



# Wildfire Mitigation Advisory Committee Meeting

**July 18, 2023**

CAL FIRE -  
Office of the State Fire Marshal





# Call to Order

---

Welcome!

- ▶ If you have technical difficulties during this meeting, please contact Kara Garrett at:
  - (916) 201-5539 or [Kara.Garrett@fire.ca.gov](mailto:Kara.Garrett@fire.ca.gov)



# Roll Call / Quorum Established

---

- ▶ Acting State Fire Marshal
  - **Daniel Berlant**
  
- ▶ Department of Forestry and Fire Protection
  - **Mike Parkes**
  
- ▶ Department of Conservation
  - **Keali'i Bright**
  
- ▶ Office of Energy Infrastructure Safety
  - **Caroline Thomas Jacobs or Sandy Cooney**
  
- ▶ State Board of Forestry and Fire Protection
  - **J. Lopez**

Continued on next slide





# Roll Call / Quorum Established

---

- ▶ Governor's Office of Emergency Services
  - **Ryan Buras or Robert Troy**
  
- ▶ California Department of Insurance
  - **Deborah Halberstadt or Mike Peterson**
  
- ▶ Governor's Office of Planning and Research
  - **Neil Matouka**
  
- ▶ California Fire Safe Council
  - **Jacy Hyde**
  
- ▶ Insurance Institute for Business & Home Safety
  - **Roy Wright**

Continued on next slide





# Roll Call / Quorum Established

---

- ▶ California Fire Chiefs Association
  - **Dave Winnacker or Todd Lando**
  
- ▶ California Building Industry Association
  - **Christopher E. Ochoa or Nick Cammarota**
  
- ▶ University of California Cooperative Extension
  - **Lenya N. Quinn-Davidson**
  
- ▶ California Fire Science Consortium
  - **Yana Valachovic**
  
- ▶ Department of Housing and Community Development
  - **Maziar Movassaghi or Clay Kerchof**

Continued on next slide



# Roll Call / Quorum Established

---

- ▶ Rural County Representatives of California
  - **Staci Heaton**
  
- ▶ California Association of Resource Conservation Districts
  - **Sophia Lemmo**
  
- ▶ League of California Cities
  - **Sean McGlynn**
  
- ▶ California State Association of Counties
  - **Catherine Freeman**
  
- ▶ A representative from tribal government
  - **Don Hankins**





# Approval of Past Meeting Minutes Motion Required

- ▶ Scan the QR Code Below to Access the Complete Meeting Minutes Document!



## WILDFIRE MITIGATION ADVISORY COMMITTEE MEETING Meeting Minutes – Tuesday, June 20, 2023 Posted: July 7, 2023



### Committee Members Present

Daniel Berlant, CAL FIRE – Office of the State Fire Marshal  
Mike Parkes, Department of Forestry and Fire Protection  
Keali'i Bright, Department of Conservation  
Caroline Thomas Jacobs, Office of Energy Infrastructure Safety  
J. Lopez, State Board of Forestry and Fire Protection  
Ryan Buras, California Office of Emergency Services  
Deborah Halberstadt, California Department of Insurance (Virtual)  
Michal Maguire, Office of Planning and Research (Virtual)  
Jacy Hyde, California Fire Safe Council  
Michael Newman, Insurance Institute for Business & Home Safety (Virtual)  
Dave Winnacker, California Fire Chiefs Association (Virtual)  
Chris Ochoa, Representative from the Building Industry  
Yana Valachovic, California Fire Science Consortium  
Clay Kerchof, Department of Housing and Community Development (Virtual)  
Staci Heaton, Rural County Representatives of California  
Sophia Lemmo, California Association of Resource Conservation Districts (Virtual)  
Sean McGlynn, League of California Cities  
Catherine Freeman, California State Association of Counties  
Don Hankins, Professor, CSU Chico (Virtual)

### Members Absent

Lenya N. Quinn-Davidson, University of California Cooperative Extension

### CAL FIRE Staff in Attendance

Frank Bigelow, Assistant Deputy Director  
Matt Damon, Staff Chief  
Jim McDougald, Staff Chief  
John Morgan, Deputy Chief  
Scott Witt, Deputy Chief  
Dennis O'Neil, Assistant Chief  
Chris Ramey, Battalion Chief (Virtual)  
Rudy Baltazar, Division Chief  
Jeff Hakala, Division Chief  
Mark Rosenberg, Research Data Manager (Virtual)  
Mark Hillskotter, Battalion Chief  
Josh Baker, Battalion Chief  
Stephen Volmer, Battalion Chief  
Jamie Sammut, Senior Staff Counsel  
Tony Andersen, Deputy Director (Virtual)  
Anale Burlaw, Assistant Deputy Director (Virtual)  
Kara Garrett, Associate Governmental Program Analyst



# Approval of Meeting Agenda Motion Required

- ▶ Scan the QR Code Below to Access the Complete Meeting Agenda Document!



## WILDFIRE MITIGATION ADVISORY COMMITTEE MEETING Meeting Agenda – Tuesday, July 18, 2023, 1:00 PM – 3:00 PM Posted: July 7, 2023



Location:  
CNRA Building, 715 P Street, 2<sup>nd</sup> Floor Conference Room 2-221(A-C)  
Sacramento, CA 95814

Zoom Meeting Information –  
Please click the link below to join the webinar:  
<https://us06web.zoom.us/j/85192423489?pwd=dnZYaUhXVFliUTFmT2lnMzJYYVlxQT09>  
Passcode: 462073

- 1. CALL TO ORDER**
  - A. Welcome
  - B. Roll Call/Quorum Established
  - C. Approval of Past Meeting Minutes (Motion Required)
  - D. Agenda Review (Motion Required)
- 2. OLD BUSINESS**
  - A. Risk Modeling
    - 1) Work Group Update
  - B. Division Report
- 3. NEW BUSINESS**
  - A. National Institute of Standards and Technology (NIST) – Camp Fire report on Notifications, Evacuations, Traffic, and Temporary Refuge Areas
- 4. ROUNDTABLE**
- 5. PUBLIC COMMENT**
- 6. UPCOMING MEETING DATES FOR 2023**
  - A. Third Tuesday of each month starting at 1 PM and ending at 3 PM.
    - a. August 15, 2023
      - i. CNRA Building, 715 P Street, 2nd Floor Conference Room 2-221  
Sacramento, CA 95814
- 7. MEETING ADJOURNMENT (Motion Required)**







# Risk Modeling Workgroup Update

Jim McDougald



# Risk Modeling Advisory Workgroup Update

---

- ▶ Workgroup is working on the Draft Report.
- ▶ Contacts for the workgroup are listed below:
  - Jim McDougald
    - [Jim.McDougald@fire.ca.gov](mailto:Jim.McDougald@fire.ca.gov)
  - Celeste Jovanovic
    - [Celeste.Jovanovic@fire.ca.gov](mailto:Celeste.Jovanovic@fire.ca.gov)







# Community Wildfire Preparedness and Mitigation Division Report





# Community Wildfire Mitigation Assistance

---

## Local Planner Training

- ▶ New grant for 12 classes this fall and into next spring.

## Firewise

- ▶ California continues to lead the nation with **693** National Fire Protection Association (NFPA) Firewise USA Communities in good standing.





# Community Wildfire Mitigation Assistance

---

## Wildfire Prevention Grants

- ▶ First year we have a full digital process for solicitation, **248** apps for **\$400** million.
- ▶ **\$115** million available to disperse.
- ▶ We expect announcements and notification letters to be sent out by the end of **July**.



# Wildfire Planning and Statistics

---

## Wildfire Planning

- ▶ Fire Hazard Severity Zones:
  - Started an additional 45-day public comment period on June 26, 2023, and will conclude on August 9, 2023 (June 15 map).
  - [www.osfm.fire.ca.gov/fhsz](http://www.osfm.fire.ca.gov/fhsz)





# Wildfire Planning and Statistics

---

## Wildfire Planning

- ▶ 106,543 acres were reclassified (0.34%)
  - Very High FHSZ down 67,096 acres
  - 37,829 High
  - 29,267 Moderate
  - Effects 52 Counties
  - Imperial, Kings, Glen, and Trinity Counties no change



# Wildfire Planning and Statistics

## Fire Prevention Efforts (July 2022 - June 2023)

- ▶ **Fuel Reduction Projects:**
  - **591** projects, **118%** of the goal
- ▶ **Combined Fuel Reduction:**
  - **72,366** acres treated, **72%** of the goal
    - Unit Projects - **42,786** acres
      - Northern Region: **21,184** acres
      - Southern Region: **21,602** acres
    - Grant Projects - **26,832** acres
- ▶ **Prescribed Fire (also counted in fuel reduction):**
  - **34,952** acres treated, **69%** of the goal





# Wildfire Preparedness

---

## Home Hardening

- ▶ On April 4th Lake County received a \$22.2 million grant from the Federal Emergency Management Agency (FEMA) to create defensible space and harden 500 homes over a three-year period.
- ▶ CWMP JPA approved a Defensible Space/Zone 0 project in Siskiyou County which will be initiated in mid to late summer.





# Wildfire Preparedness

---

## Defensible Space

- ▶ 379,393 inspections, 152% of the goal
  - ▶ Northern Region: 70,051
  - ▶ Southern Region: 309,342
  - ▶ Statewide: 379,393

## Burn Permits

- ▶ Since Jan 1, 2023, we've issued 50,977 burn permits throughout the state using the new electronic burn permit system.





# Wildfire Preparedness

---

## Utility Wildfire Mitigation

- ▶ Year To Date 2023 Ignitions in CAL FIRS:
  - Utility-related ignitions **74**, same time last year there were **181**.
- ▶ CAL FIRE website updated with Summer preparedness dates.





# National Institute of Standards and Technology (NIST)

CAMP 4 - Camp Fire report on Notifications, Evacuations, Traffic, and Temporary Refuge Areas





# Roundtable / Public Comment

---

- ▶ Roundtable
- ▶ Topic Suggestions for Next Meetings
  - <https://forms.gle/Wefg6YnrnUGYS8ua9>
- ▶ Public Comment



# Next Meeting Information

---

**August 15, 2023**

CNRA Building, 2-221(A-C) Conference Room  
715 P St, Sacramento, CA

- **Office of Energy Infrastructure Safety:**
  - Brief on the 2022 safety culture assessments process and your findings for the 2021/2022 cycles
- **CAL FIRE - Chief Len Neilson - Prescribed Fire Claims Fund:**
  - Prescribed Fire Claims Fund.





# Meeting Adjournment (Motion Required)

---

- ▶ Copies of the written materials have been posted on the Office of the State Fire Marshal web site at <https://osfm.fire.ca.gov/>.
- ▶ For information concerning the Advisory Committee Meeting, please contact Kara Garrett at (916) 201-5539 or [Kara.Garrett@fire.ca.gov](mailto:Kara.Garrett@fire.ca.gov).
- ▶ NOTE: Items designated for information are appropriate for committee action if the committee chooses to act. The agenda order is tentative and subject to change. Agenda items may be taken out of order to facilitate the effective transaction of business. The Committee may not discuss or act on any matter raised during the public forum period, except to decide whether to place the matter on the notice and agenda of a future committee meeting.



# A Case Study of the Camp Fire –

## *Notification, Evacuation, Traffic, and Temporary Refuge Areas (NETTRA)*

presented to: CAL FIRE Wildfire Mitigation Advisory Committee  
July 18, 2023



Photo courtesy of Paradise Police Department



Photo courtesy of CAL FIRE

**Alexander Maranghides**  
**Eric Link**  
National Institute of Standards and Technology





# 192 Contributors — THANK YOU!

Office of the State Fire Marshal

Law Enforcement

Emergency Medical Services

Damage Inspectors (DINS)

Town of Paradise

National Weather Service

Data Collectors

Transportation

Reviewers

Fire Departments

Water Districts

Public Affairs Office



# The NIST Camp Fire Case Study

- ✓ **Report #1:** Camp Fire Preliminary Reconnaissance (TN 2105)
- ✓ **Report #2:** Preliminary Data Collected from the Camp Fire Reconnaissance (TN 2128)
- ✓ **Report #3:** Fire Progression Timeline (TN 2135)
- ✓ **Report #4:** *Notification, Evacuation, Temporary Refuge Areas, and Burnovers* (TN 2252 & TN 2252sup)
- **Report #5:** Emergency Response and Defensive Actions
- Data Visualization Tool

<https://doi.org/10.6028/NIST.TN.2252>

<https://doi.org/10.6028/NIST.TN.2252sup>



Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary

# Camp Fire Introduction

*fire progression | contributing factors*

# Module Themes

- Rapid fire spread to and within Paradise
  - Impact on life safety, response, and losses
- Widespread spot fire ignitions in Paradise
- Intermix community with limited fire history
- Extensive length of fire front impacting community

Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary



# Camp Fire – Overview and Fire Spread

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

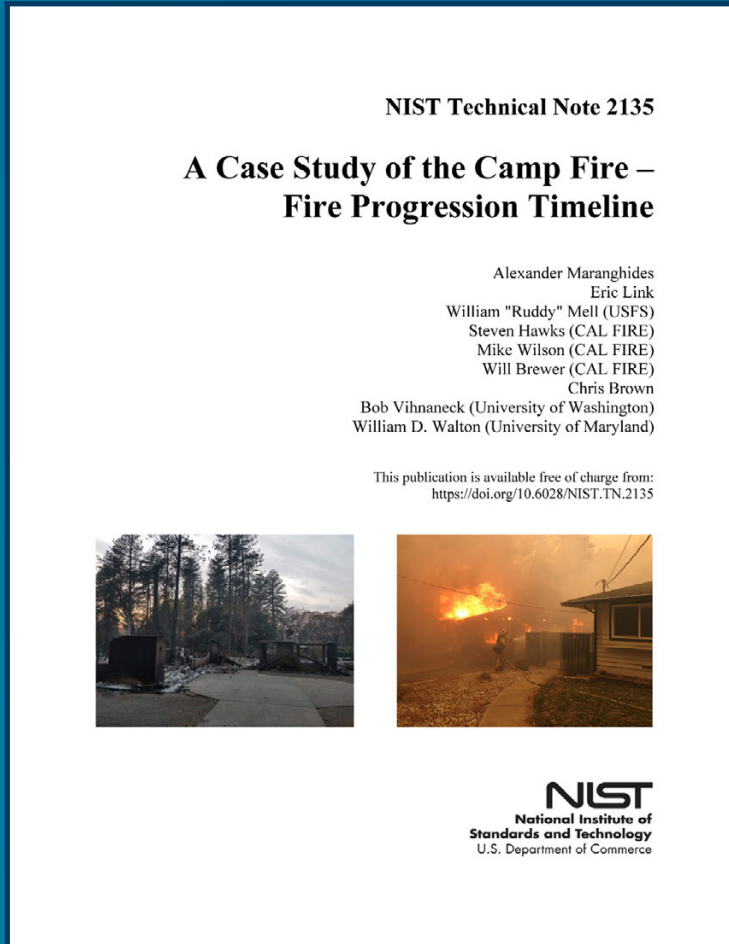
Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary



## NIST Camp Fire Case Study Website:

<https://www.nist.gov/el/fire-research-division-73300/wildland-urban-interface-fire-73305/nist-investigation-california>



- Reports
- Presentation slides
- Recorded presentations

# Fire Progression Summary by 10:45

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

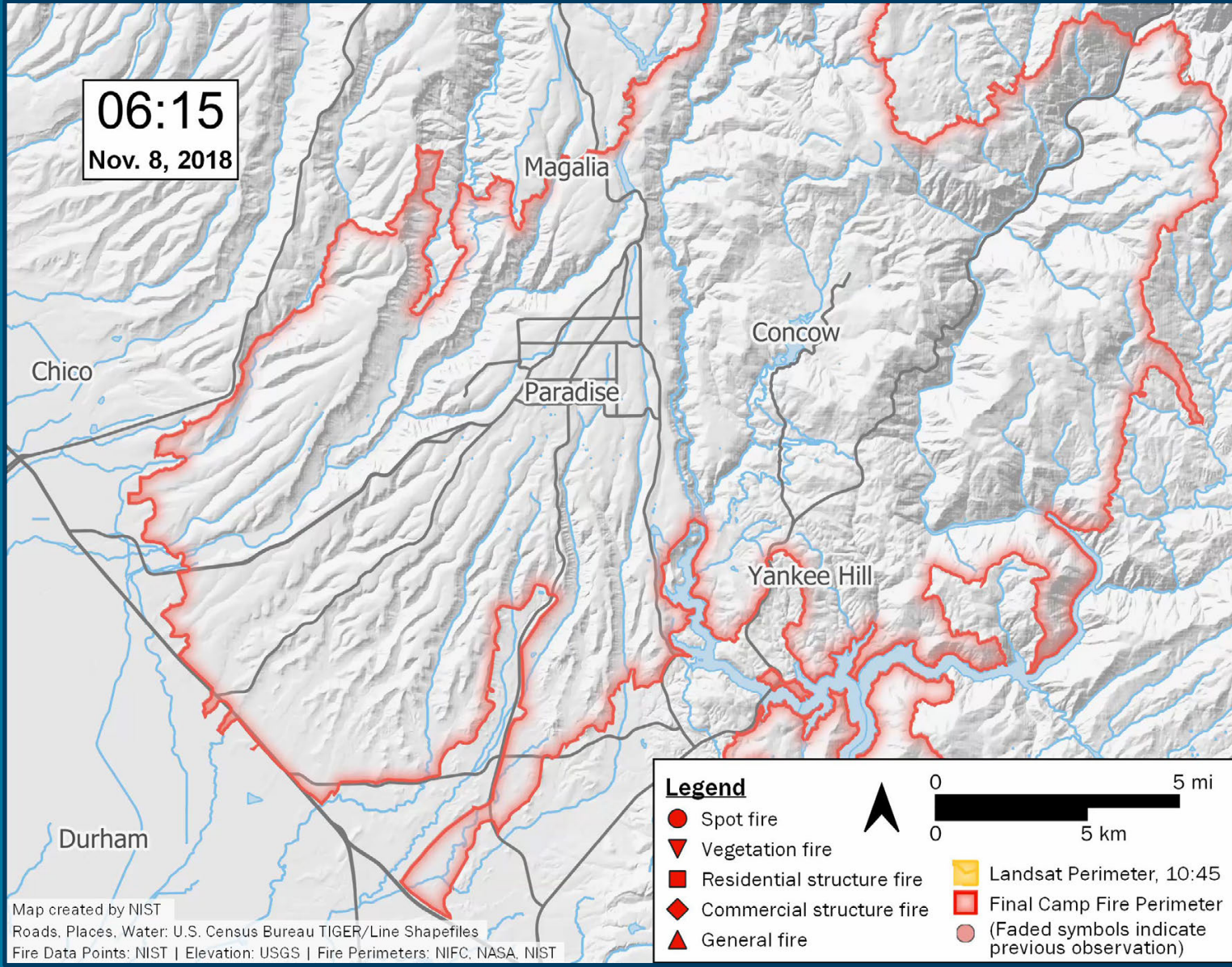
Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary

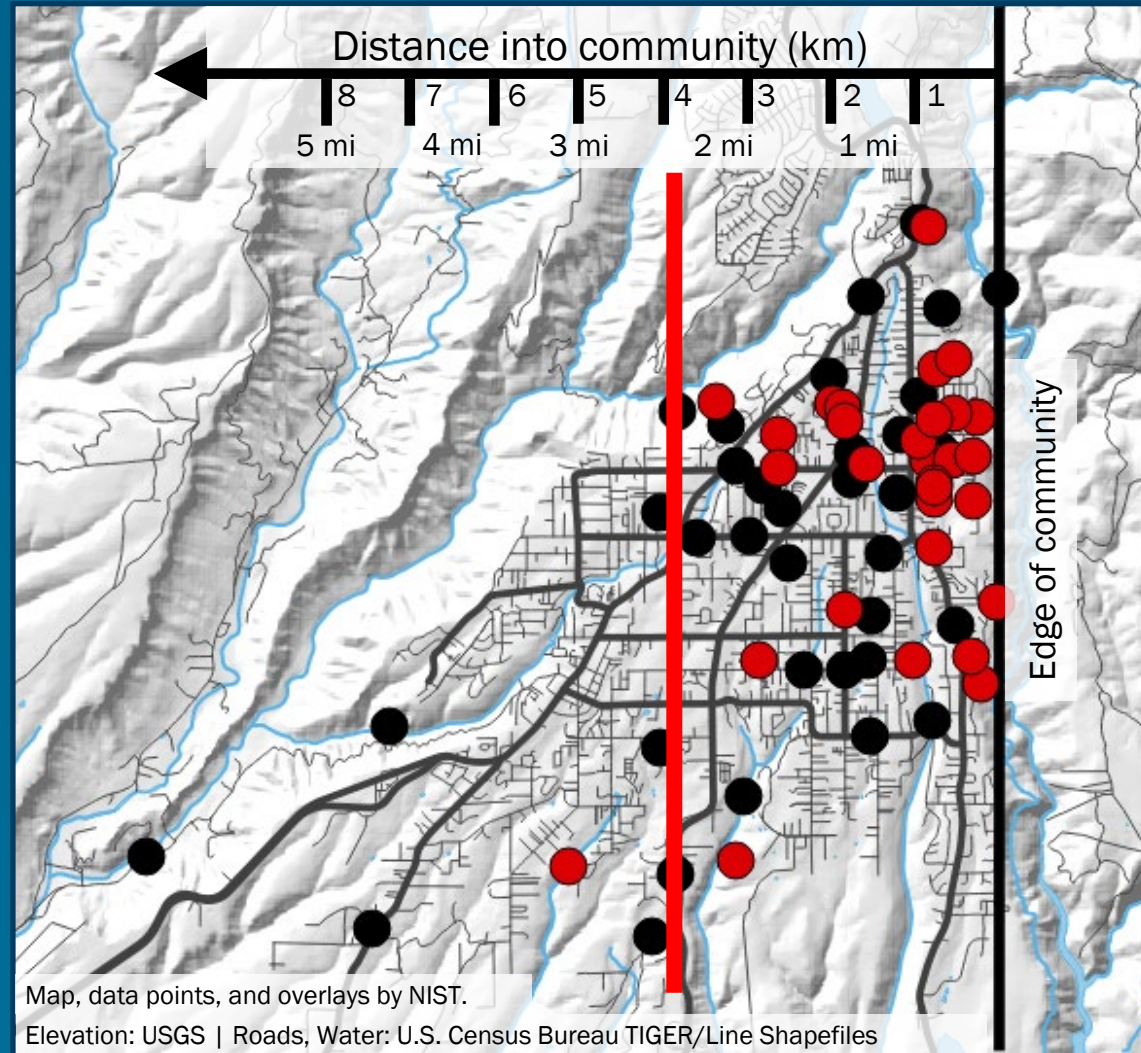




# Early Spot Fires in Paradise

**Spot Fire Ignitions**

- 07:49 – 08:30 (N=30)
- 08:30 – 10:30 (N=35)



