APPENDIX F

Local Road Safety Plan

LOCAL ROAD SAFETY PLAN

July 21, 2022

Prepared for:

Mark Thomas

MARK THOMAS

Town of Paradise
5555 Skyway
Paradise, CA 95969

Prepared by:

HEADWAY TRANSPORTATION

Headway Transportation, LLC
2240 St. George Lane, Suite 1
Chico, CA 95926

Statutory Notice

23 U.S.C. 409: US Code – Section 409: Discovery and admission as evidence of certain reports and surveys

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway- highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

Table of Contents

Figures

Tables

Appendix

Executive Summary

This *Local Road Safety Plan* (LRSP) for the Town of Paradise is prepared as part of the *Paradise Transportation Master Plan (TMP).* The purpose of an LRSP is to establish the framework and processes for identifying, evaluating, and prioritizing transportation safety improvements on local streets, primarily to reduce the risk of serious injury and fatal crashes.

The LRSP is an update to the 2018 *Paradise Systemic Safety Analysis Final Report (SSAR)*[1] *(Kittelson & Associates, 2018)* to reflect significant changes that have occurred following the 2018 Camp Fire. The 2018 Camp Fire devastated the Town of Paradise and significantly altered the roadway network, traffic volumes, and transportation-related priorities. In addition, the COVID-19 pandemic resulted in shifts to traffic patterns across the country; notably, many municipalities observed reductions in traffic volumes due to restrictions, business and school closures, or operating in a home-based/virtual setting.

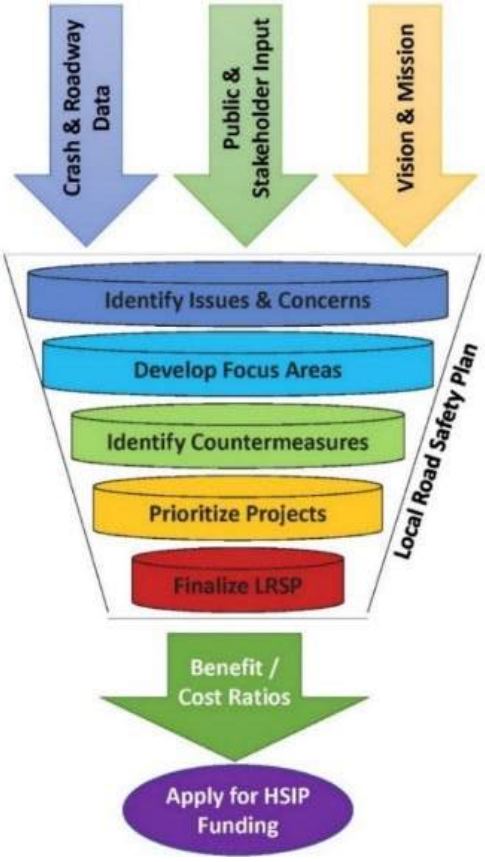


Exhibit 1. A Local Road Safety Plan is developed in partnership with stakeholders to establish a framework for safety improvements on local streets.

The LRSP accomplishes the following objectives:

- Updates the analysis in the *2018 SSAR* with the most recent six (6) years of available crash data: 2015-2020. The crash data analysis is separated by pre- and post-Camp Fire occurrences. Although utilizing five years of data is typical, six years were evaluated to create before and after comparisons and since 2019 and 2020 had very low traffic volumes following the Camp Fire.
- Incorporates new stakeholder collaboration initiatives
- Incorporates new public outreach efforts
- Updates the status and priority of the recommendations in the *2018 SSAR*. This report documents whether the recommendations and proposed projects have been incorporated, are planned to be incorporated, or have shifted in priority.
- Provides updated recommendations and priorities across the 4 E's of traffic safety:
  - Engineering
  - Enforcement
  - Education
  - Emergency Services

[1] The SSAR used crash data from 2012-2016

- Meets the Federal Highway Administration Requirements for an LRSP or equivalent document to apply for the next round of Highway Safety Improvement Program (HSIP) funding.

The key findings in the LRSP are:

- Population in the Town of Paradise, traffic volumes, and crashes decreased following the Camp Fire of 2018. Substantial efforts are underway to plan for and rebuild a more resilient and safer roadway network to encourage economic development and population return. The Town is rebuilding at a steady pace.
- Stakeholder and public priorities have shifted to infrastructure and other transportation-related improvements geared toward safety and efficient evacuation. The public outreach efforts conducted for this LRSP update generated a total of 834 completed surveys.
- There were 966 crashes within the Town of Paradise between 2015 and 2020 with the majority occurring prior to the Camp Fire that began on November 8, 2018.
- Crash trends in the pre-fire data (January 1, 2015 – November 7, 2018) were similar to those identified in the previous *SSAR*.
- Following the Camp Fire, fatal and serious injury crashes have represented a higher percentage of the overall crashes.
- Most crashes have occurred along roadway segments (as opposed to at intersections).
- Many of the recommendations in the *SSAR* are planned to be implemented through HSIP funding awards or are addressed in the *TMP*, *Active Transportation Plan (ATP)*, or the *2020 BCAG Regional Transportation Plan & Sustainable Communities Strategy*.
- Potential opportunities for new engineering projects include:
    - Systemic countermeasures along key roadways – Skyway, Clark Road, Pentz Road, Pearson Road, Elliott Road, Wagstaff Road (**Tables 11-12**)
    - Systemic countermeasures at signalized intersections (**Tables 13-14**)
    - Systemic pedestrian/bicycle improvements (**Tables 19-20**)
    - Summary (**Table 21)**

The LRSP is intended to be a living document, which will be updated approximately every five years using the most up-to-date crash data to evaluate the performance of implemented countermeasures and re-evaluate and re-prioritize focus areas.

Introduction

The LRSP provides a framework for developing safety improvements on local roads with a goal of reducing fatalities and serious injuries on the local road network. This is achieved through a process of analyzing data, engaging stakeholders and the public, creating focus areas, developing countermeasures and an implementation plan, and identifying funding sources. Identified countermeasures fall under one of the four "E's" of traffic safety which include Engineering, Enforcement, Education, and Emergency Services. Engineering safety projects may be systemic or location specific.

The LRSP is a critical need as local roads are less traveled but tend to have a higher rate of serious injury and fatal crashes. In addition, an LRSP (or equivalent) is required to apply for future HSIP funding cycles.

Following the crash analysis, countermeasures are identified based on the types, frequency, and contributing elements of crashes, with a focus on reducing fatal and serious injury crashes. Identified countermeasures are included in the applicable focus areas (i.e., intersection safety, impaired driving, speeding, etc.) and further categorized based on the "E" which they address. Education and Enforcement strategies are often best implemented with input from community partners and stakeholders. Developing countermeasures across these four areas of traffic safety ensures a plan which improves traffic safety through a variety of approaches. "Emerging Technologies" is considered a new fifth category and was considered in the countermeasure process.

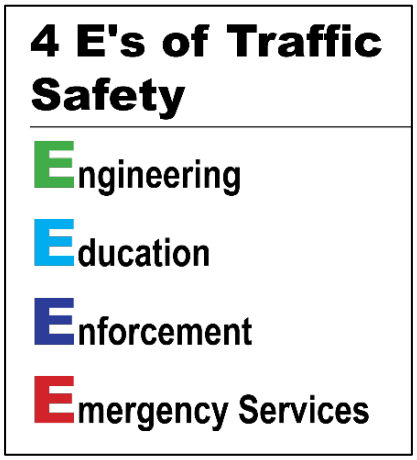


Exhibit 2. Countermeasures are developed across four areas of traffic safety.

Implementation of identified countermeasures typically requires additional grant funding for many agencies. As of 2020, the LRSP will be a required document for any agencies applying for HSIP funding. The HSIP is a federal aid program which requires states to develop comprehensive Statewide Highway Safety Plans (SHSP) focused on reducing fatal and serious injury crashes. The HSIP Grant Program is one of the primary funding mechanisms for roadway safety enhancements across the United States. Each state department of transportation can allocate HSIP funding to local entities for traffic safety projects focused on reducing fatal and serious injury crashes. The California Department of Transportation (Caltrans) will require any agency applying for HSIP funding to first complete an LRSP for funding Cycle 11 and beyond.

This report is an update to the *2018 SSAR* to identify significant changes that have occurred following the 2018 Camp Fire.

This LRSP has been tailored to the needs of the Town of Paradise. The 2018 Camp Fire devastated the Town of Paradise and significantly altered the roadway network, traffic volumes, and transportation-related priorities. Since that event, the population has returned to 35 percent of pre-Fire[2] level. Substantial efforts are underway to

[2] Source: Draft Town of Paradise Commercial Retail Market Analysis (EPS, August 2021)

plan for and rebuild a more resilient and safer roadway network to encourage economic development and population return.

This report updates the analysis in the *2018 SSAR* with the most recent six (6) years of available crash data: 2015-2020; separating the crash data analysis by pre- and post-Camp Fire, to discern how crash patterns have changed, while also recognizing that post-Camp Fire conditions are based on significantly less daily traffic.

Source: FWHA

Exhibit 3. A six-step process is used to develop the LRSP.

Vision and Mission Statement

The vision and mission statements guide the LRSP and ensure that the final recommendations improve safety, while furthering the vision and existing efforts of the Town.

Vision Statement

"The Town of Paradise roadway system is free of major injuries and fatalities and promotes safe mobility through the use of multiple transportation modes."

Mission Statement

"To reduce the number of fatalities and serious injuries occurring on the roadway system for all modes of travel."

Stakeholder Engagement

The stakeholder engagement for the LRSP was conducted as part of the overall *Transportation Master Plan (TMP)* development, anticipated for completion in 2022. The process included collaboration with stakeholders in multiple agencies including:

- Town of Paradise Public Works
- Paradise Police
- California Highway Patrol
- Butte County
- Caltrans

In addition to the primary stakeholders, a multiagency task force was developed to address safety concerns related to evacuation. The group consisted of over 20 agencies with the goal of developing agreements and actions in the case of an emergency.

Stakeholders provided valuable insight into the unique needs and concerns for the Town of Paradise through several meetings and engagement opportunities. Key input from the stakeholders included:

- With high numbers of residents still displaced and less traffic volume on the roadways, traffic safety issues are less noticeable; however, speeding appears to be more evident.
- Safety improvements should focus on creating a more resilient roadway network that would facilitate evacuation needs as well as everyday safety. Examples include improvements such as roadway connections, shoulders and/or multiuse paths that could be used by first responders.
- Multimodal considerations such as bicycle lanes, sidewalks, off-street paths, etc. that contribute to roadway safety are part of the overall vision of the Town.
- Safety improvements that include vertical elements in the roadway (i.e., splitter islands, medians, etc.) that contribute to everyday safety, but can hinder evacuation flow, should be discouraged.

The stakeholders will also be key in implementing countermeasures, measuring outcomes, and updating the plan in the future. The LRSP is intended to be a living document, which will be updated approximately every five years using the most up to date crash data to evaluate the performance of implemented countermeasures and re-evaluate focus areas.

Related Studies

This LRSP has been prepared as part of the overall Town of *Paradise Transportation Master Plan* (TMP) which includes several related reports and technical memorandums. In addition, several roadway projects are in various stages of planning. All related studies, reports, and planned projects will be considered in planning and prioritizing countermeasures in the LRSP.

Related Reports & Documents:

- *2020 BCAG Regional Transportation Plan & Sustainable Communities Strategy*: This report includes planned projects for Butte County, including the Town of Paradise.
- *Active Transportation Plan (ATP)*: This report is anticipated in 2022 as part of the *TMP* and details the existing, planned, and recommended non-vehicular transportation network including bicycle lanes, sidewalks, multiuse paths, pedestrian crosswalks, etc. **Figure 1** shows the preliminary proposed multimodal facilities in the *ATP*.

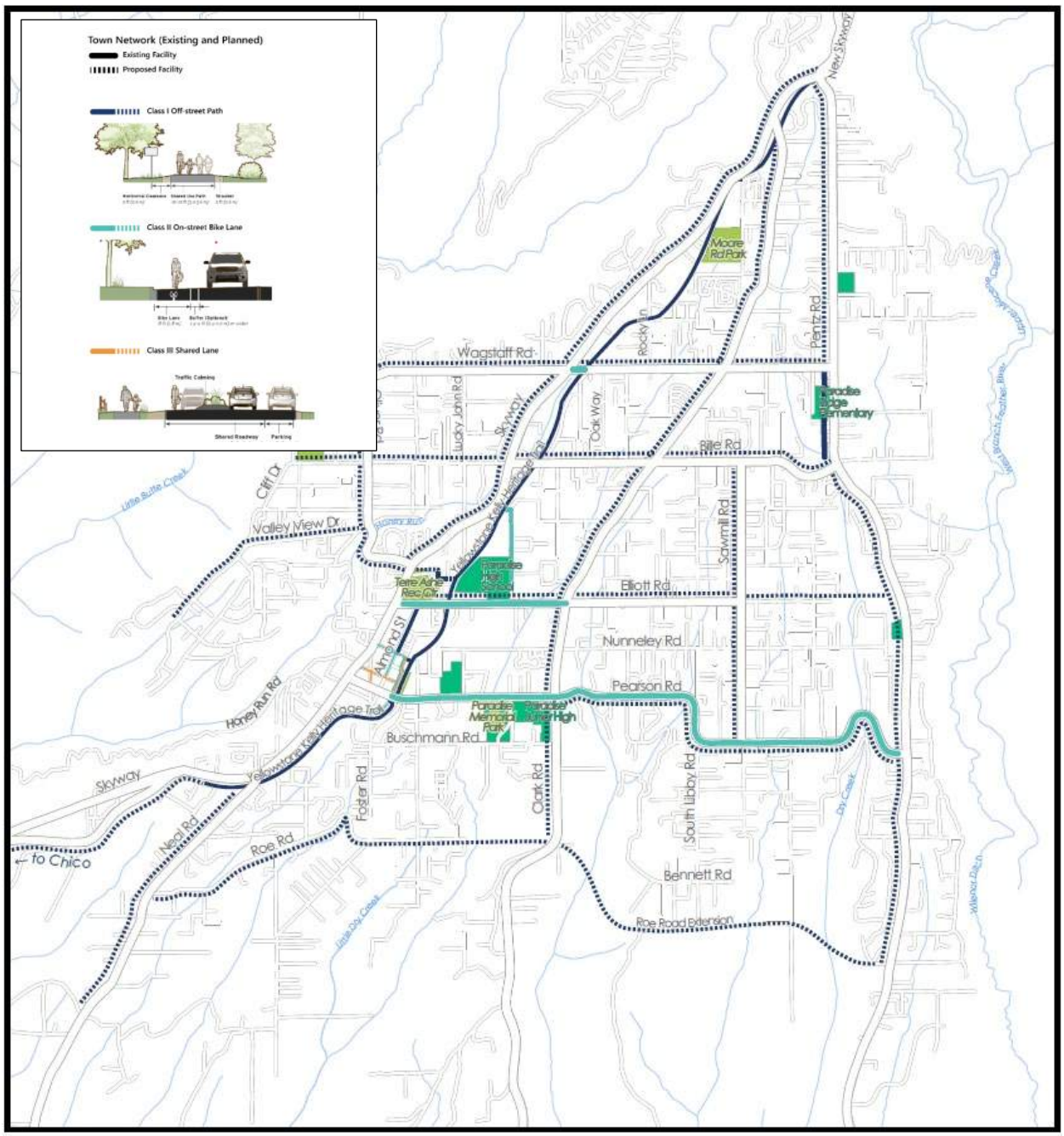


Figure 1. Proposed Multimodal Facilities
Source: Draft ATP, Mark Thomas

- *Roadway Improvement/Circulation Technical Memorandum* and *Evacuation Technical Memorandums*: These reports are anticipated in 2022 as part of the *TMP* and outline recommended improvements to the roadway network and select intersections to address existing and future daily needs and improvements to facilitate an evacuation. **Figure 2** shows the planned recommended improvements, summarized as:

  - Proposed Roadway Widening
    - Widening from 2 lanes to 3 Lanes with a Multiuse Path on:
      - Upper Skyway
      - Upper Clark Road
      - Pentz Road
      - Neal Road
    - Other Widening
      - Clark Road Widening (sub segment between Bille Road and Wagstaff Road)
      - Roe Road Widening (Phase 5 between Neal Road and Scottwood Road)
      - Clark Road Extend Dual Southbound Lanes (south of Pearson Road)
  - Potential New Road/Extension
    - Roe Road Extension (Phases 1-4, Skyway to Neal Road and Scottwood Road to Pentz Road)
    - Sawmill Extension
    - Elliott Road Extension (west of Skyway toward Valley View area)
    - Elliott Road Extension (east of Sawmill to Pentz Road)
    - Forest Service Road Extensions (east and west of Clark Road)
    - Buschmann Road Extensions (west to Skyway and east to Libby Road)
    - Middle Libby Road Extension
    - Bille Road Extension
    - Shay Lane Extension
  - Reconfiguration/ Modification
    - Skyway Capacity Improvements, Pearson Road to Elliott Road
    - Honey Run Road Improvements (20-foot paved roadway with 2-foot shoulders)
    - Toyon Lane (reconstruction)
    - Moore Road (improve to public standards)
  - Intersection Improvements
    - Foster Drive/Black Olive Drive
    - Pearson Road/Pentz Road
    - Skyway/Pentz Road
    - Other intersections improvements as part of roadway extensions
  - Planned new or revised policies
    - Pedestrian Crosswalk Policy
    - Vertical Elements Policy
    - Arterials Policy

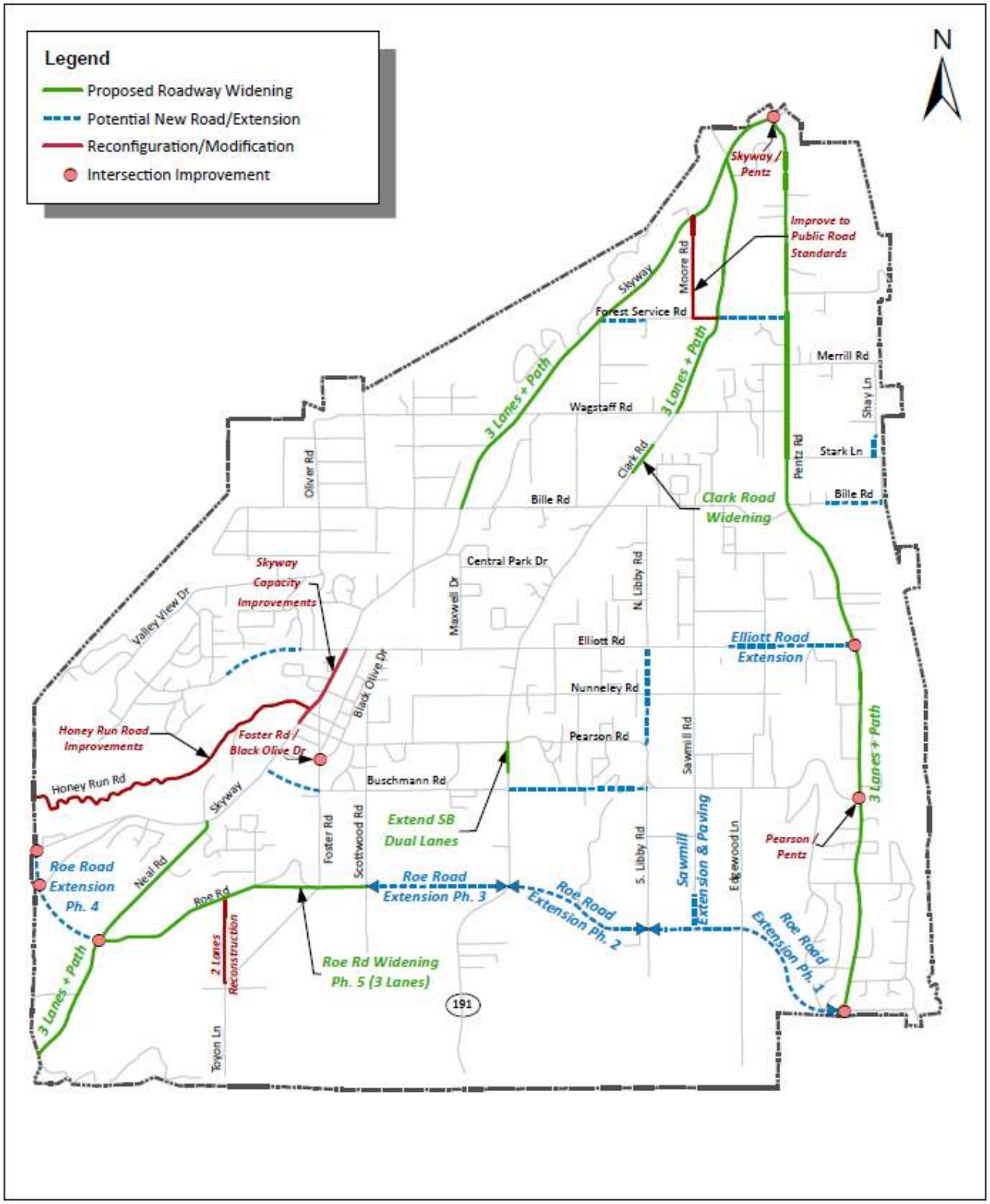


Figure 2. Roadway and Intersection Recommendations

Prior Efforts and Planned Projects

Prior Efforts

The town of Paradise has long been engaged in efforts to improve transportation safety including:

- Prior ATP grants:
  - Class I paths on Pentz Road and a center turn lane between Wagstaff Road and Bille Road
  - Ponderosa Elementary Safe Routes to School Project Active Transportation Education Services (pending project; school now is named Paradise Ridge Elementary School)
- Congestion Mitigation and Air Quality (CMAQ) funded projects:
  - Skyway-Neal Bike Ped Project (CIP 9390)
  - Oliver Curve Pathway Project (CIP 9391)
  - Pentz Pathway Phase II (CIP 9389)

Planned Projects - Almond Street Multi-Modal Improvements and Gap Closure Complex

The project includes downtown improvements, including sidewalks and bikeways on:

- Almond Street
- Foster Road (Pearson Road to Birch Street)
- Birch Street
- Black Olive Drive
- Fir Street
- Elliott Road (Skyway to Almond Street)

Public Outreach

Public Outreach Methods

Public outreach was conducted primarily online due to continuing restrictions from the COVID-19 pandemic and to reach as many residents as possible. The public outreach for the LRSP was conducted with other transportation related topics as part of the *Transportation Master Plan (TMP)* update through a series of Town Hall Meetings. The transportation-focused Town Hall meeting was held via Zoom on June 22, 2021, and included outreach on daily traffic needs, evacuation needs, and roadway safety, as these topics are all-interrelated.

