combined with the SAE Technical Paper estimations for dry grass ignition. Even if you apply a large confidence interval on the intermittent temperature below 500-degree C. **It can be established that at 30 feet, dry grass could ignite from the radiated energy of an enclosure fire engagement in the range of 5 – 8 minutes.**



How does fire get to grasslands?

1. Ejected embers – “Spotting”
2. Radiant heat from container

Dry grass ignition at 30 feet in 5 – 8 minutes.

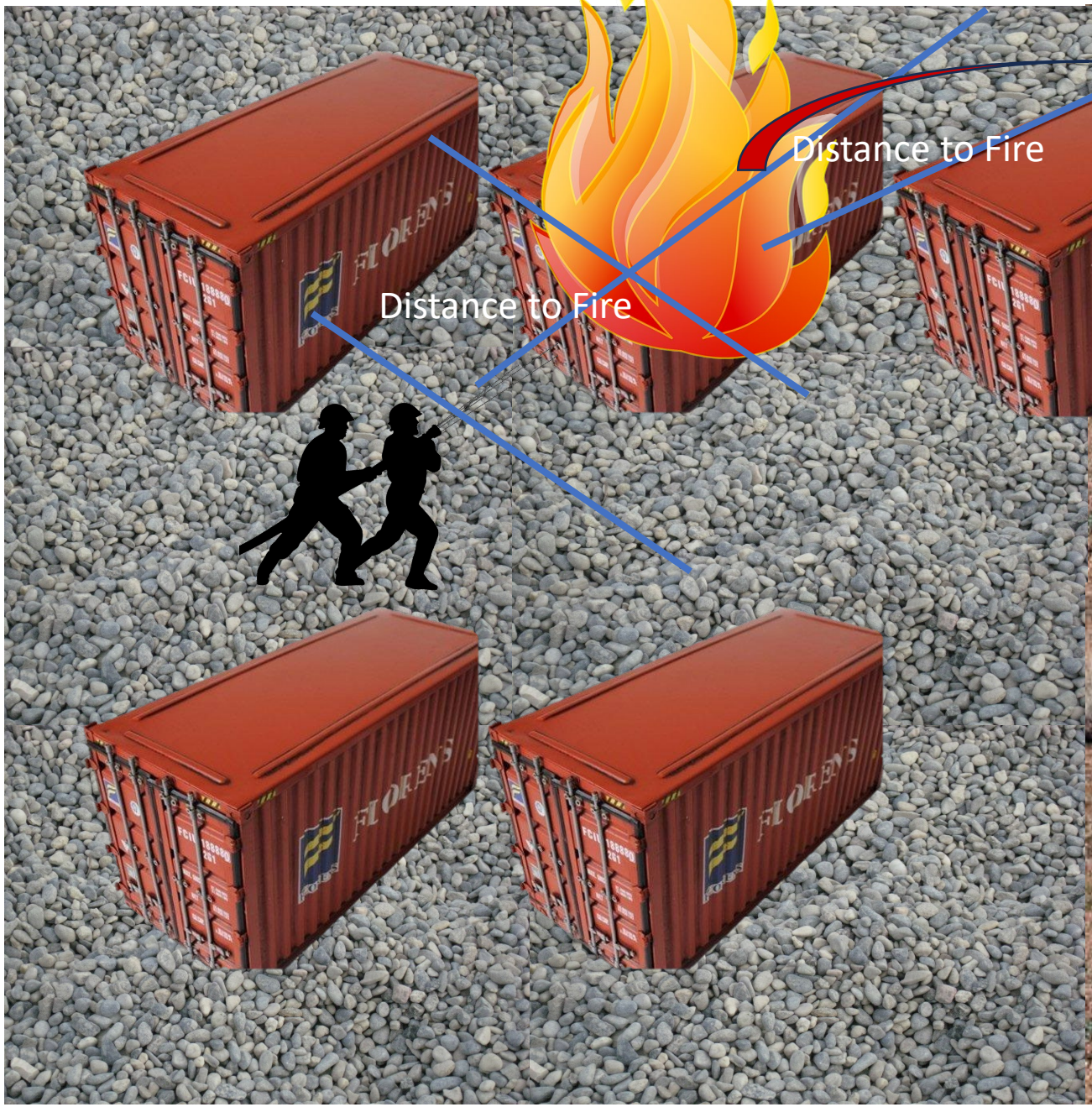
Fuel Model 3 (Tall Grass – 2.5 ft)