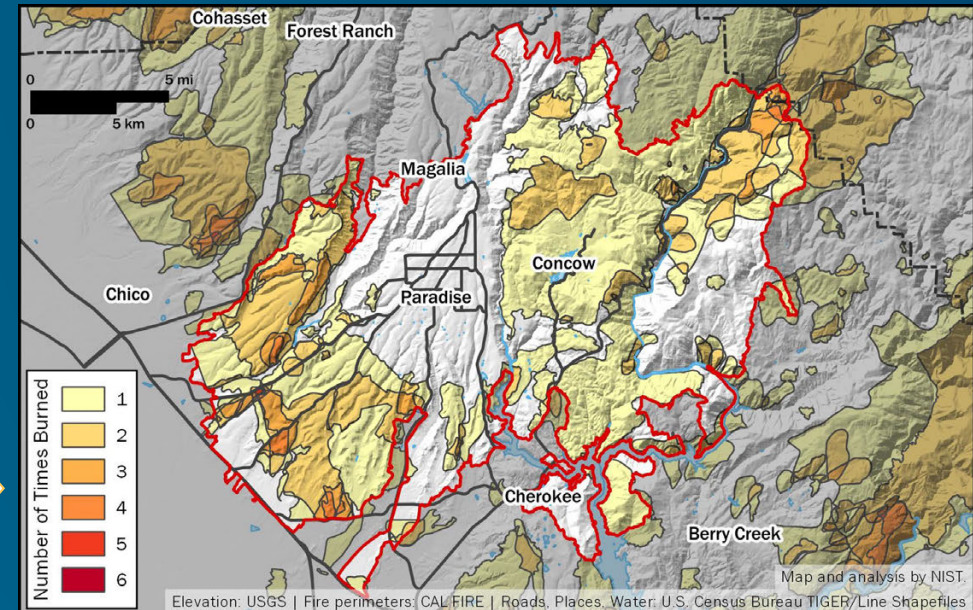
30 identified spot fires within first 40 minutes (red)



# Fire History

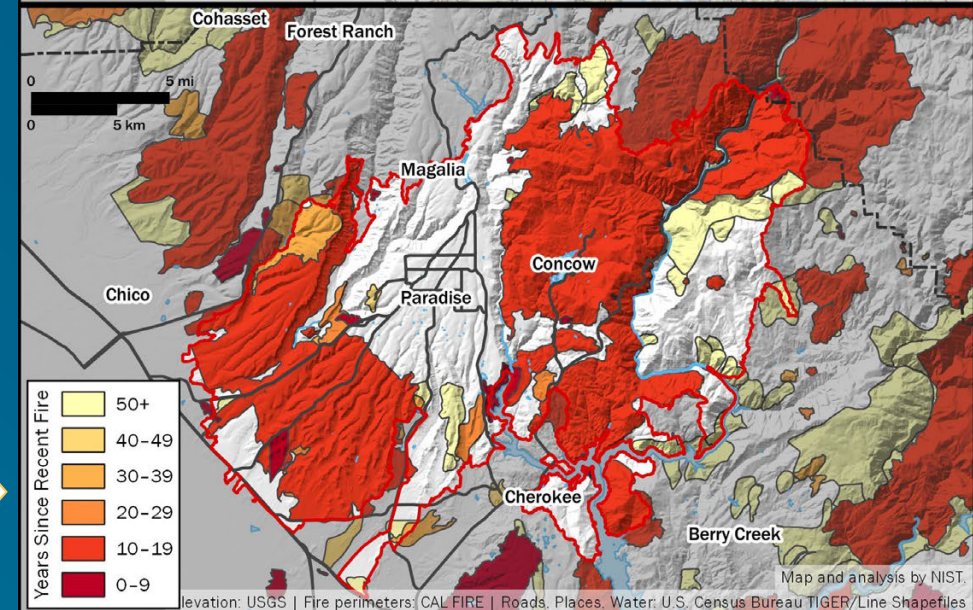
## Historic fire perimeters in northern Butte County (1911–2018)

Number of times each area has burned. →



- 42% had never burned including all area in/around Paradise.
- 17 of 20 prior years had 1 or more fires

Number of years since the last fire. →



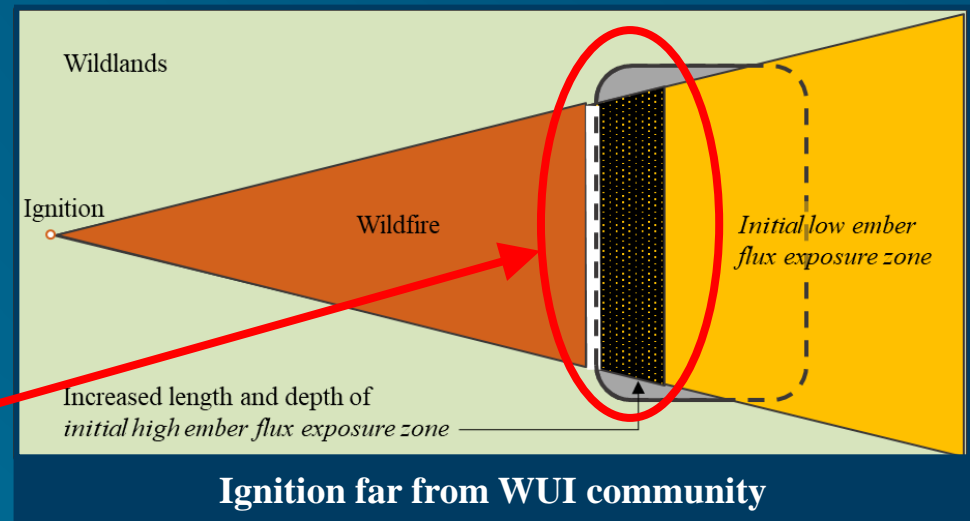
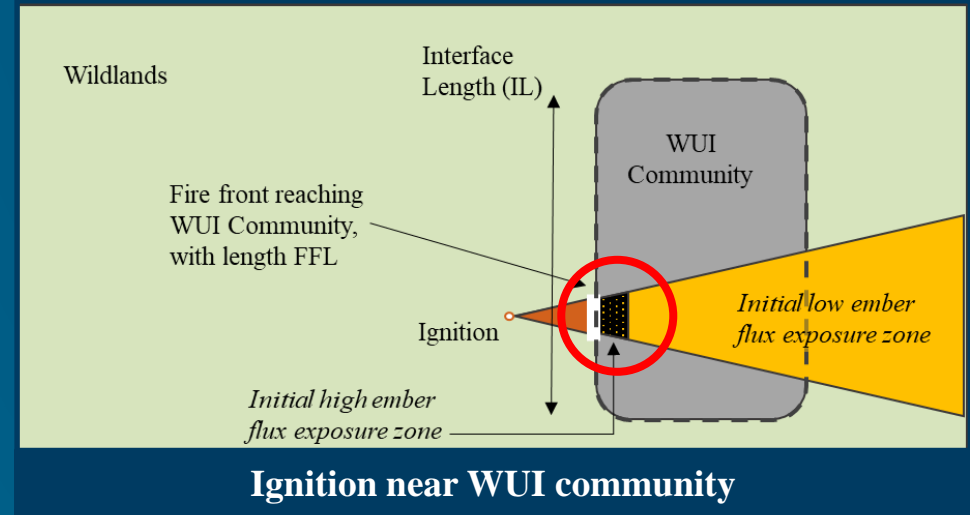


# Extent/Size of Fire Front Reaching the Communities

Idealized relationship between ignition location, near or far from WUI Community, and fire front and ember exposures reaching the community.

The wind is directed from left to right.

Critical difference in community-scale exposure



Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary

# NETTRA Study Overview

*notification / evacuation / traffic / TRAs / rescues*



# NETTRA Case Study Overview

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

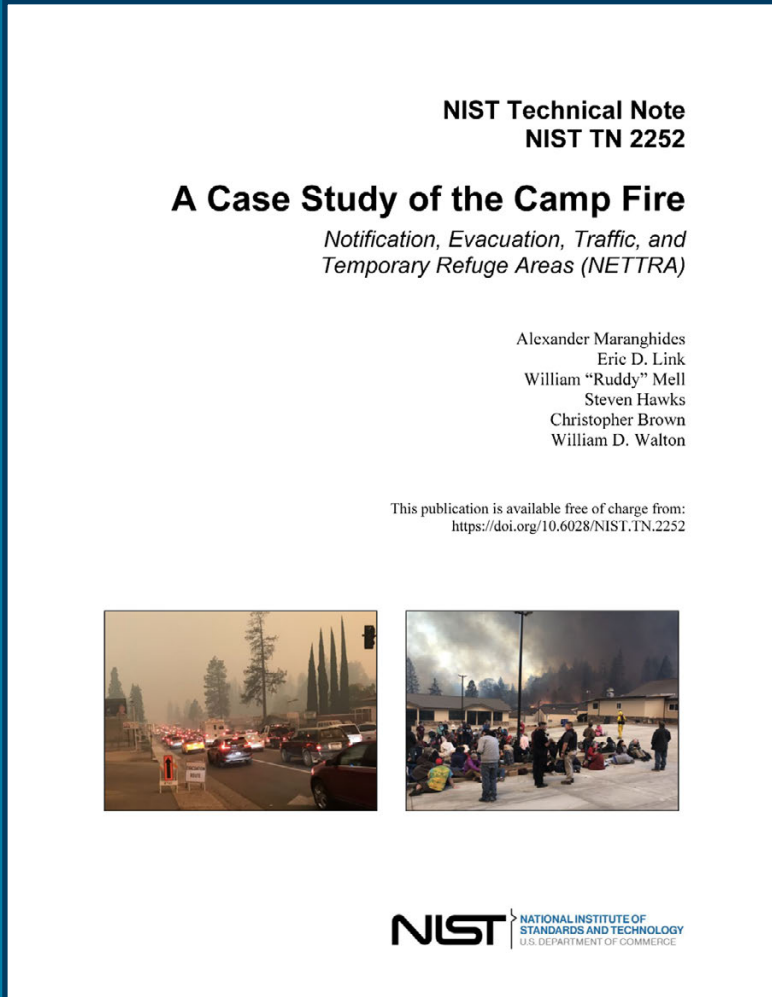
Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary



*Module 1: Notification and Evacuation Pre-Fire Conditions and Planning*

*Module 2: Notification Timeline, Evacuations, Traffic Flow and Road Closures*

*Module 3: Burnovers and TRAs*

*Module 4: Rescues*

*Module 5: NETTRA Summary*

# Camp Fire Study Overview

## Camp 3 (Fire Progression) to Camp 4 (NETTRA)

- Fire location and behavior provide the technical foundation for developing the notification and evacuations components of the case study
- To understand incident notification and evacuation we need to characterize the systems and processes that were in place before the fire





# NETTRA Research Questions

- a) What were the design parameters of the Paradise evacuation plan? (**Sec. 5**)
- b) What were the roads and access characteristics of Concow, Paradise, and Magalia? (**Sec. 4**)
- c) How was the notification of civilians in Concow, Paradise, and Magalia achieved? (**Sec. 6**)
- d) When were evacuation notifications and orders issued, and how does this timing relate to fire progression? (**Sec. 6.2 and 6.3**)
- e) How did fire impact evacuations of Concow, Paradise, and Magalia? (**Sec. 7.5, 8, and 9**)

# NETTRA Research Questions

- f) What were the primary factors that impacted traffic flow during evacuation?  
**(Sec. 7.5, 8, and 9)**
  
- g) How did the use of wildfire safety zones and the creation of TRAs impact civilian life safety and how many civilians utilized TRAs?  
**(Sec. 9)**
  
- h) When were TRAs formed and what were the physical characteristics of the TRAs used?  
**(Sec. 9 and Appendix I)**
  
- i) What were the attributes of the rescues performed and how many civilians were rescued?  
**(Sec. 10)**



# Methodology and Uncertainties

## Temporal and Spatial Integration of Data

- 2664 NETTRA data points
- geolocated and timestamped
- cross-referenced
- quality control review

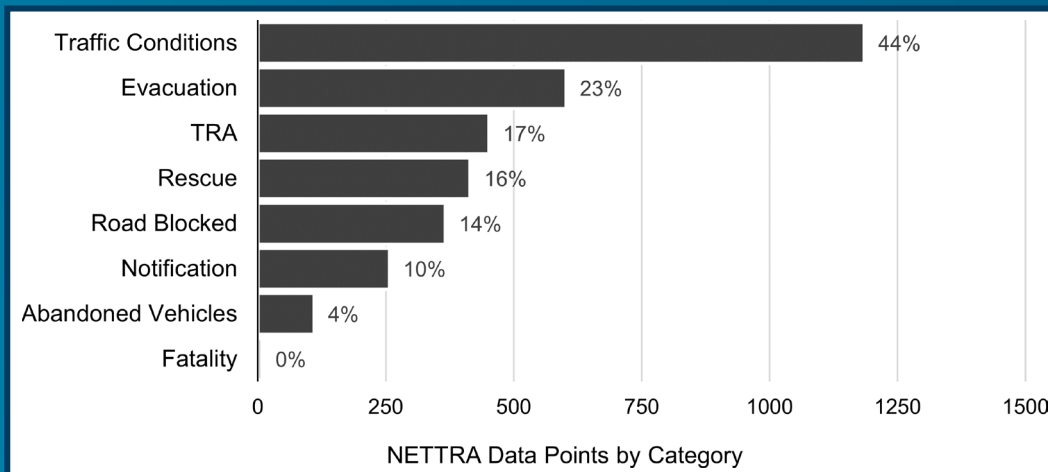


Table 2. Uncertainty ranges of various data sources.

Data Source	Data Attributes	Temporal Uncertainty	Spatial Uncertainty
Picture/video	Geolocated Timestamped	±1 min	±5 m
AVL position	Geolocated Timestamped	±1 min	±10 m
Radio log (fire or PPD)	Variable location Timestamped	±1 min – Variable	±0 m – Variable
Picture/video	Geolocated No timestamp	±1 min – Variable	±5 m
TD observation	Location estimated Time estimated	Variable	Variable
TD Inferred time	Time estimated	Variable	n/a
DINS post-fire damage pictures	Geolocated	n/a <sup>a</sup>	Linked to structure
NIST post-fire pictures	Geolocated Timestamped	n/a	±5 m
Drone and satellite imagery	Geolocated	n/a	±(1 m to 100 m) <sup>b</sup>

Note: Values provided are Type B uncertainties as defined in NIST Technical Note 1297 [33].

<sup>a</sup>Data without temporal information (such as DINS, drone, and NIST post fire images) were used as supplemental information to cross-reference and confirm events in time.

<sup>b</sup>For a limited area on the west edge of fire east of Chico, there was an imagery “stitching” offset.

Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary

# Pre-Fire Conditions and Planning

*notification | evacuation | road network*



# Module Themes

- Pre-Fire Planning
  - Well-developed evacuation plan
  - Training
  - Communication
- Evacuation Road Network Capacity
- Evacuation Route Bottlenecks

Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

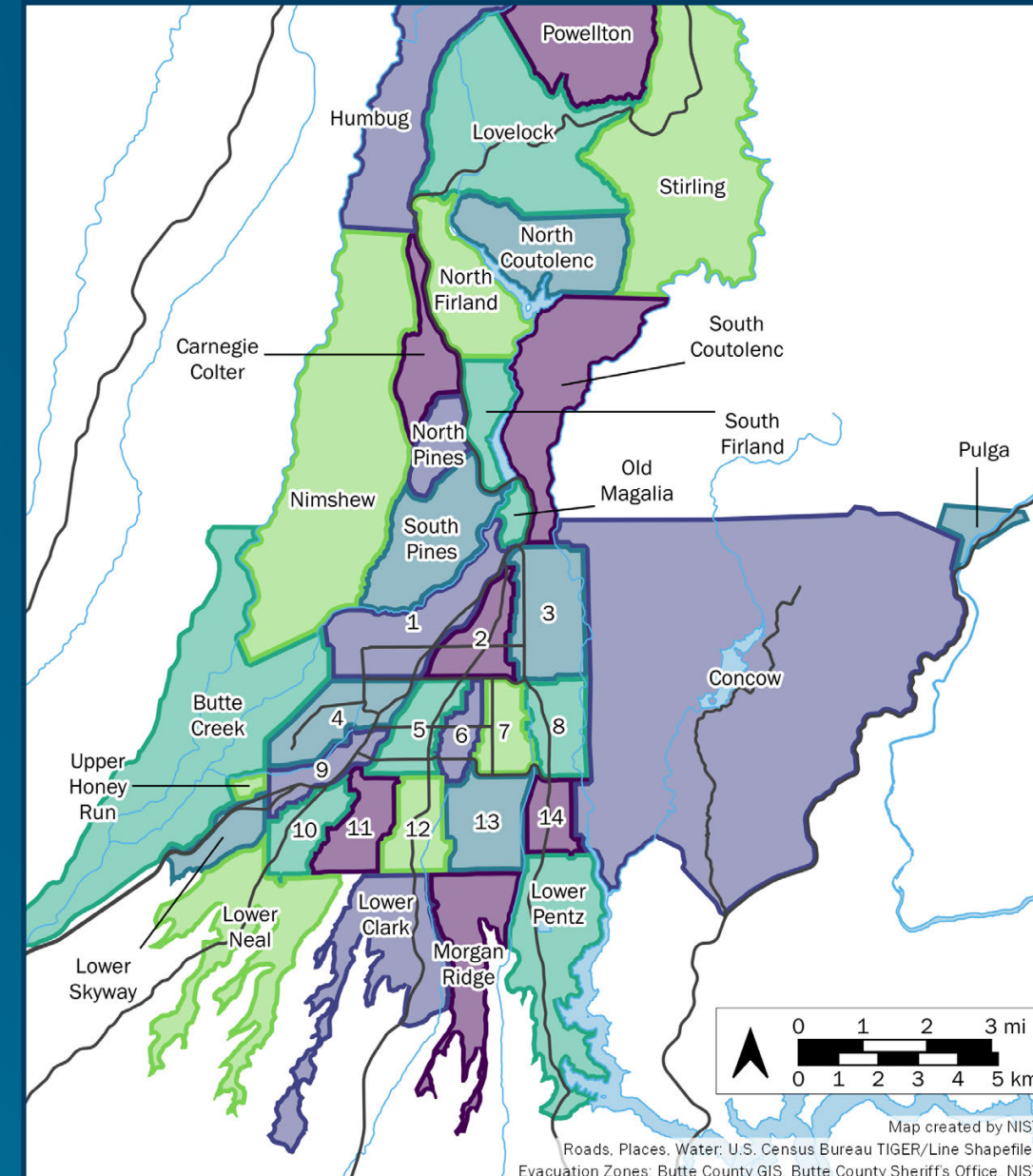
Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary

# Evacuation Plan

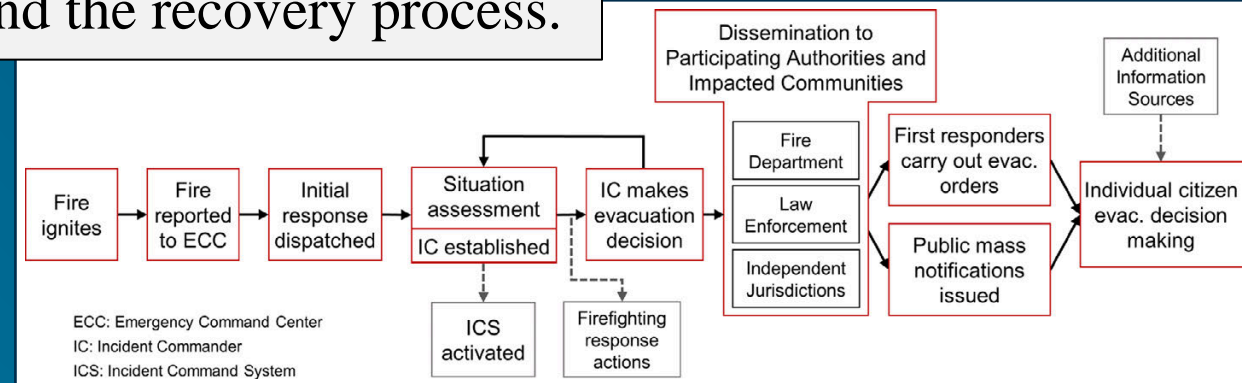
- Zoned system designed for partial evacuations
- Included a limited number of pre-designated public assembly areas
- Plan designed to utilize contraflow on Skyway and Pentz Road
- Pamphlets/mailers sent to residents
- Complex and extensive multiagency training exercise in 2016





# Paradise Emergency Operations Plan NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY U.S. DEPARTMENT OF COMMERCE

- Establishes the emergency management organization required to mitigate any significant emergency or disaster affecting the Town of Paradise.
- Identifies the roles and responsibilities required to protect the health and safety of Paradise residents, public and private property and the environmental effects of natural and technological emergencies and disasters.
- Establishes the operational concepts associated with a field response to emergencies, the Town of Paradise Emergency Operations Center (EOC) activities and the recovery process.



# Complex and Comprehensive Multiagency Exercise (2016)

1. One-way southbound traffic (**contraflow**) was implemented on Skyway between Elliott Road and Pearson Road between 07:00 and 08:00.
2. **Simulated WUI fire scenario** in the area of Neal Road, including actual dispatch of fire equipment (engines, hand crews, dozers, and aircraft) and a dynamic incident escalation.
3. Town of Paradise Emergency Operations Center (**EOC**) **was activated.**
4. **Simulated activation** of one-way southbound traffic on Pentz Road from Pearson Road to CA Highway 70.