During the presentation, the online public outreach was unveiled, including a virtual survey. The survey was made available to the public for a three-week period from June 22 to July 13, 2021. The survey contained approximately 20 questions including demographics, project prioritization, alternatives for various improvement options for everyday needs and evacuation, etc. The survey included an opportunity for participants to rank their priorities for the following focus areas:

- Walking and Biking
- Unsafe Speeds or Vehicle Movements
- Pavement Conditions
- Sight Distance (vegetation and curves)
- Lighting

Following the Town Hall meeting, the survey was distributed to the public through the following methods:

- Town of Paradise website
- Town of Paradise Facebook page
- "Make it Paradise" Newsletter
- A flyer posted at a local event called "Party in the Park" that included a QR code to allow immediate scanning access to the survey using a smartphone.

Public Outreach Results

The outreach effort produced a total of 843 completed surveys. Additional response details are found in **Appendix A**. A summary of pertinent survey results is presented in **Table 1**.

Table 1. Summary Table of Survey Results

Survey Question		Top Response(s)
What is your primary mode of transportation?		Personal Vehicle - **98.2%**
Which best describes you?		Current resident of Paradise - **56.2%** Planning to return as a resident of Paradise - **17.4%** Former Resident of Paradise - **13.4%** Other - **13.0%**
What is your age range?		51 to 65 - **36.3%** 65+ - **28.6%**
Skyway Design Options		**Option C** - Five Lanes (2 Northbound, 2 Southbound, 1 Center Turn Lane) + Eastside Parking
Should the Town keep or remove the following marked crosswalks on Skyway?	Terry Ashe Park	Keep - **70.9%**
	Lucky John Road	Keep - **64.9%**
Pearson Road Redesign Options		Existing Conditions - No Change
What should be done with Honey Run Road?		Reopen two lanes with minimum $80,000 in safety upgrades on Town portion (new guardrails and more paved turnouts) - **64%**
Top three projects for daily travel needs		**1.** Skyway Capacity Improvements **2**. 3 Lanes + Path on Upper Skyway **3**. 3 Lanes + Path on Pentz Road
Potential New Road Extension for daily travel needs		Elliott Road (Sawmill to Pentz Road) - **18%**
Top Three Ranked Evacuation Improvements		**1**. Increase number of lanes on Skyway downtown **2**. 3 lanes on Upper Skyway, Upper Clark Road, Pentz Road, and Neal Road **3**. Adding roadway connections / connecting dead-end streets
Should the Town implement a policy which discourages future vertical elements on public roads?		Yes - **74.8%**
Keep or Remove median in front of Town Hall?		Remove - **74.7%**
Everyday Safety Focus Areas ranking		**1**. Pavement Conditions **2**. Speeding **3**. Sight distance at intersections **4**. Roadway / Intersection Lighting **5**. Walking / Biking Accommodations

The survey was unique in that over 43 percent of respondents are those not currently living in the Town due to displacement from the Camp Fire. Additionally, priorities have shifted with an emphasis not on daily needs, but centered around improvements to expedite future evacuations. This is evidenced in responses to the question "Please rank your preference of Skyway design options shown above" in which responders preferred cross sections with more travel lanes at the expense of complete street and multimodal elements.

Respondents also favored projects widening two-lane roadway segments to three-lane roads with a multiuse path and roadway extensions; improvements that have benefits for everyday use and in an emergency. The top three projects for daily travel needs include increasing capacity on Skyway and widening Pentz Road and Upper Skyway to three lanes with a multiuse path. Most respondents voted to keep the two crosswalks on Skyway considered for removal (Terry Ashe Park and Lucky John Road).

Even elements geared toward everyday safety, such as "raised" elements (medians, pedestrian refuge islands, splitter islands) were not preferred as these may limit capacity of a roadway or intersection during an evacuation. Nearly 75 percent of responders favored implementing a policy which discouraged vertical elements on public roads. Similarly, approximately 75 percent of responders voted to removed medians on key roadways to provide greater flexibility in traffic evacuations.

The survey asked responders to rank the top safety areas (not related to evacuation) from the list of main themes identified in the *SSAR.* The safety areas were ranked in the following order:

1. Pavement Conditions
2. Speeding
3. Sight distance at intersections
4. Roadway/Intersection Lighting
5. Walking/Biking Accommodations

The survey provided valuable information on the priorities of the local community. Countermeasures were developed considering the preference for improvements identified above and that support evacuation efforts, or at least would not impede an evacuation.

Focus Areas

Based on the previous *SSAR* and new stakeholder input, the following focus areas were identified:

- Intersection Safety
- Distracted Driving
- Pedestrian and Bicycle Safety
- Impaired Driving
- Speeding
- Lane Departures
- Roadway/Intersection Lighting

Crash Data Analysis

Crash data records contain detailed information for each crash including the type of crash, time of day, lighting conditions, alcohol involvement, and other contributing factors. Analyzing all crashes which occurred over several years helps to identify crash patterns and specific areas which may have safety issues.

Methodology

Crash data for the most recent six years (2015-2020) was obtained from the Statewide Integrated Traffic Records System (SWITRS) database and utilized to identify crash trends and high frequency crash intersections and roadway segments. The Camp Fire in November 2018 was a significant event which altered traffic patterns. Immediately following the fire, traffic volumes dropped significantly. As of mid-2021 the population was approximately 35 percent of pre-fire levels. It is therefore expected that pre-Camp Fire and post-Camp Fire crash patterns would be significantly different; therefore, the crash data analysis is separated between pre- and post-Camp Fire occurrences.

The crash data analysis is an update to the analysis conducted in the *SSAR*. Crash data records were evaluated by location (intersection/road segment), crash type, and contributing factors. Analyzing crash data based on these multiple contributing factors helps to gain a more thorough understanding of specific safety issues and crash trends throughout Paradise.

Overall Crashes

Figure 3 shows all crashes (2015-2020) in the Town of Paradise by severity (i.e., fatal, injury, etc.). **Figure 4** shows a heatmap to identify areas of high crash frequency. In total, 966 crashes occurred from 2015-2020.

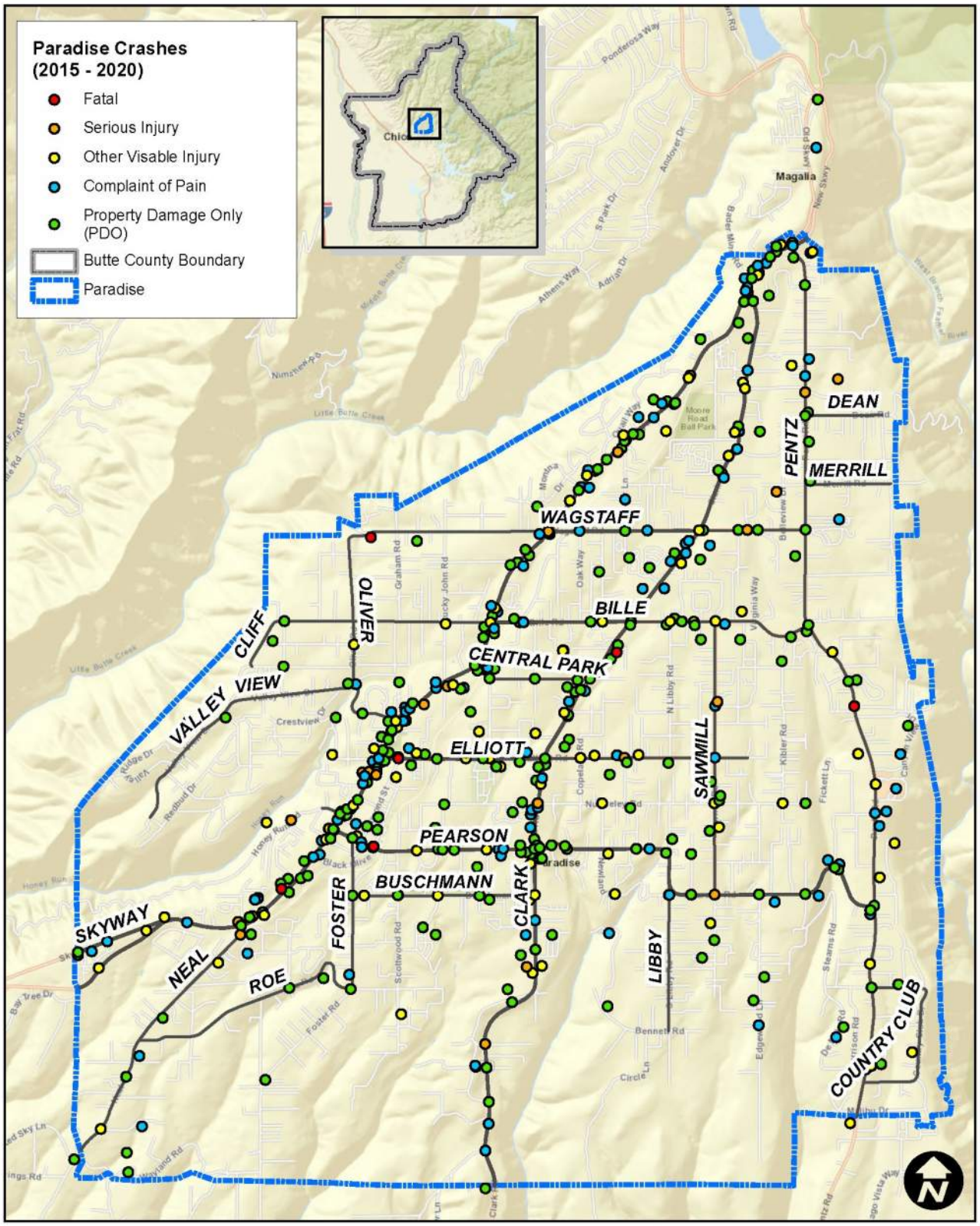


Figure 3. Crashes by Severity

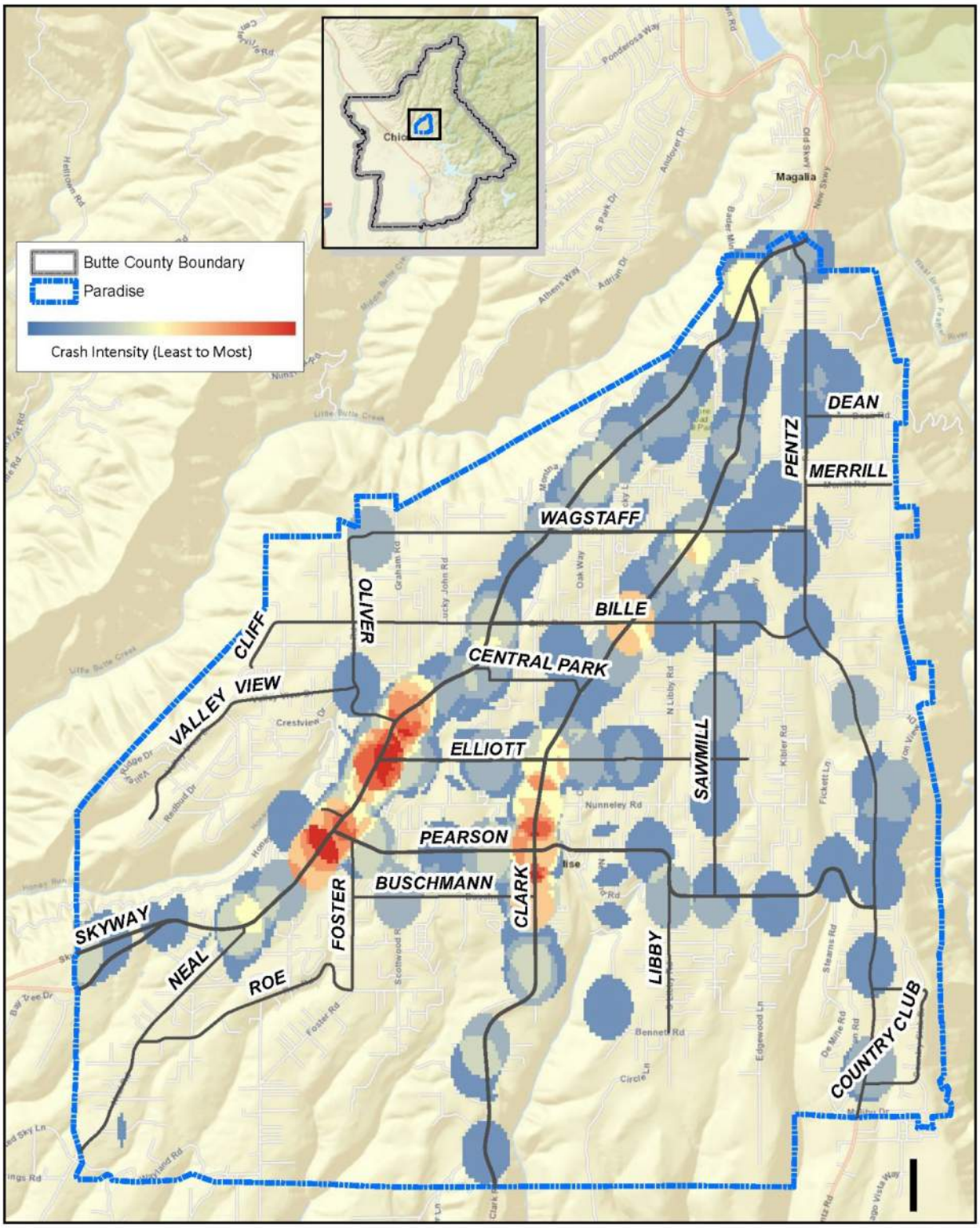
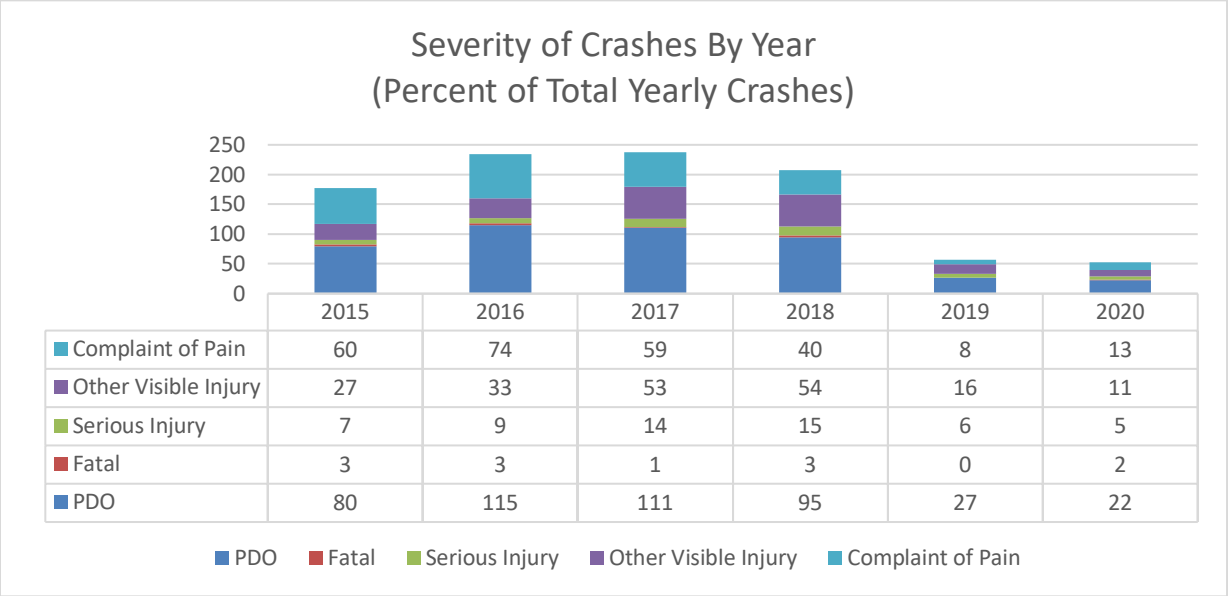


Figure 4. Heatmap of Areas of Crash Frequency

Figures 5-7 show the crashes by year, severity, type, and Primary Collision Factor (PCF).



	2015	2016	2017	2018	2019	2020
Complaint of Pain	60	74	59	40	8	13
Other Visible Injury	27	33	53	54	16	11
Serious Injury	7	9	14	15	6	5
Fatal	3	3	1	3	0	2
PDO	80	115	111	95	27	22

Figure 5. Severity of Crashes by Year

Year 2015 and 2016 data was included in the *SSAR*. The total number of crashes for 2017 was slightly higher (2 percent) than 2016 data. The total number of crashes for 2018 was approximately 10 percent lower than in 2017, which may be due to the reduced traffic volumes following the Camp Fire in November 2018. The sharp decrease in crashes in 2019 and 2020 is attributed to lower daily traffic volumes in the Town following the Camp Fire. Restrictions associated with COVID-19 may have impacted the 2020 crash data as well.

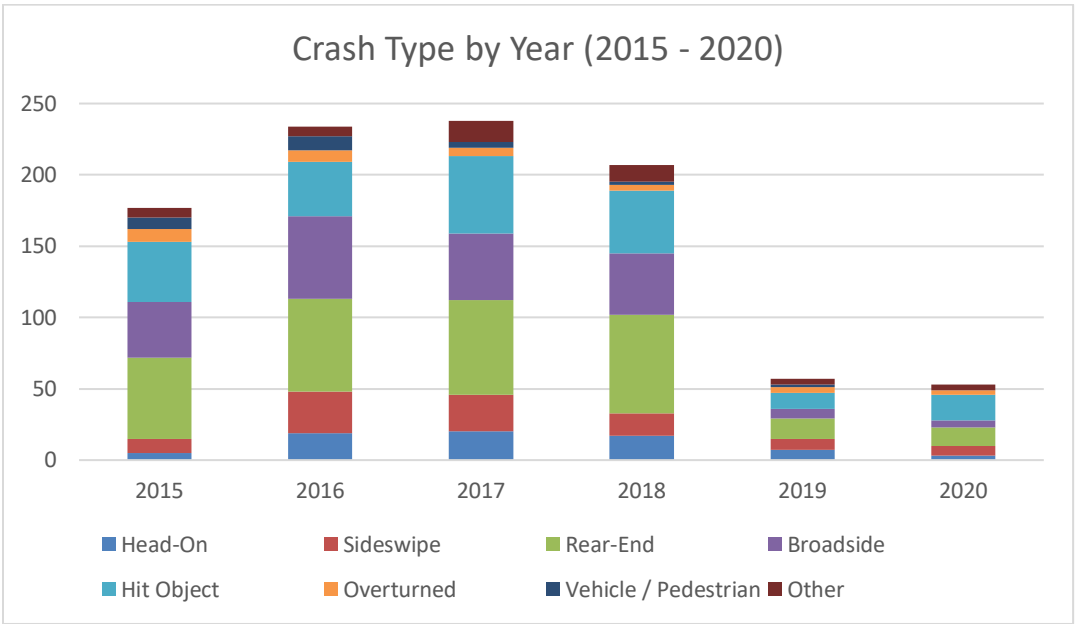


Figure 6. Crash Type by Year (2015-2020)

As shown in **Figure 6**, the most common crash type were rear-end collisions, which is, consistent with the *SSAR*.

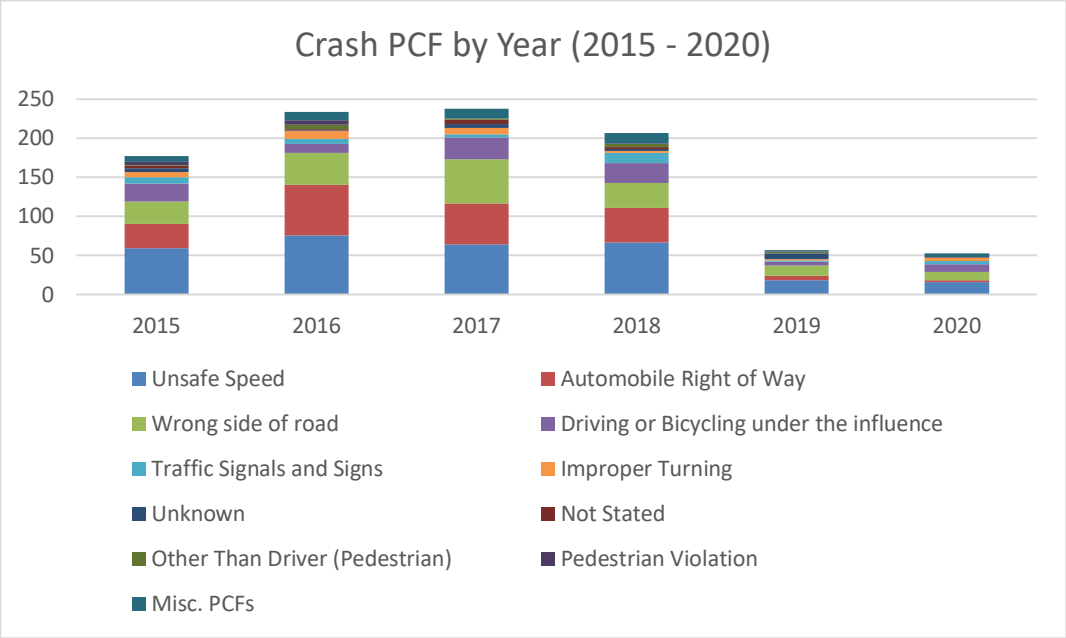


Figure 7. Crash PCF by Year (2015-2020)

As shown in **Figure 7**, the most common PCF was unsafe speed, also consistent with the *SSAR*.

Fatal & Serious Injuries

Figure 8 shows the locations of the serious injury and fatal crashes in the Town of Paradise. The majority occurred along Skyway and Clark Road.