Surface Fire Behavior Lookup Tables (NWCG.GOV)

Fires in this fuel are the most intense of the grass group and display high rates of spread under the influence of wind. Wind may drive fire into the upper heights of the grass and across standing water. Stands are tall, averaging about 3 feet (1 m), but considerable variation may occur. Approximately 1/3 or more of the stand is considered dead or cured and maintains the fire. Wild or cultivated grains that have not been harvested can be considered similar to tall prairie and marshland grasses.

SPREAD Ch/hr		Effective Windspeed(EWS), mph *Use 20ft/FCST wind only if EWS = MFWS and assumes unsheltered wind adjustment (0.4)												
*20ft/FCST		NWNS/0	Back - ½	Flank - 1	5	10	15	20	25	30	35	40	45	50
EWS					2	4	6	8	10	12	14	16	18	20
1-hr Moisture, %	1	8	18	32	68	157	261	377	502	636	776	923	1076	1234
	3	6	14	25	52	121	201	290	387	490	598	712	829	951
	5	5	11	20	42	97	162	234	312	395	482	574	669	767
	7	4	9	17	36	82	137	198	264	335	409	486	566	650
	9	4	8	15	32	73	122	176	234	296	362	430	501	575
	11	3	8	14	29	67	111	161	214	271	331	393	458	526
	13	3	7	13	27	62	103	149	198	251	306	364	425	487
	15	3	6	12	25	57	95	137	182	231	282	335	391	448
	17	3	6	10	22	51	85	122	163	207	252	300	350	401
	19	2	5	9	19	43	71	103	137	174	212	253	294	338
	21	2	4	7	14	32	53	77	103	130	159	189	194	194
	23	1	2	4	8	18	30	43	54	54	54	54	54	54

Low	Moderate	High	Very High	Extreme



Wildfire Spread:
Source: National Wildfire Coordinating Group
Landscape – Tall Grass
Effective Wind Speed – 8 mph
Fuel Moisture – 9%
Fire Travel 176 chains/hr = 11,616 ft/hr
From Surface fire behavior lookup tables, ~200ft/min
1 mile in 26 minutes, Double @ 13 mph wind

Source: windhistory.com - Predominant wind direction
March thru June – West, Threatens Eldorado
July thru Sept – SouthWest, Threatens Ranch Viejo
Oct thru Feb – South, Threatens Santa Fe and Eldorado