Training exercise enhanced multiagency communication and coordination and built “muscle memory”

# Road System in and Around Paradise

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

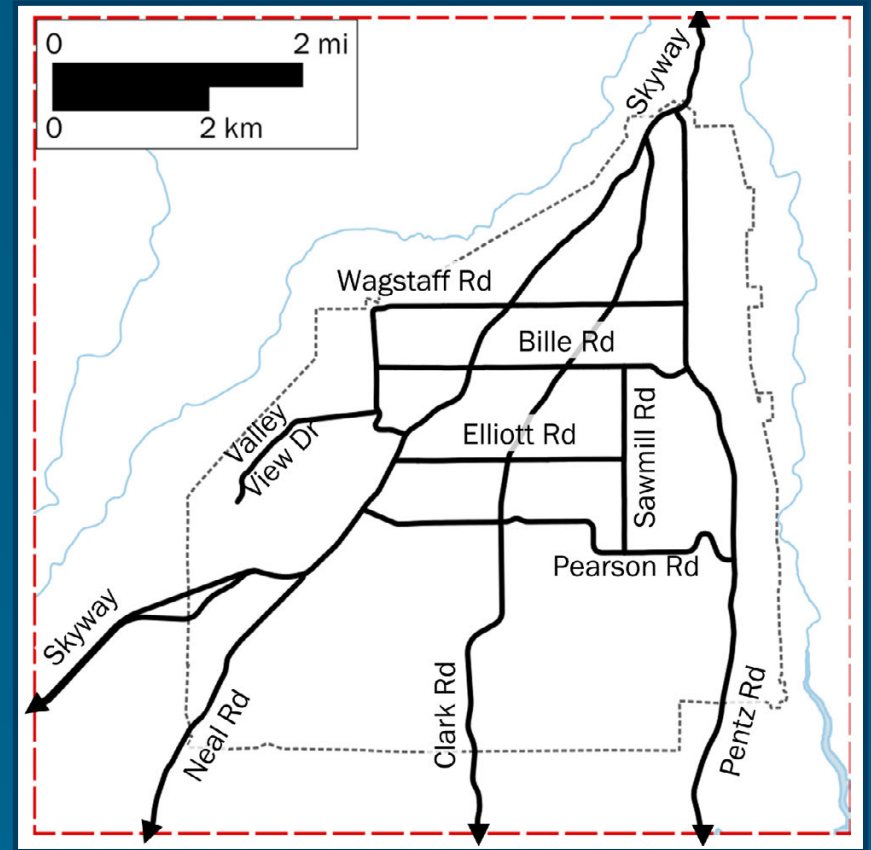
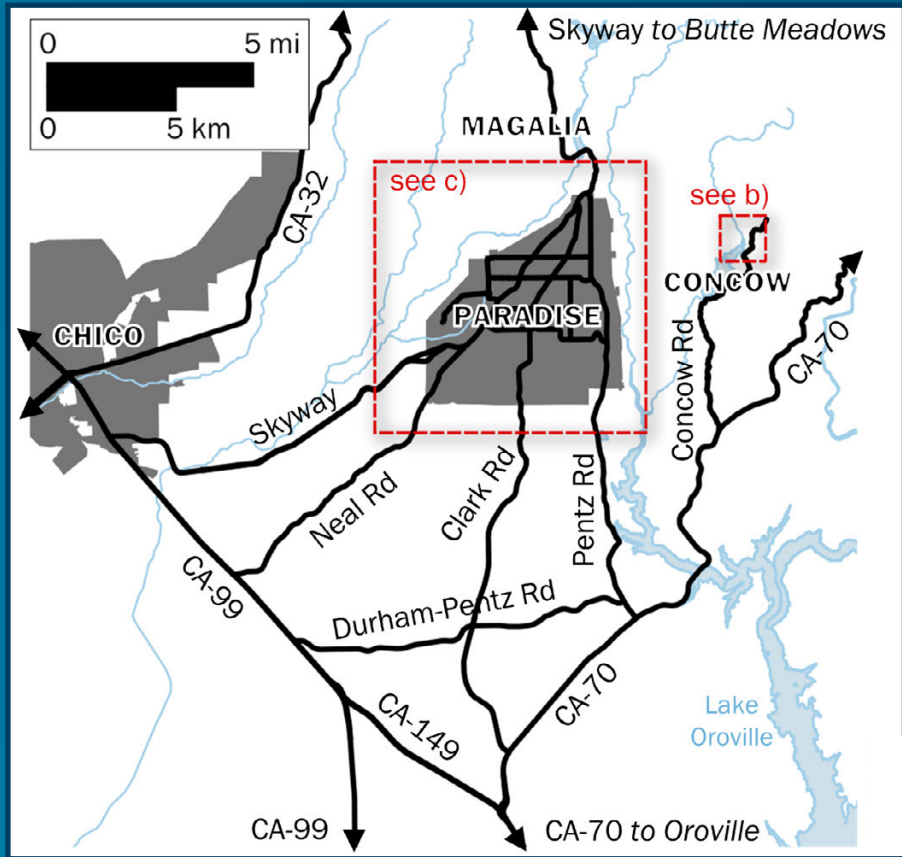
Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary



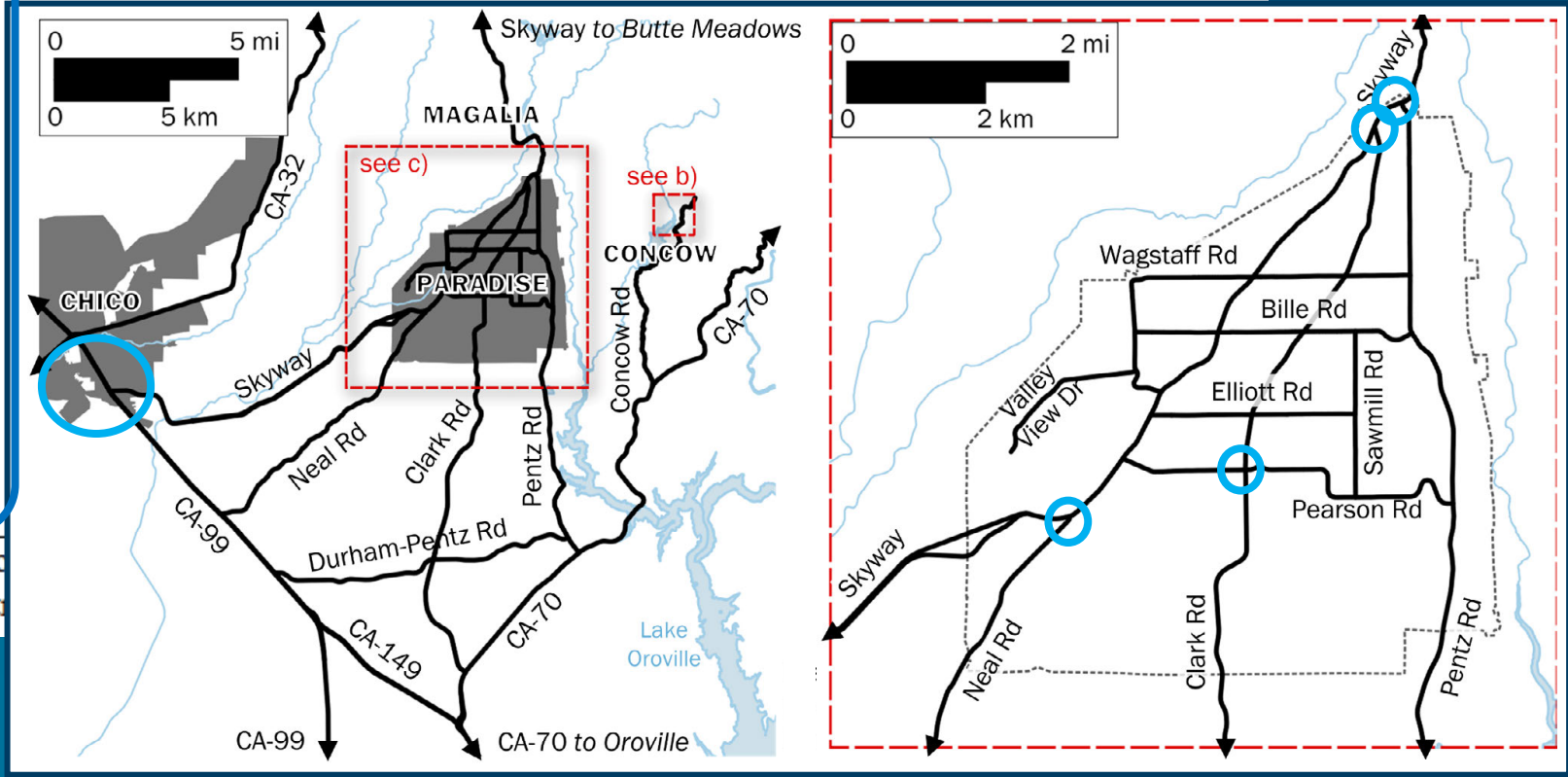


# Road System in and Around Paradise

Table 3. Egress routes and primary road arteries leaving Paradise.

Roadway	Total Lanes <sup>a</sup>	Pavement Width, m (ft)	Notes
Skyway (SB)	4	2 × 8.5 (28)	Divided roadway, 2 lanes inbound, 2 lanes outbound. Leads through Chico and CA-99.
Clark Road	2		
Pentz Road	2		
Neal Road	2		
Skyway (NB)	2		

Note: SB – southbound, NB – northbound  
<sup>a</sup> Total number of lanes in both directions



- Camp Fire Introduction
- NETTRA Study Overview
- Pre-Fire Conditions and Planning
- Notification and Evacuation Timeline
- Traffic
- Burnovers and Temporary Refuge Areas (TRAs)
- Rescues
- Summary

# Road Capacity and Population

**Table 4.** Total population and egress lanes per community.

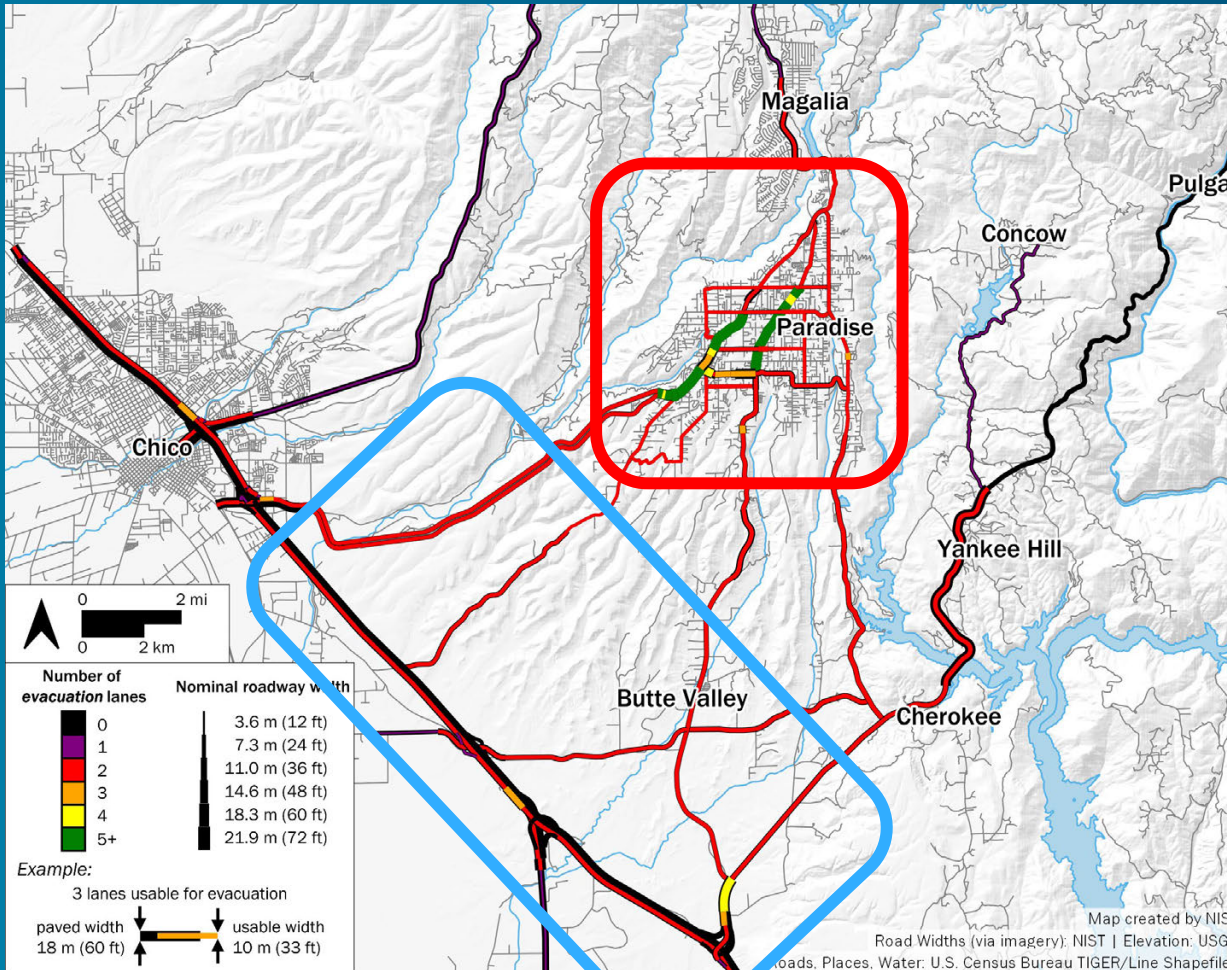
Location	Pop.	Area, km <sup>2</sup> (mi <sup>2</sup> )	Pop. Density, p/km <sup>2</sup> (p/mi <sup>2</sup> )	DINS Residential Struct. [35]	Occupied Housing Units (OHU) [34]	Max. Egress Routes	Max. Egress Lanes	OHU / Egress Lane
Paradise	26543	47.5 (18.3)	559 (1450)	12198	11118	5 <sup>a</sup>	12	927
Magalia	12671	36.3 (14.0)	349 (905)	2753 <sup>b</sup>	5054	2 <sup>a</sup>	4	1264
Concow	743	72.0 (27.8)	10 (27)	429	327	1	2	164

<sup>a</sup> The only Paradise egress route to the north must travel through Magalia. The Magalia egress route to the south must travel through Paradise.

<sup>b</sup> Only the fire-impacted southern portion of Magalia was included in structure damage inspection data; the entire structure count is unavailable. Area was truncated at the extent of available data.

*interdependence*

# Egress Routes and Lanes



**Table 6.** Maximum number of egress routes and lanes used during the Camp Fire evacuation per community and/or subregion.

Selected Subregion	Occupied Housing Units (OHU) [34]	Egress Routes	Total Lanes Used <sup>a</sup>	OHU / Egress Lane
Concow	327	1 <i>Concow Rd</i>	1	327
Magalia	5054	2 <i>Skyway (NB)</i> <i>Skyway (SB)</i>	2	2527
Paradise	11118	4 <i>Skyway (SB)</i> <i>Clark Rd</i> <i>Neal Rd</i> <i>Pentz Rd</i>	7 (4) (1) (1) (1)	1588
Paradise and Magalia	16172	5 <i>Skyway (SB)</i> <i>Clark Rd</i> <i>Neal Rd</i> <i>Pentz Rd</i> <i>Skyway (NB)</i>	8 (4) (1) (1) (1) (1)	2022
Paradise, Magalia, Butte Valley, and Butte Creek merging into highways south of Paradise	17700 <sup>b</sup>	3 <sup>c</sup> <i>Skyway (SB)</i> <i>CA-99 (SB)</i> <i>CA-70 (SB)</i>	6 or 7 (2 or 3) (2) (2)	2950 or 2529

<sup>a</sup> Number of lanes used during Camp Fire evacuation accounting for contraflow and open lanes for first responder access and other local conditions.

<sup>b</sup> estimated via OHU and DINS from foothills north of CA-70 and Butte Creek.

<sup>c</sup> majority of civilians evacuating Paradise evacuated south; northern route was blocked by fire early



# Comparing Partial and Full Evacuation Road Capacities

**Table 5.** Egress capacity for evacuation of selected zones in Paradise via southbound routes only.

Selected Zones/Subregion	DINS		Potential Egress Lanes	OHU / Egress Lane
	Residential Struct. [35]	Potential Egress Routes		
Zones 3, 8, 14 (Pentz Road corridor)	2210	4 <i>Pentz Rd</i> <i>Clark Rd</i> <i>Skyway</i> <i>Neal Rd</i>	7 (2) (2) (2) (1)	316
Zones 10, 11, Lower Neal (southeast Paradise)	1391	3 <i>Neal Rd</i> <i>Skyway</i> <i>Clark Rd</i>	5 (1) (2) (2)	278
Valley View and Valley Ridge (part of Zone 4)	560	2 <i>Valley View Dr</i> <i>Elliott Rd</i>	3 (2) (1)	187

*OHU/Egress Lane* increased by 3 to 5 times between  
*Partial* and *Full* evacuation scenarios

Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary

# Notification and Evacuation

*methods / timeline*

# Module Overview

- Well-prepared intermix community
  - temporal component of evacuation orders
  - partial vs. full community evacuation
- Notification/Fire Timing
- Evacuation/Fire Timing

Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

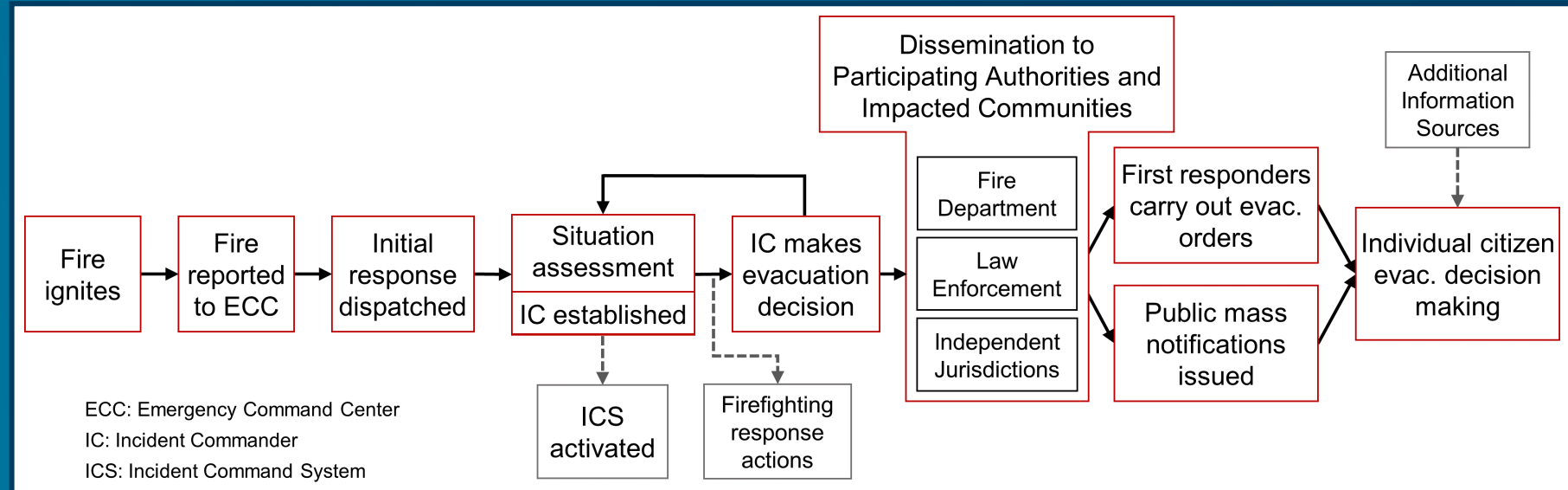
Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary



# Notification Workflow and Complications



- Multiple emergency communication hubs
- Two interconnected reverse-911 (CodeRED) systems
- Three different 911 systems (Butte County, Paradise, and Chico)
- Shutdown of the Town of Paradise 911 system and PPD dispatch to evacuate
- Door-to-door notification prevalent

There is a non-zero *minimum* time from detection to *the start* of public notification

# CodeRED from 07:57 to 09:30

**Table 8.** Selected statistics from CodeRED notifications in Paradise and Magalia, 07:57 to 09:30.

Agency	Primary Call Batches	Email	Text Message	Phone Numbers	Delivered Calls <sup>a</sup>	Voice Mail <sup>a</sup>	Not Reached	Attempted Calls
BCSO	6	2770	2888	14737	4916	4543	7720	28162
Town of Paradise	2 <sup>b</sup>	n/d <sup>c</sup>	n/d	6189	1657	1657	2927	10359
<b>Total</b>				<b>20926</b>	<b>6573</b>	<b>6200</b>	<b>10647</b>	<b>38521</b>

<sup>a</sup> estimated using a rounded percentage and the number of attempted calls

<sup>b</sup> data for the second batch were not available and were not included in the Town of Paradise totals

<sup>c</sup> no data available

- Combined BCSO and ToP CodeRED notifications directly delivered: 6573
- 31 % of attempted phone numbers

Only 17 % of the combined population of Paradise and Magalia were reached via CodeRED from 07:57 to 09:30

# Notification Timeline

Time of Day	Evacuation Sequence	Time from Ignition* (min)	Time from First Engine on Scene (min)
06:25 to 07:31	Evacuation orders and warnings requested for Pulga and Concow	0 to +66	-20 to +46
07:32 to 07:54	Evacuation orders expanded to Concow, and warnings expanded to Pentz Road in Paradise	+67 to +84	+47 to +64
07:55 to 08:03	Evacuation orders expanded to Pentz Road in Paradise	+85 to +93	+65 to +73
08:04 to 09:03	Evacuation orders expanded to the entire town of Paradise and into Magalia and Butte Creek Canyon	+94 to +153	+84 to +133