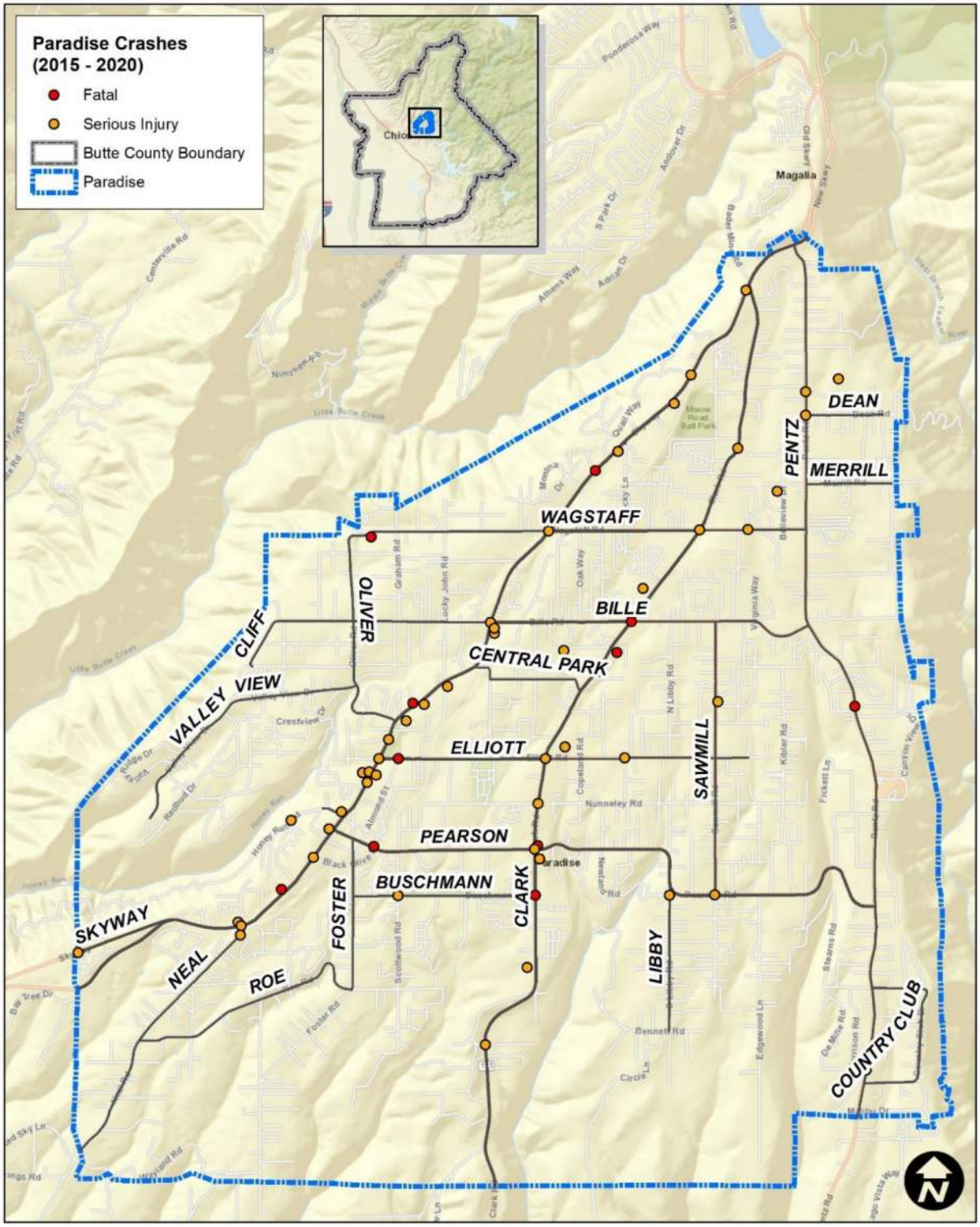


Figure 8. Location of Serious Injury and Fatal Crashes (2015-2020)

Figures 9-10 show the total amount and percentage of fatal and serious injury crashes before and after the Camp Fire.

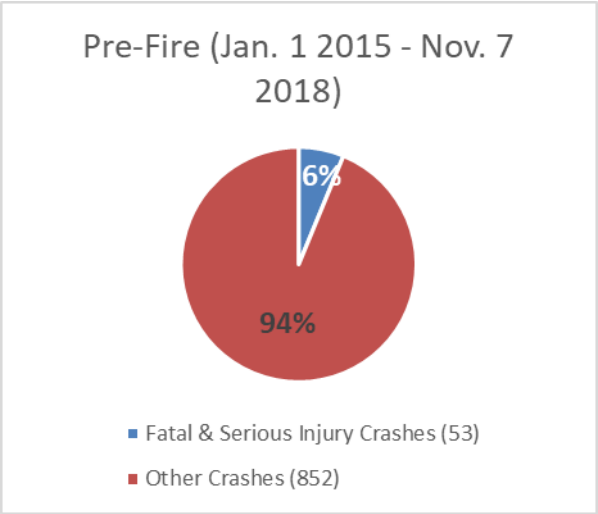


Figure 9. Pre-Fire Crashes

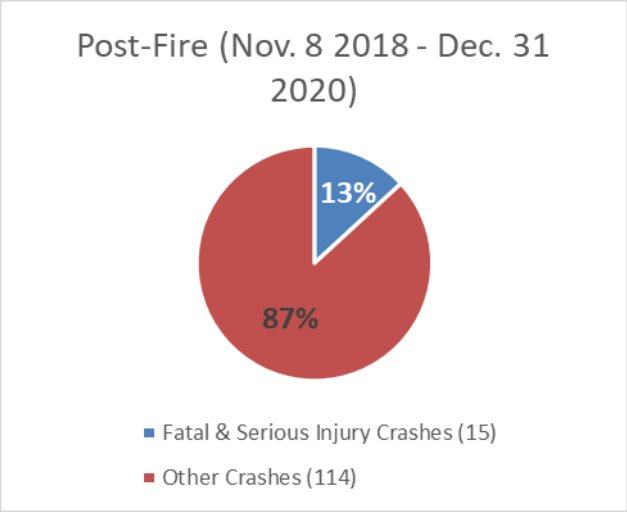


Figure 10. Post-Fire Crashes

The percentage of fatal and serious injury crashes increased from 6 percent of all crashes pre-fire to 13 percent of all crashes post-fire. These values can range from year to year and by area. The values both pre- and post-fire are in the range of noted values in similar jurisdictions of 3 percent to 20 percent. **Figure 11** shows the serious injury and fatal crashes by types, pre- and post-Camp Fire.

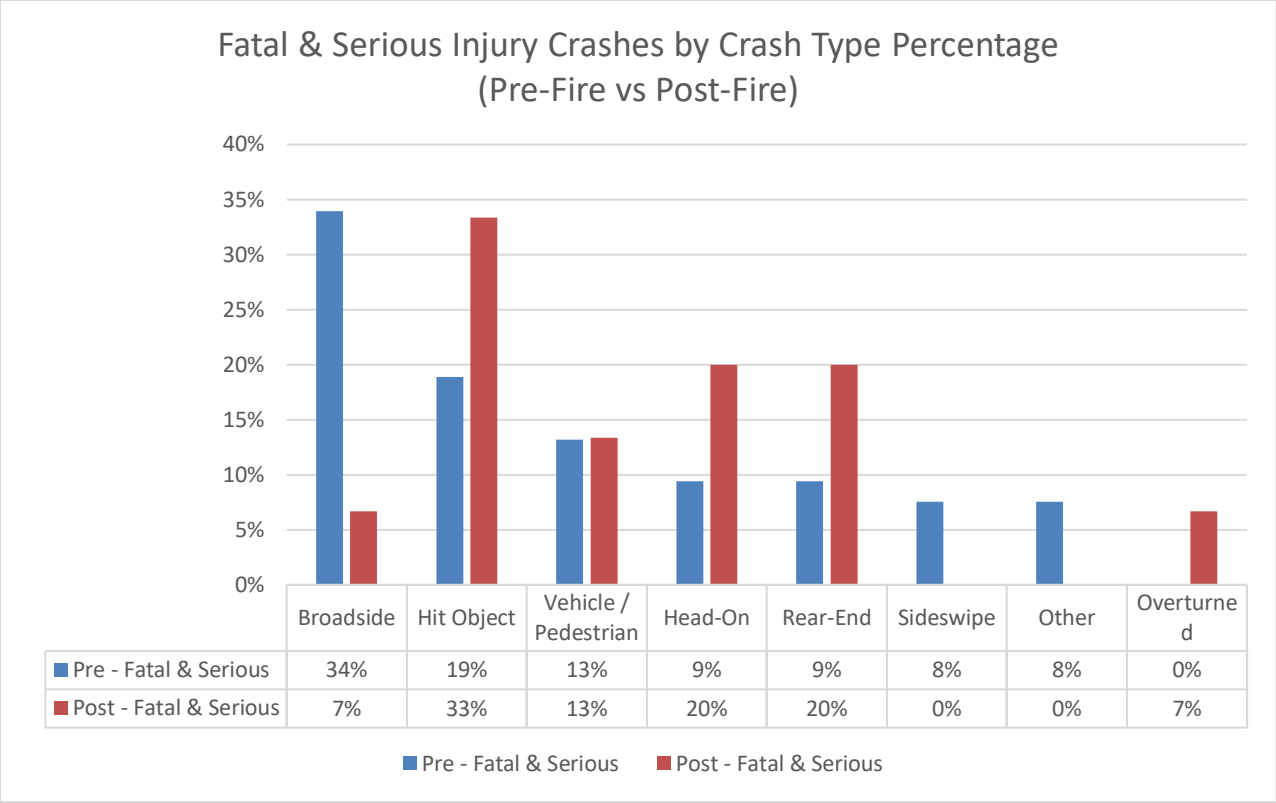


Figure 11. Fatal and Serious Injury Crashes by Crash Type

Before the fire, the leading crash type for fatal and serious injury crashes was Broadside. Following the fire, with fewer vehicles on the road the leading type of fatal and serious injury became Hit Object. Additionally, the percentage of head-on and rear-end crash types increased following the Camp Fire.

Intersection vs Roadway

Figures 12-13 show the breakdown of crashes that occurred on roadway segments and crashes that are attributed to intersections.

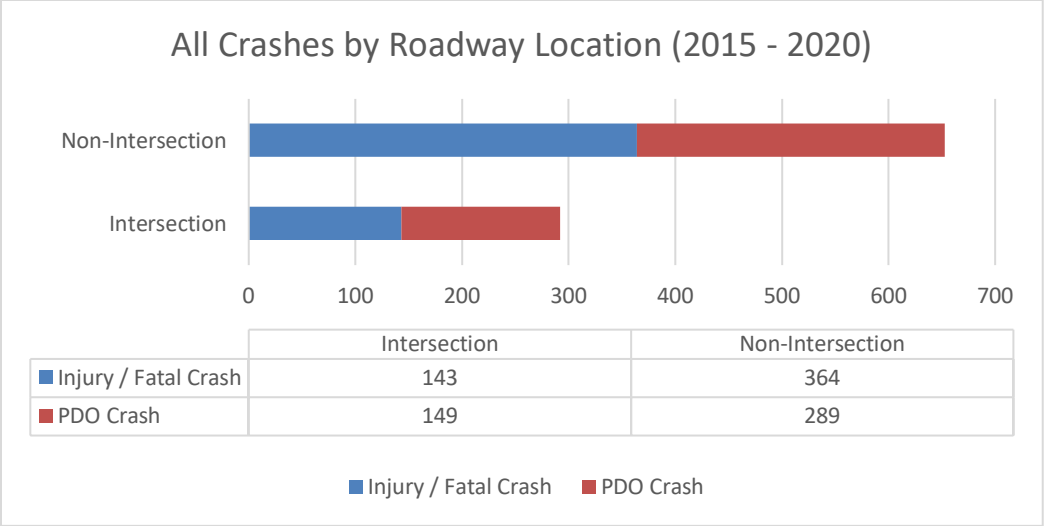


Figure 12. All Crashes by Roadway Location (2015-2020)

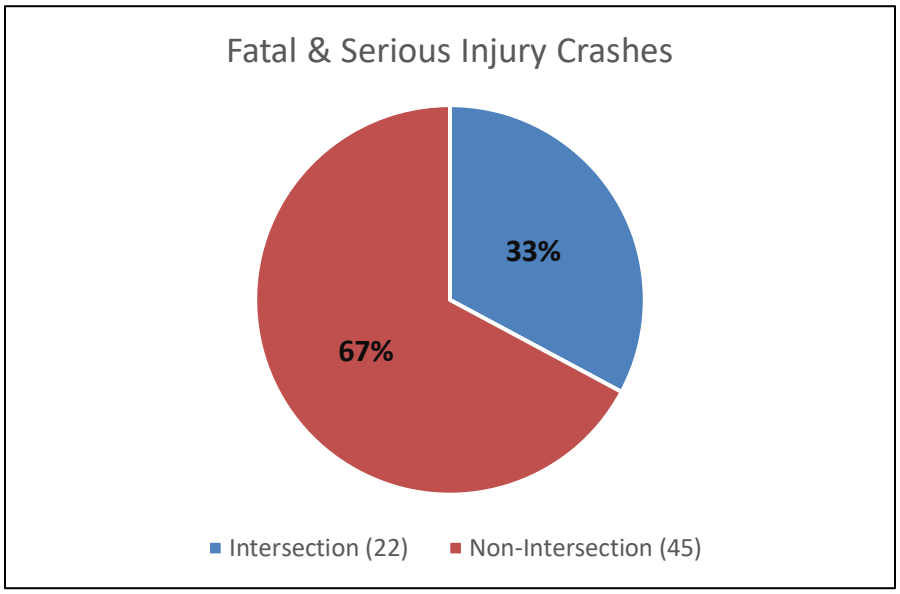


Figure 13. Fatal and Serious Injury Crashes

As shown in **Figures 12** and **13**, most serious injury and fatal crashes occurred on roadway segments.

Roadway Segments

Crashes that occurred along roadway segments (not intersection related) are shown in **Figure 14**.

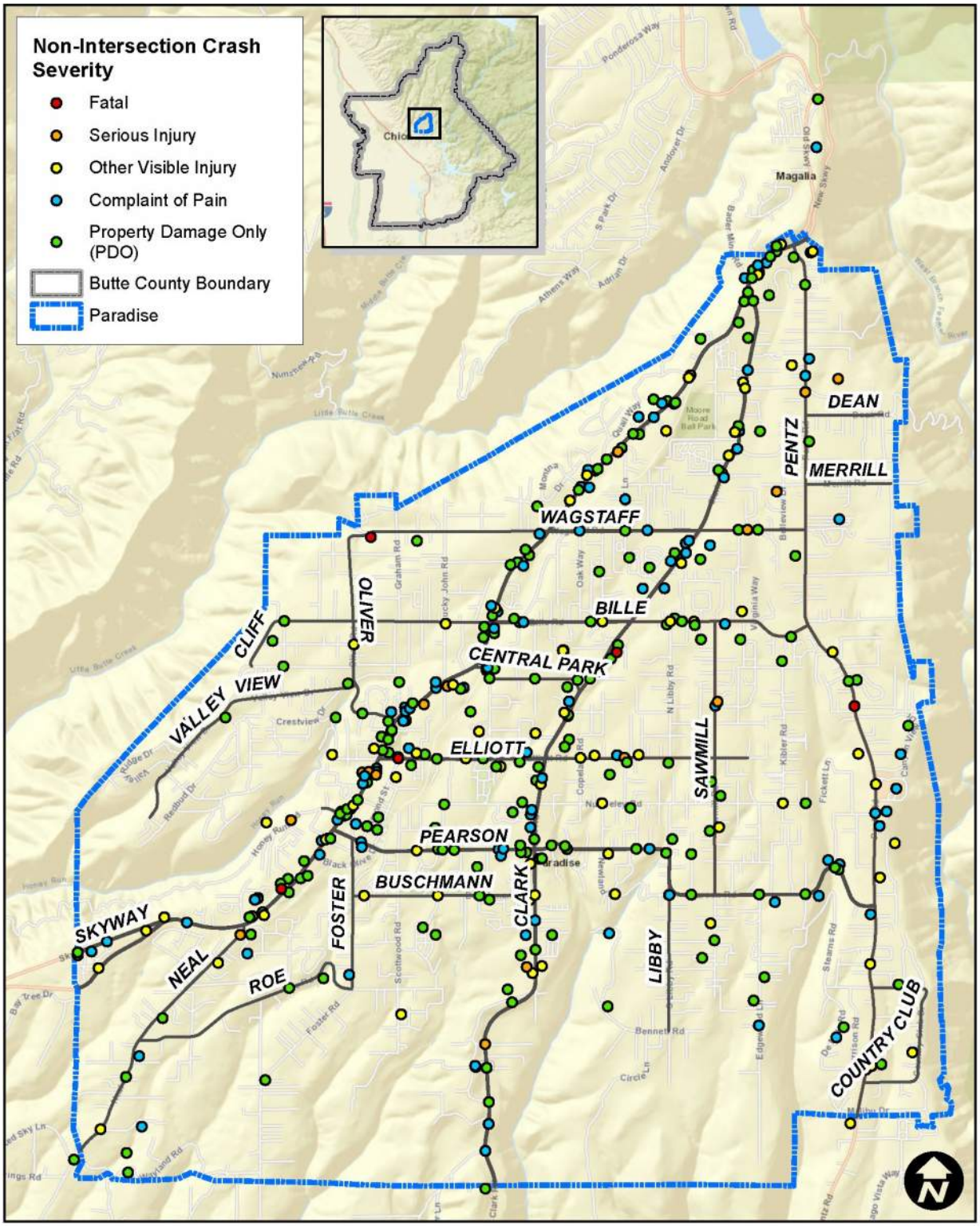


Figure 14. Crashes on Roadway Segments

The roadways in the Town of Paradise that experience the highest number of crashes represent the strongest candidates for safety improvements. Crash data along the highest rated roadway segments (based on number of crashes) was analyzed based on the total number of crashes along the corridor, crash type, and number of crashes per mile. **Table 2** shows the total number of intersections related and non-intersection related crashes. **Table 3** shows the intersection related crashes and **Table 4** shows the non-intersection related crashes.

Table 2. Crashes per Mile (Intersection and Non-Intersection) on Primary Roads by Severity

Roadway	PDO	Fatal	Serious Injury	Other Visible Injury	Complaint of Pain	Total	Segment Length (miles)	Crashes per Mile
SKYWAY	156	3	23	71	92	345	6.7	51.5
CLARK RD	64	4	11	31	62	172	5.4	31.9
PEARSON RD	33	1	1	11	28	74	3.4	21.8
PENTZ RD	21	1	5	17	20	64	4.9	13.1
ELLIOTT RD	19	1	3	11	6	40	2.4	16.7
BILLE RD	19	0	2	8	3	32	2.5	12.8
NEAL RD	9	0	4	4	2	19	1.6	11.9
WAGSTAFF RD	8	1	0	4	5	18	2.3	7.8
OLIVER RD	9	0	0	3	3	15	1.5	10.0
SAWMILL RD	6	0	2	3	3	14	2	7.0

Table 3. Intersection Crashes on Primary Roads by Severity

Roadway	PDO	Fatal	Serious Injury	Other Visible Injury	Complaint of Pain	Grand Total
SKYWAY	49	1	6	23	20	99
CLARK RD	18	2	4	7	16	47
PEARSON RD	9	0	0	3	8	20
ELLIOTT RD	5	0	2	6	5	18
PENTZ RD	8	0	2	3	0	13
BUSCHMANN RD	9	0	0	2	0	11
WAGSTAFF RD	3	0	3	2	1	9
SAWMILL RD	4	0	0	2	2	8
BILLE RD	5	0	0	0	1	6
NUNNELEY RD	2	0	0	1	2	5

Table 4. Non-Intersection Crashes on Primary Roads by Severity

Roadway	PDO	Fatal	Serious Injury	Other Visible Injury	Complaint of Pain	Grand Total	Segment Length (miles)	Crashes per Mile
SKYWAY	107	2	17	48	72	246	6.7	36.7
CLARK RD	46	2	7	24	46	125	5.4	23.1
PEARSON RD	24	1	1	8	20	54	3.4	15.9
PENTZ RD	16	1	3	11	15	46	4.9	9.4
ELLIOTT RD	11	1	1	8	6	27	2.4	11.3
BILLE RD	10	0	2	6	3	21	2.5	8.4
NEAL RD	6	0	1	2	1	10	1.6	6.3
WAGSTAFF RD	4	1	0	2	3	10	2.3	4.3
OLIVER RD	4	0	0	3	2	9	1.5	6.0
SAWMILL RD	4	0	2	2	1	9	2	4.5

The crashes per mile by segments are shown on **Figure 15**, and the segments with the most fatal and serious injury crash segments are shown in **Figure 16**.