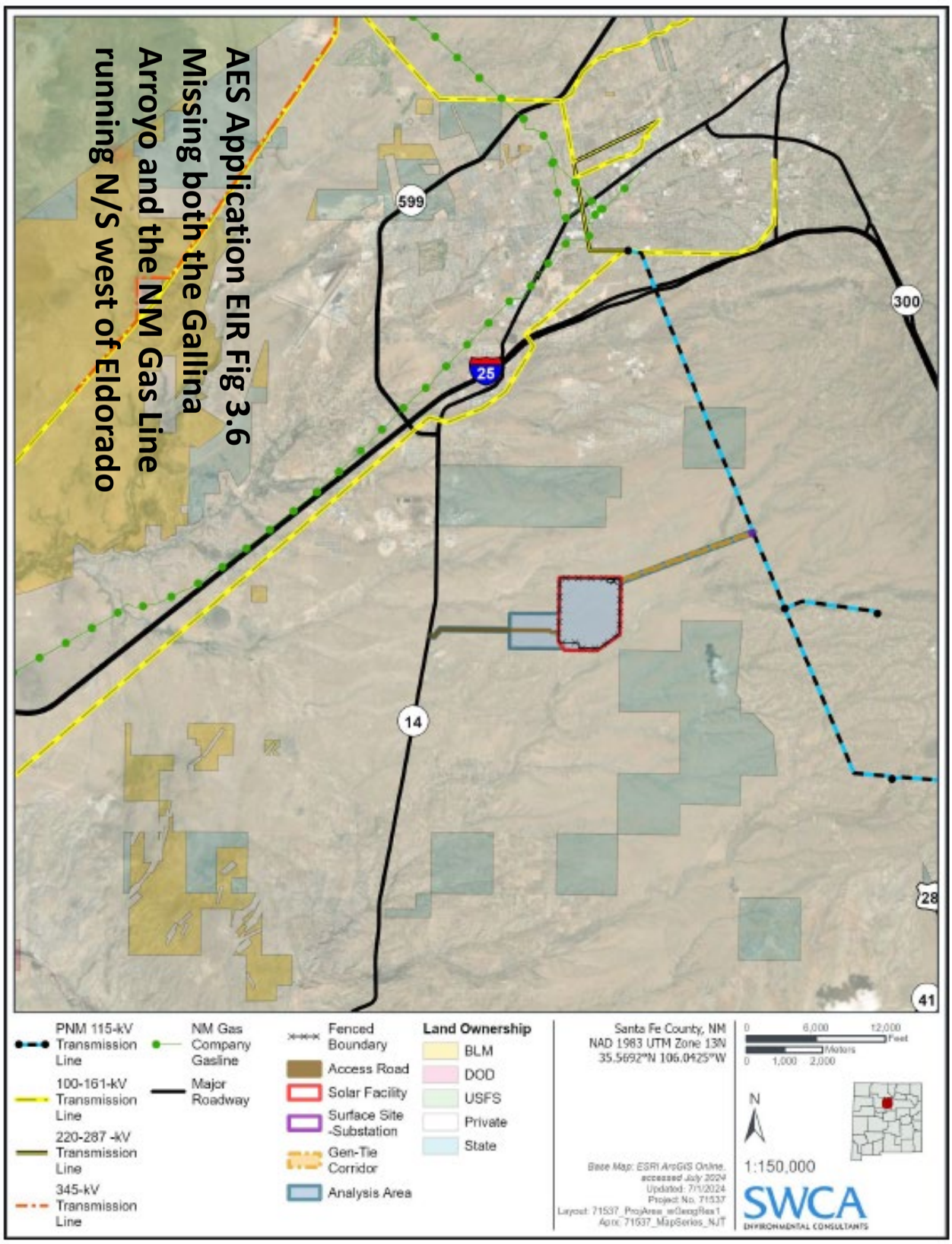
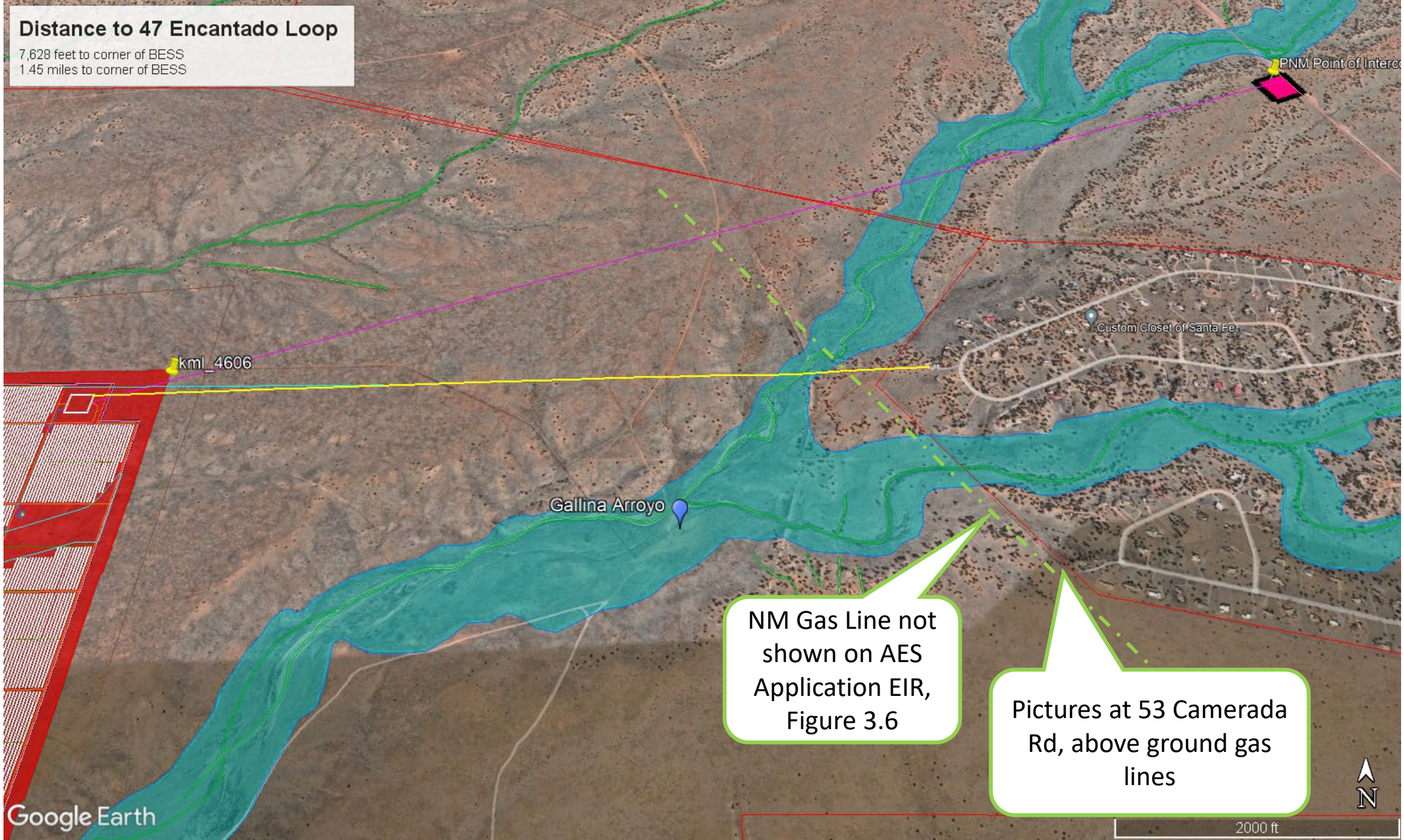