\* Time of first 911 call

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

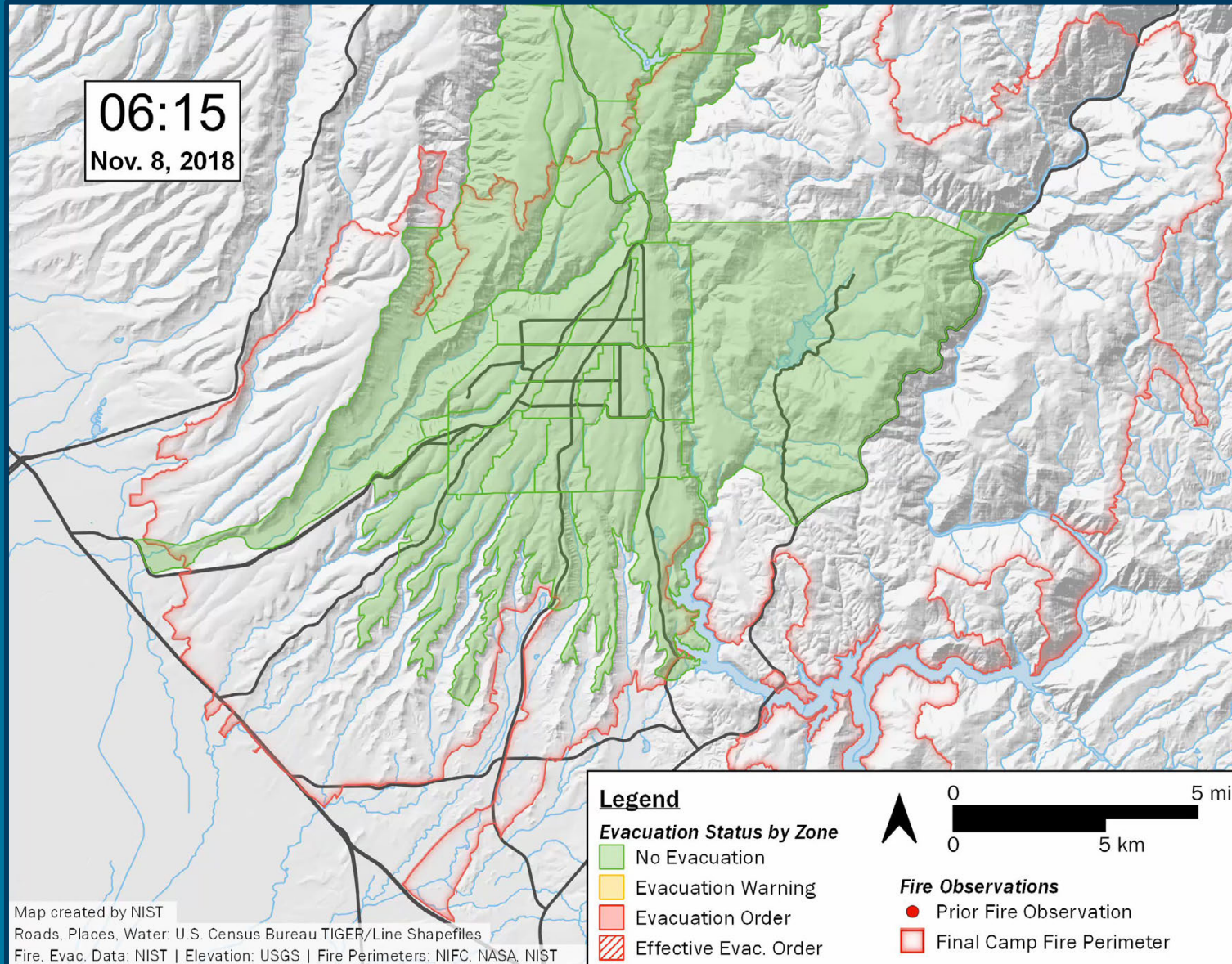
Rescues

Summary



# Evacuation Timeline

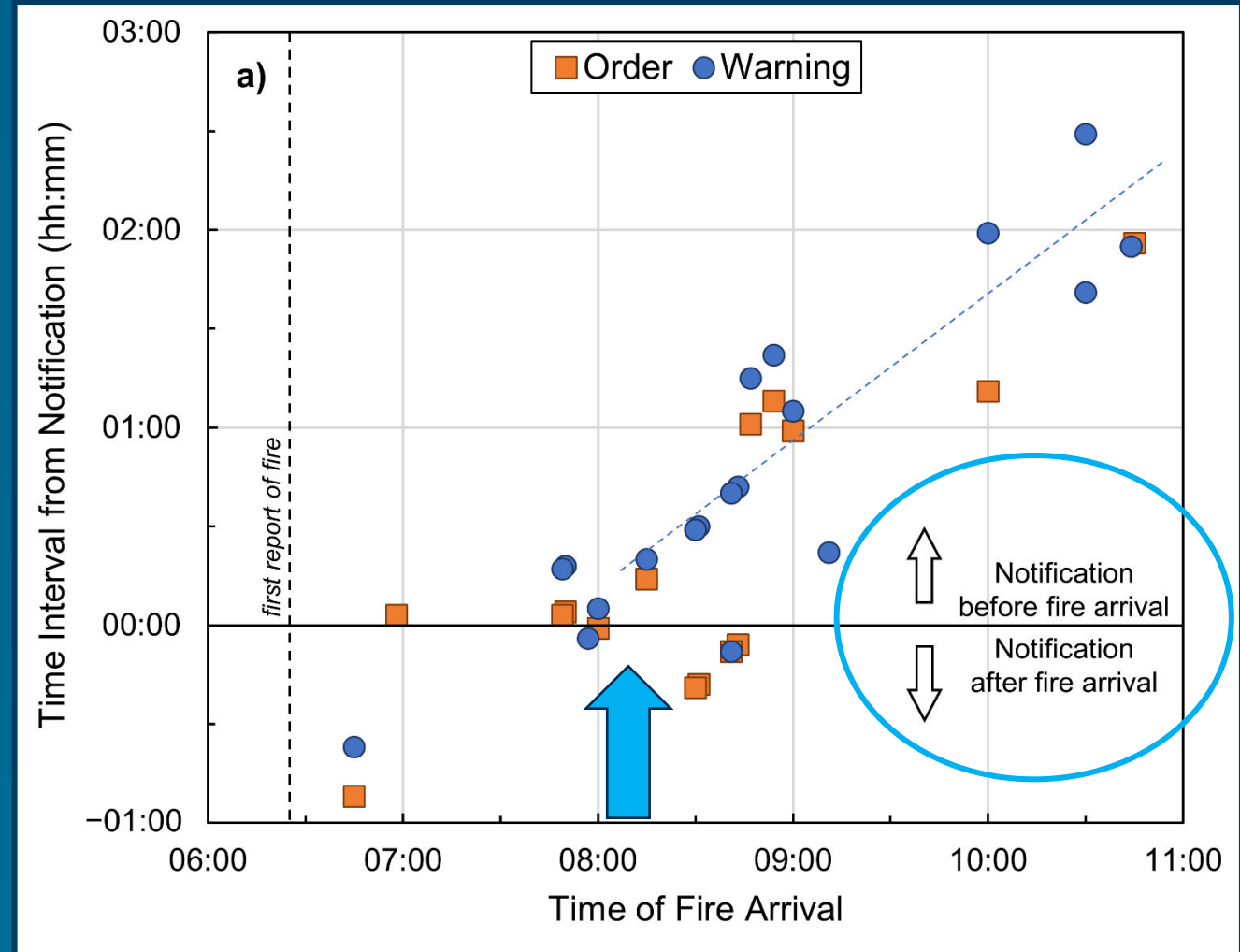
- Camp Fire Introduction
- NETTRA Study Overview
- Pre-Fire Conditions and Planning
- Notification and Evacuation Timeline
- Traffic
- Burnovers and Temporary Refuge Areas (TRAs)
- Rescues
- Summary



NIST TN 2252, Figure 13.

# Notification Analysis

Time between fire arrival and request for evacuation notification



Time lag between notification and fire becomes positive ~ 90 minutes after ignition

# Temporal Relationship between Zone Notification and Burnovers

**Table 12.** Relationship of burnover event times to evacuation notification times.

BO ID	BO Name	BO Start Time $t_{BO}$	Zone	First Fire Obs. $t_f$	Evac. Order $t_e$	Fire to BO $t_{BO-t_f}$ (h:min)	Evac. to BO $t_{BO-t_e}$ (h:min)
1	Hoffman Rd	07:50	Concow	06:45	07:37	1:05	0:13
2	Concow Rd	07:50	Concow	06:45	07:37	1:05	0:13
20	Camelot Ln	07:55 <sup>a</sup>	Concow	06:45	07:37	1:10 <sup>a</sup>	0:18 <sup>a</sup>
4	Skyway (upper)	08:30	2	08:15	08:01	0:15	0:29
5	Windermere Ln	08:35 <sup>a</sup>	Concow	06:45	07:37	1:50 <sup>a</sup>	0:58 <sup>a</sup>
6	Pentz Rd	08:45	8	07:49	07:46	0:56	0:59
7	Pearson Rd	09:15	7	08:00	08:01	1:15	1:14
			8	07:49	07:46	1:27	1:29
			13	09:00	08:01	0:15	1:14
			14	08:47	07:46	0:28	1:29
8	Bille Rd	09:25	2	08:15	08:01	1:10	1:24
			3	07:50	07:46	1:35	1:39
			7	08:00	08:01	1:25	1:24
			8	07:49	07:46	1:36	1:39

<sup>a</sup> Earliest available data point; burnover conditions existed before first recorded observation.



# Concow Burnovers

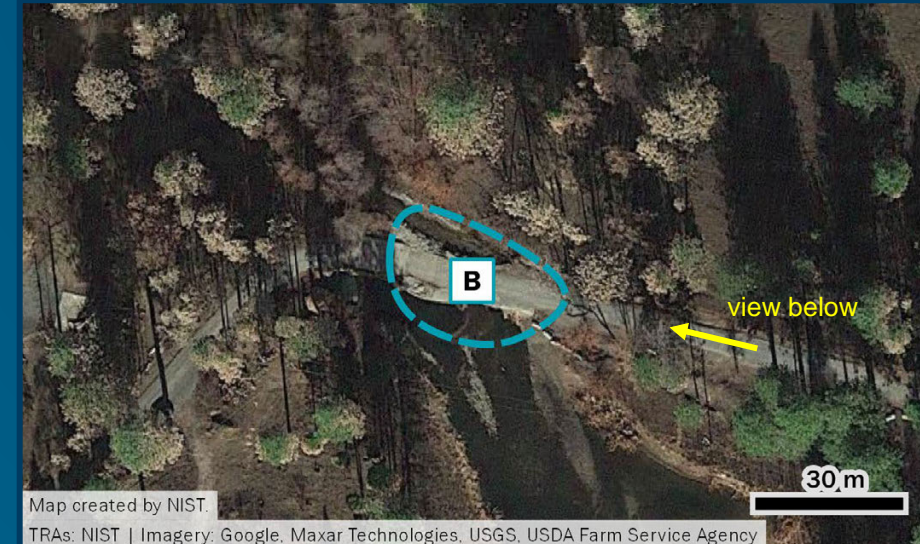
## Negative Contributions:

1. Multiple spot fire ignitions (accentuated by fuel receptivity and fuel loading)
2. **Early time of impact** when some people were asleep
3. No documented CodeRED notifications sent
4. **Single egress route**
5. **Remote location** requiring extensive transit time for first responders
6. No siren notification system

Fire Related

## Positive Contributions:

1. Timely and effective communication between IC and LE
2. Short time-span between fire observation information transferred to IC and evacuation request
3. **Presence of first responders to form TRAs** and lead civilian convoys to Camelot Wildfire Safety Zone



Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary

# Traffic

*fire / backups / blockages & closures / bottlenecks*

# Module Overview

- Rapid accumulation of evacuation traffic
- Fire significantly impacted egress arteries
- Active/extensive traffic management
- Impact of bottlenecks inside and outside the evacuating community



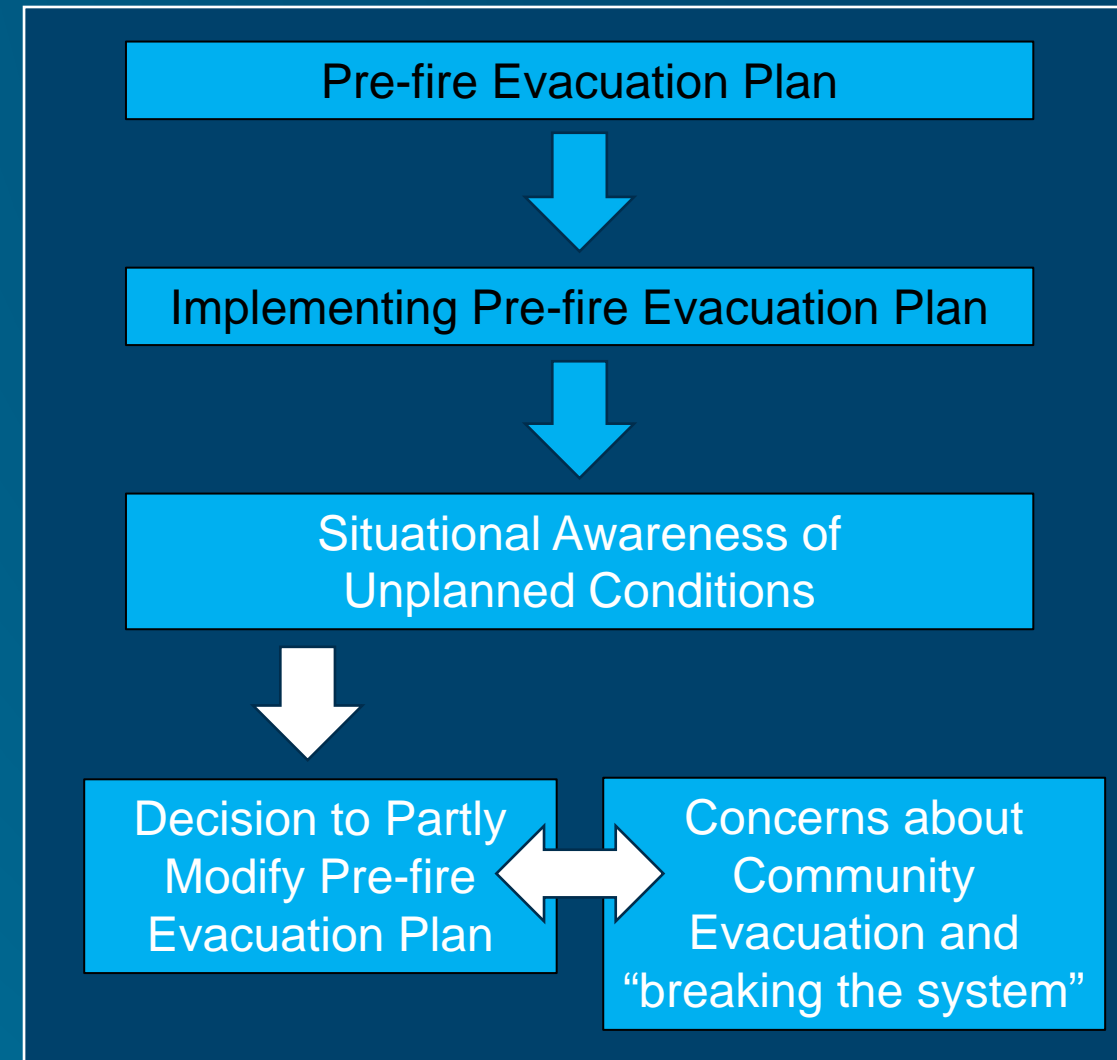
# Traffic Overview – Paradise (1 of 2)

The Paradise evacuation plan was *designed* to be implemented *for a few zones* of Paradise at a time rather than the entire town all at once.

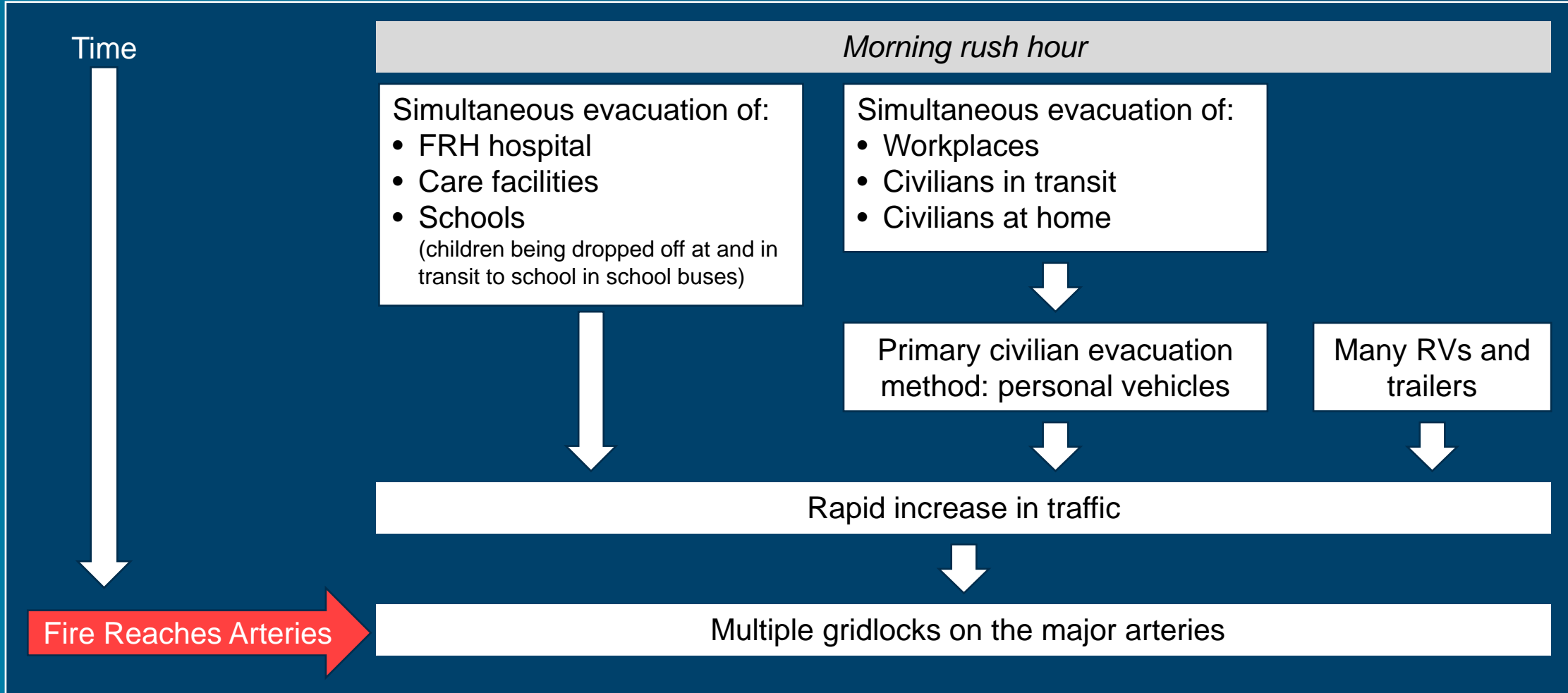
The IC initiated evacuation orders for the eastern zones first.

The *ember cast ahead of the fire front* and reports of multiple simultaneous ignitions instigated discussions between the IC, BCSO, PPD, and Paradise Town Hall about the evacuation of all of Paradise as the progressive evacuation approach from east to west was being implemented;

There was concern of “*breaking the system*” if the entire town were to be evacuated at once.



# Traffic Overview – Paradise (2 of 2)



Rapidly advancing fire hit gridlocked arteries

- Camp Fire Introduction
- NETTRA Study Overview
- Pre-Fire Conditions and Planning
- Notification and Evacuation Timeline
- Traffic
- Burnovers and Temporary Refuge Areas (TRAs)
- Rescues
- Summary

# Paradise Evacuation Traffic Summary

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary

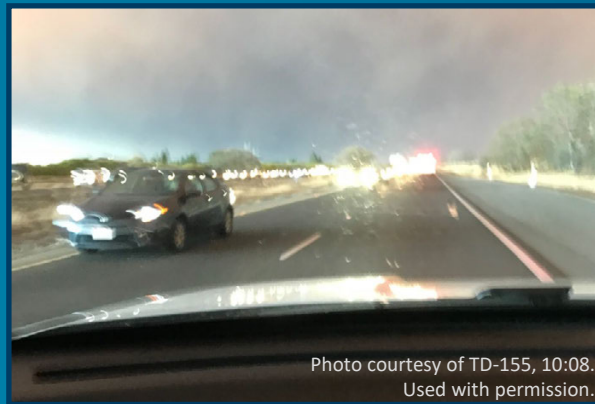


Table 13. Paradise evacuation summary timeline.

Time	Fire	Evacuation/Traffic
07:46		First evacuation orders requested for eastern Paradise (Pentz Rd).
07:49	First spot fire in Paradise.	
08:03		Butte ECC and PPD issue evacuation orders for all of Paradise.
08:30	At least 30 spot fires have ignited throughout eastern Paradise.	
08:30	First burnover starts on major egress artery – upper Skyway.	Major north-south egress artery is gridlocked impacting evacuation of upper Paradise and the evacuation of Magalia. Some vehicles utilize the bike path to head south. Other intersections see increased traffic.
08:45	Burnover starts on Pentz Rd.	Major egress artery is closed, impacting evacuation of upper western Paradise and the evacuation of Magalia.
09:00		Evacuation of FRH and the nearby Feather Canyon retirement community completed.
09:00	Burnover starts on Pearson Rd.	Major east-west artery is closed impacting west to east traffic and evacuations.
09:15	Burnover starts on Bille Rd.	Major east-west artery is closed impacting west to east traffic and evacuations.
09:25	Burnover starts on Wagstaff Rd.	Major east-west artery is closed impacting west to east traffic and evacuations.
10:00	Burnover starts on Clark Rd at American Way.	Major egress artery is closed impacting evacuation of all of Paradise and the evacuation of Magalia.
10:15	Burnover starts on Lower Skyway.	Heavy fire activity impacts Skyway at the lane divide during peak evacuation. Fire is burning structures on both sides of the road. All lanes are being used for SB traffic.
10:45		All traffic is held at Clark Rd and Skyway due to fire conditions on Skyway between Wagstaff Rd and Clark Rd; people stuck in this area are abandoning vehicles and fleeing on foot.
11:30		Clark Rd in Paradise is largely free of traffic. After opening for a short time, Clark Rd recloses due to fire south of town.
12:30	Burnover starts on Neal Rd.	The north-south egress artery Neal Rd is closed. Fuels change beyond the town limits to grassland with few or no structures. Fire and egress problems are confined to within the town limits on Neal Rd.
13:15–13:45		Traffic is clearing out through Paradise. Most traffic on Skyway is now south of Pearson Rd and is slowed by the downed power lines near the lane divide. Neal Rd is clear of Traffic at 13:15.
14:00		A strike team headed to Magalia moves cars and trailers by hand to clear a pathway through the gridlock of abandoned vehicles on Clark Rd at Skyway.





# Paradise Traffic Summary

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary

08:45	Burnover starts on Pentz Rd.	Major egress artery is closed, impacting evacuation of upper western Paradise and the evacuation of Magalia.
09:00		Evacuation of FRH and the nearby Feather Canyon retirement community completed.
09:00	Burnover starts on Pearson Rd.	Major east-west artery is closed impacting west to east traffic and evacuations.
09:15	Burnover starts on Bille Rd.	Major east-west artery is closed impacting west to east traffic and evacuations.
09:25	Burnover starts on Wagstaff Rd.	Major east-west artery is closed impacting west to east traffic and evacuations.
10:00	Burnover starts on Clark Rd at American Way.	Major egress artery is closed impacting evacuation of all of Paradise and the evacuation of Magalia.
10:15	Burnover starts on Lower Skyway.	Heavy fire activity impacts Skyway at the lane divide during peak evacuation. Fire is burning structures on both sides of the road. All lanes are being used for SB traffic.
10:45		All traffic is held at Clark Rd and Skyway due to fire conditions on Skyway between Wagstaff Rd and Clark Rd; people stuck in this area are abandoning vehicles and fleeing on foot.