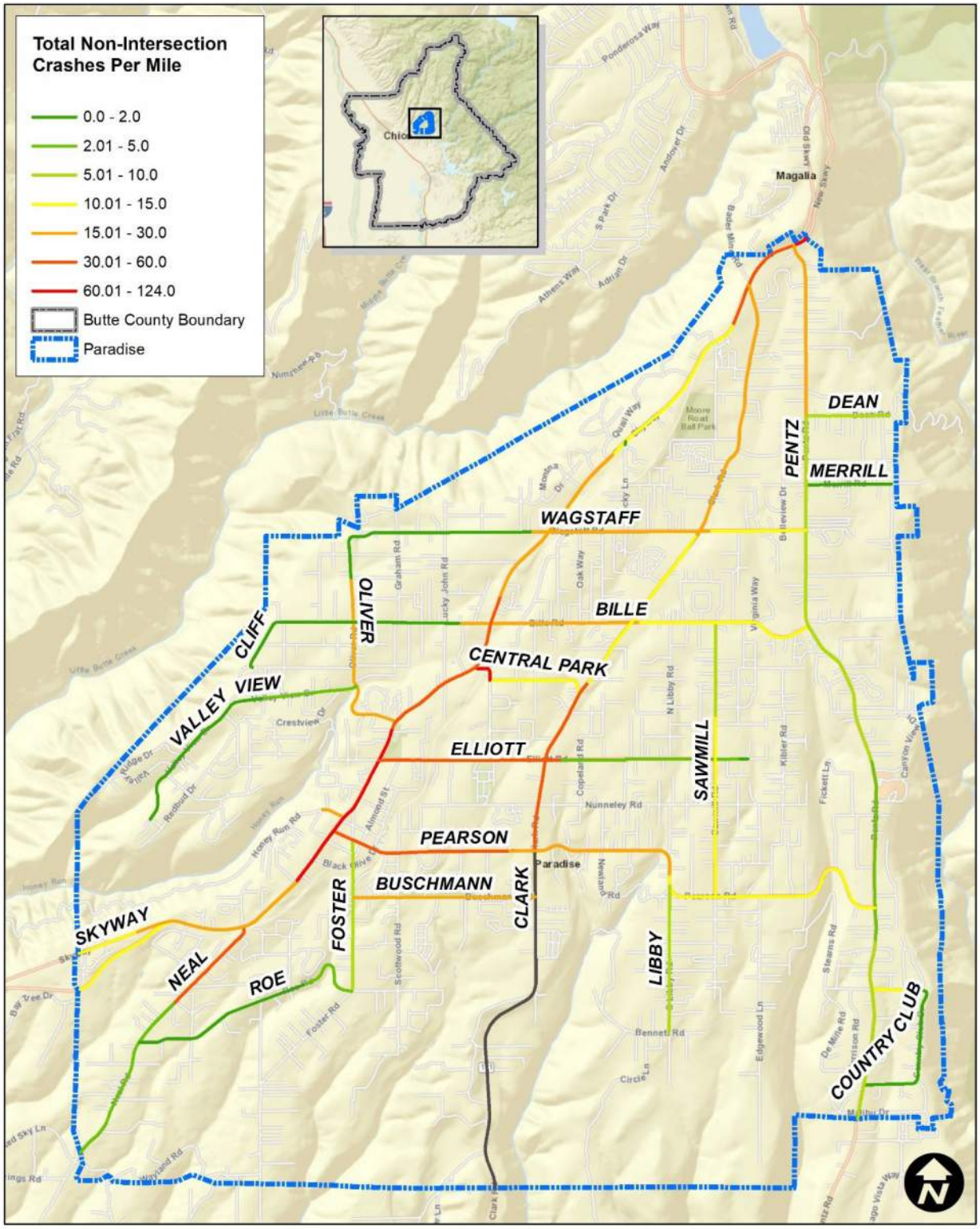


Figure 15. Total Crashes Per Mile (2015-2020)

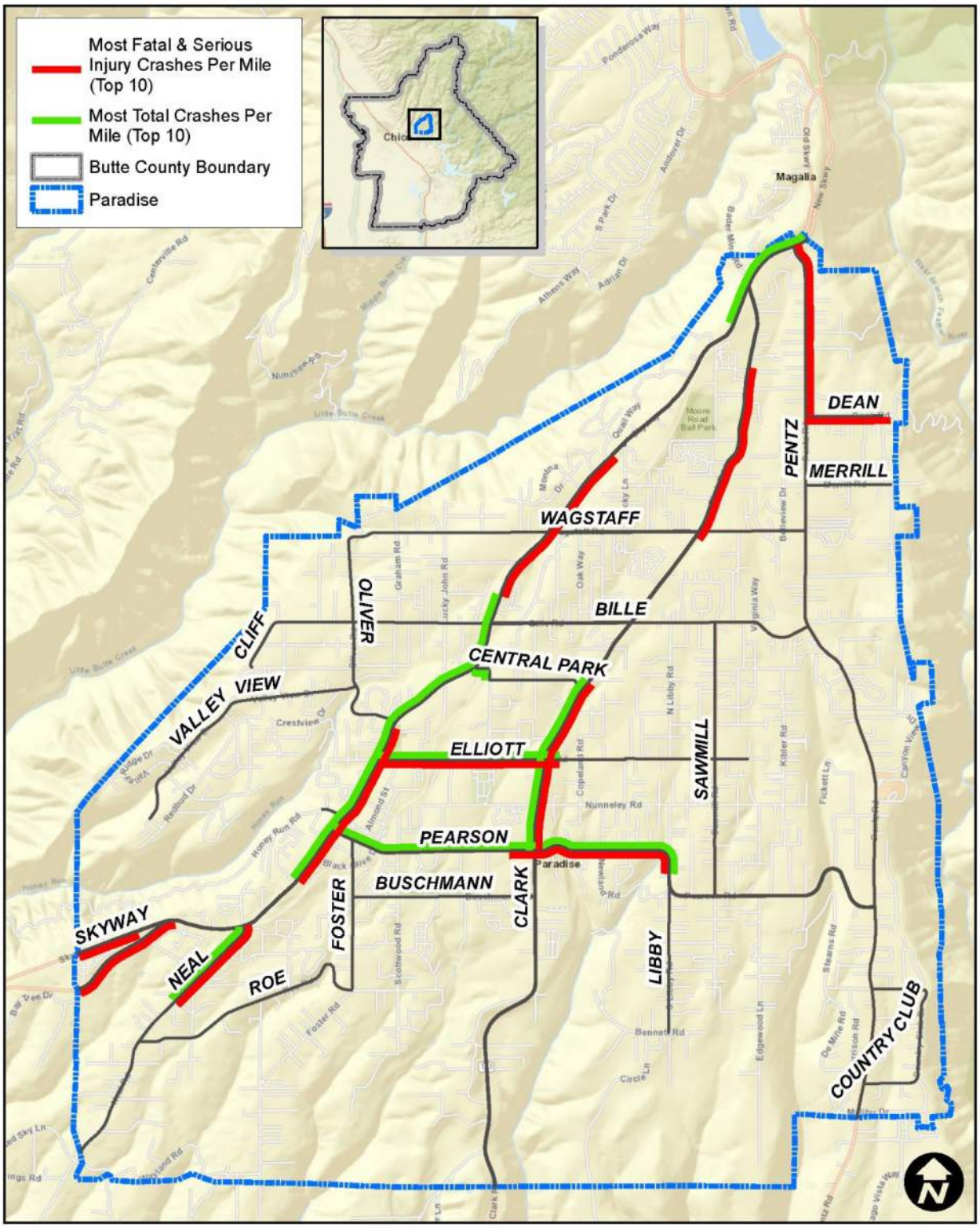


Figure 16. Top Fatal & Serious Injury Crash Segments

As shown in **Tables 2** through **4** and **Figure 16**, Skyway, Clark Road, and Pearson Road had the highest number of crashes from 2015 to 2020. In the *2018 SSAR*, Skyway North, Elliott Road, and Pentz Road were identified as having the highest number of crashes.

The leading Primary Collision Factors (PCF) for crashes along top crash corridors is shown in **Table 5**.

Table 5. Primary Collision Factors on Primary Roadways

Roadway	Unsafe Speed	Wrong Side of Road	Automobile Right of Way	Driving Under the Influence	Traffic Signals and Signs	Improper Turning	Other PCFs	Total
SKYWAY	150	44	82	25	9	14	36	360
CLARK RD	41	30	51	11	12	4	26	175
PEARSON RD	29	9	15	9	3	5	5	75
PENTZ RD	10	21	5	12	1	3	8	60
ELLIOTT RD	18	10	6	3	4	1	6	48
Total Crashes:	**248**	**114**	**159**	**61**	**29**	**27**	**81**	**719**

Crash trends differ from road to road based on the various roadway characteristics, adjacent land-use, and urban context. The leading PCFs for each roadway may help to indicate a leading safety issue on that specific roadway. Nearly half of all crashes on Skyway were due to “Unsafe Speed” which indicates that high speeds are prevalent along Skyway. Additionally, “Driving Under the Influence” was the second most common PCF for crashes on Pentz Road with a total of 20 percent of all crashes. Pentz Road is a main road connecting the Lime Saddle Marina/Memorial Park, a popular weekend recreation destination, and the Town of Paradise which may indicate that this roadway is a strong candidate for increased DUI enforcement.

Top Crash Intersections

The intersections with the highest number of crashes are shown in **Tables 6** and **7**.

Table 6. Number of Crashes at Signalized Intersections

Intersection	Type	Fatal	Serious Injury	Other Injury	PDO	Total
Clark Rd / Pearson Rd	Signal	1	2	9	12	24
Skyway / Black Olive Rd	Signal	0	1	14	6	21
Skyway / Elliott Rd	Signal	0	1	11	9	21
Skyway / Neal Rd	Signal	0	2	3	15	20
Skyway / Pearson Rd	Signal	0	1	8	5	14
Skyway / Wagstaff Rd	Signal	0	1	6	7	14
Clark Rd / Nunneley Rd	Signal	0	1	9	3	13
Skyway / Bille Rd	Signal	0	1	5	7	13
Clark Rd / Elliott Rd	Signal	0	2	7	3	12
Skyway / Clark Rd	Signal	0	1	8	3	12
Bille Rd / Clark Rd	Signal	1	0	3	7	11
Clark Rd / Wagstaff Rd	Signal	0	1	5	4	10
Skyway / Oliver Dr	Signal	0	0	5	5	10
Skyway / Central Park Rd	Signal	0	0	3	4	7
Clark Rd / Central Park Rd	Signal	0	0	2	2	4
Pearson Rd / Black Olive Rd	Signal	1	0	0	3	4
Pearson Rd / Churchill Rd	Signal	0	0	4	0	4
Total:		**3**	**14**	**102**	**95**	**214**

Table 7. Number of Crashes at Unsignalized Intersections

Intersection	Type	Fatal	Serious Injury	Other Injury	PDO	Total
Pearson Rd / Sawmill Rd	All Way STOP	0	1	2	5	8
Bille Rd / Pentz Rd	All Way STOP	0	0	2	4	6
Sawmill Rd / Nunneley Rd	All Way STOP	0	0	2	1	3
Sawmill Rd / Bille Rd	All Way STOP	0	0	2	1	3
Total:		**0**	**1**	**8**	**11**	**20**

Figure 17 shows the crash types at the top intersections.

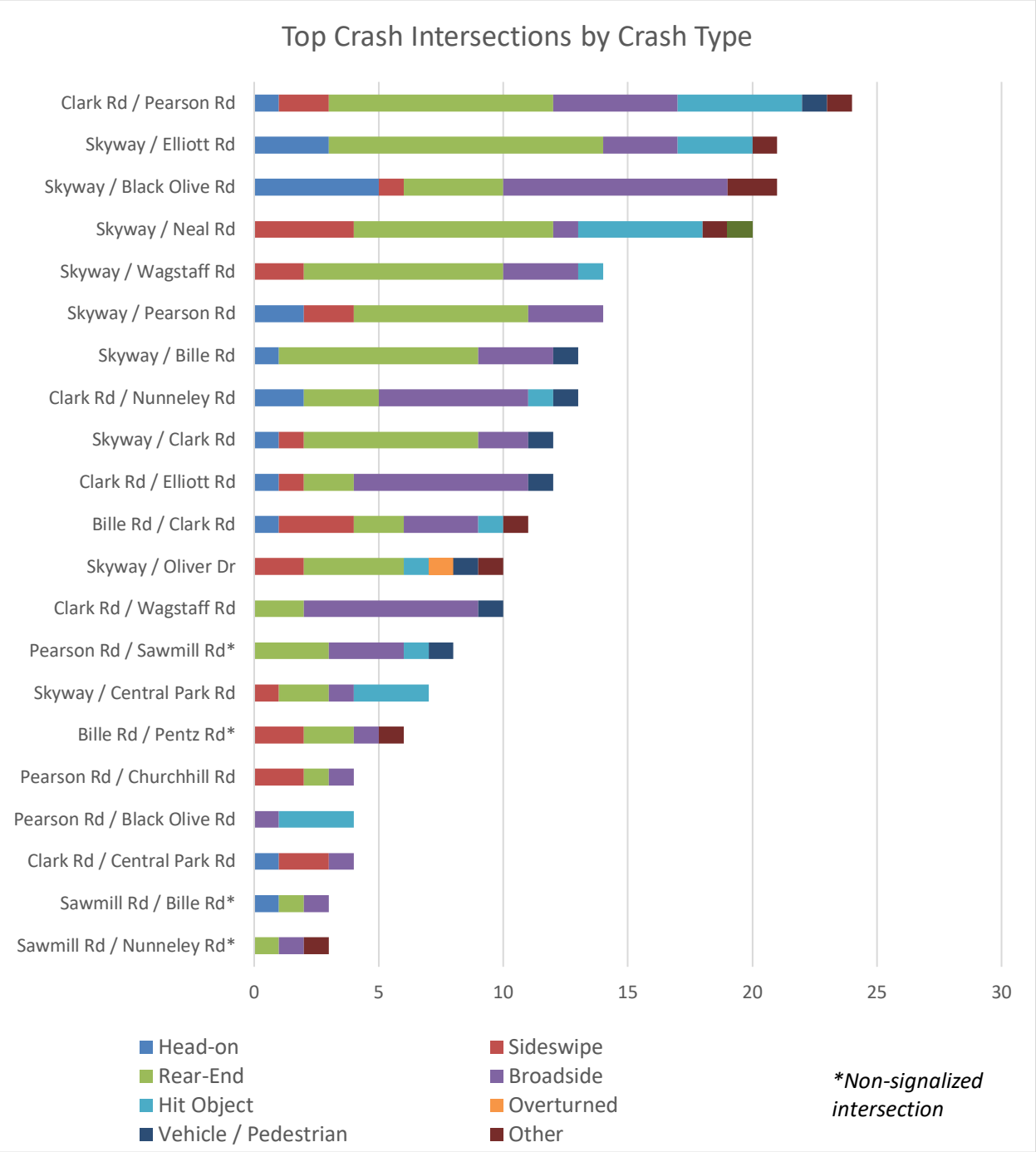


Figure 17. Top Crash Intersections by Crash Type

Pedestrian Crashes

Thirty-two crashes involved a pedestrian, representing three percent of the overall crashes. This is consistent with the findings in the *SSAR*, which indicated that four percent of crashes involved a pedestrian.

The actions of pedestrians immediately prior to a crash help to identify safety trends and overarching safety issues. **Figure 18** shows the pedestrian crash actions. The locations and other identifying information are detailed on **Figure 19**.

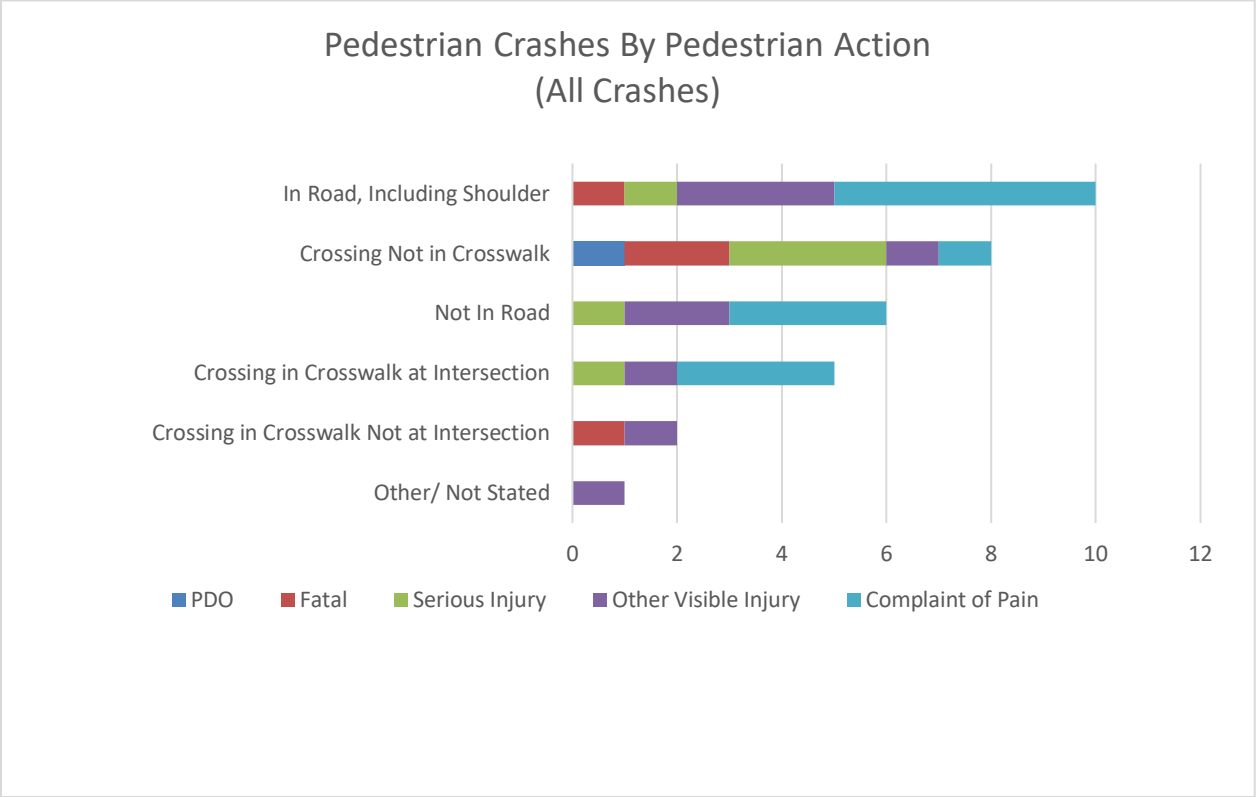


Figure 18. Pedestrian Crashes by Pedestrian Action

Most of these crashes (approximately 90 percent) were pre-fire. Post-Fire, with less population and pedestrian traffic, three pedestrian-related crashes occurred - one *Serious Injury, Crossing Not in Crosswalk*; one *Serious Injury, Not in Road*; and one *Other Visible Injury, In Road, Including Shoulder*.

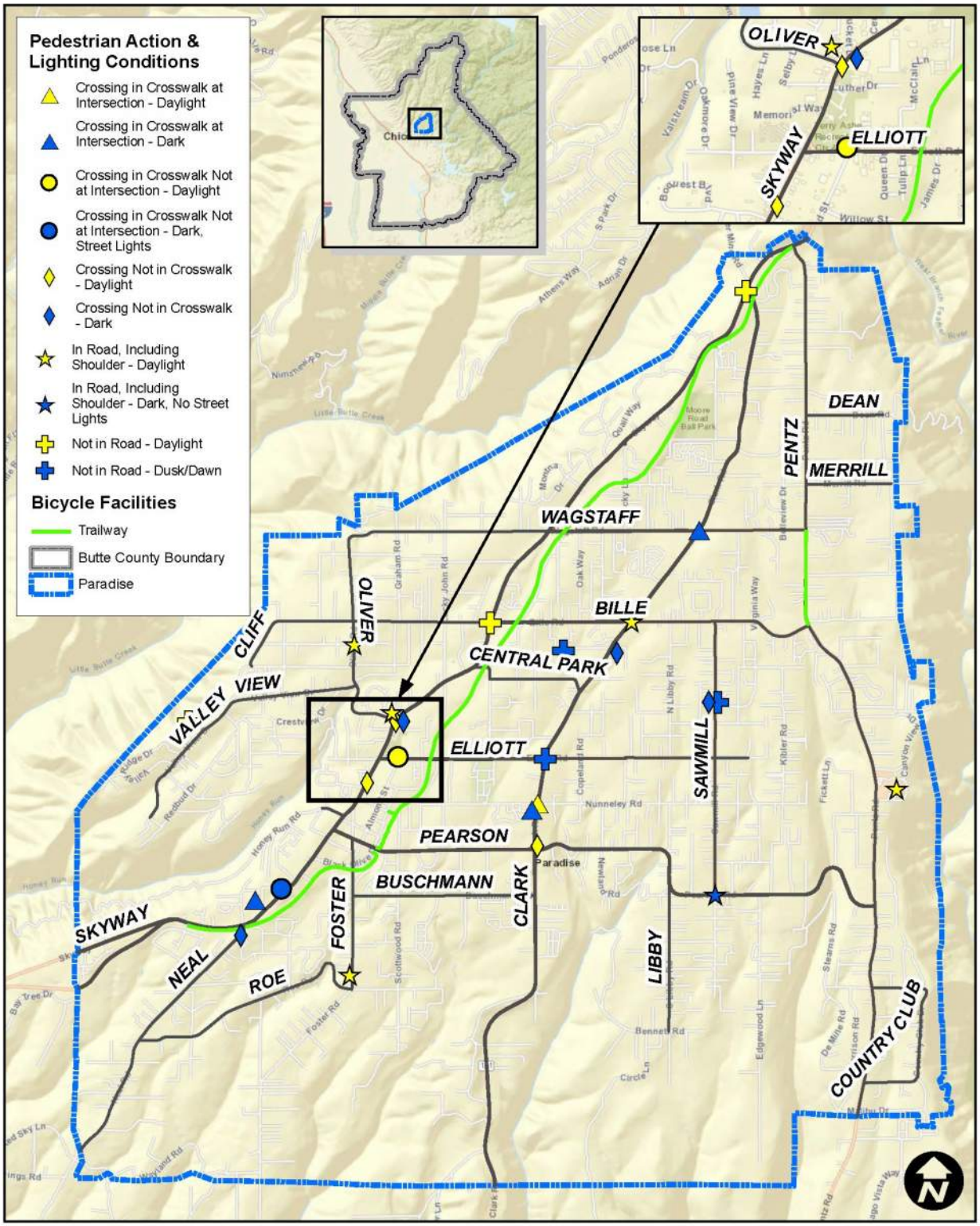


Figure 19. Pedestrian Crashes by Location

Based on the data shown in **Figure 18**, pedestrians involved in a crash were most commonly walking along the shoulder of the road. This is a common condition along roadways where no sidewalk is available. Additionally, half of pedestrian fatalities and serious injuries involved a pedestrian crossing outside of a crosswalk. **Tables 8** and **9** shows the pedestrian crashes on primary roads and at intersections.

Table 8. Pedestrian Crashes on Primary Roads (Includes Intersections)

Roadway	Fatal	Serious Injury	Other Visible Injury	Complaint of Pain	PDO	Total
SKYWAY	1	1	4	3	1	10
CLARK RD	3	1	0	3	0	7
SAWMILL RD	0	2	1	0	0	3
FOSTER RD	0	0	1	1	0	2
WAGSTAFF RD	0	1	1	0	0	2
EDGEWOOD	0	0	0	1	0	1
ELLIOTT RD	0	0	1	0	0	1
NEAL RD	0	1	0	0	0	1
OLIVER RD	0	0	0	1	0	1
PEARSON RD	0	0	0	1	0	1
PENTZ RD	0	0	0	1	0	1
SUNSET DR	0	0	1	0	0	1
VALLEY VIEW DR	0	0	0	1	0	1
Total:	**4**	**6**	**9**	**12**	**1**	**32**

Table 9. Pedestrian Crashes at Intersections

Intersection	Type	Crash Severity	Crash Type	Pedestrian Action	Pre/Post Fire	Primary Collision Factor
Clark Rd / Bille Rd	Signal	Fatal	Broadside	In Road, Including Shoulder	Pre	Automobile Right of Way
Clark Rd / Clark Rd 6701	Commercial Driveway	Serious Injury	Vehicle / Pedestrian	Not in Road potentially movie theater parking lot)	Post	Unsafe Speed
Skyway / Wildwood Ln	Side-Street STOP	Serious Injury	Vehicle / Pedestrian	Crossing, Not in Crosswalk	Post	Pedestrian Violation
Wagstaff Rd / Clark Rd	Signal	Other Injury	Vehicle / Pedestrian	Crossing in Crosswalk at Intersection	Pre	Pedestrian Violation
Sunset Rd / Oliver Rd	Side-Street STOP	Other Injury	Sideswipe	In Road, Including Shoulder	Post	Unknown
Clark Rd / Nunneley Rd	Signal	Other Injury	Vehicle / Pedestrian	Crossing in Crosswalk at Intersection	Pre	Unknown

The pedestrian crashes at intersections and the traffic control are shown on **Figure 20**.