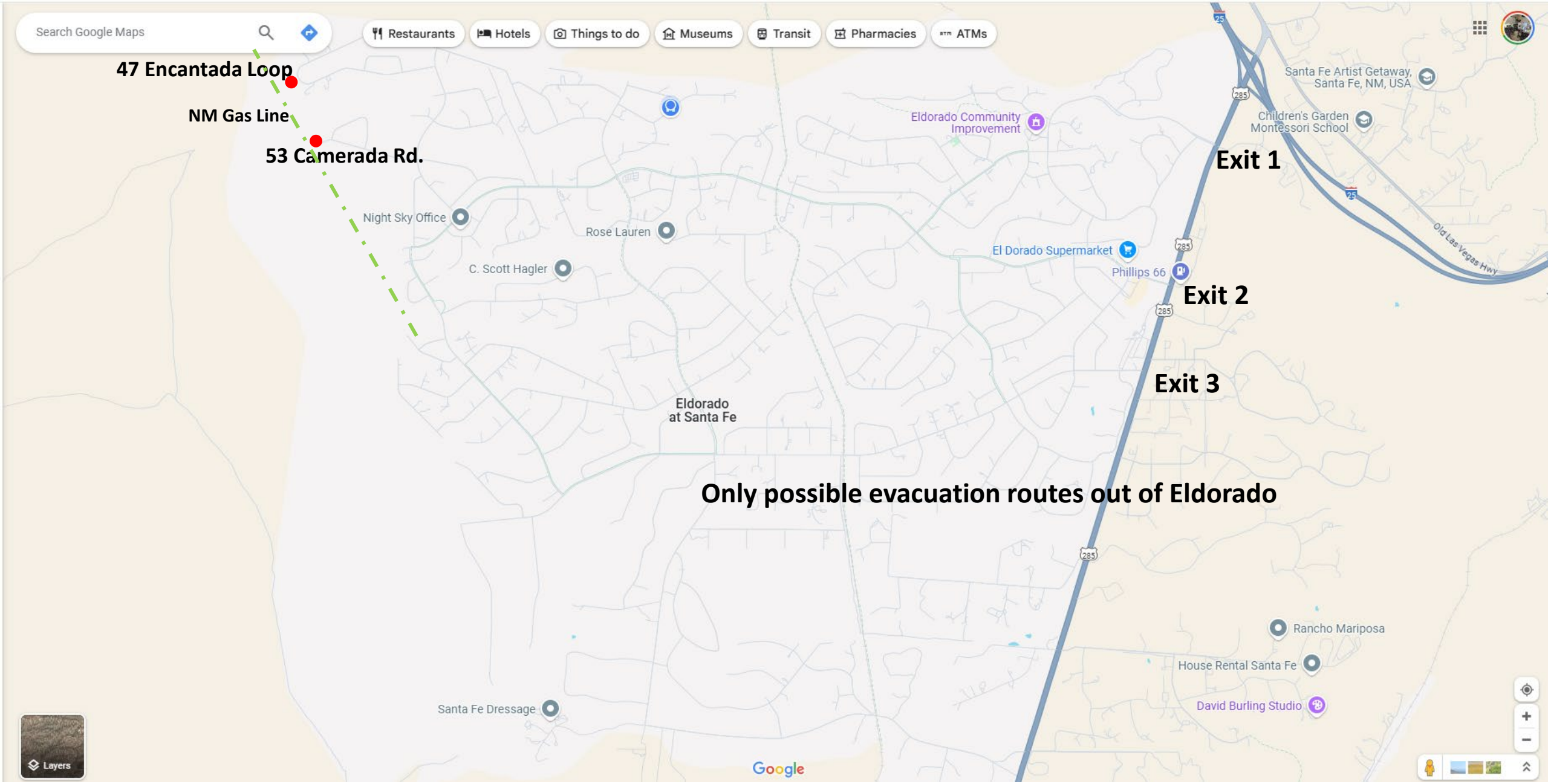