Between 8:30 and 10:15 burnovers affect:  
  
3 out of 4 North-South and 3 out of 3 East-West arteries

# Summary of Road Conditions

## Traffic conditions documentation and analysis

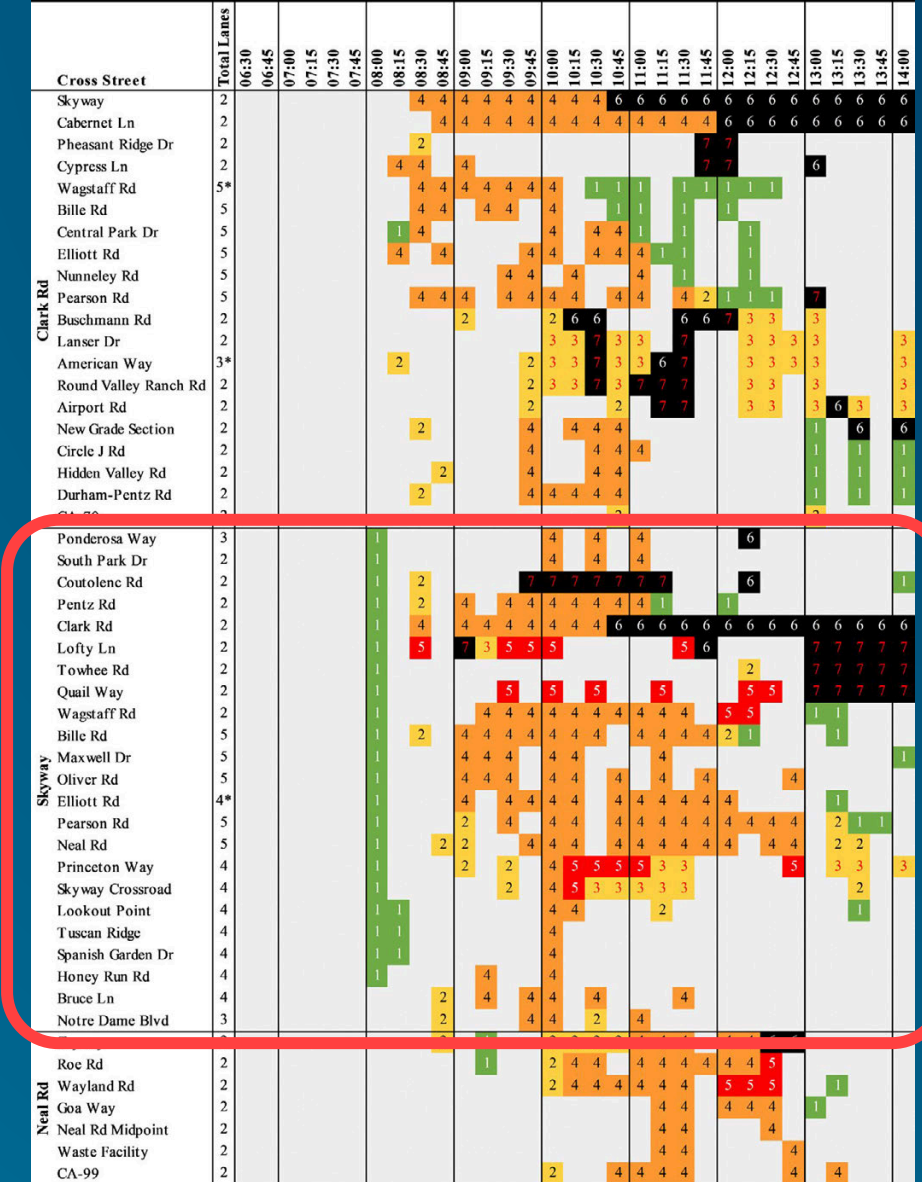
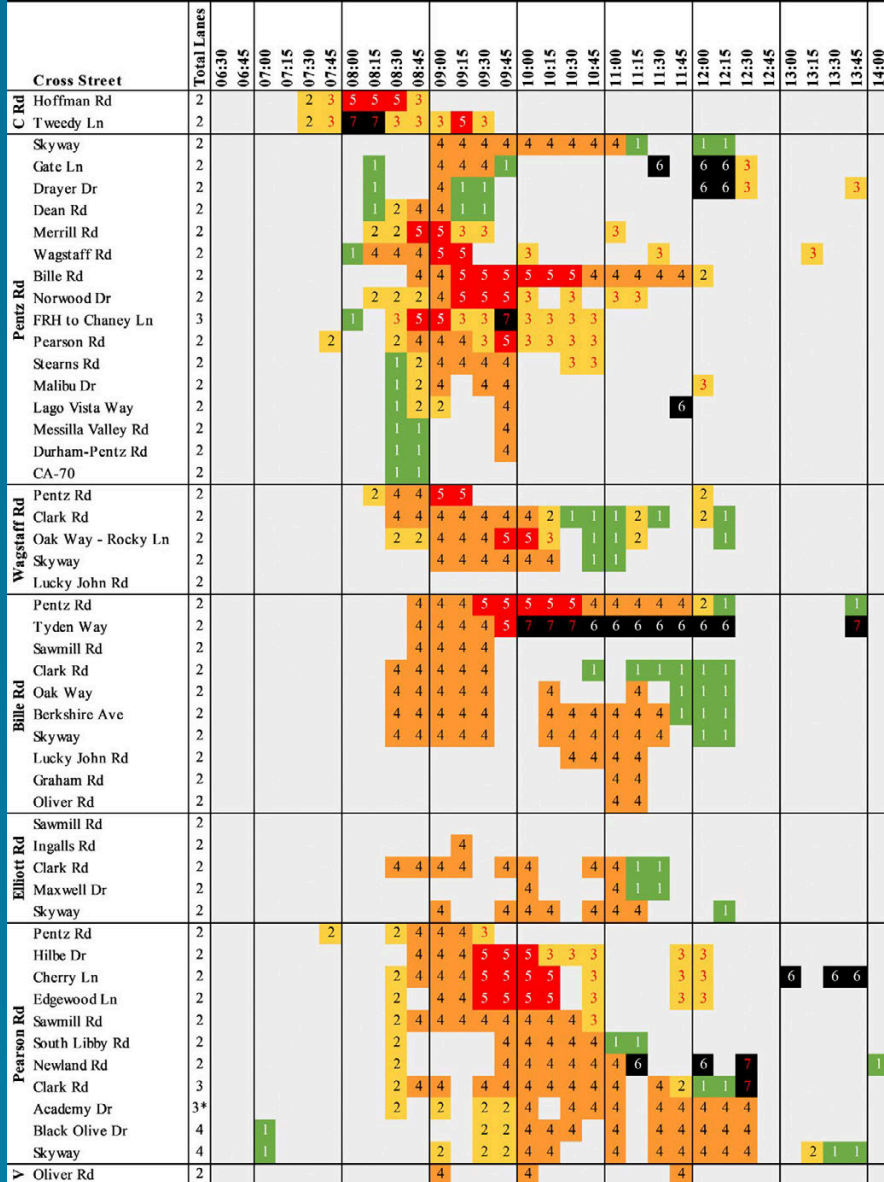
- On major egress arteries and cross streets in Paradise
- Expanded beyond Paradise to identify flow restrictions
- Intersection/segment-based
- Seven distinct categories developed to capture different conditions
- Traffic analysis by roadway also included in report after summary table



**Table 17.** Definition key of traffic flow conditions.

Category	Description	Notes
	no data	
1	no traffic / flowing	Roadway may be smoky and/or dark, but there is no hazard to the roadway from fire.
2	congested / slowed (traffic)	
3	obstructed / slowed (fire-power lines-visibility)	Not all 3's are equal. Some exposures may be more severe, and traffic flow may be light or heavy. May indicate segment is passable by a few individuals not a large convoy. May just indicate an area where passage is obstructed.
4	very heavy / gridlocked / stopped (traffic)	
5	very heavy / stopped (fire-power lines-visibility)	Not all 5's are equal. Exposures may vary, but traffic is stopped (including partial lane closures) and stuck where fire was impacting the roadway.
6	closed / blocked by other (no people)	Roadway is blocked by downed utility lines, trees, debris, or is actively closed by law enforcement.
7	closed / blocked by fire (no people)	Active fire is the primary closure.

# Evolution of Traffic Conditions



NIST TN 2252, Figure 16.







# Traffic Conditions along Skyway

Cross Street	Total Lanes	06:30		07:00		08:00		09:00		10:00		11:00		12:00		13:00		14:00																					
		06:30	06:45	07:00	07:15	07:30	07:45	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	13:00	13:15	13:30	13:45	14:00							
Ponderosa Way	3					1					4		4			6																							
South Park Dr	2					1					4		4																										
Coutolenc Rd	2					1		2				7	7	7	7	7	7							6													1		
Pentz Rd	2					1		2		4		4	4	4	4	4	4	1					1																
Clark Rd	2					1		4		4	4	4	4	4	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
Lofty Ln	2					1		5		7	3	5	5	5				5	6																				
Towhee Rd	2					1																	2																
Quail Way	2					1						5		5		5		5							5	5													
Wagstaff Rd	2					1					4	4	4	4	4	4	4	4	4	4	4	4	4	5	5														
Bille Rd	5					1		2		4	4	4	4	4	4	4	4	4	4	4	4	4	2	1															
Maxwell Dr	5					1				4	4	4			4																							1	
Oliver Rd	5					1				4	4	4		4	4		4					4																	
Elliott Rd	4*					1				4		4	4	4	4	4	4	4	4	4	4	4																	1
Pearson Rd	5					1				2		4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2
Neal Rd	5					1		2		2		4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2
Princeton Way	4					1				2		2		4	5	5	5	5	3	3							5												3
Skyway Crossroad	4					1						2		4	5	3	3	3	3	3																			2
Lookout Point	4					1	1							4	4																								1



# Paradise Southern Egress Closures

## 08:00 to 14:00

**Table 29. Summary of southern egress closures in Paradise.**

	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	13:00	13:15	13:30	13:45	14:00
<b>Number of southern egress arteries with at least one closure</b>					1			2	1	2	2	2	2	2	3	3	3	3	3	3	2	2	2	2	2
<b>Total intersections blocked<sup>a</sup></b> (out of 114 <sup>b</sup> , not including Concow)	1	1			1			2	2	3	6	4	6	9	10	9	10	8	6	5	8	7	6	8	7
<b>Total intersections blocked along north-south arteries</b> (out of 66 <sup>b</sup> )								2							1	1	2	2							
<b>Fraction of main southern egress arteries closed due to fire</b>					1/4			1/2	1/4	1/2	1/2	1/2	1/2	1/2	3/4	3/4	3/4	3/4	3/4	3/4	1/2	1/2	1/2	1/2	1/2

<sup>a</sup> Blocked by fire or other reasons with no civilians present (categories 6 and 7) as defined in Table 17.

<sup>b</sup> Intersections/segments identified in Fig. 16.

During the evacuation of Paradise 1/4 of the time only one southbound artery was fully open

# Bottlenecks Outside Paradise

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

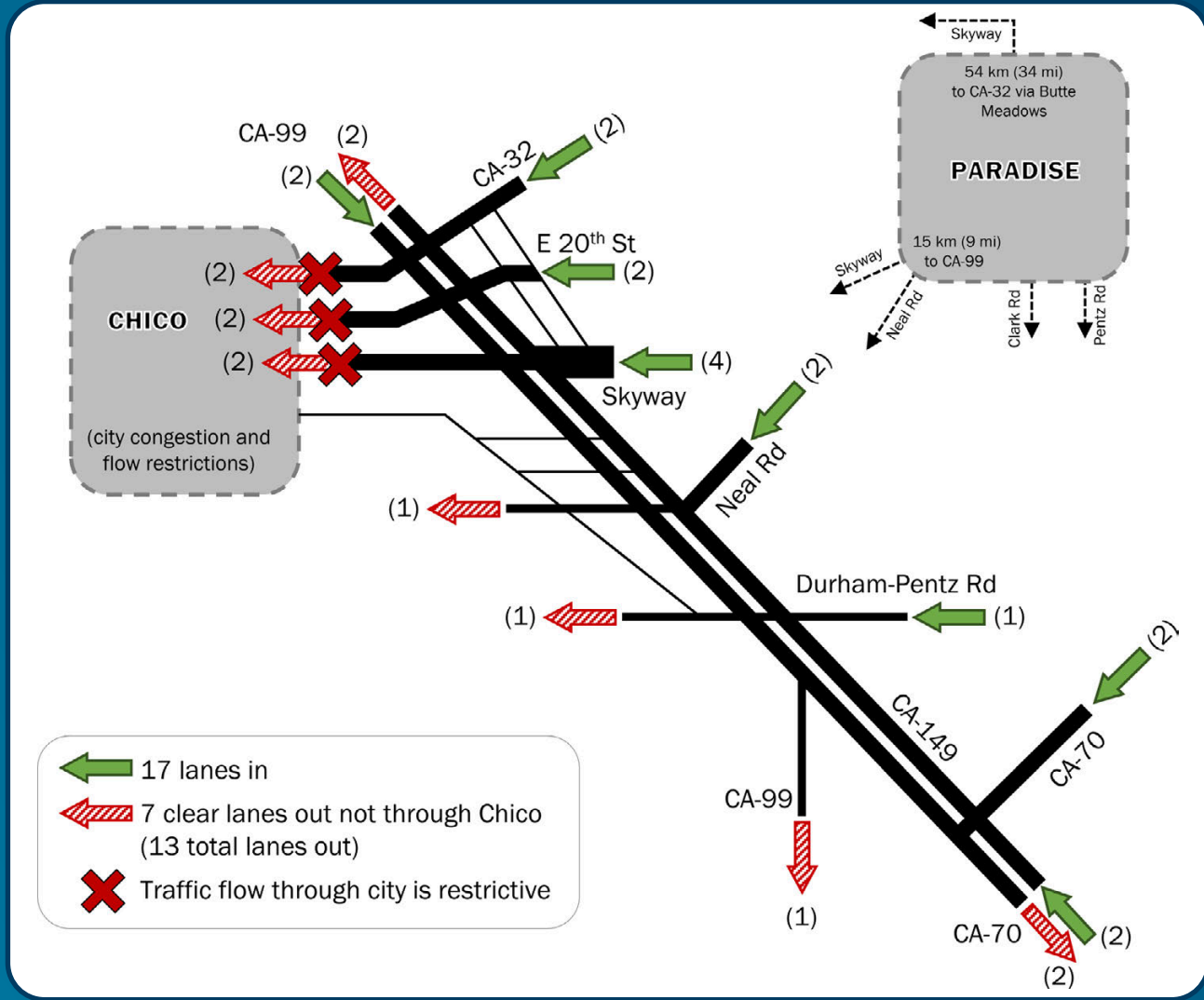
Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary



17 into 7 lanes, 9+ miles away, resulted in significant backups all the way into Paradise

Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary

# Burnovers and Temporary Refuge Areas

*fire / evacuation / life safety*



# Module Overview

- 23 identified burnover events
- Burnovers impacted evacuating civilians
- Burnovers led to formation of TRAs
  
- 31 Temporary Refuge Areas implemented
- TRAs saved hundreds of lives
- TRAs served two primary purposes
  - Immediate life safety, evacuation management

# 23 Identified Burnovers

*Report describes identified:  
burnovers, entrapments, and “near misses”*

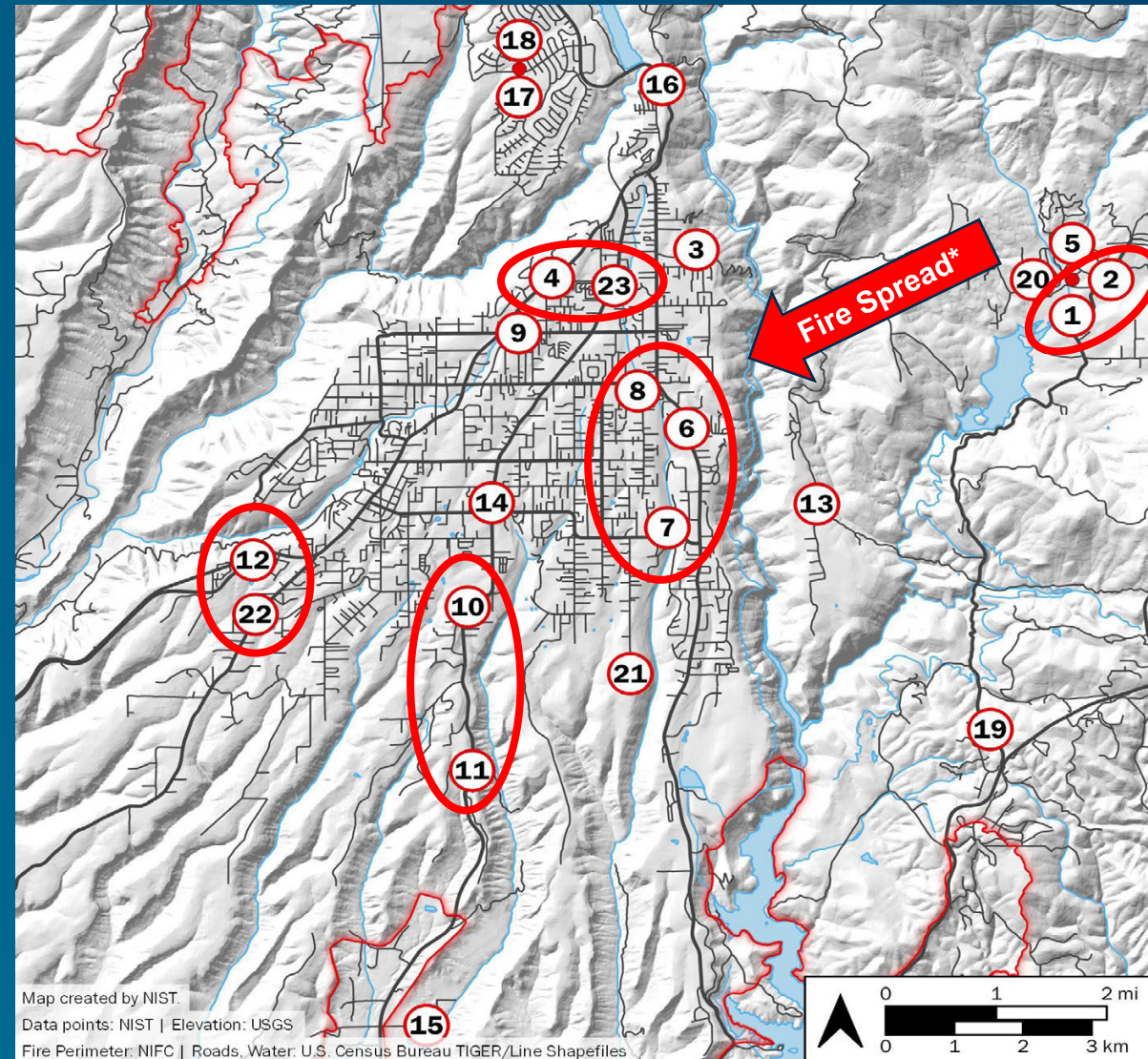
- Unexpectedly caught
- Life-threatening position
- Fire overtakes personnel or equipment
- Escape routes or safety zones are absent, inadequate, or compromised
- May or may not result in injury
- Possible damage to equipment



Source: ViralHog  
Used with permission.

# Burnover Locations

- 23 identified events
- Concow impacted first
- Paradise arteries impacted from E to W and S
- Progression from E to W
- Significant contributions from spot fires
- 12 on primary egress arteries

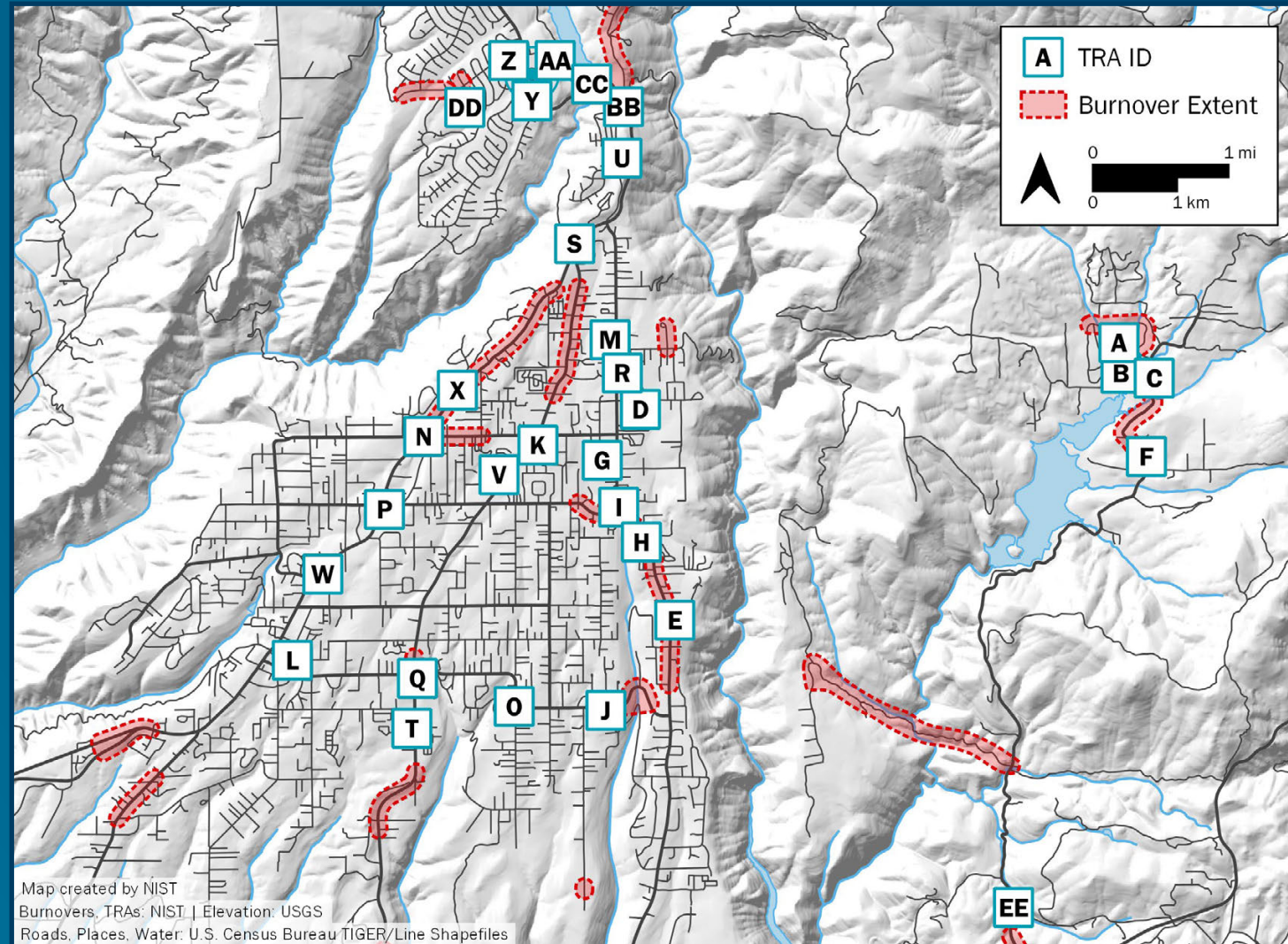


\* General initial fire spread direction



# Temporary Refuge Areas (TRAs)

- 31 different TRAs
- 12 TRAs directly in response to burnovers
- Parking lots, roadways, structures, natural areas
- Classified by urgency of formation and peak hazard level