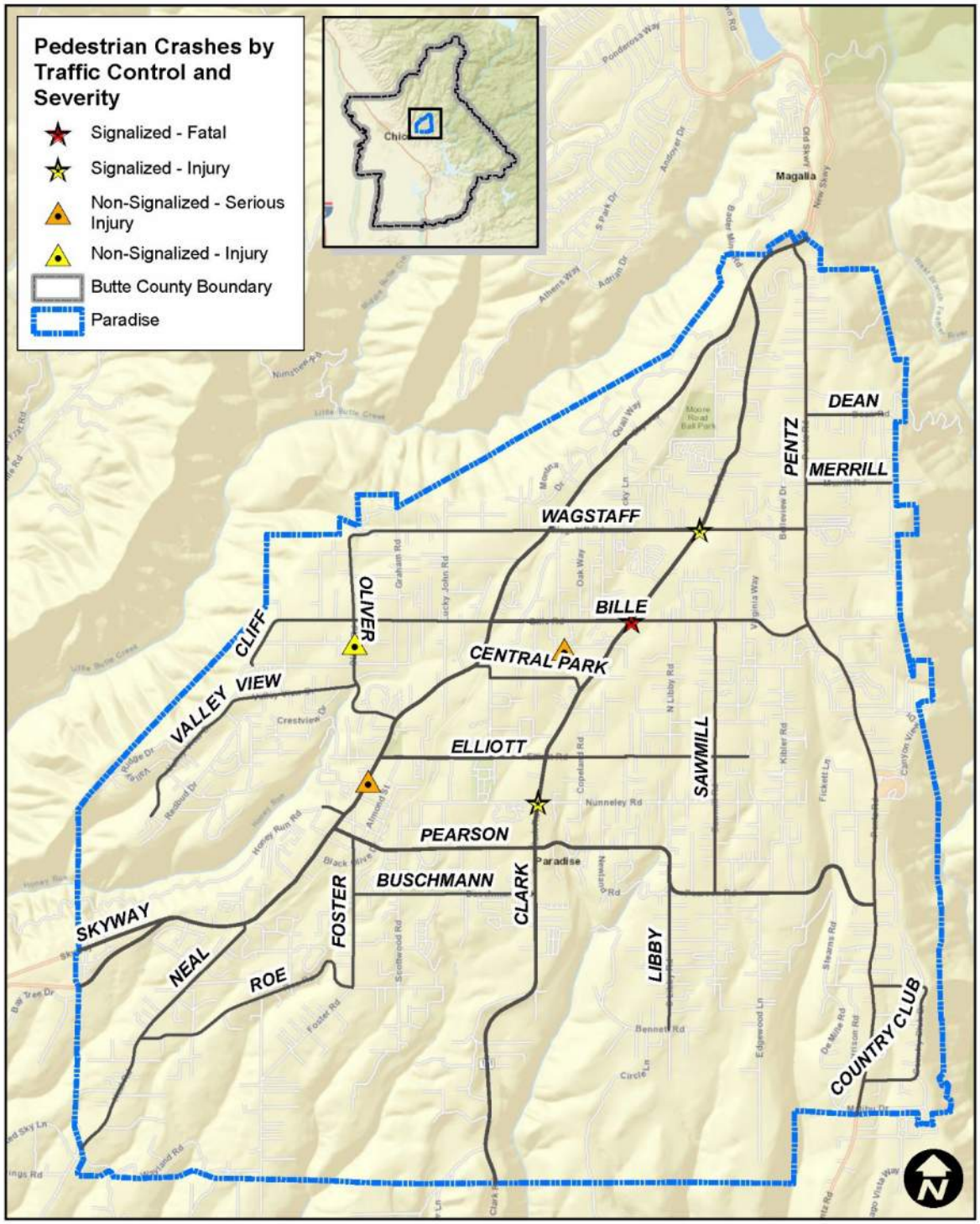


Figure 20. Pedestrian Crashes at Intersections by Location

Bicycle Crashes

Bicyclists represent a vulnerable roadway user type which often mixes with vehicle traffic for long stretches of roadway. **Table 10** shows the bicycle collisions.

Table 10. Bicycle Collisions by Corridor and Primary Collision Factor

Road Segments	Wrong Side of Road	Automobile Right of Way	Unsafe Speed	Traffic Signals and Signs	Other PCFs	Total
Skyway	3	1	2	1	4	11
Elliott Rd	3	0	0	1	1	5
Bille Rd	1	1	1	1	0	4
Clark Rd	1	1	0	0	1	3
Pentz Rd	0	0	2	0	0	2
Bike Path	0	1	0	0	0	1
College Hill Rd	0	0	0	0	1	1
Edgewood Ln	0	1	0	0	0	1
Maxwell Dr	1	0	0	0	0	1
Newland Rd	0	1	0	0	0	1
Nunneley Rd	0	0	0	0	1	1
Pearson Rd	0	1	0	0	0	1
Total:	**9**	**7**	**5**	**3**	**8**	**32**

Nearly one third of the total crashes occurred on Skyway. The leading PCF for bicycle-involved crashes was “Wrong Side of Road”.

Figure 21 shows the locations of bicycle-involved crashes, as well as existing bicycle facilities (i.e., bicycle lanes, trailways, etc.).

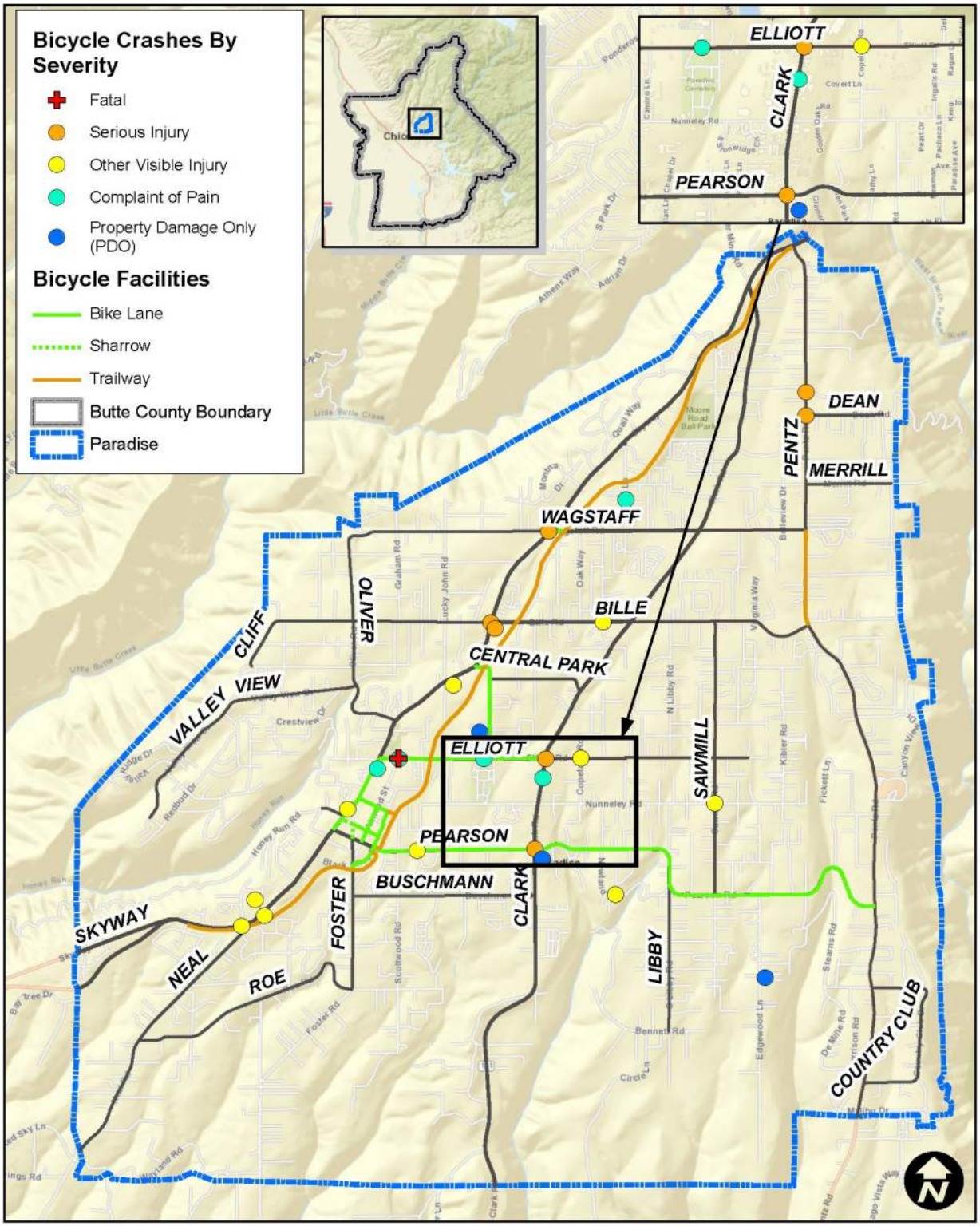


Figure 21. Location of Bicycle Involved Crashes

Lighting

The lighting conditions for fatal and serious injury crashes are shown in **Figure 22**.

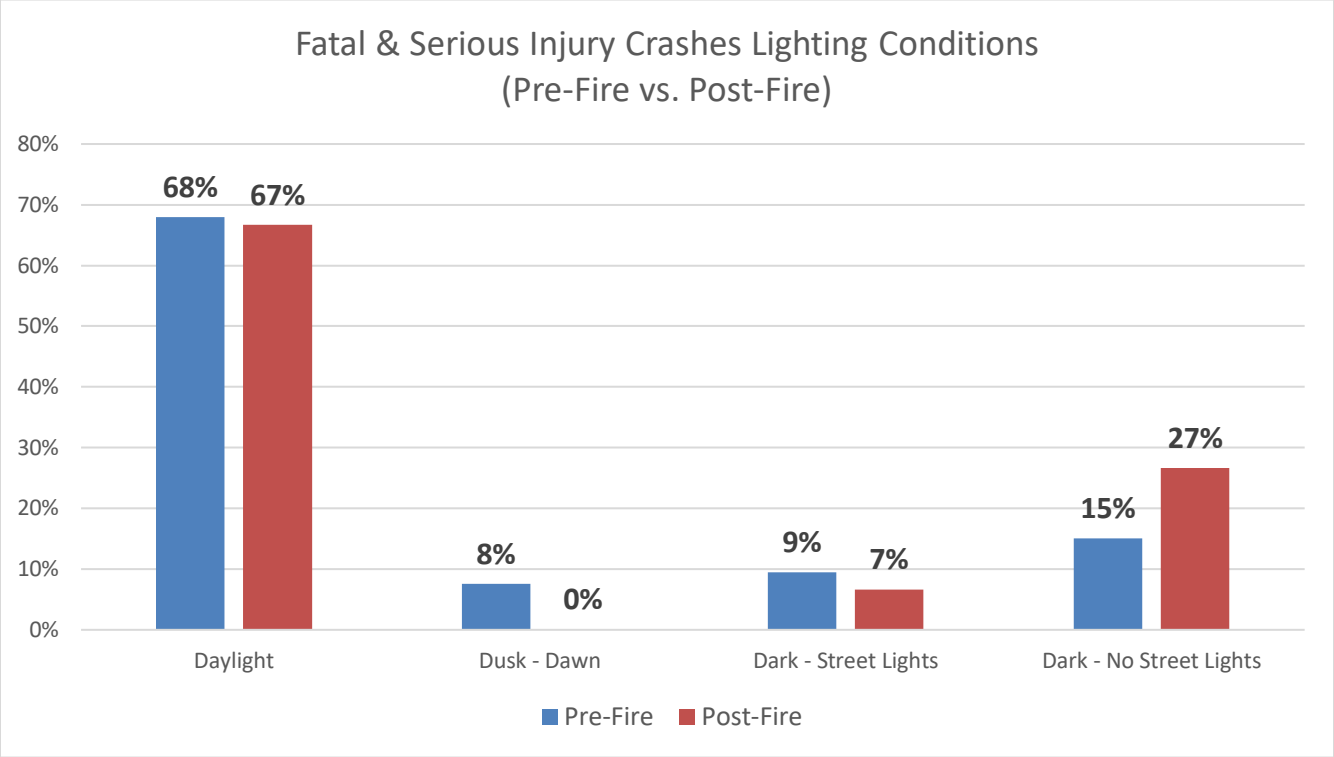


Figure 22. Fatal and Serious Injury Crashes Lighting Conditions

The percentage of fatal and serious injury crashes with "Dark – No Street Light" lighting conditions nearly doubled following the Camp Fire. This may partially be due to damaged streetlighting following the Camp Fire. Infrastructure project data indicates 30 locations had been prioritized to replace damaged street lighting.

Figure 23 shows all dark conditions crashes by severity, and **Figure 24** shows the dark conditions intersection crashes by severity and traffic control.

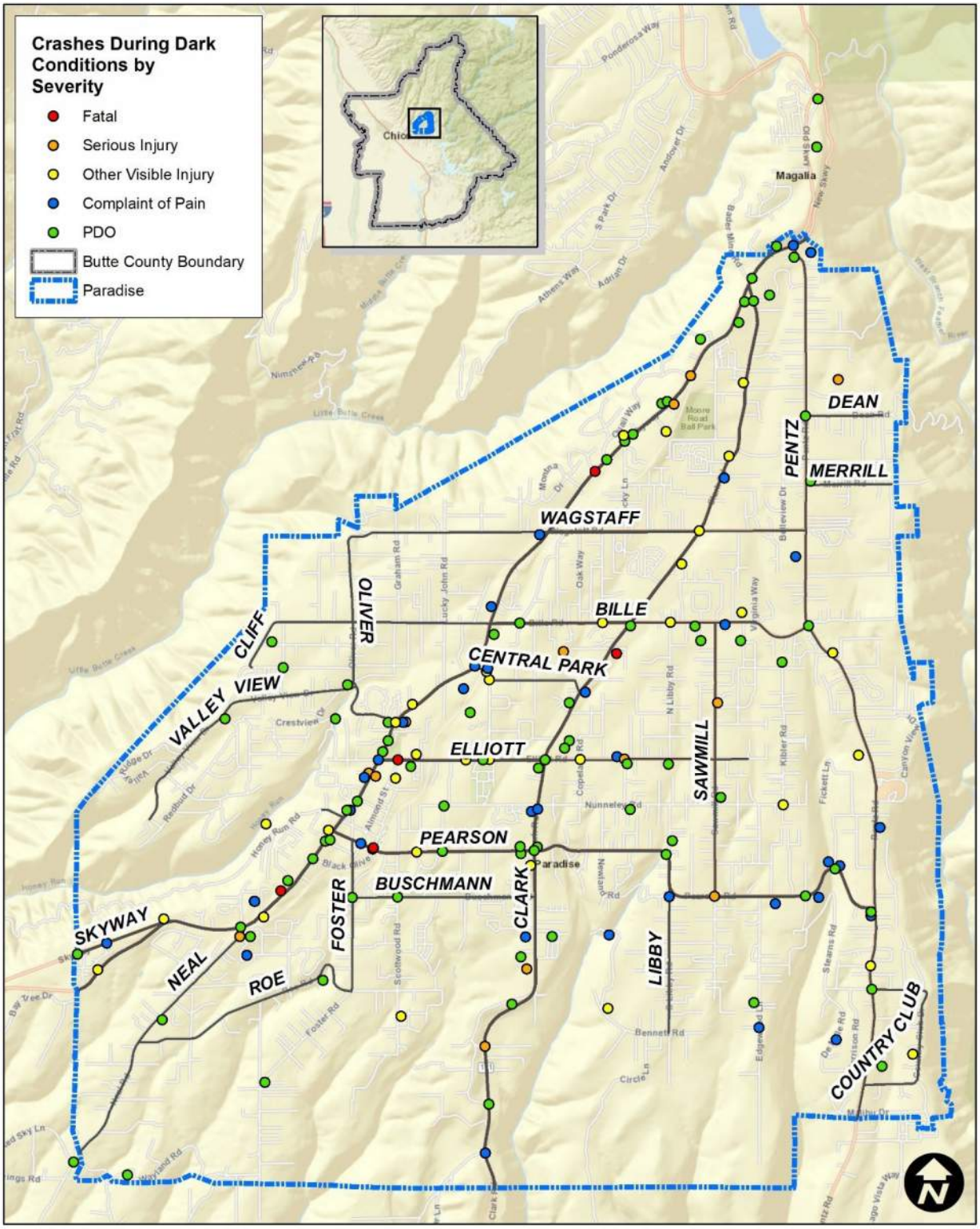


Figure 23. Dark Conditions Crashes by Severity

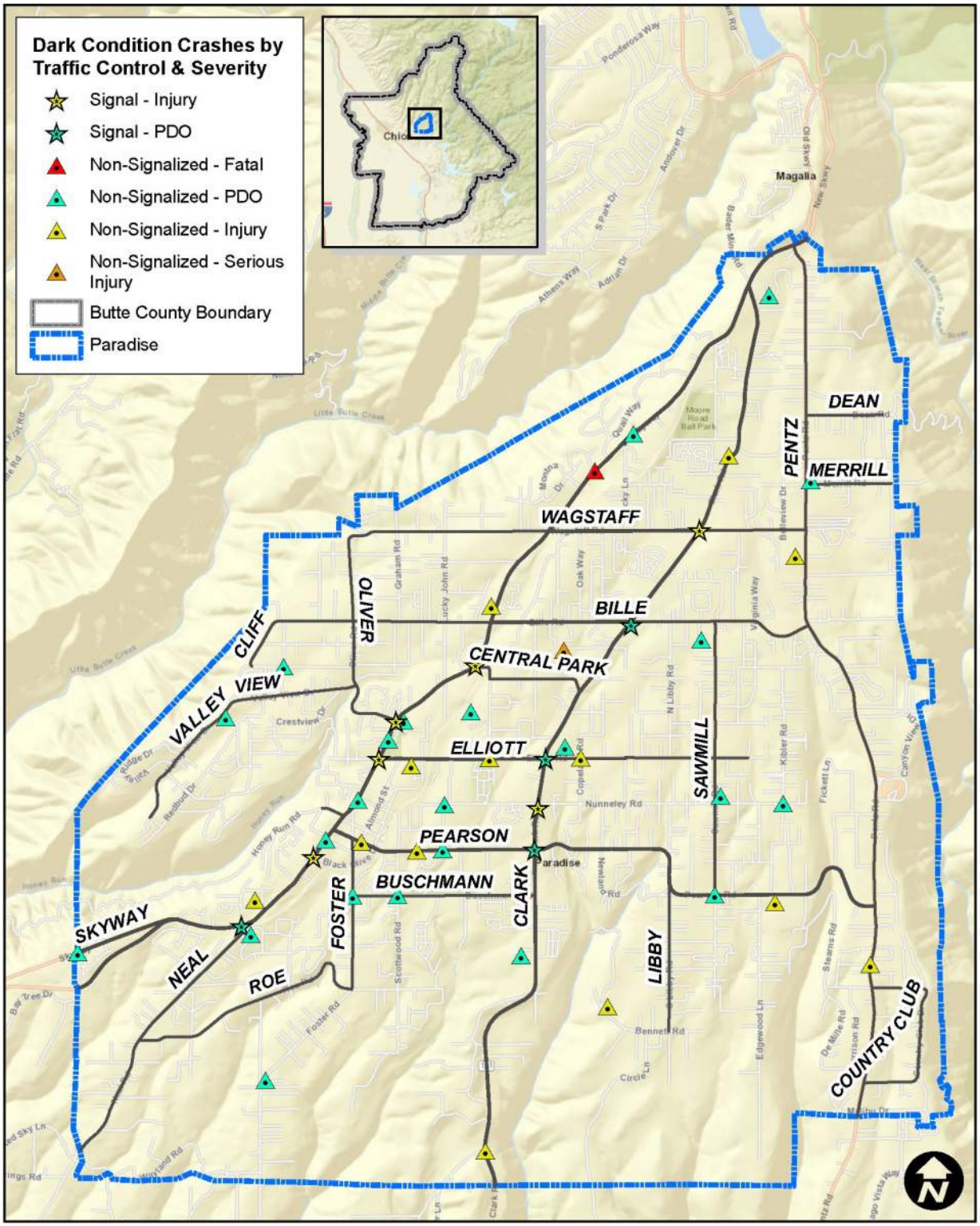


Figure 24. Dark Conditions Intersection Crashes by Severity and Traffic Control

The dark condition crashes tended to occur more often at unsignalized locations. The highest concentration occurred on Skyway between Neal Road and Oliver Road.

Status of Recommendations from the SSAR

Countermeasures are an action or device designed to negate or offset a crash risk. The *Paradise Systemic Safety Analysis Final Report (SSAR, Kittelson & Associates, 2018)* provided recommendations for systemic countermeasures for intersections and roadways and proposed ten project scopes based on a comprehensive crash data analysis. Per the *SSAR*:

> "*These treatments were selected based on the crash patterns and trends from the systemic safety analysis, observations from field reviews, and professional resources such as the Caltrans Local Road Safety Manual and the Federal Highway Administration's resources regarding systemic safety.*"

SSAR Identified Systemic Treatment Options for Intersections

The *SSAR* indicated that these countermeasures were selected based on field observations and the potential effectiveness of at reducing crash frequency or severity, and to address minor-street stop-controlled "tee" intersections identified as a risk factor.

- **Install Splitter-Islands and Additional Stop Sign on Stop-Controlled Approaches**
- **Upgrade Intersection Pavement Markings and Signs**
- **Improve Sight Distance to Intersections**
- These projects are part of the Highway Safety Improvement Program (HSIP) Cycle 9 Award and are listed in the 2020 RTP/SCS. At the time of this report, the projects have not been constructed and the Town has requested a scope change to remove the splitter islands to support the Town policy of discouraging future use of vertical elements. The policy was implemented in 2021 as vertical elements can be an impediment during an evacuation. If the scope change is approved, the project will construct only sight distance improvements and improved pavement markings and signs.

SSAR Identified Systemic Treatment Options for Roadway Segments

The *SSAR* indicated that these countermeasures were selected based on run-off the road crash patterns and the potential effectiveness of at reducing crash frequency or severity, and to address identified roadway risk factors.

- **Install edge-line and centerlines:** This effort is included in the Striping Standard Updates on all collectors and arterials and is planned for roadways downtown as part of the *Almond Street Multimodal Project* and *Gap Closure Project*.
- **Increase Clear Recovery Zone**: The need for this project should be re-evaluated as the Camp Fire reduced vegetation at many intersections and clearing out vegetation was part of other post-fire efforts.
- **Centerline Rumble Strips**: While the recommendation is still supported by the updated crash data, centerline rumble strips may not be ideal along primary evacuation routes. No current projects are identified.