Figure 3.6. Analysis area and surrounding land uses.


Distance to 47 Encantado Loop
7,628 feet to corner of BESS
1.45 miles to corner of BESS
PNM Point of Interc
Custom Closet of Santa Fe
kml_4606
Gallina Arroyo
NM Gas Line not shown on AES Application EIR, Figure 3.6
Pictures at 53 Camerada Rd, above ground gas lines
N
2000 ft
Google Earth


View from 53 Camerada Rd. showing general wildfire fuel potential. Grass and shrubs, a mix of short and tall grasses depending on seasonal conditions.
KOP 1: View from Camerada Road looking west - Simulated Condition

NM Gas Line not shown on AES Application EIR, Figure 3.6


Search Google Maps
Restaurants
Hotels
Things to do
Museums
Transit
Pharmacies
ATMs
47 Encantada Loop
NM Gas Line
53 Camerada Rd.
Exit 1
Exit 2
Exit 3
Only possible evacuation routes out of Eldorado
Eldorado Community Improvement
Santa Fe Artist Getaway, Santa Fe, NM, USA
Children's Garden Montessori School
Night Sky Office
Rose Lauren
C. Scott Hagler
El Dorado Supermarket
Phillips 66
Old Las Vegas Hwy
Eldorado at Santa Fe
Rancho Mariposa
House Rental Santa Fe
David Burling Studio
Santa Fe Dressage
Layers
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