At least 1200 civilians took refuge in TRAs



# TRAs and Burnovers

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary

TRA	07:00	07:15	07:30	07:45	08:00	08:15	08:30	08:45	09:00	09:15	09:30	09:45	10:00	10:15	10:30	10:45	11:00	11:15	11:30	11:45	12:00	12:15	12:30	12:45	13:00	13:15	13:30	13:45	14:00	14:15	14:30	14:45
<b>Total Active TRA</b>	0	0	0	1	2	2	2	2	5	4	5	7	6	6	7	7	9	11	12	12	10	11	10	9	8	7	9	9	8	8	7	6
<b>TRA Impacted by BO</b>	0	0	0	1	2	2	2	1	1	2	4	4	4	3	4	4	4	5	5	3	2	2	2	2	1	1	2	2	1	1	0	0
<b>Fraction Impacted by BO (%)</b>	0	0	0	100	100	100	100	50	20	50	80	57	67	50	57	57	44	45	42	25	20	18	20	22	13	14	22	22	13	13	0	0





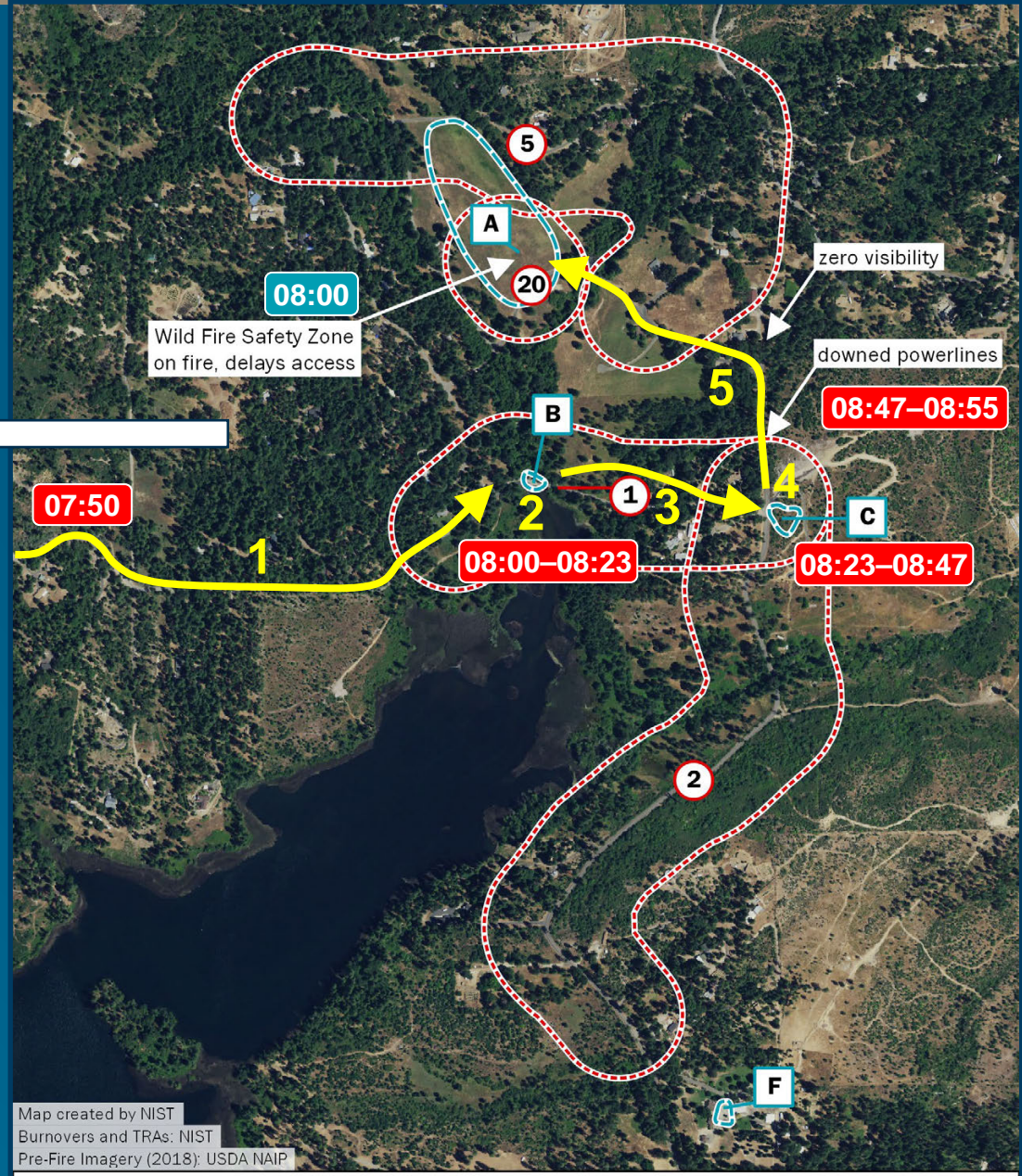
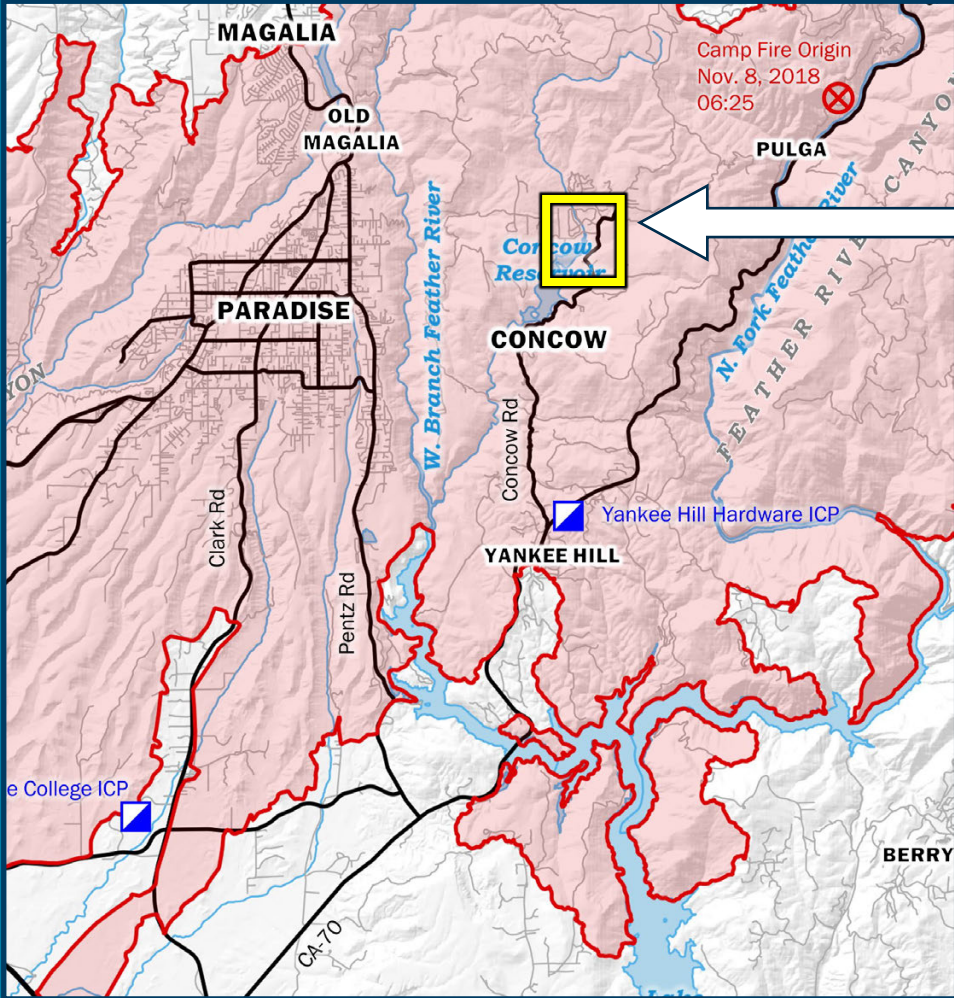
# TRAs – Temporal Analysis

Time of Day	Time Interval (hours)	Number of TRAs Formed	Locations
07:50 to 09:35	1.5	10	Concow and eastern Paradise
09:35 to 12:00	2.5	10	Central and western Paradise
12:00 to 19:15	7	7	Paradise and Magalia
00:00 to 07:45	8	4	Magalia and Concow

One third (10/31) of the TRAs were formed between 07:55 and 09:35; four in Concow and six in Paradise



# Concow Burnover/TRA Sequence



Map created by NIST  
 Burnovers and TRAs: NIST  
 Pre-Fire Imagery (2018): USDA NAIP

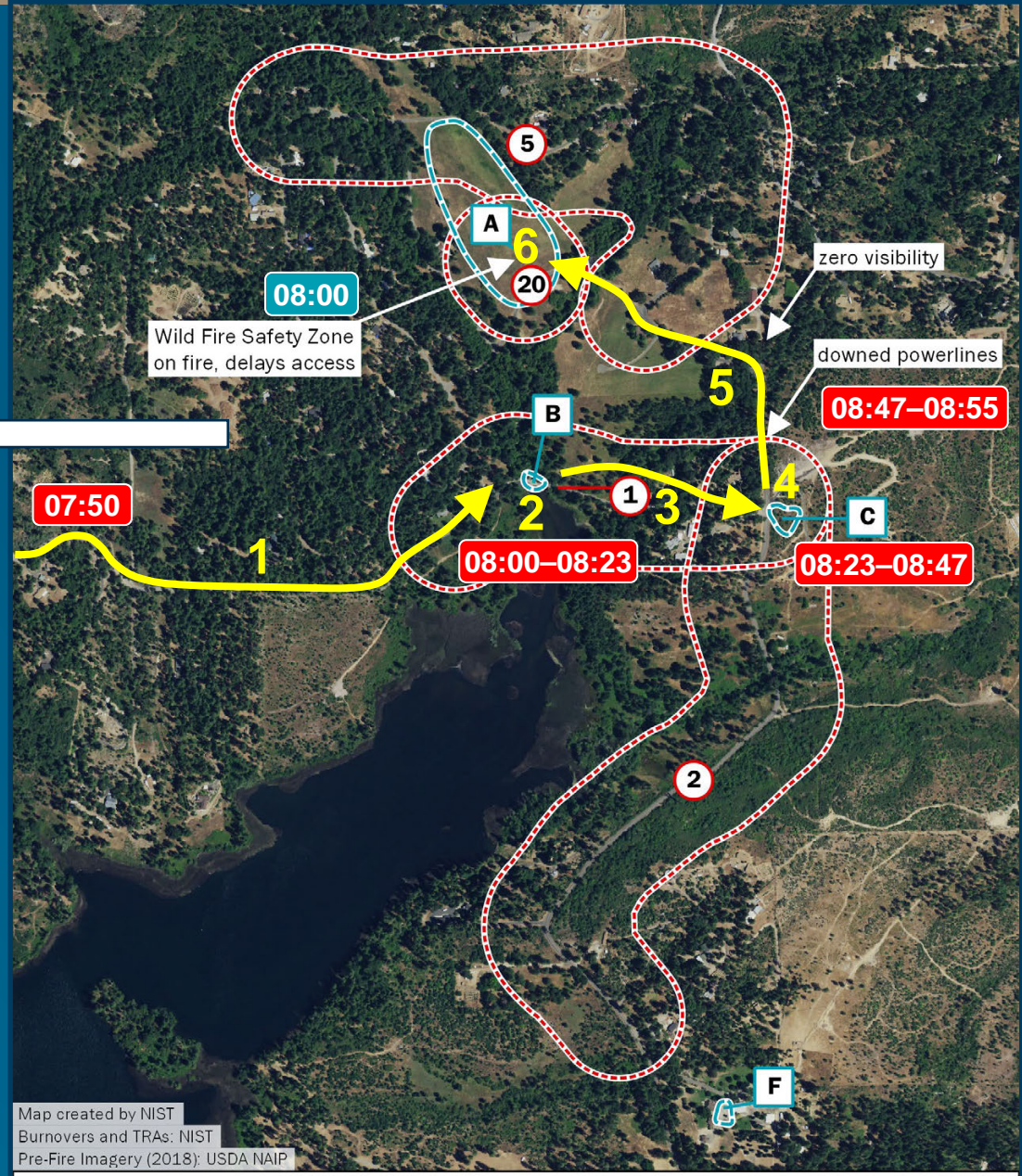
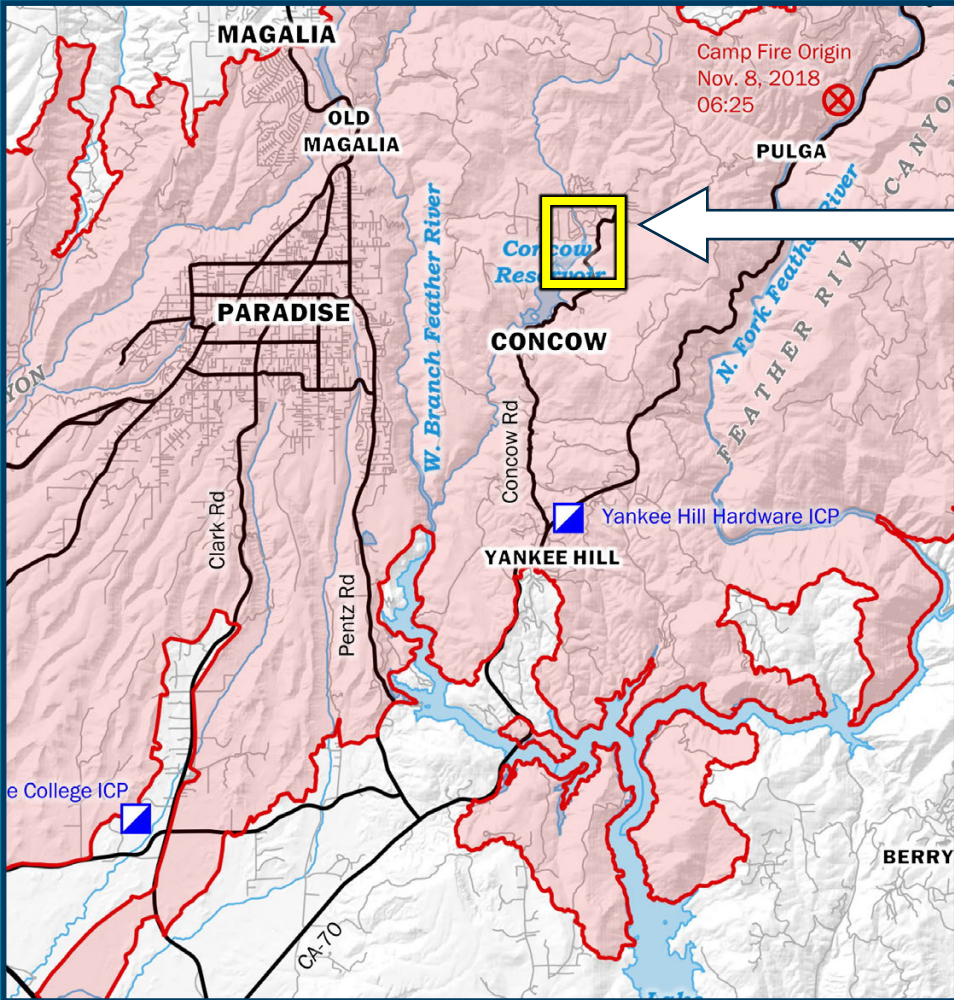
“multiple spot fires” to “impassable” in 10 minutes



- Camp Fire Introduction
- NETTRA Study Overview
- Pre-Fire Conditions and Planning
- Notification and Evacuation Timeline
- Traffic
- Burnovers and Temporary Refuge Areas (TRAs)
- Rescues
- Summary



# Concow Burnover/TRA Sequence



Multiple TRAs used en route to safety zone

Map created by NIST  
 Burnovers and TRAs: NIST  
 Pre-Fire Imagery (2018): USDA NAIP

0 0.25 mi  
0 200 400 m

<b>A</b> TRA ID	<b>1</b> Burnover ID
<span style="border: 1px dashed blue; padding: 2px;"> </span> TRA Extent	<span style="border: 1px dashed red; padding: 2px;"> </span> Burnover Extent

- Camp Fire Introduction
- NETTRA Study Overview
- Pre-Fire Conditions and Planning
- Notification and Evacuation Timeline
- Traffic
- Burnovers and Temporary Refuge Areas (TRAs)
- Rescues
- Summary



# High Urgency TRAs (07:55 to 09:35)

**Table 39.** Head count of civilians involved in high urgency of formation TRAs, assuming one person per vehicle.

	ID	TRA Name	PHL	Civilian Head Count	
				Min	Max
<b>Concow</b>					
	A	Camelot Meadow Wild Fire Safety Zone	▲▲▲	70	85
	B	Hoffman Rd	▲▲▲	24 <sup>a</sup>	24 <sup>a</sup>
	C	Concow Rd “dozer zone”	▲▲▲	30 <sup>a</sup>	45 <sup>a</sup>
<b>Paradise</b>					
	E	Feather River Hospital	▲▲	115	225
	G	Ponderosa Elementary School	▲▲	6	6
	H	Chloe Ct	▲▲▲	7 <sup>b</sup>	14 <sup>b</sup>
	I	Bille Rd	▲▲▲	70	100
	J	Pearson Rd	▲▲▲	30 <sup>b</sup>	70 <sup>b</sup>
<b>Total</b>				<b>352</b>	<b>569</b>
				<b>(261 individuals)</b>	<b>(416 individuals)</b>

*Note:* The tabulated civilian head count assumes only 1 person per vehicle. The min and max values reflect uncertainty in the number of pedestrians and vehicles. The true maximum is likely higher than 1 person per vehicle. Total is the (person × exposure) count. Some individuals were located in multiple locations, as follows:

<sup>a</sup> Consolidated into *TRA-A*.

<sup>b</sup> Consolidated into *TRA-E*.

**Listed headcount assumes one person per vehicle.**



# Bille Road TRA



← view indicated above



# Defensive Actions at TRAs

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

Notification and Evacuation Timeline

Traffic

Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary

- 1. Life safety
- 2. Protect infrastructure
- 3. Reduce exposures



Photo courtesy of TD-112, 15:10. Used with permission.

a)



Photo courtesy of TD-127, 03:09 (Nov 9). Used with permission.

b)



Photo courtesy of TD-041, 14:12. Used with permission.

c)

Defensive actions by first responders took place at half of the TRAs

Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary

# Rescues

*rescue type | timeline | Concow*

# Module Overview

- 198 identified rescue events involved over 1000 civilians [*underestimate*]
- Events ranged from well-documented efforts to rescue entrapped civilians to chance encounters
- 44 % of those rescued were associated with TRAs; represents only 36 % of civilians involved in TRAs
- 50 % of rescues occurred before 10:30, and 85 % occurred before 15:00

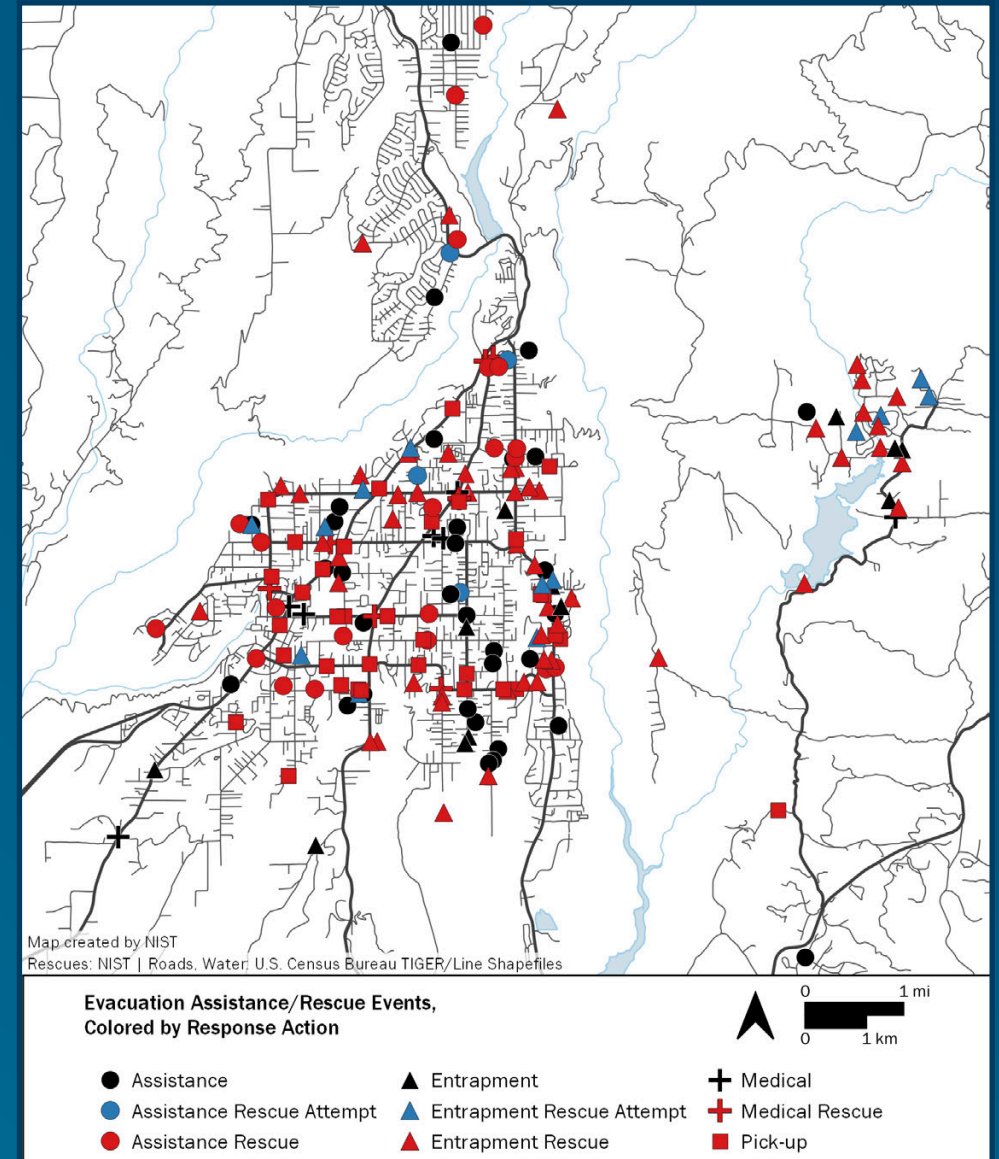
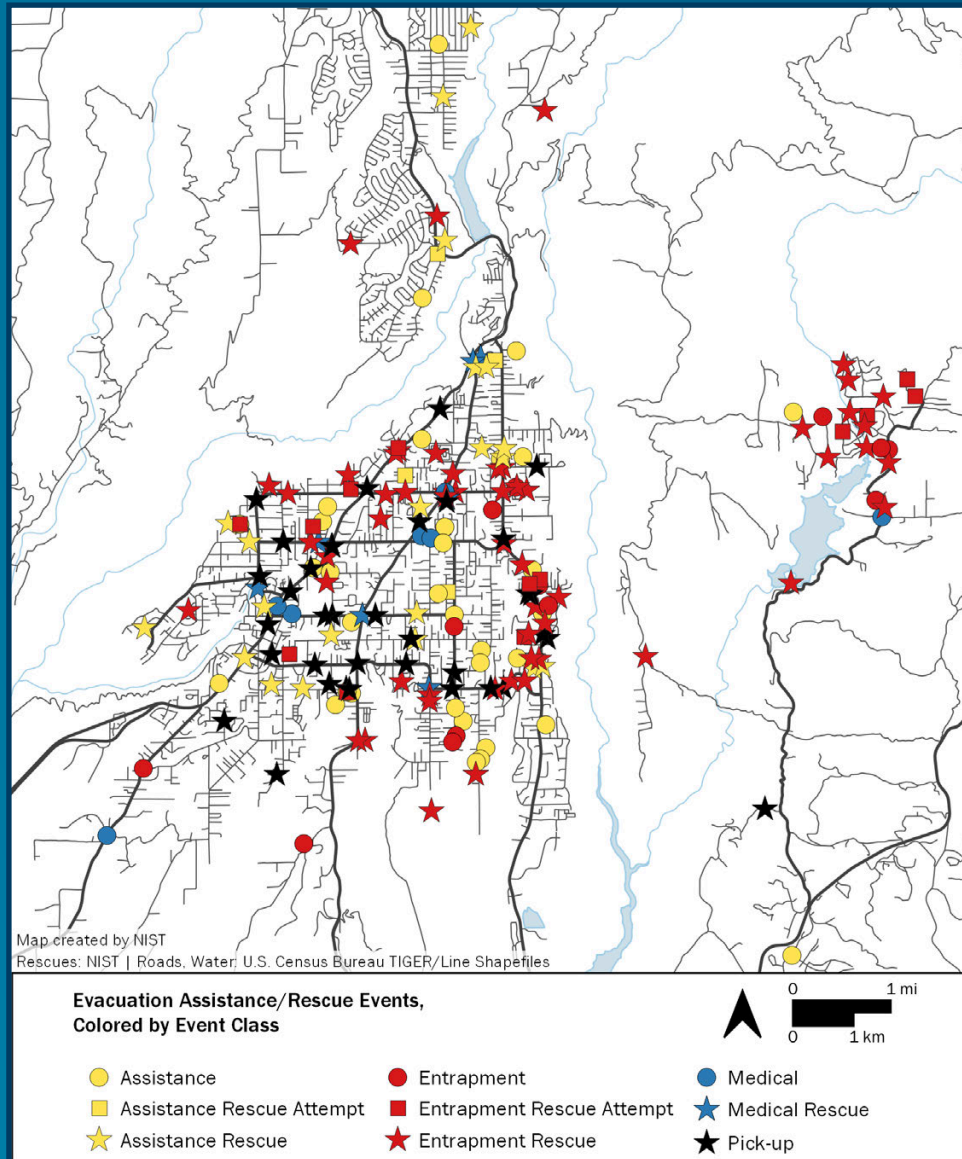