- **Install Safety Edge**: Safety Edge technology reshapes the roadway edge to 30 degrees to provide a transition for lane departing vehicles to return to the roadway safely. The updated crash data supports this recommendation, and the Safety Edge would be advantageous during evacuations. No current projects are identified.
- **Widen Unpaved Shoulder**: The updated crash data supports this recommendation, and this would be advantageous during evacuations. No current projects are identified; however, this recommendation is part of the *TMP* to add paths, close ditches, etc.
- **Speed Feedback Signs:** The updated crash data supports this recommendation. No current projects are identified.
- **Curve Delineation Signs and Post-Mounted Reflective Delineation**: The updated crash data supports this recommendation, and lower traffic volumes on the roadways may be contributing to higher speeds. No current projects are identified.
- **Flattening Side Slopes**: The updated crash data supports this recommendation, and this would be advantageous during evacuations. No current projects are identified; however, this recommendation is part of *TMP* plans to add paths, close ditches, etc.
- **Install Sidewalks (or Multiuse Paths) to Fill Gaps:** The updated crash data supports this recommendation. Recommendations for off-street paths, on-street bicycle lanes, and shared lanes are included in the *Active Transportation Plan (ATP)* included with the *TMP,* both anticipated in 2022.
- **Enhanced Pedestrian Crossing:** The updated crash data supports this recommendation. Recommendations for pedestrian facilities are included in the *ATP*.
- **High Friction Surface Treatment**: The updated crash data supports this recommendation with a high percentage of crashes along primary corridors. No current projects are identified.

SSAR Defined Project Scopes

- **Project Scope #1 – Shared use path along Pentz Road:** Recommended project in the *ATP* and *Roadway Improvements Report*.
- **Project Scope #2 – Shared use path along Neal Road and Skyway:** Recommended project in the *ATP* and *Roadway Improvements Report*.
- **Project Scope #3 - Shared use path along Oliver Road:** The updated crash data does not indicate a high frequency of pedestrian or bicycle related crashes on Oliver Road.
- **Project Scope #4 - Marked crosswalk at Pearson Road and Sawmill Road**: The updated crash data identifies the Pearson Road/Sawmill Road intersection as a top crash location for unsignalized intersections; no pedestrian-involved crashes were reported.
- **Project Scope #5 – Improvements to Pearson Road and Middle Libby Road:** Included in the Highway Safety Improvement Program (HSIP) Cycle 9 Award and in the 2020 RTP/SCS. Construction is estimated to be completed in 2025.
- **Project Scope #6 – Improvements to Almond Street and Elliott Road:** Included in the HSIP Cycle 9 Award and in the 2020 RTP/SCS. Construction is estimated to be completed in 2025.
- **Project Scope #7 – Improvements to Rocky Lane and Skyway:** Included in the HSIP Cycle 9 Award and in the *2020 RTP/SCS*. Construction is estimated to be completed in 2025.

- **Project Scope #8 - Improvements to Twin Oaks Drive and Wagstaff Road:** Included in the HSIP Cycle 9 Award and in the *2020 RTP/SCS*. Construction is estimated to be completed in 2025.
- **Project Scope #9 – Improvements to Buschmann Road and Clark Road:** Included in the HSIP Cycle 9 Award and in the *2020 RTP/SCS*. Construction is estimated to be completed in 2025.
- **Project Scope #10 – Improvements to Neal Road and Circlewood Drive:** Included in the HSIP Cycle 9 Award and in the *2020 RTP/SCS*. Construction is estimated to be completed in 2025.

Non-Engineering Programs

- **Safe Routes to Schools Program:** The Town has a Safe Routes to School program which should be promoted, continued, and/or expanded through the *Active Transportation Plan* or other grants.
- **Public Education Campaigns:** Public education campaigns for everyday safety needs has likely stalled due to recovery efforts/shifts of focus for the Town of Paradise. Public outreach campaigns in the *SSAR* should be pursued as resources are available.
- **Active Transportation Plan (ATP) Update:** This update is being prepared as part of the *TMP.*

Potential Updated Countermeasures

Developing a program of countermeasures and strategies across the four E's of safety planning (Engineering, Education, Enforcement, and Emergency Services) is critical to ensure that the complex issue of local road safety is being addressed in a holistic manner consistent with current needs of the community.

Since the *2018 SSAR* was published, the Town of Paradise experienced a catastrophic fire and following, loss of population. Traffic volumes have remained low but are steadily increasing as communities are rebuilt and infrastructure is repaired. In the meantime, stakeholder and public priorities have shifted to infrastructure and other transportation-related improvements that prioritize evacuation safety over everyday needs.
Future safety measures should be implemented to facilitate, at least not hinder, an evacuation.

Key Components of Non-Engineering Implementation

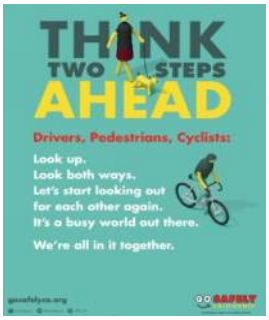
Non-engineering components primarily comprise the Education and Enforcement "E's". The most critical steps for implementation of the non-engineering LRSP countermeasures are building strong public outreach messaging, expanding, and leveraging partnerships and collaborations with stakeholders and local agencies, and obtaining grant funding for expanded initiatives and outreach. While all countermeasures identified in the plan are important for improving safety in the Town, the following countermeasures and general strategies are most feasible for early implementation and provide the greatest safety benefit from non-engineering countermeasures.

Social Media Campaign and Continued Outreach

Providing the public with important safety information and messaging through a variety of platforms including social media, online advertisements, TV, and radio is an important strategy for increasing awareness around safety and reducing crashes. The specific type of media used for each campaign depends on the audience, the message, and available resources. Some outreach campaigns may focus exclusively on social media, and some may require more holistic approaches including more traditional media like TV, newspaper, and radio. However, these larger outreach campaigns may require longer time frames for implementation and higher budget considerations. A targeted social media campaign can be implemented quickly with very little budget by utilizing existing messaging, such as those provided by the Caltrans Office of Traffic Safety through the "Go Safely, California" program, highlighted below.

Exhibit 4. Distracted Driving Campaign

"Go Safely, California" – Public outreach and education materials covering a variety of safety topics including impaired driving, distracted driving, and bicycle and pedestrian safety are available through the **"Go Safely, California"** website. These resources provide local agencies with free and compelling materials to educate the public on the dangers of distracted driving, impaired driving, pedestrian & bicyclist safety, and speeding. Pre-made toolkits are available to supplement existing outreach efforts.



Source: www.gosafelyca.org

Targeted social media messaging campaigns can focus outreach efforts to a particular demographic, such as young drivers between 15 and 23 years of age regarding the potential risks of distracted driving and impaired driving. Targeted messaging campaigns through social media will help to ensure their message is received by those in the target group with minimal budget impacts. Additionally, the reach of social media messages and campaigns may be amplified many times if stakeholders share the safety campaign messages through their own social media accounts. This strategy was utilized during the public outreach process, which resulted in a significantly higher rate of responses than anticipated by the project team.

Partnerships & Collaborations

Roadway safety is a shared responsibility and so too is the implementation of roadway safety plans. The Town must work collaboratively with numerous stakeholders and form interdepartmental and interagency partnerships to successfully implement many of the identified strategies. The identified strategies will require direct partnerships and close collaboration to be successful.

Bicycle & Pedestrian Trainings

Incorporating pedestrian and bicycle training into the physical education curriculum for elementary school students will require close collaboration between the Town, school district, parents, teachers, and students.

The Town may work collaboratively to support and enhance existing bicycle safety courses offered by various entities. This may include providing course materials, sponsoring American League of Bicyclists Certified Instructors to train the course, or providing bicycle safety materials to support these on-going trainings. The Town should collaborate with these organizations to identify the greatest need.

Exhibit 5. Enhance pedestrian and bicycle training/safety.

The Town may work with the Department of Motor Vehicles and other driver instruction providers to include information about bicyclist safety and bicyclists' rights into driver training materials. Changing existing driver training materials is anticipated to be a long process which may require convening driver instruction providers to address the issue holistically at a local level.

Sober Ride Home

Transportation Network Companies such as Uber and Lyft, as well as traditional taxi companies, may work with the Town to provide discounted or free rides home to intoxicated individuals to avoid driving while under the influence of drugs or alcohol. This program may first be focused on specific time periods/dates such as Saint Patrick's Day, New Year's Eve, or Halloween and expanded based on funding and need later on.

Responsible Beverage Service (RBS)

Following the passage of Assembly Bill 82, any alcohol server and their manager will be required to have a valid RBS certification from an Alcoholic Beverage Control (ABC) accredited RBS training provider and pass an online ABC administered RBS exam within 60 calendar days from the first date of employment as of July 1, 2022[3]. The Town may work with the local chamber of commerce and local alcohol server training providers to promote face-to-face training programs as the standard for local businesses, as these programs have been shown to be effective.

RBS
Responsible
Beverage
Service

Exhibit 6. RBS certification programs have been shown to be effective.

Crash Data Records

To ensure that local data represents the most accurate information, the Town Public Works department should update the crash data with the most up-to-date local data. A lag in reporting periods may result in a crash victim passing away from their injuries, which requires the crash data record to be updated to a fatality. To aid in improving accuracy, the Town Public Works department and police departments should convene to evaluate how data is collected and reported to best support future safety analysis and include outside agencies (Caltrans, CHP, etc.) in the overall discussion about improving local crash data records and the record keeping process, as appropriate.

[3] https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa09028/resources/countermeasures.pdf

Recommended Non-Engineering Countermeasures for Paradise

- Education Initiatives (short-term and medium-term timeframes):
  - Distracted Driving Public Outreach Campaign: Local distracted driving messaging campaign using a variety of media outlets.
  - Drunk & Impaired Driving Awareness Campaign: Local impaired driving messaging campaign using a variety of media outlets.
  - Speed Kills Campaign: Conduct public outreach campaign about the importance of driving the speed limit and the impact just 5 mph can have on the severity of a crash.
  - Safe Routes to School: Safe Routes to School plan created for local elementary and middle schools with identified projects and recommended improvements.
  - Bike Safety Education for Children: Bike safety instruction for children through school or Town program(s).
  - Active Lighting/Conspicuity Enhancement: Make pedestrians & bicyclists more visible at night to avoid collisions by providing free lighting equipment and retroreflective clothing.
  - Share the Road & Pedestrian Safety Awareness Messaging: Increase driver awareness of pedestrian and bicyclist rights and needs on the roadway.
- Enforcement Initiatives (short-term and medium-term timeframes):
  - High-Visibility Cell Phone/Text Messaging Enforcement Campaign: Conduct high visibility enforcement program, contingent on staff resources, and issue citations as appropriate. High visibility programs incorporate several strategies designed to increase enforcement and create public awareness.
  - Passive Alcohol Sensors (PAS): Equip law enforcement officers with Passive Alcohol Sensors to increase efficiency of Alcohol Checkpoints and normal traffic stops.
  - Publicized Sobriety Checkpoints: Highly publicized sobriety checkpoints conducted regularly to increase perceived risk of arrest for impaired driving.
  - High-Visibility Saturation Patrols: Focused patrols around specific areas where impaired-driving crashes are common as part of an on-going saturation program.
  - Targeted Speed Enforcement Program: Reduce speeding issues along select corridors through regular and targeted enforcement patrols.

Potential Engineering Countermeasures

Engineering countermeasures can be applied at site-specific locations or systemically. HSIP eligible countermeasures are provided in the *Local Roadway Safety: A Manual for California's Local Road Owners (April 2020)* and as part of the *HSIP Analyzer Manual for Benefit Cost Ratio (BCR) Applications*. A table of the countermeasures is included in **Appendix B**. The HSIP number is represented by "S" (for signalized), "NS" for unsignalized or "R" for roadway followed by corresponding number and description.

The table shows the countermeasure name, type, applicable crash type(s), crash reduction factors (CRFs), federal funding eligibility, and opportunity for systemic implementation, divided into three groups: signalized intersections, non-signalized intersections, and roadway segments. This data was used as a guide to develop

improvements that will provide potential for funding opportunity. The table is not an exhaustive list of safety improvements. Other non-HSIP eligible improvements are also considered and recommended as applicable.

Countermeasures may be applied systemically or at specific sites.

Systemic Applications

Systemic countermeasures are applied to multiple locations based on crash data and similar geometric features. This approach can also be used proactively to apply countermeasures at locations without a significant crash history, but high-risk factors. Risk factors identify common roadway or intersection characteristics that may contribute to past crashes or increase the risk of future crashes. The HSIP countermeasure table in **Appendix B** indicates if the countermeasure is a "Low" to "Very High" opportunity for systemic implementation. Systemic improvements may be incorporated into regular maintenance activities as budgets allow or implemented through HSIP grant funds.

Site Specific Applications

Potential projects can be developed for high crash frequency site-specific locations if the risk factors and recommended improvements do not fit into a systemic application.

Potential Projects

Crash trends were evaluated to identify how/where the same countermeasures could be applied to multiple locations (systemic project) and assess the high-level potential for HSIP funding based on the number and severity of crashes. The annual societal costs from the *FHWA BCA Systemic Project Selection Tool*[4] were utilized to quantify crash costs and potential safety benefits. The combination of sites with the highest potential for HSIP funding award are highlighted in the table and potential countermeasures are included. The timeframe for these projects is generally medium-long term; striping and other improvements that can be done as part of routine maintenance may be short term.

It is important to note that the assessment includes six years of crash data (2015-2020) since traffic volumes and consequently crash data were significantly lower than previous years following the Camp Fire in November 2018. Typically, the HSIP program requires three to five years of crash data in funding applications; however, the previous three to five years of available data would not capture typical conditions or provide a fair assessment of need for a Town that is quickly rebuilding and realizing higher than normal percent change traffic volume growth on an annual basis. Future HSIP applications should clearly state which years of data are used and explain the extenuating circumstances. The application should not use any crash data that was used in the previous cycle (Cycle 9). The *SSAR* utilized crash data from 2012-2016 and the HSIP Cycle 9 awards to the Town were for systemic unsignalized intersection improvements.

[4] Source: https://safety.fhwa.dot.gov/hsip/planning.cfm

Roadway Systemic Project Development

Table 11 shows the roadway (non-intersection related) crash locations with the highest weighted crashes and severity, noted as crash costs. Crash cost calculations are provided by FHWA to determine economic justification/benefits of improvements and generally, should only be used for this purpose. The costs consider tangible costs (property damages, medical bills, etc.) and intangible costs, or lost quality of life, based on the crash severity. Crash costs details are found in the *Crash Costs for Highway Safety Analysis*[5] (FHWA 2018).

Table 11. Roadway (Non-Intersection Related) Weighted Crashes

Roadways	Fatal	Serious Injury	Other Visible Injury	Complaint of Pain	PDO	Grand Total	Segment Length (miles)	Crash Costs	Per Mile
SKYWAY	2	17	48	72	107	246	6.7	$55,122,387	$8,227,221.94
CLARK RD	2	7	24	46	46	125	5.4	$39,386,811	$7,293,853.89
PENTZ RD	1	3	11	15	16	46	4.9	$18,035,322	$3,680,677.96
PEARSON RD	1	1	8	20	24	54	3.4	$16,816,056	$4,945,898.82
ELLIOTT RD	1	1	8	6	11	27	2.4	$14,852,638	$6,188,599.17
WAGSTAFF RD	1	0	2	3	4	10	2.3	$12,481,668	$5,426,812.17
BILLE RD	0	2	6	3	10	21	2.5	$3,081,647	$1,232,658.80
SAWMILL RD	0	2	2	1	4	9	2	$1,934,425	$967,212.50
NEAL RD	0	1	2	1	6	10	1.6	$1,284,288	$802,680.00
OLIVER RD	0	0	3	2	4	9	1.5	$918,863	$612,575.33
Total:	**8**	**34**	**114**	**169**	**232**	**557**			

Notes: Highlighted roadways have the highest weighted crashes

Per **Table 11**, the primary routes including Skyway, Clark Road, Pentz Road, Pearson Road, Elliott Road, and Wagstaff Road (highlighted in gray) have the highest weighted crash costs. This indicates that potential countermeasures may result in higher benefit-cost ratios and be more competitive for HSIP funding application. Potential countermeasures are shown in **Table 12**. The HSIP number is represented by "S" (for signalized), "NS" for unsignalized or "R" for roadway followed by corresponding number and description.

[5] https://safety.fhwa.dot.gov/hsip/docs/fhwasa17071.pdf

Table 12. Potential Roadway Countermeasures

HSIP No.	Type	Countermeasure Name	Crash Type	Crash Reduction Factor (CRF)	Expected Life (Years)	HSIP Eligibility	Systemic Approach Opportunity?
R01	Lighting	Add segment lighting	Night	35%	20	100%	Medium
R02	Remove/ Shield Obstacles	Remove or relocate fixed objects outside of Clear Recovery Zone	All	35%	20	90%	High
R15	Geometric Modification	Widen shoulder	All	30%	20	90%	High
R21	Geometric Modification	Improve pavement friction (High Friction Surface Treatments)	All	55%	10	100%	Medium
R28	Operation / Warning	Install edgelines and centerlines	All	25%	10	100%	Very High
R30	Operation / Warning	Install centerline rumble strips/stripes	All	20%	10	100%	High
R31	Operation / Warning	Install edgeline rumble strips/stripes	All	15%	10	100%	High
RS32PB - RS35PB	Ped and Bike	Variety of Pedestrian/Bicycle Improvements	Ped and Bike	Varies (35% - 80%)	20	90%	Medium-High

Source: *HSIP Analyzer Manual for BCR Applications*

These countermeasures are recommended as beneficial for improving roadways, are supported by public input, and are consistent with the goals of the Town of Paradise *TMP* (anticipated in 2022) and the stakeholders. Countermeasures related to *Geometric Modification, Operation/ Warning,* and *Remove/ Shield Obstacles* will provide an overall safety benefit on roadway sections lacking these elements. These countermeasures would particularly improve lane departure type crashes, and several would be beneficial for evacuation considerations. Removing fixed objects outside of Clear Recovery may provide an additional advantage of hindering fire spread if vegetation is removed.

Lighting countermeasures may reduce nighttime crashes, a key consideration as almost 30 percent of serious injury and fatal crashes occurred in "Dark – No Street Lights" conditions. Most dark conditions crashes on roadways occurred along Skyway and Clark Road. This countermeasure should be implemented at locations with insufficient lighting as identified through an engineering evaluation.

Pedestrian and bicycle improvements along roadways are another key consideration as the highest pedestrian action associated with pedestrian involved crashes was "In Road, Including Shoulder". Two pedestrian crashes involved "crossing in a crosswalk not at an intersection". The majority of pedestrian involved crashes occurred on Skyway and Clark Road. Most bicycle crashes occurred on Skyway and Elliott Road. Improvements including bicycle lanes, multiuse paths, etc. should be applied consistent with *Active Transportation Plan* (*ATP)* recommendations for overall multimodal connectivity.

Future HSIP funding pursuits should consider a systemic roadway project for Skyway, Clark Road, Pentz Road, Pearson Road, Elliott Road, and Wagstaff Road applying a combination of the countermeasures above. Countermeasures should be verified by a site evaluation to identify risk factors.

Signalized Intersection Systemic Project Development

Table 13 shows the signalized intersections with the highest weighted crashes and severity, noted as crash costs.

Table 13. Signalized Intersection Weighted Crashes

Intersection	Control Type	Fatal	Serious Injury	Other Visible Injury	Complaint of Pain	PDO	Total	Crash Costs
Clark Rd / Pearson Rd	Signal	1	2	2	7	12	24	$14,443,242
Bille Rd / Clark Rd	Signal	1	0	0	3	7	11	$12,109,706
Pearson Rd / Black Olive Rd	Signal	1	0	0	0	3	4	$11,674,271
Skyway / Black Olive Rd	Signal	0	1	7	7	6	21	$3,079,009
Skyway / Elliott Rd	Signal	0	1	4	7	9	21	$2,502,904
Clark Rd / Elliott Rd	Signal	0	2	2	5	3	12	$2,438,321
Skyway / Clark Rd	Signal	0	1	5	3	3	12	$2,118,395
Skyway / Neal Rd	Signal	0	2	2	1	15	20	$2,067,613
Skyway / Pearson Rd	Signal	0	1	4	4	5	14	$2,067,469
Clark Rd / Nunneley Rd	Signal	0	1	1	8	3	13	$1,946,828
Skyway / Wagstaff Rd	Signal	0	1	2	4	7	14	$1,683,399
Clark Rd / Wagstaff Rd	Signal	0	1	3	2	4	10	$1,593,216
Skyway / Bille Rd	Signal	0	1	2	3	7	13	$1,554,398
Skyway / Oliver Dr	Signal	0	0	3	2	5	10	$930,971
Pearson Rd / Churchill Rd	Signal	0	0	2	2	0	4	$666,288
Skyway / Central Park Rd	Signal	0	0	2	1	4	7	$585,719
Clark Rd / Central Park Rd	Signal	0	0	0	2	2	4	$282,218
Total:		**3**	**14**	**41**	**61**	**95**	**214**	**$61,743,967**

Notes: Highlighted intersections have the highest weighted crashes

As shown in **Table 13**, several intersections on Skyway, Clark Road, and Pearson Road (highlighted in gray) have the greatest potential for application and funding of systemic signalized intersection countermeasures. Potential countermeasures for the intersections in **Table 13** are shown in **Table 14**.

Table 14. Potential Signalized Intersection Countermeasures

HSIP No.	Type	Countermeasure Name	Crash Type	Crash Reduction Factor (CRF)	Expected Life (Years)	HSIP Eligibility	Systemic Approach Opportunity?
S01	Lighting	Add intersection lighting	Night	40%	20	100%	Medium
S02	Signal Modification	Improve signal hardware	All	15%	10	100%	Very High
S09	Operation / Warning	Install raised pavement markers and striping (through intersection)	All	10%	10	100%	Very High
S11	Operation / Warning	Improve pavement friction (High Friction Surface Treatments)	All	55%	10	100%	Medium
S18PB	Ped and Bike	Install pedestrian crossing	Ped and Bike	25%	20	100%	High
S21PB	Ped and Bike	Modify signal phasing to implement a Leading Pedestrian Interval	Ped and Bike	60%	10	100%	Very High

Source: *HSIP Analyzer Manual for BCR Applications*

These countermeasures are recommended as improving intersections is endorsed by the public, and in line with goals of the TMP and the Town. Countermeasures should be verified by a site evaluation to identify risk factors. Countermeasures related to *Signal Modification* and *Operation/ Warning* can increase visibility and improve all crash types.

Lighting countermeasures address a key consideration as almost 30 percent of serious injury and fatal crashes occurred in "Dark – No Street Lights" conditions. Approximately nine nighttime crashes (six with injuries) occurred at a signalized intersection. This countermeasure should be implemented at intersections with insufficient lighting as identified through an engineering evaluation.