# Rescues Methodology

- Terminology “rescue events,” the acronym EA/R is introduced [meaning Evacuation Assistance or Rescue] to differentiate between the specific *Rescue* term
- *Rescue* takes on a specific meaning regarding the actual action of responding to an incident
- Classification hierarchy depending on type and action
- Event attributes include:
  - time and location, source,
  - number of civilians involved,
  - agency of participating first responder(s),
  - outcome, and
  - other circumstances including injuries, pre-existing conditions
- Documented events include:
  - completed rescues,
  - attempted rescues, and
  - notifications/communications of requests for rescue or evacuation assistance



# Rescues by Type



# Rescues in Concow vs. Paradise

**Table 47.** EA/R event frequency by community, organized by Event Class / Response Action.

Event Type Class / Action	Concow	Paradise	Magalia	Other	Total
<b>Assistance</b>	<b>1</b>	<b>55</b>	<b>6</b>	<b>2</b>	<b>64</b>
Notification	1	31	2	2	36
Rescue Attempt		5	1		6
Rescue		19	3		22
<b>Entrapment</b>	<b>20</b>	<b>58</b>	<b>3</b>	<b>1</b>	<b>82</b>
Notification	4	10			14
Rescue Attempt	4	9			13
Rescue	12	39	3	1	55
<b>Medical</b>	<b>1</b>	<b>13</b>			<b>14</b>
Notification	1	6			7
Rescue		7			7
<b>Pick-up</b>	<b>1</b>	<b>37</b>			<b>38</b>
Notification		1			1
Rescue	1	36			37
<b>Total</b>	<b>23</b>	<b>163</b>	<b>9</b>	<b>3</b>	<b>198</b>

Note: "Other" events occurred in Yankee Hill, Stilson Canyon, and an undetermined location.



# Rescues in Concow vs. Paradise

Location	Population	Rescues	Rescues per capita
Paradise	26543	39	0.0015
Concow	743	12	0.016



Table 47. EAVR event frequency by community, organized by

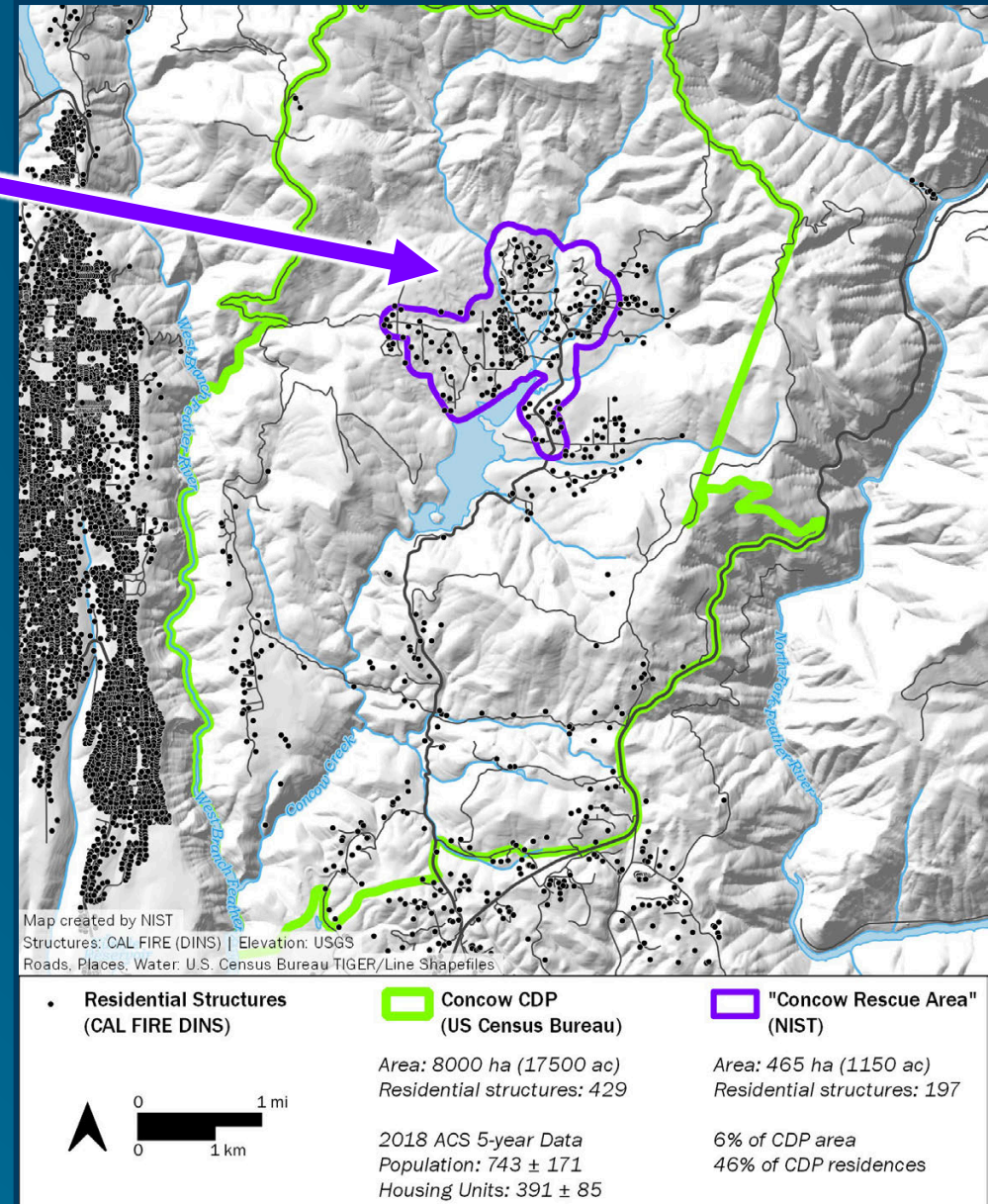
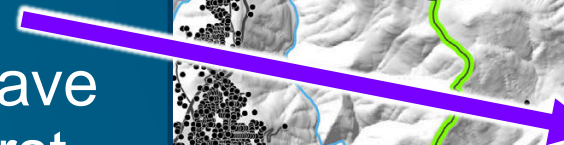
Event Type Class / Action	Concow	Paradise	M
<b>Assistance</b>	1	55	
Notification	1	31	
Rescue Attempt		5	
Rescue		19	
<b>Entrapment</b>	20	58	
Notification	4	10	
Rescue Attempt	4	9	
Rescue	12	39	
<b>Medical</b>	1	13	
Notification	1	6	
Rescue		7	
<b>Pick-up</b>	1	37	
Notification		1	
Rescue	1	36	
<b>Total</b>	23	163	

Note: "Other" events occurred in Yankee Hill, Stilson Canyon

10x more Rescues per capita in Concow than in Paradise

# Concow Rescue Area (1 of 3)

- 200 m buffer around roadways involved in EA/Rs or known to have been patrolled or accessed by first responders
- 1.80 mi<sup>2</sup> with 13.5 mi of roadways
- 6 % of the Concow CDP administrative land area
- 46 % of residential structures in the CDP



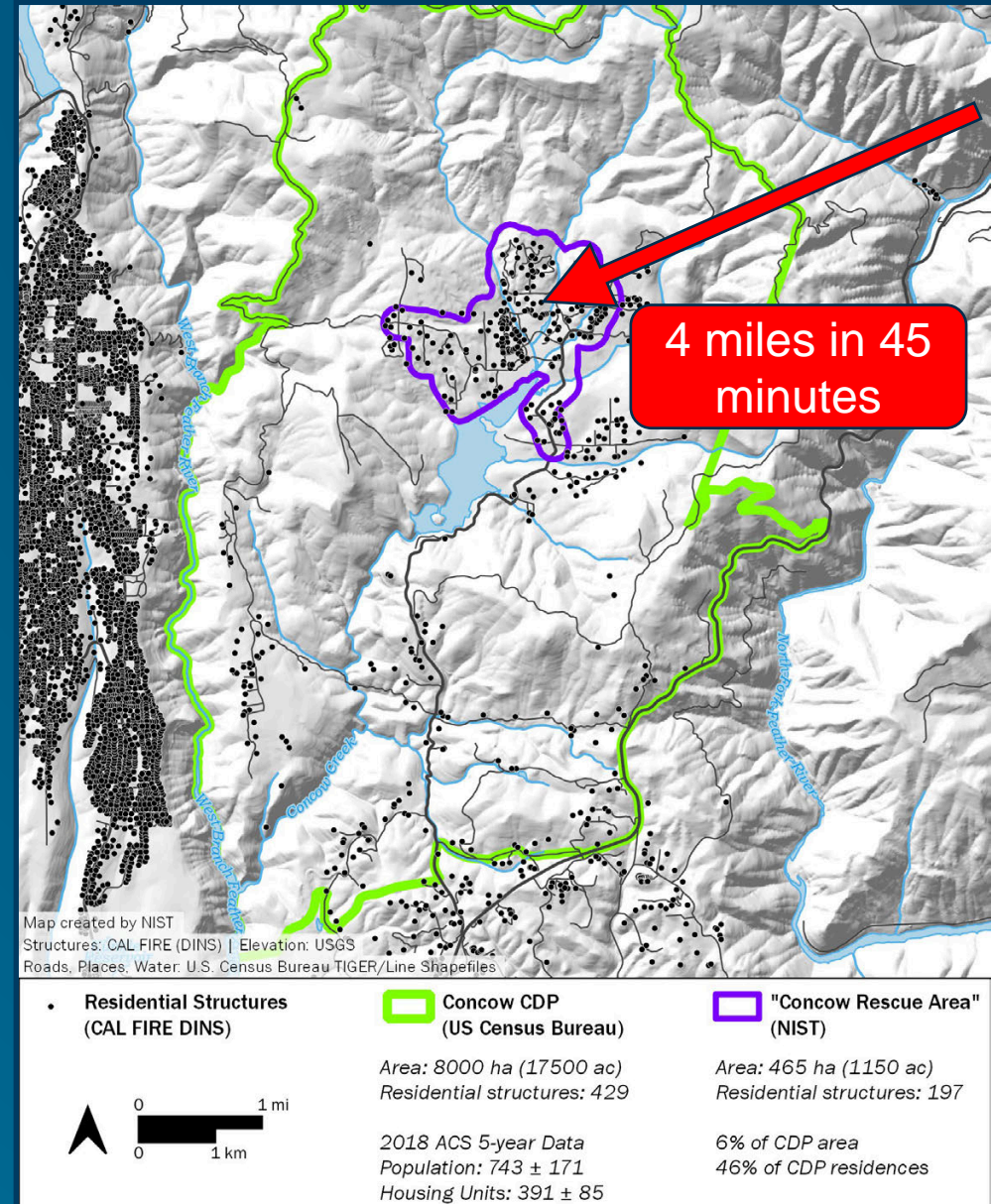


# Concow Rescue Area (2 of 3)

- Concow population: 743
- Identified EA/R activities involved a total of 110 civilians
  - 15 % of the entire Concow population
- CRA population\*: 342
- 110/342 involved in EA/R

32 % of residents in the CRA involved in EA/Rs activities in the 4.5 hours after the fire arrived

\*Assuming population is evenly distributed among residential structures





# Concow EA/Rs Summary (1 of 2)

- At least  $\frac{1}{4}$  of residents in the CRA were rescued through the implementation of TRAs
  - ➔ *Life safety hazards exist in intermix communities with high fuel loadings during high wind / low fuel moisture events.*
- Severe hazards can be particularly impactful when there is little time to evacuate or to get to a safety zone.
- 95 % of people rescued in Concow were rescued within a 90-minute window.

Need for easily and rapidly accessible safety zones

# Concow EA/Rs Summary (2 of 2)

- Concow rescues were made possible by:
  - Rapid and effectively coordinated response of emergency personnel,
  - Including both LE and fire service
  - Community evacuation notifications were performed before and during the arrival of the fire.
- There is a need to quickly engage in life safety operations

Critical need for preplanning

# Rescues Summary

- Over 1000 civilians involved in 198 identified events
- 44 % of all civilians in EA/R (443/1007) were involved in TRAs.
- 55 % of civilians *Rescued* (443/809) were involved in TRAs.
- 58 events had no identified response action, with most of them (62 %) being requests for evacuation *Assistance*.
  - Most had unknown, but non-fatal, outcomes
  - 4 of the 58 events were associated with seven fatalities

9 out of 10 civilians in *Entrapment* EA/R events were *Rescued* (659/733)



Camp Fire  
Introduction

NETTRA Study  
Overview

Pre-Fire  
Conditions and  
Planning

Notification and  
Evacuation  
Timeline

Traffic

Burnovers and  
Temporary Refuge  
Areas (TRAs)

Rescues

Summary

# Summary

*planning | notification & evacuation | traffic  
burnovers | TRAs | rescues*

# NETTRA Summary

Camp Fire Introduction

NETTRA Study Overview

Pre-Fire Conditions and Planning

Notification and Evacuation Timeline

Traffic

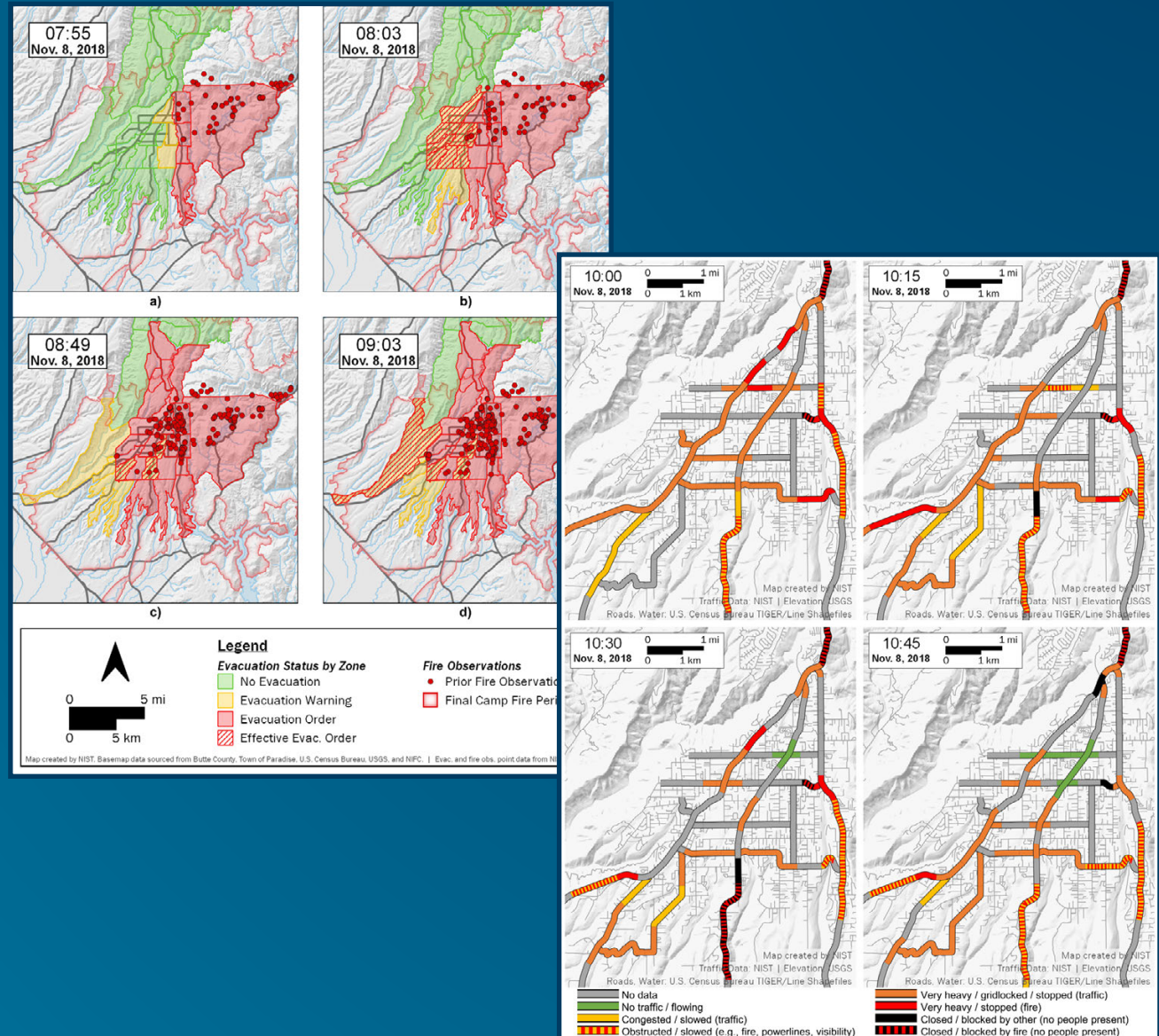
Burnovers and Temporary Refuge Areas (TRAs)

Rescues

Summary

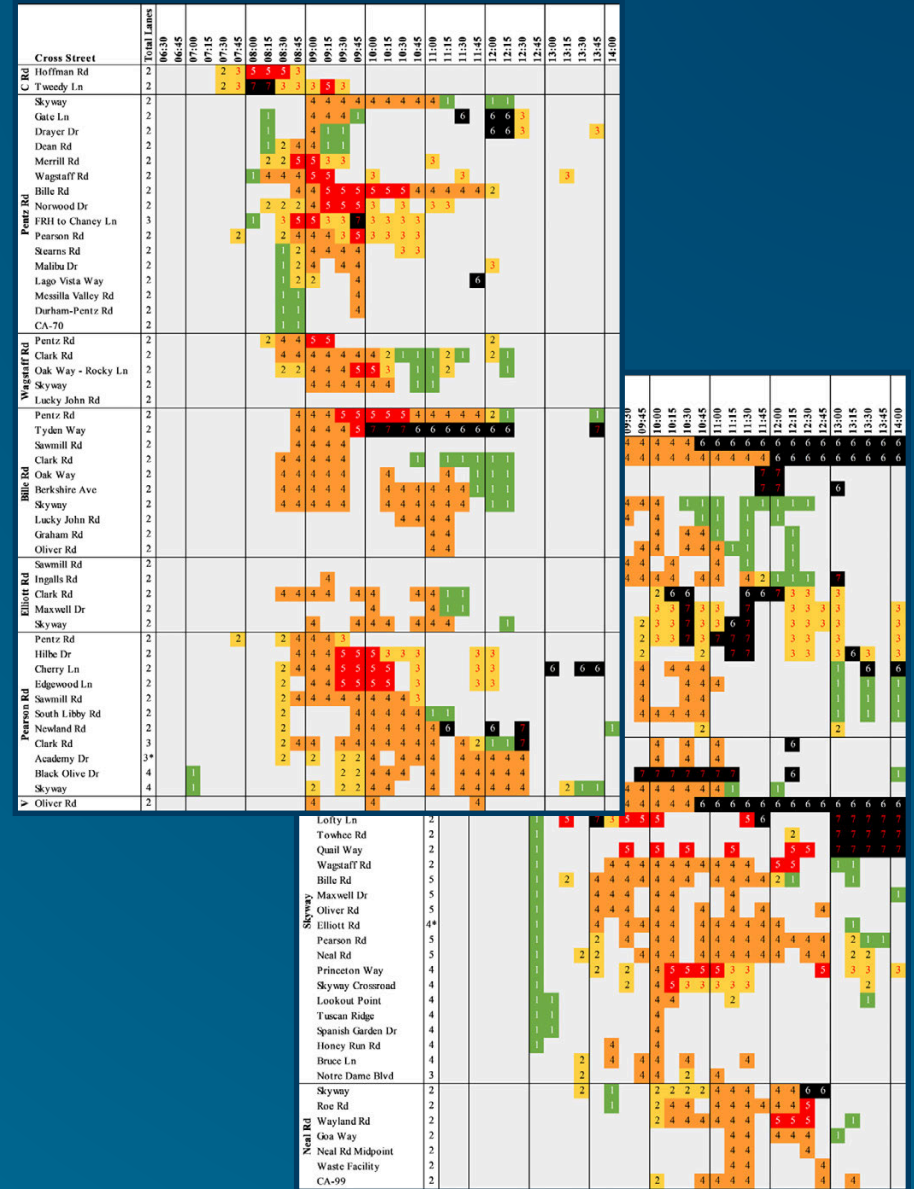
- Overview
- Concow
- Paradise
- Magalia
- Paths Forward