Pedestrian and Bicycle countermeasures for signalized intersections address a key focus area. Three signalized intersections had a pedestrian crash:

- Clark Road / Bille Road – pedestrian crosswalks on all legs
- Clark Road / Wagstaff Road – pedestrian crosswalks on all legs
- Clark Road / Nunneley Road – pedestrian crosswalks on all legs

These intersections have pedestrian crosswalks and the countermeasure S18PB could be to upgrade the markings to continental style crosswalks.

Unsignalized Intersection Systemic Projects Development

Table 15 shows the unsignalized intersections with the highest weighted crashes and severity, noted as crash costs.

Table 15. Unsignalized Intersection Weighted Crashes

Intersection	Control Type	Fatal	Serious Injury	Other Visible Injury	Complaint of Pain	PDO	Total	Crash Costs
Pearson Rd/ Sawmill Rd	All Way STOP	0	1	1	1	5	8	$1,068,037
Sawmill Rd/ Nunneley Rd	All Way STOP	0	0	2	0	1	3	$420,394
Bille Rd/ Pentz Rd	All Way STOP	0	0	1	1	4	6	$381,576
Sawmill Rd/ Bille Rd	All Way STOP	0	0	1	1	1	3	$345,252
Total:		**0**	**1**	**5**	**3**	**11**	**20**	**$2,215,259**

Notes: Highlighted roadways have the highest weighted crashes

Per **Table 15**, Pearson Road/Sawmill Road has the greatest potential for the application and HSIP funding of unsignalized countermeasures. This intersection was identified in the *SSAR* for a potential project to add marked crosswalks.

Potential countermeasures are shown on **Table 16**.

Table 16. Potential Unsignalized Intersection Countermeasures

HSIP No.	Type	Countermeasure Name	Crash Type	Crash Reduction Factor (CRF)	Expected Life (Years)	HSIP Eligibility	Systemic Approach Opportunity?
NS01	Lighting	Add intersection lighting	Night	40%	20	100%	Medium
NS06	Operation / Warning	Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs	All	15%	10	100%	Very High
NS07	Operation / Warning	Upgrade intersection pavement markings	All	25%	10	100%	Very High
NS08	Operation / Warning	Install Flashing Beacons at Stop-Controlled Intersections	All	15%	10	100%	High
NS09	Operation / Warning	Install flashing beacons as advance warning	All	30%	10	100%	High
NS10	Operation / Warning	Install transverse rumble strips on approaches	All	20%	10	90%	High
NS11	Operation/ Warning	Improve sight distance to intersection (Clear Sight Triangles)	All	20%	10	90%	High
NS20PB - NS23PB	Ped and Bike	Variety of Pedestrian/Bicycle Improvements	Ped and Bike	25% - 35%	10 - 20	100%	Low-High

Source: *HSIP Analyzer Manual for BCR Applications*

Countermeasures should be verified through a field evaluation to identify risk factors. Other than potential pedestrian improvements described below, countermeasures for unsignalized intersections do not represent an overall highest-need priority of the Town. It is recommended that future funding applications focus on other areas.

Pedestrian/Bicycle Systemic Projects Development

Tables 17 through **18** show the pedestrian and bicycle crash locations with the highest weighted crashes and severity, noted as crash costs.

Table 17. Bicycle and Pedestrian Weighted Crashes by Roadway

Location	Category	Fatal	Serious Injury	Other Visible Injury	Complaint of Pain	PDO	Total	Crash Costs
CLARK RD	Roadway	2	0	0	3	1	6	$23,675,005
SKYWAY	Roadway	1	1	9	4	1	16	$14,677,699
ELLIOTT RD	Roadway	1	0	1	0	0	2	$11,842,090
BILLE RD	Roadway	0	2	1	0	0	3	$1,552,849
SAWMILL RD	Roadway	0	2	1	0	0	3	$1,552,849
PEARSON RD	Roadway	0	1	0	1	0	2	$803,354
PENTZ RD	Roadway	0	1	0	1	0	2	$803,354
NEAL RD	Roadway	0	1	0	0	0	1	$674,353
FOSTER RD	Roadway	0	0	1	1	0	2	$333,144
NUNNELEY RD	Roadway	0	0	1	0	0	1	$204,143
EDGEWOOD	Roadway	0	0	0	1	0	1	$129,001
OLIVER RD	Roadway	0	0	0	1	0	1	$129,001
VALLEY VIEW DR	Roadway	0	0	0	1	0	1	$129,001
MAXWELL DR	Roadway	0	0	0	0	1	1	$12,108

Notes: Highlighted roadways have the highest weighted crashes

Table 18. Bicycle and Pedestrian Weighted Crashes by Intersection

Location[1]	Fatal	Serious Injury	Other Visible Injury	Complaint of Pain	PDO	Total	Crash Costs
CLARK RD/ BILLE RD[2]	1	0	0	0	0	1	$11,637,947
WAGSTAFF RD/ CLARK RD[2]	0	0	1	0	0	1	$204,143
CLARK RD/ NUNNELEY RD[2]	0	0	0	1	0	1	$129,001
WAGSTAFF RD/ BIKE PATH	0	1	0	0	0	1	$674,353
PENTZ RD/ DEAN RD	0	1	0	0	0	1	$674,353
ELLIOTT RD/ BIKE PATH	0	1	0	0	0	1	$674,353
CLARK RD/ CLARK RD 6701	0	1	0	0	0	1	$674,353
SKYWAY/ WILDWOOD LN	0	1	0	0	0	1	$674,353
SKYWAY/ ELLIOTT RD	0	0	1	0	0	1	$204,143
SKYWAY/ SCHMALE LN	0	0	1	0	0	1	$204,143
ELLIOTT RD/ COPELAND RD	0	0	1	0	0	1	$204,143
COLLEGE HILL RD/ PEARSON RD	0	0	1	0	0	1	$204,143
SUNSET DR/ OLIVER RD	0	0	1	0	0	1	$204,143
SKYWAY/ SKYWAY 7186	0	0	1	0	0	1	$204,143
NEWLAND RD/ ANGEL DR	0	0	1	0	0	1	$204,143
SKYWAY/ OLIVER RD	0	0	1	0	0	1	$204,143
CLARK RD/ CYPRESS LN	0	0	1	0	0	1	$204,143
BILLE RD/ BIKE PATH	0	0	0	1	0	1	$129,001
ELLIOTT RD/ MAXWELL DR	0	0	0	1	0	1	$129,001
ELLIOTT RD/ ALMOND ST	0	0	0	1	0	1	$129,001
BIKE PATH/ ROCKY LN	0	0	0	1	0	1	$129,001
EDGEWOOD LN/ JARAMILLO LN	0	0	0	0	1	1	$12,108

Notes: 1. Location may represent the nearest intersection, path or driveway
2. Signalized intersection

Per **Tables 17** through **18,** the locations with the highest potential for pedestrian and bicycle countermeasures are Skyway, Clark Road, Elliott Road, and the Clark Road/Billie Road signalized intersection.

Tables 19 and 20 provide potential countermeasures for bicycle and pedestrian related crashes.

Table 19. Potential Pedestrian and Bicycle Countermeasures for Intersections

HSIP No.	Type	Countermeasure Name	Crash Type	Crash Reduction Factor (CRF)	Expected Life (Years)	HSIP Eligibility	Systemic Approach Opportunity?
S18PB	Ped and Bike	Install pedestrian crossing	Ped and Bike	25%	20	100%	High
S21PB	Ped and Bike	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)	Ped and Bike	60%	10	100%	Very High
NS20PB	Ped and Bike	Install pedestrian crossing at uncontrolled locations (new signs and markings only)	Ped and Bike	25%	10	100%	High
NS21PB	Ped and Bike	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)	Ped and Bike	35%	10	100%	Medium
NS22PB	Ped and Bike	Install Rectangular Rapid Flashing Beacon (RRFB)	Ped and Bike	35%	10	100%	Medium
NS23PB	Ped and Bike	Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK)	Ped and Bike	55%	10	100%	Low

Source: *HSIP Analyzer Manual for BCR Applications*

Table 20. Potential Pedestrian and Bicycle Countermeasures for Roadways

HSIP No.	Type	Countermeasure Name	Crash Type	Crash Reduction Factor (CRF)	Expected Life (Years)	HSIP Eligibility	Systemic Approach Opportunity?
R32PB	Ped and Bike	Install bike lanes	Ped and Bike	35%	20	90%	High
R33PB	Ped and Bike	Install Separated Bike Lanes	Ped and Bike	45%	20	90%	High
R34PB	Ped and Bike	Install sidewalk / pathway (to avoid walking along roadway)	Ped and Bike	80%	20	90%	Medium
R35PB	Ped and Bike	Install/upgrade pedestrian crossing (with enhanced safety features)	Ped and Bike	35%	20	90%	Medium

Source: *HSIP Analyzer Manual for BCR Applications*

These countermeasures are recommended as they are consistent with the goals of the *ATP* to provide more non-motorized facilities.

Key Considerations for Future HSIP Applications

Site evaluations should be conducted for all potential projects to determine risk factors – elements that the location lacks or could be enhanced to improve safety - and appropriate countermeasures.

The next steps would be to prepare cost estimates and prepare projects descriptions based on the Benefit-Cost Ratio. During the process of preparing countermeasures and benefit-cost calculations, the Town should take care in selecting what years of crash data will be included, justify any years outside the typical requirements of 3-5 years, and avoid any crash data that was included in previous applications. The Town previously received HSIP Cycle 9 funding for improvements at 16 unsignalized intersections using crash history from 2012-2016.

At a preliminary level, it appears the most competitive projects may be:

- Systemic countermeasures along key roadways – Skyway, Clark Road, Pentz Road, Pearson Road, Elliott Road, Wagstaff Road
- Systemic countermeasures at signalized intersections
- Systemic pedestrian/bicycle improvements

Potential Funding Sources

The Town of Paradise and local stakeholders will likely pursue grant opportunities to implement many of the identified countermeasures and strategies. Additionally, the timeframes for implementation will be contingent on obtaining grant funding as well as maintaining existing maintenance and construction funding levels. The following section highlights key considerations for each potential grant funding opportunity.

Highway Safety Improvement Program (HSIP)

This federal program is managed by Caltrans and focuses on infrastructure projects with nationally recognized crash reduction factors. This is one of the major funding mechanisms for safety projects across California and is closely tied to the LRSP. Agencies must have completed LRSP plans prior to submitting future HSIP applications. Calls for projects under this funding program are typically announced every other year. The next round of HSIP funding is anticipated to open in April 2022. Two potential projects were developed as part of the LRSP for cost estimates and BCR calculations to facilitate HSIP application.

Active Transportation Program (ATP)

This competitive statewide program, managed by Caltrans, consolidates federal and state funding from several sources including the State Senate Bill 1 (SB1), Transportation Alternatives Program (TAP), Bicycle Transportation Account (BTA), and State Safe Routes to School (SRTS). This program is focused on increasing the use of walking and biking by increasing safety and mobility for non-motorized users, advancing regional active transportation efforts, and providing a broad spectrum of projects to benefit many types of active transportation users. Eligible grant applicants include public schools and school districts as well as local, regional, or state agencies. For a project to qualify as a Safe Routes to School project, it must be within two miles of a public school or within the vicinity of a public-school bus stop with the students intended as the primary beneficiaries of the project. This program typically releases calls for projects annually, however, this may be impacted due to COVID-19 and should be monitored closely.

Exhibit 7. Increase safety and mobility for non-motorized users

Congestion Mitigation and Air-Quality Improvement Program (CMAQ)

This flexible federal funding program managed by Caltrans may be used for a variety of projects which further the goals of the Clean Air Act and its amendments on a reimbursable basis. Projects must be included in the *Transportation Improvement Program (TIP)* to be eligible for this funding stream. This funding may be used for bicycle & pedestrian outreach programs, constructing bicycle and pedestrian facilities which are not exclusively recreational and reduce vehicle trips, and public education and outreach activities.

National Highway & Traffic Safety Administration (NHTSA)

The NHTSA provides traffic safety grants through the California Office of Traffic Safety. Based on the most recent guidance, Caltrans Office of Traffic Safety (OTS) accepts applications for this funding program on a regular annual basis with an annual deadline of January 30. This timeline may have changed based on impacts from COVID-19. The following grant opportunities were identified as the most applicable:

- *Section 402: State & Community Highway Safety Grant Program* – This versatile funding program can be used for a variety of initiatives focused on reducing deaths and serious injuries on our roadways including enhancing pedestrian and bicycle safety, increasing enforcement of traffic safety laws, improving traffic records, or reducing speeding.

- *Section 405: National Priority Safety Program* – This program authorizes funding to address high priority safety issues across the nation including impaired driving, distracted driving, and non-motorized safety. Funding for each issue is authorized as a separate tier under the Section 405 program.

  - Section 405(d): Impaired Driving Countermeasures – This tier represents 52.5 percent of the total annual funding for the full Section 405 program. These funds are intended for programs which reduce the risk of driving under the influence of alcohol or drugs. A matching share of 20 percent must be provided by the local agency.
  - Section 405(e): Distracted Driving – A total of 8.5 percent of Section 405 funds are allocated for distracted driving incentive grants. Funds are intended for programs which reduce the risk of distracted driving.
  - Section 405(h): Non-motorized Safety – 5 percent of Section 405 funds are available under this tier for states where the combined bicycle and pedestrian fatalities represent more than 15 percent of all roadway fatalities in that state based on the most recent Fatality Analysis Reporting System (FARS) data from National Highway Traffic Safety Administration (NHTSA). Funding under this tier requires a 20 percent match and is only eligible for training law enforcement on state laws applicable to pedestrian and bicycle safety, enforcement mobilizations and campaigns designed to enforce those state laws, or public education and awareness programs designed to inform motorists, pedestrians, and bicyclists.

California Highway Patrol (CHP) Cannabis Tax Fund Grant Program (CTFGP)

Funding for this program comes from the passage of Proposition 64, The Control, Regulate, and Tax Adult Use Marijuana Act (AUMA) in 2016. The intent of this program is to reduce the number of crashes by impaired drivers, increase public awareness related to the dangers of impaired driving, and improve highway safety. The purpose of the funds is to supplement and not supplant funding for current activities and programs. The next application window is anticipated to open in February 2022.

Implementation Plan

This plan was developed as a guide to facilitate the implementation of safety countermeasures and strategies to reduce fatal and serious injury crashes.

Key Steps for Successful LRSP Implementation

In July 2020, the FHWA released guidance (*Implementing a Local Road Safety Plan*) based on best practices and lessons learned by agencies around the country for implementing LRSPs. This guidance identified six key steps:

1. **Maintain buy-in and support:** Maintaining and expanding the stakeholder and public support fostered during the development of this LRSP will require on-going communication and coordination through educational materials, news releases, and meetings. Implementation of many non-engineering countermeasures will require partnerships with stakeholders to achieve a successful outcome. The Town should identify the specific outreach methods and level of detail that is achievable for continued communications with stakeholders, the public, and decision makers. Education and Enforcement

strategies are often best implemented following buy-in from community partners and stakeholders. It will be critical to work closely with stakeholders and community partners to ensure that resources and efforts are shared whenever possible.

2. **Identify funding mechanisms:** LRSPs are required for future HSIP funding, however, other funding mechanisms can also be used to improve local safety.

3. **Identify and prioritize projects:** Projects, programs, and initiatives should be prioritized based on the potential safety improvement and ease of obtaining funding and implementation.

4. **Determine project delivery methods:** Projects identified through this LRSP will be primarily pursued through grant funded projects and initiatives due to existing funding constraints. When possible, countermeasures should be included in on-going maintenance programs and incorporated into other projects.

5. **Evaluate effectiveness:** This living document is intended to be updated every four years. However, the Town would benefit from tracking safety metrics annually in order to gauge implementation outcomes on a more frequent basis. Ideally, effectiveness is measured by a reduction in serious injury and fatal crashes, as well as a reduction in all crashes. This is evaluated by tracking crash trends over time. Interim evaluations may include monitoring the occurrences of:

    a. Grants applied for and received
    b. Social media or educational programs established
    c. Enforcement programs executed

6. **Continue communication and coordination:** Similar to step 1, it is important to maintain close communication with stakeholders to coordinate efforts whenever possible and provide the public with updates regarding implementation progress and outcomes.

Implementation Timelines

The approximate timeframe for completion was broken into three possible timeframes:

- Short-Term: 1 – 2 years. This timeframe is typically for countermeasures that can be accomplished within the agency's resources or with established grants such as social media campaigns, improvements that are part of regular roadway maintenance, routine law enforcement, developing Safe Routes to School Plans, etc.
- Medium-Term: 3 – 5 years. This timeframe is typically for programs/ outreach campaigns that require planning or grant funding, or smaller-scale engineering projects such as signage/equipment projects.
- Long-Term: 6 – 10 years. This timeframe is typically for larger-scale engineering projects including widenings, shoulder additions, intersection modifications, etc.

Countermeasures and strategies with Medium- and Long-term implementation timeframes may be revisited during future LRSP update cycles.

Disadvantaged Communities Considerations

Selection of projects and program countermeasures should consider historically disadvantaged communities. The U.S. Department of Transportation provides a mapping tool of the criteria; these are provided in **Appendix C**:

- Historically Disadvantaged Community
- Transportation Disadvantage Community
- Health Disadvantage Community
- Economy Disadvantage Community
- Equity Disadvantage Community
- Resilience Disadvantage Community
- Environmental Disadvantage Community

The Town of Paradise or portions of the Town meet the criteria for each category.

Key Findings

This Local Road Safety Plan (LRSP) used a methodical process and input from stakeholders and the public to identify focus areas, analyze crash trends and develop countermeasures across the four E's of safety planning (Engineering, Education, Enforcement, and Emergency Services). Key findings are recommendations for the LRSP as follows:

- Population in the Town of Paradise, traffic volumes, and crashes have decreased following the Camp Fire of 2018. Substantial efforts are underway to plan for and rebuild a more resilient and safer roadway network to encourage economic development and population return.
- Stakeholder and public priorities have shifted to infrastructure and other transportation-related improvements geared toward evacuation safety. The public outreach efforts generated a total of 834 completed surveys.
- There were 966 crashes within the Town of Paradise between 2015 and 2020 with the majority occurring prior to the Camp Fire on November 7, 2018.
- Crash trends in the pre-fire data (January 1, 2015 – November 7, 2018) were similar to those identified in the previous *SSAR*.
- Following the Camp Fire, fatal and serious injury crashes have represented a higher percentage of overall crashes.
- Most crashes occur along roadway segments (as opposed to intersections).
- Many of the recommendations in the *SSAR* are planned to be implemented through HSIP funding awards or are being addressed through the *TMP*, *Active Transportation Plan (ATP)*, or the *2020 BCAG Regional Transportation Plan & Sustainable Communities Strategy*.
- Potential opportunities for engineering projects are summarized in **Table 21** and include:

- Systemic countermeasures along key roadways – Skyway, Clark Road, Pentz Road, Pearson Road, Elliott Road, Wagstaff Road (**Tables 11-12**)
- Systemic countermeasures at signalized intersections (**Tables 13-14**)
- Systemic pedestrian/bicycle improvements (**Tables 19-20**)

Table 21. Summary of Recommendations

Potential Applications	**Roadways**	
	SKYWAY	
	CLARK RD	
	PENTZ RD	
	PEARSON RD	
	ELLIOTT RD	
	WAGSTAFF RD	
Potential Countermeasures	**HSIP No.**	**Countermeasure Name**
	R01	Add segment lighting
	R02	Remove or relocate fixed objects outside of Clear Recovery Zone
	R15	Widen shoulder
	R21	Improve pavement friction (High Friction Surface Treatments)
	R28	Install edgelines and centerlines
	R30	Install centerline rumble strips/stripes
	R31	Install edgeline rumble strips/stripes
	RS32PB - RS35PB	Variety of Pedestrian/Bicycle Improvements

Table continues onto page 62

Table 21 continued. Summary of Recommendations

Potential Applications	**Signalized Intersections**	
	Clark Rd / Pearson Rd	
	Bille Rd / Clark Rd	
	Pearson Rd / Black Olive Rd	
	Skyway / Black Olive Rd	
	Skyway / Elliott Rd	
	Clark Rd / Elliott Rd	
	Skyway / Clark Rd	
	Skyway / Neal Rd	
	Skyway / Pearson Rd	
Potential Countermeasures	**HSIP No.**	**Countermeasure Name**
	S01	Add intersection lighting
	S02	Improve signal hardware
	S09	Install raised pavement markers and striping (through intersection)
	S11	Improve pavement friction (High Friction Surface Treatments)
	S18PB	Install pedestrian crossing
	S21PB	Modify signal phasing to implement a Leading Pedestrian Interval
Potential Applications	**Pedestrian & Bicycle**	
	CLARK RD - Roadway	
	SKYWAY- Roadway	
	ELLIOTT RD - Roadway	
	CLARK RD / BILLE RD – Intersection	
Potential Countermeasures	**HSIP No.**	**Countermeasure Name**
	S18PB	Install pedestrian crossing
	S21PB	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)
	R32PB	Install bike lanes
	R33PB	Install Separated Bike Lanes
	R34PB	Install sidewalk/pathway (to avoid walking along roadway)
	R35PB	Install/upgrade pedestrian crossing (with enhanced safety features)

Appendix A
Public Outreach Results

What is your primary mode of transportation? - Other
Work truck
Paratransit, shuttle.

Which best describes you? - Other
Magalia Resident
Live in magalia, drive thru Paradise daily
Magalia resident
Lost home in Paradise to fire, now in Magalia which is also affected by Paradise evacuation routes
Magalia
15 years Paradise, 25 years Magalia
Neighboring community of Forest Ranch
Magalia
Resident of Magalia, works in Paradise
Magalia resident
Upper Ridge resident
Magalia Resident Paradise is my evac route
Magalia resident, working in and traveling through paradise daily(for 25 years)
Magalia resident
Live on the out side of town and did a lot of shopping there
Current resident of Magalia
Butte Valley resident
Returning Magalia Resident's Daughter
Fire victim
Magalia resident
Magalia resident
Chico resident
live in concow but go to paradise often
Upper Ridge
Resident of Magalia
Resident of Magalia, commute to Chico
Former Magalia resident
Daily Visitor
magalia
resident of Magalia and would use Skyway through Paradise as an escape route
magalia resident
Work in Paradise
My dad lives there and I visit frequently.