64 Technical Findings  
26 Recommendations



# NETTRA Summary

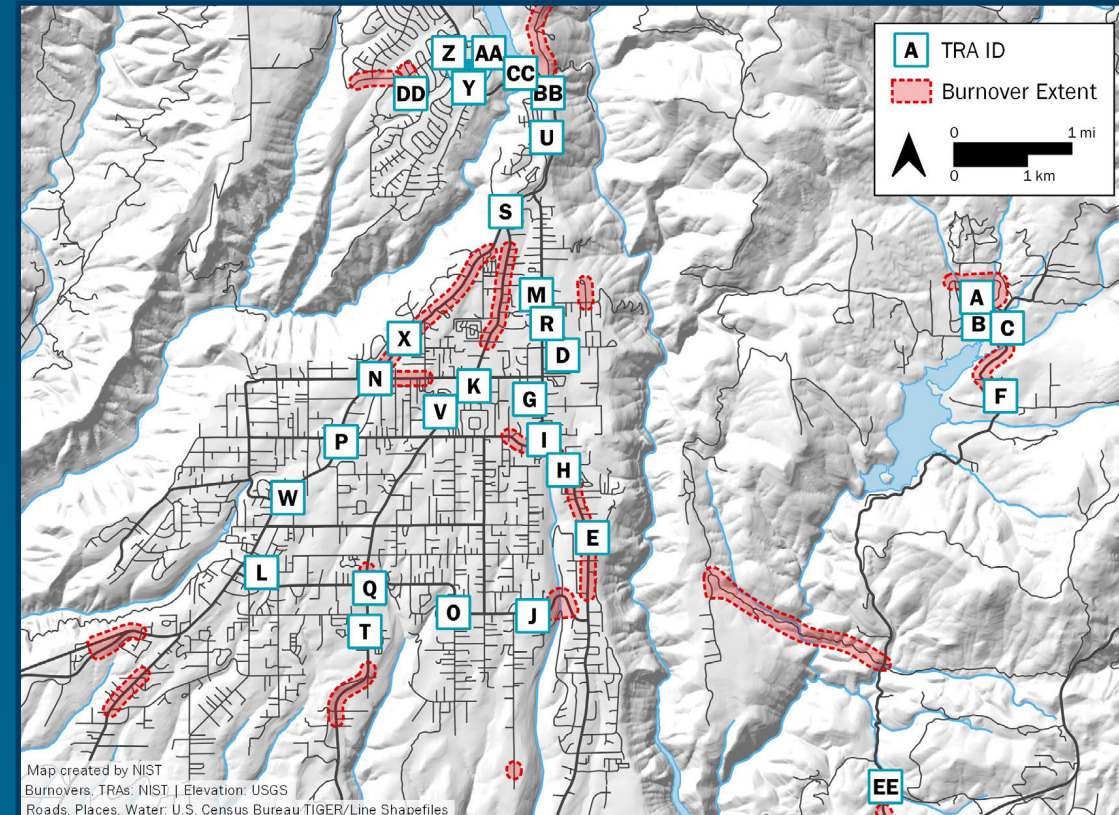
- The three impacted communities (Concow, Paradise, and Magalia) experienced the Camp Fire very differently.
- Evacuation was constrained by burnovers that closed the main egress arteries.
- Rescue activities were impacted by the intensity of the rapidly moving fire.





# NETTRA Summary

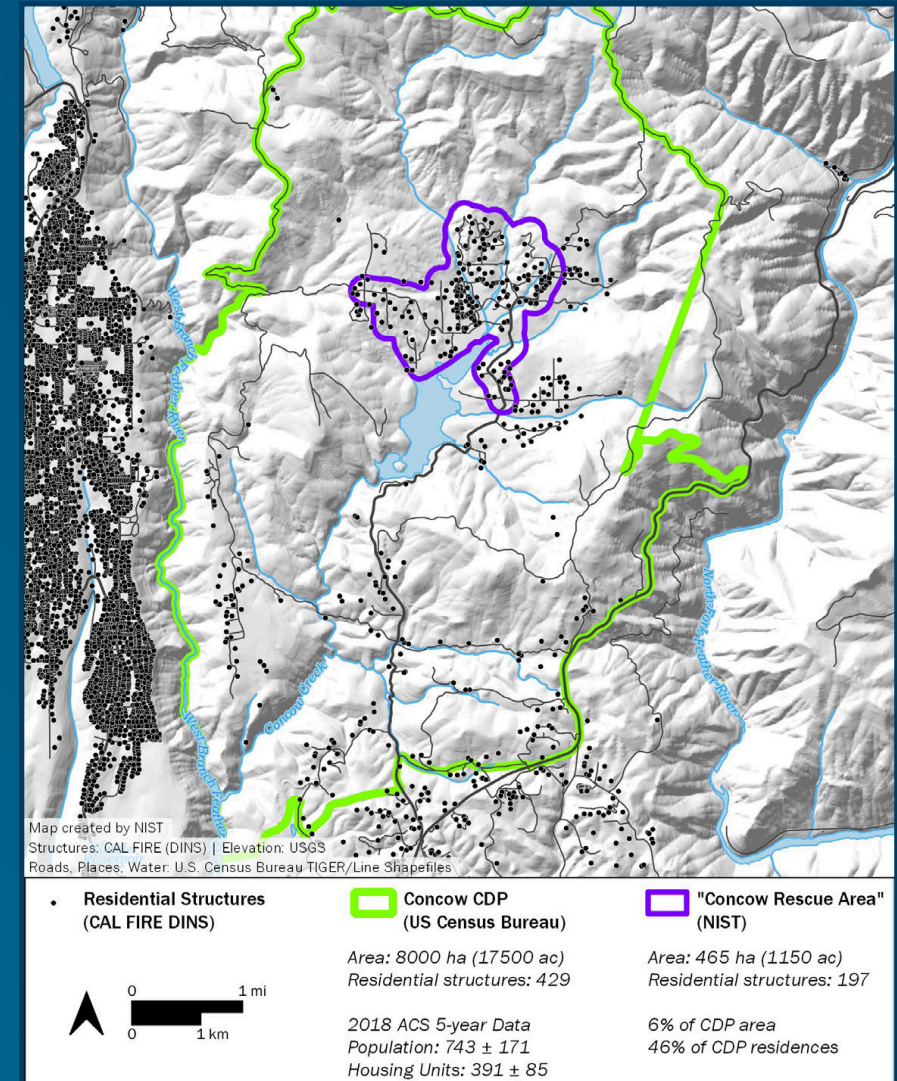
- A total of at least 1200 civilians were involved in 31 TRAs, including over 200 civilians in high-risk environments.
- Additionally, 198 distinct evacuation assistance/rescue (EA/R) events were identified and classified. The unique dataset was analyzed with respect to response actions, outcomes, and circumstances of each rescue.
- At least 1000 civilians were involved in EA/R events, many independent of the civilians included in TRAs.
- A limited analysis was performed on the available information regarding the 85 fatalities suffered in the fire.



# NETTRA Summary

## Concow (1 of 2)

- Located near the fire origin (6.5 km [4 mi]), Concow was impacted within 1 hour of ignition.
- There was little time for widespread community notification. Door-to-door notification activities by first responders and neighbors were instrumental in informing residents.
- A large fraction of the population in the Concow Rescue Area (CRA; the area surrounding Camelot and near the reservoir) was caught in high hazard conditions.

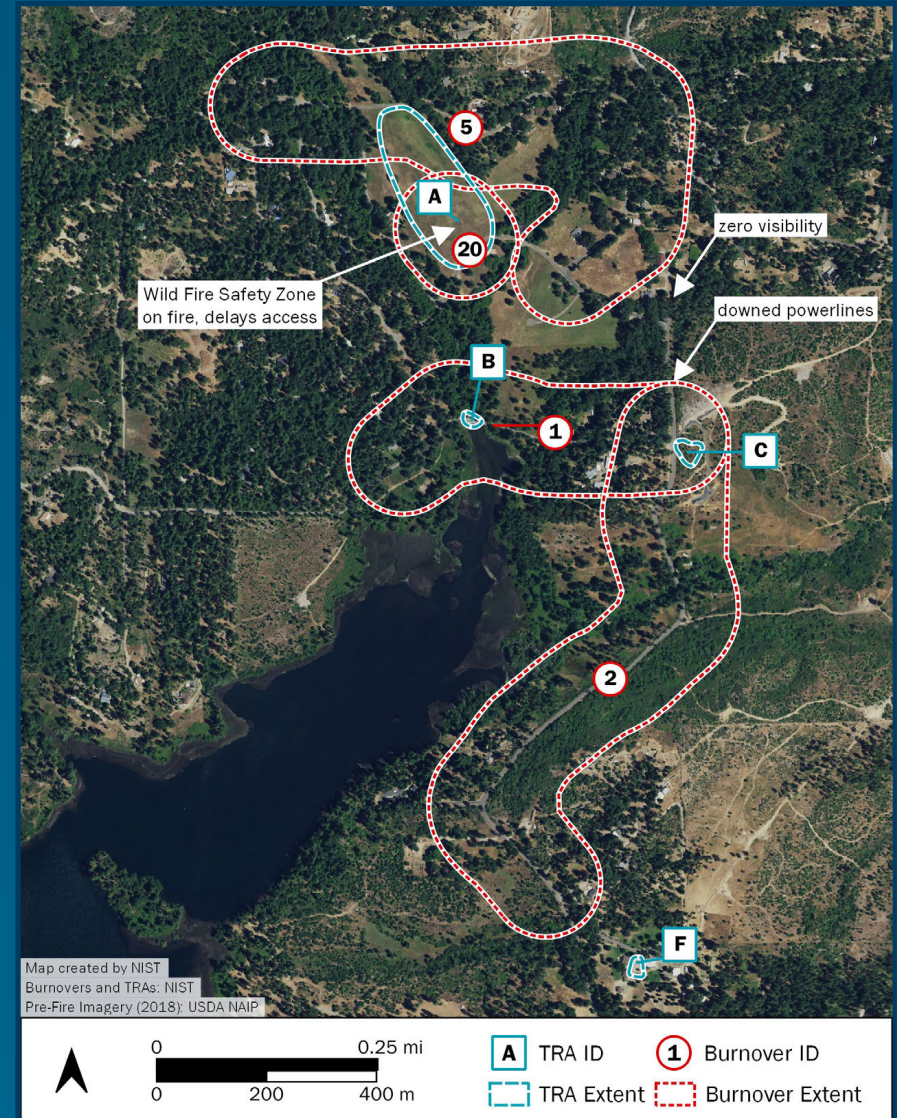




# NETTRA Summary

## Concow (2 of 2)

- 110 civilians, representing approximately 32 % of the population in the CRA, were involved in evacuation assistance or rescue (EA/R) events.
- Multiple TRAs in close proximity to each other had to be formed to maintain life safety for both civilians and first responders.
- Rescue activities were impacted by the intensity of the rapidly moving fire.
- Evacuation was constrained by burnovers that closed the main egress artery (Concow Road).

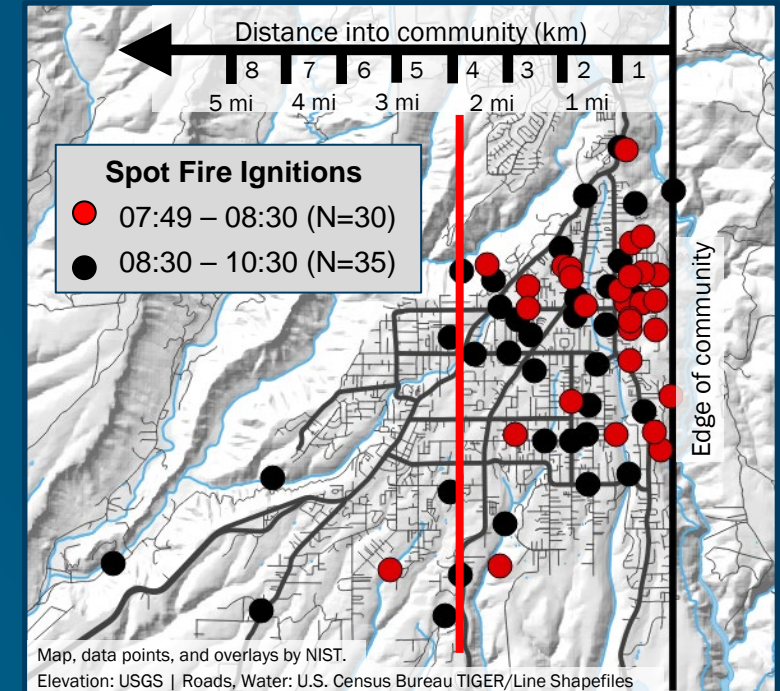




# NETTRA Summary

## Paradise (1 of 2)

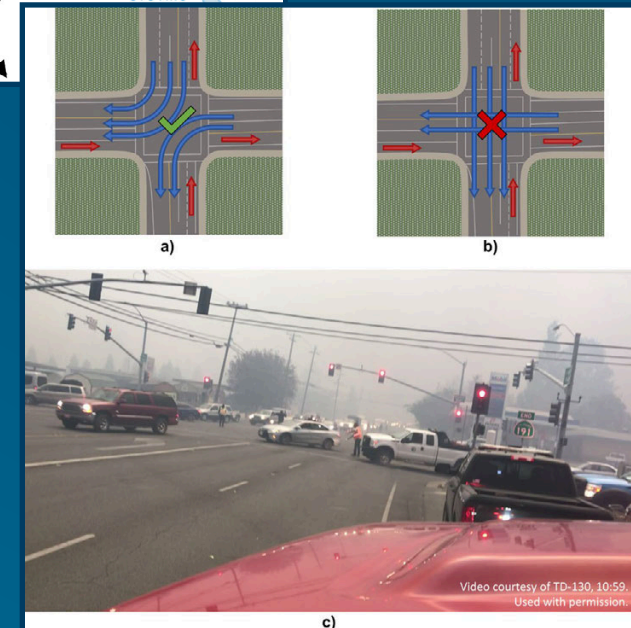
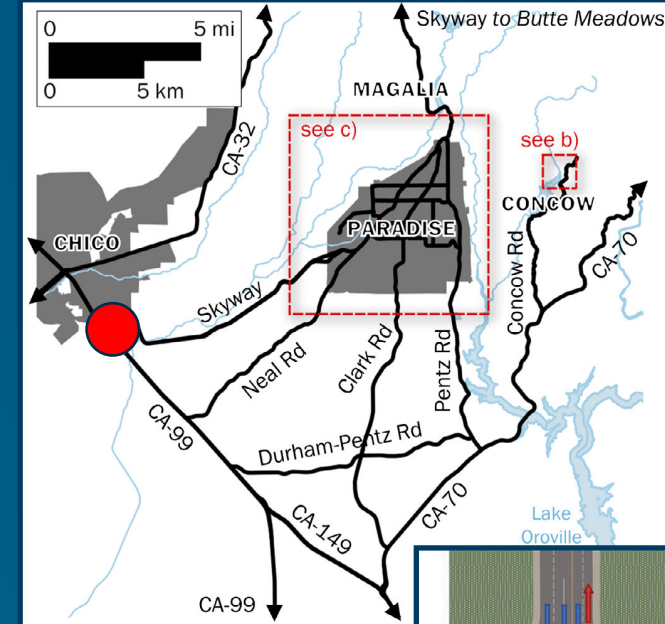
- Spot fires began impacting Paradise at 07:49, 35 minutes after Concow. The fire front arrived approximately 40 minutes later at around 08:30.
- The fire significantly impacted evacuations along the Pentz Road corridor (eastern Paradise) where multiple burnovers occurred, trapping and endangering dozens of civilians.
- Evacuation notifications caught up with the fire progression, and by 09:00 CodeRED reverse 911 evacuation notifications were sent to the public ahead of the fire.



# NETTRA Summary

## Paradise (2 of 2)

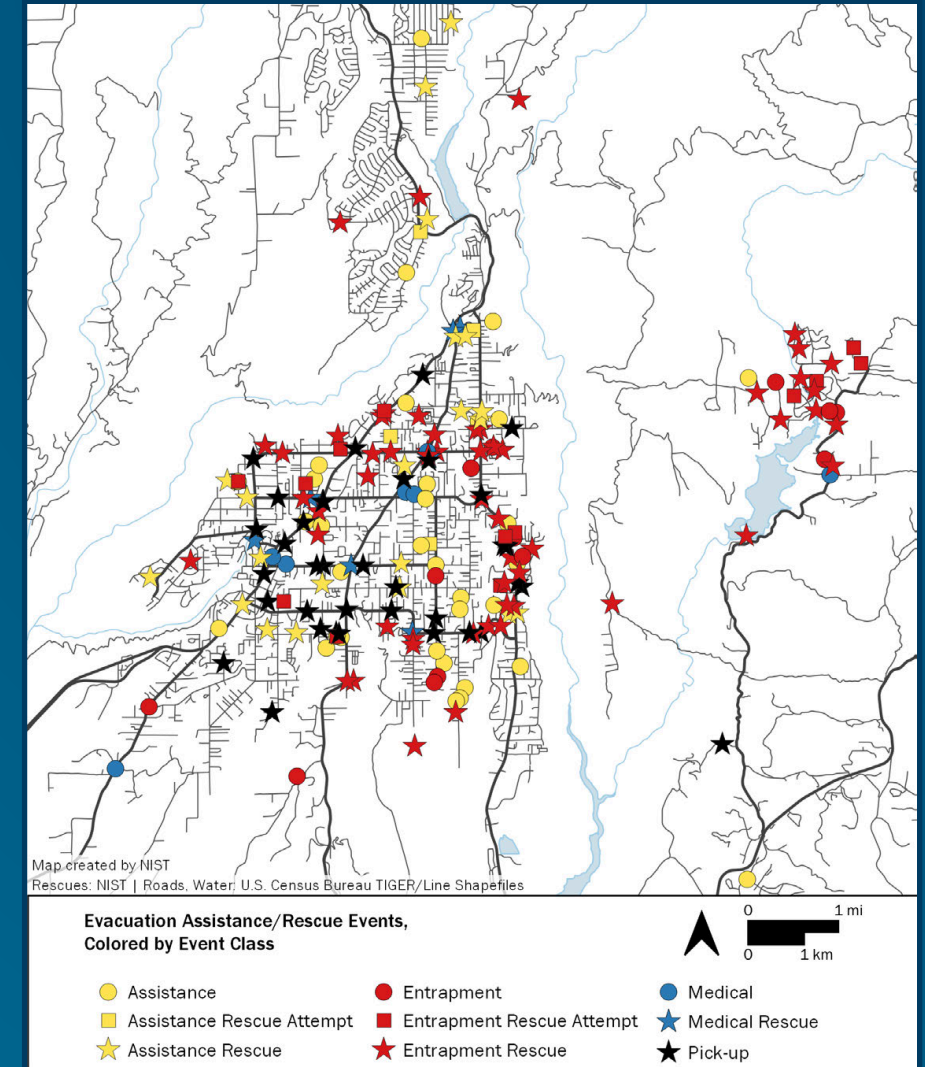
- Traffic was pushed to the west, first to Clark Road then to Skyway as the fire generally progressed southwest.
- Traffic leaving Paradise gridlocked in Chico and the valley, and the backup extended all the way up Skyway into Paradise.
- Traffic management by first responders was used to shuffle vehicles and evacuating civilians away from fire exposures as much as possible.



# NETTRA Summary

## Paradise (3 of 3)

- Rescues and the use of TRAs occurred throughout the morning of November 8 as burnovers entrapped civilians and closed many of the egress arteries.
- Mutual aid responders were instrumental in conducting numerous rescues.
- First responder access was restricted by fire, road closures, and heavy evacuating traffic.
- Most civilians had evacuated by 14:00.





# NETTRA Summary

## *Magalia (1 of 2)*

- The southern extent of Magalia and the Old Magalia neighborhood also experienced fire the morning of November 8.
- The closure of Skyway through Paradise prevented civilians from evacuating using the southern routes after 10:00. Many residents in Magalia felt that the fire was not going to reach their community. The southern evacuation route reopened after 17:30 and was passable with an escort through Paradise.



Photo courtesy of TD-041, 14:12.  
Used with permission.

# NETTRA Summary

## *Magalia (2 of 2)*

- Intense fire pushed deeper into Magalia overnight after fire flared up along Coutolenc Road and progressed north and west.
- The delayed arrival of the fire to parts of Magalia enabled the communication of notification information to the public well ahead of the fire.
- Most civilians had evacuated by that time; however, there were evacuations and rescues into the night and through the morning of November 9.



# Lessons Learned and Paths Forward

**Goal:** Facilitate the use of lessons learned from Camp Fire NETTRA.

➔ Assembled a methodology for small to intermediate sizes intermix communities to help with **Evacuation Sheltering Considerations: Assessment, Planning and Execution (ESCAPE)**.

NIST Technical Note  
 NIST TN XXXX DRAFT  
**WUI Fire Evacuation and Sheltering Considerations**  
*Assessment, Planning, and Execution (ESCAPE)*

Alexander Maranghides  
 Eric D. Link

This publication is available free of charge from:  
<https://doi.org/10.6028/NIST.TN.XXXX>





# Thank You

## Contact Information:

Alexander Maranghides

[alexm@nist.gov](mailto:alexm@nist.gov)

202-567-1634

Eric Link

[eric.link@nist.gov](mailto:eric.link@nist.gov)

Direct link to NETTRA reports:

<https://doi.org/10.6028/NIST.TN.2252>

<https://doi.org/10.6028/NIST.TN.2252sup>

## Camp Fire



<https://www.nist.gov/el/fire-research-division-73300/wildland-urban-interface-fire-73305/nist-investigation-california>

## Hazard Mitigation Methodology (HMM)



<https://www.nist.gov/el/fire-research-division-73300/wildland-urban-interface-fire-73305/hazard-mitigation-methodology>