Other - In your opinion, should the Town keep the midblock Crosswalk at Terry Ashe Park (shown above)?
Remove but add for event/seasonal crossing
crosswalk needs to be just up the block between the two bus stops, but since the road geometry precludes a refuge island, even RRFBs won't make the crossing safe from inattentive drivers
Idk

Other - What should be done with Honey Run Road?
Gate it. Open to local traffic only.
Bikes both directions, vehicles westbound only. Uphill bikes and downhill vehicles can safely share the road. Uphill vehicles create problems for both downhill bikes and downhill cars, so eliminate them.
Make it two way split. From 5am until 2pm downhill only 2pm until 5am uphill only.
Closed to motor vehicles, but enhance roadway for evacuations & emergency vehicles.
Keep as is
For evacuation purposes employ good traffic control and downhill only. Otherwise no change
Redo the road.
Let the county deal with it. Even if it was a better road traffic from skyway should not be sent down it during and evacuation
Gate it. Open to local traffic only.
Bikes both directions, vehicles westbound only. Uphill bikes and downhill vehicles can safely share the road. Uphill vehicles create problems for both downhill bikes and downhill cars, so eliminate them.
Leave it alone.
Motor vehicles only in evacuation purposes plus the 80,000 in safety upgrades!
leave it alone, don't need to micro manage the whole town
Make it two way split. From 5am until 2pm downhill only 2pm until 5am uphill only.
Make it safe for bikers both directions
Leave it alone
Leave it as is.

Appendix B
HSIP Countermeasure

HSIP Analyzer Manual

(For BCR Applications)

HSIP Analyzer is a PDF form-based software that streamlines the process of cost estimate, safety improvement countermeasure evaluation, crash data input and Benefit Cost Ratio (BCR) calculation. The use of the HSIP Analyzer is required for all applications for Highway Safety Improvement Program (HSIP) Cycle 10 Call for Projects. The completed HSIP Analyzer is one of the required attachments to the HSIP Application Form (Attachment No. 5, last page of the application form).

There are two HSIP application categories: BCR and Funding Set-asides. **This manual provides instructions for using the HSIP Analyzer to prepare a BCR application. Please use the other manual for Funding Set-aside Applications.**

Please review these instructions thoroughly before you start to prepare a BCR application.

For more information regarding the HSIP program, please review the HSIP Guidelines, Local Roadway Safety Manual for California Local Road Owners and other related information at https://dot.ca.gov/programs/local-assistance/fed-and-state-programs/highway-safety-improvement-program.

Table of Contents

For an application that needs a BCR, the HSIP Analyzer consists of the below sections:

- **General Information**

  Provides Application ID, Project Location, Project Description, type of project locations (signalized intersections, non-signalized intersections or roadways), safety countermeasures to be applied, estimated project schedule and other general information.

- **Section I: Construction Cost Estimate and Cost Breakdown**

  Provides estimate for construction items, determines the project's maximum Funding Reimbursement Ratio (FRR).

- **Section II: Project Cost Estimate**

  Provides the cost estimate for the entire project, including all phases (PE, ROW, CON and CE). Also determines the requested HSIP funding amount.

- **Section III. Crash Data**

  Provide crash data for the purpose of calculating the project benefit in Section IV.

- **Section IV. Calculation and Results**

  Calculate the project benefit, the BCR and provide calculation result summaries. Errors are displayed in lieu of calculation results if detected.

One BCR application may include one or multiple locations. Please note:

a. All the locations in the application must be of the same type: Signalized Intersections (S), Non-Signalized Intersections (NS), or Roadways (R). For example, an application may have 5 Non-Signalized Intersections, but it cannot have 2 Non-Signalized Intersections, 1 Signalized Intersection and 2 roadway sections.

b. All the locations in the application must receive the same proposed safety improvements, i.e. all the safety countermeasures (CMs) must be applied to all the locations. Up to three (3) safety countermeasures may be used in calculating the benefit of the project.

If the above criteria are not met, please break your proposed project into multiple applications. Applicants may consider combining the applications into one project during implementation if multiple applications of small sizes are selected for funding. The purpose of this requirement is to evaluate the locations of same characteristics with similar safety concerns together and justify the selection of the locations based on their own expected safety benefits.

Example:

A project includes 20 signalized intersections. CMs "Add Intersection Lighting" (S01) and "Install pedestrian countdown signal heads" (S17PB) will be applied to all 20 intersections. If for another set of 12 intersections only CM S17PB will be installed since lighting exists, these 12 intersections should have a separate application.

Exception 1: If your project has only very few locations that the situation is different from the majority, you may include all locations in one application. Multiple HSIP Analyzer files will be needed if the project includes locations/sites of different types (S, NS and R). Please attach all your HSIP Analyzer files to the application form. Please sum the benefits and calculate the application's BCR as (Total benefits/Total Project Cost). Enter the BCR into the application form.

Example:

A project includes 20 signalized intersections. CMs "Add Intersection Lighting" (S01) and "Install pedestrian countdown signal heads" (S17PB) will be applied to all 20 intersections. If you have 2 more intersections that only CM S17PB will be applied, you may include all 22 intersections in one application. Since all locations are of the same type (S), only one HSIP Analyzer file is needed.

Exception 2: If your project proposes corridor safety improvements which may include a number of signalized intersections, non-signalized Intersections, and roadway sections, you may include all locations in one application which then needs multiple HSIP Analyzer files. All HSIP Analyzer files pertaining to your application must be attached to the last page of the application form. Please sum the benefits and calculate the application's BCR manually as (Total benefits/Total Project Cost). Enter the BCR into the application form.

Exception 3: If your project uses a systemic approach, you may include all locations in one application though the proposed safety improvements may be different. For example, for a project that includes many curve road segments that have an existing or potential roadway-departure crash problem, all road segments can be in one application, though the safety countermeasures may vary. Since all locations are of the same type (R), only one HSIP Analyzer file is needed. Please note the maximum number of safety countermeasures allowed in one HSIP Analyzer file is 3.

General Information

Application ID: Enter the exact Application ID from the Application Form, e.g. 03-Sacramento-1.

Save the completed HSIP Analyzer as file name "HA" + Application ID before you attach it to the last page of the Application Form (e.g. "HA03-Sacramento-1.pdf").

If your application has multiple HSIP Analyzer files (this is rare), please use different file names and attach all to the application form. See the previous page for more explanation.

Project Location: Enter (copy & paste) the exact Project Location from the Application Form.

Project Description: Enter (copy & paste) the exact Project Description from the Application Form.

Application Category, Location Type and Countermeasures:

- Select "Benefit Cost Ratio (BCR)" from the drop-down list;
- Select the location type ("Signalized Intersections", "Non-Signalized Intersections" or "Roadway Sections"). only countermeasures (CMs) pertaining to the selected location type will be displayed in the below drop-down lists for CM selection.
- Number of Intersections and Miles of Roadway: provide number of intersections (if ("Signalized Intersections" or "Non-Signalized Intersections" is selected above) or the length of roadways (if "Roadway Sections" is selected above).
- Select number of countermeasures for the project (1, 2 or 3); and
- Select the name for each countermeasure.

The countermeasures selected here will be populated in Section I (Construction Cost Estimate and Cost Breakdown) and Section III (Crash Data).

If an error message is displayed at the bottom of this page, the message must be cleared before proceeding to the next page. An error message will be displayed if one of the following specific CM rules is violated:

1) S08 and S02 should not be selected together.

   S08 ("Convert signal to mast arm (from pedestal-mounted)") and S02 ("Improve signal hardware: lenses, back-plates, mounting, size, and number") should not be selected together as the work of S02 is considered part of CM S08.

2) Any of the below CMs should not be selected in combination with any other CMs:
   - S16 - Convert intersection to roundabout (from signal);
   - NS03 - Install signals;
   - NS04 - Convert intersection to roundabout (from all way stop);
   - NS05 - Convert intersection to roundabout (from stop or yield control on minor road).

Project information

Most of the information requested in this session is required for Caltrans to meet its annual safety program reporting requirements to the FHWA. Responses to these questions will NOT be used in the scoring, ranking or selection process. The responses will be incorporated in statewide and national safety program assessments and used to determine the health of the overall program and potential areas of focus for future program improvements.

Some of the questions are self-explanatory so not all questions are explained here.

Functional Classification (FC):
Visit https://dot.ca.gov/programs/research-innovation-system-information/office-of-highway-system-information-performance, click "California Road System (CRS) maps" in the middle of the webpage, and determine the Functional Classification (FC) of the road(s) where most of the work will be constructed. If the amounts of work are equal among multiple FCs, use the highest FC. Select the FC from the drop-down list.

Urban/Rural Area:
Select "Urban" or "Rural" from the drop-down list, when most of the proposed work is in urban or rural area.

What is the approximate total cost percentage that is HR3 eligible?
Work in **rural** area and associated with roads functionally classified as "Major Collector", "Minor Collector" and/or "Local", is High-Risk-Rural-Roads (HR3) eligible. HR3 eligible projects, when selected for funding, will be tracked separately due to the FHWA's special requirements. Provide an approximate total cost percentage that is HR3 eligible (rounded to the nearest ten percent).

Annual Average Daily Traffic and Year Collected:

Indicate the existing (or most current) Annual Average Daily Traffic (AADT) volume at the project location and the year the data were collected.

- If the proposed improvement is on a road segment, the AADT is the number of vehicles that use that section of roadway, in both directions, on an average day. You may enter the same number for the Major Road and Minor Road.
- If the proposed improvement is at an intersection, separate the AADT volumes approaching the intersection into Major Road and Minor Road.
- If the proposed improvements span a large distance and/or are spread out over several routes/locations, provide the range of AADT volumes with the high-end input in the "Major Road" field and the low-end input in the "Minor Road" field.

Posted Speed Limit (mph):
Input the highest posted speed within the project limits.

SHSP Challenge Area:
The goal of this question is to tie the improvements to California's Strategy Highway Safety Plan (SHSP). Most projects should fall within one of the Challenge Areas. Select the primary one if multiple Challenge Areas apply. Visit https://dot.ca.gov/programs/traffic-operations/shsp for more details on the California SHSP Challenge Areas.

Is the project focused primarily on "spot location(s)" or "systemic" improvements?
The Local Roadway Safety Manual includes a detailed description of these two approaches. When more than one type of systemic improvements is proposed in one application, applicants need to select a single "primary type".

Approximate percentage of project cost going to improvements related to motorized travel:
HSIP projects benefit a mix of roadway users and modes of travel. For statewide tracking purposes, Caltrans needs to approximate the percent of the overall project costs going to improvements for motorized vs. non-motorized roadway users. Please make the best approximation of the percentage related to motorized travel based on the estimated project cost and the primary goals and objectives of the project.

Project Schedule:

The local agency is expected to deliver the project per the HSIP Program Delivery requirements. The delivery requirements for HSIP Cycle 10 projects are: (1) Preliminary Engineering (PE) Authorization by 9/30/2021; and (2) Construction (CON) Authorization by 12/31/2023.
The exceptions are:

- The milestone of PE authorization does not apply if the project will not use the HSIP funds for PE;
- For a project that a consultant is used for the PE work, an additional time of 6 months is allowed for meeting the CON Authorization milestone. The additional time is for the agency to advertise and select the consultant for the work of the PE phase.

Please answer the below two questions:

- Will this project use HSIP funds for Preliminary Engineering (PE) Phase?
- Will an external consultant be hired to do the PE work?

Then specific delivery requirements for your proposed project, if selected for funding, will be displayed.

Please provide your best estimated dates for the following implementation milestones (leave blank if not applicable). Please make sure the proposed schedule will meet the above delivery requirements.

- PE Authorization Date;
- Environmental Clearance Date;
- Right of Way Clearance Date;
- Final PS&E Date;
- CON Authorization Date;
- Construction Contract Award Date;
- Construction Completion Date; and
- Project Close-Out Date.

Section I: Construction Cost Estimate and Cost Breakdown

The purpose of this section is to:

- Provide a detailed engineer's estimate for construction items. The costs for other phases i.e. Preliminary Engineering (PE), Right of Way (ROW), and Construction Engineering (CE) will be accounted for in Section II.
- Determine the maximum Funding Reimbursement Ratio (FRR) of the project.

****

I.1 Countermeasures (CMs) applied to all locations (from Page No. 1)

The CM information comes from Page No. 1.

I.2 Detailed Engineer's Estimate for Construction Items:

- **Table for Detailed Engineer's Estimate:**

  The gray fields are calculated and read-only. Each line is for one construction item. Click + or – buttons to add a new line or delete an existing line.

  In each line, enter the construction item description, quantity, unit, unit cost, and the cost percentages that are directly attributed to each of the countermeasures (CMs) and OS ("other safety-related components"). The remaining percentage is calculated and goes to NS ("non-safety-related components").

  At the bottom of the table, an overall cost percentage will be calculated for each CM, OS and NS.

- **Contingencies**:

  In general, not all project construction costs are well defined at the time the HSIP applications are prepared. For this reason, applicants are allowed to include Construction Item Contingencies as a percentage of the known construction costs. This is the only project contingencies allowed in an HSIP application. When applicants calculate their Preliminary Engineering (PE) and Construction Engineering (CE) costs as a percentage of the Total Construction Cost, contingencies will automatically be built into the PE and CE costs.

- **Total Construction Cost**:

  The total construction cost is the sum of the construction item costs and the contingencies, rounded up to the nearest hundreds.

I.3 Funding Reimbursement Ratio

The project's maximum FRR is calculated as:

- The smallest of the Funding Eligibility (FE) percentages of the selected CMs, when the percentage of the non-safety- related components is no more than 10%;

  For example, if the FEs of the 3 CMs are 100%, 90% and 100%, and the % of the non-safety- related components is 8%, the project's maximum FRR will be 90%.

- OR the smallest of the FE percentages of the selected CMs minus the percentage of the non-safety-related-components exceeding 10%, when the percentage of the non-safety related components is more than 10%.

  For example, if the FEs of the 3 CMs are 100%, 90% and 100%, and the % of the non-safety- related components is 18%, the project's maximum FRR will be 90%-(18%-10%)=82%.

After the completion of Section I, the following data will be transferred to Section II (Project Cost Estimate) automatically: (1) Total Construction Cost; and (2) Maximum Funding Reimbursement Ratio (FRR). FRR will be used as the maximum "HSIP/Total" percentage allowed in Section II.

Section II: Project Cost Estimate

Section II of the application form is used for the overall project cost estimate including all applicable phases, i.e. Preliminary Engineering (PE), Right of Way (ROW), Construction (CON), and Construction Engineering (CE). All project costs (all phases and funding sources) must be accounted for in this section.

The costs included in the application represent the likely total project cost necessary to fully construct the proposed scope. If the proposed project is a piece of a larger construction project, the entire scope of the larger project must be identified and included in this section even if substantial elements are to be funded by other sources. The Total Project Cost from this section will be used in the later Benefit Cost Ratio (BCR) calculation.

The following data are transferred to this section from Section I:
- *Total Construction Cost;*
- *Maximum Funding Reimbursement Ratio (FRR), i.e. Maximum "HSIP/Total" percentage allowed for this project.*

All the grey fields contain formulas and are read-only.

For each line in the table, enter the total cost (rounded up to the nearest hundred dollars) and the desired HSIP/Total Cost ratio. The desired HSIP/Total ratio cannot be more than the project's maximum FRR. You may click the "Set" button on top of the table to set all "HSIP/Total" percentages to the project's max FRR. The amounts of HSIP Funds and Local/Other Funds will be calculated by the form.

Check Box indicating Agency does NOT request HSIP funds for PE Phase:

If no HSIP funds for the PE Phase are requested, this Check Box will be checked automatically. This information will only be used for project delivery tracking. It will not affect the ranking or selection of applications for funding.

Automatic Data Validation:

Once all costs and ratios are entered, a message will appear if errors are detected, based on the below criteria. Please fix the errors unless justification for exceptions is provided in narrative question no. 3 in the Application Form.

1) The "HSIP Funds" for Construction Items may not be zero.
2) "HSIP Funds" for Preliminary Engineering may not exceed 25% of the HSIP Construction Cost.

   Exception: for low cost systematic projects such as Roadway Safety Signing Audits (RSSA), Caltrans anticipates approving PE costs over 25%. For more information on this type of project, see the example document at the HSIP website.
3) "HSIP Funds" for Right of Way may not exceed 10% of the HSIP Construction Cost.
4) "HSIP Funds" for Construction Engineering may not exceed 15% of the HSIP Construction Cost.
5) "HSIP Funds" may not exceed $10,000,000.
6) To maintain efficiencies in the overall Program and Project Management, the "Total HSIP Funds" must be $100,000 or more. If needed, agencies should consider extending the project limits and /or adding another safety improvement in order to increase both the total project Benefits and Costs.

   Exception: (1) Caltrans recognizes that for some rural agencies with extremely small numbers of crashes, this $100,000 minimum HSIP funding requirement may not be achievable without their applications having low B/C ratios, which may not be fundable. If an agency believes their jurisdiction falls into this category, they may request an exception to this $100,000 minimum funding requirement through their District Local Assistance Engineer; (2) You may combine multiple applications (if selected for funding) in implementation so the combined project has more than $100,000 of HSIP funds.

After the completion of the project cost estimate, "Total Project Cost" will be automatically transferred to Section IV (Calculation and Results).

Section III: Crash Data

The benefit of an HSIP safety project is achieved by reducing potential future crashes due to the application of the safety countermeasures (CMs). In this section, you will need to provide information regarding the historical crash data at the project sites.

Different CMs will reduce crashes of different types during the life of the safety improvements. Depending on the selected CMs for the application, you will be required to fill in one or more crash data tables, for any combination of the five crash types (datasets): "All" , "Night" , Ped& Bike", "Emergency Vehicle", and "Animal" (Each of the later four datasets is a sub-dataset of the "All" dataset.)

If a Roundabout CM (S16 or NS04 or NS05) is selected, additional information (such as roundabout configuration and ADT) is required.

Please refer to the Local Roadway Safety Manual for information.

Please answer the below two questions:

- Please indicate the sources of the crash data. Typical sources include Statewide Integrated Traffic Records System (SWITRS), UCBerkeley SafeTREC TIMS, your locally preferred mapping software (such as Crossroads) or any other data sources.
- Please explain how “incremental approach” has been pursued If CM R15, R16, R17 or R18 is proposed. Please skip this question of none of these CMs are being proposed.

  Countermeasure R15 (Widen shoulder), R16 (Curve shoulder widening (outside only)), R17 (Improve horizontal alignment (flatten curves)) and R18 (Flatten crest vertical curve) are not eligible unless they are done as the last step of an "incremental approach". Applicants need to document they have already installed lower cost and lower impact CMs but the crash rate is unacceptably high. What safety improvements have been pursued and installed at the project sites within the last ten years?

  Applicants need to demonstrate lower cost and lower impact CMs have already installed, such as signing/striping upgrades to MUTCD standards/recommendations, rumble strips, improving pavement friction (High Friction Surface Treatment, or HFST), etc. You have already monitored the crash occurrences after these improvements were installed, and the 'after' crash rate is still unacceptably high. In addition, a summary of the 'before' and 'after' crash analysis is preferred and provided as the last attached to the HSIP Application Form).

  If “incremental approach” has not been pursued while CM R15, R16, R17 or R18 is proposed, please explain why a special exception should be made to your application.

III.1: List of project locations

List all locations/sites included in this project. Please note all locations/sites must be of the location type as entered on page 1.

Location groups: all locations (sites) in the same group must have exactly the same safety countermeasures. No location (site) may be in multiple groups.

One location is pre-populated for each location group. Click “+” button to add a new line, or click “-“ to delete an existing line. Enter a location description for each line.

The locations may be intersections or roadway sections, e.g. “Intersection of A St. and B St.”, “A St. between B St. and C St.”, etc. If your project has a large number of locations, please aggregate some locations into one description, e.g. 10 stop controlled intersections, 5 horizontal curves, etc., as long as they have similar features and the safety improvements to be implemented are the same. Please limit the number of rows in the table to no more than 25.

The locations in this list will be pre-populated in the crash data table(s) for each group in Section III.2.

Grouping example:

A project has 5 road segments. All 5 segments (A, B, C, D & E) utilize CM “Install curve advance warning signs” (R24). In addition, 3 of the 5 segments (C, D & E) utilize “Install edgeline rumble strips/stripes” (R31) as well.

There will be 2 groups for this project:

Group 1: Segments A & B, with CM = R24 only;

Group 2: Segments C, D & E, with 2 CMs (R24 & R31).

Note: we cannot have only one group with all 5 segments, as that will imply all segments will be treated with both R24 and R31.

III.2: Countermeasures and crash data

1) Countermeasures to be applied: The CM information is pre-populated from the inputs on page 1. Each CM has a corresponding crash type that the CM targets. The crash types are: “All”, “Night”, “Ped & Bike”, “Emergency Vehicle” and “Animal”. Each of the later four is a subset of the first. Based on the CMs for the project, only the tables for the required crash data types are displayed.

   Note: If a “**roundabout**” CM, i.e. S16, NS04 or NS05 (CM ID), is used, the below information is required as the benefit calculation for roundabouts is different from the other CMs.

   - Project location: “Urban” or “Rural” (select from dropdown list)
   - Intersection type: “Full Intersection” or “T intersection” (select from dropdown list)
   - Roundabout: “1 lane” or “2 lanes” (select from dropdown list)
   - Average Daily Traffic (ADT), Major Road: ADT on the major road of the intersection
   - Average Daily Traffic (ADT), Minor Road: ADT on the cross road of the intersection

2) Enter the date range of the crash data. The crash data time period must be a minimum of 3 years and a maximum of 5 years. The most recent available crash data must be used.

3) Based on the CMs that are selected, crash data tables of the required categories ("All", "Night", “Ped & Bike", "Emergency Vehicle", and "Animal") are displayed for data entry.

Important information regarding countermeasures and crash data

Below is more information and explanations regarding countermeasures and crash data. Please read and make sure the data provided are correct. Past HSIP calls for projects indicated that the most flaws found in disqualified applications are related to misapplication of countermeasures and miscounting of crash data.

Safety Countermeasures vs. Crash Data Tables

A total of 82 countermeasures are available to be utilized in the HSIP Analyzer. Different countermeasures may target different crash types. For example, installing a new signal at an intersection intends to reduce crashes of all types, while installing pedestrian countdown signal heads only reduces crashes related to pedestrians and bicyclists (Ped & Bike), and adding intersection lighting targets crashes at night only.

For the use of the HSIP Analysis, there are 5 different crash types: “All”, “Night”, “Ped & Bike”, “Emergency Vehicle” and “Animal”. Each of the later four datasets is a sub-dataset of the "All" dataset. Refer to the Appendix for more information. In the 82 countermeasures listed in the Appendix, 59 are for crashes of all types, 18 for Ped&Bike crashes, 3 for night crashes, 1 for crashes with emergency vehicles, and 1 for crashes with animals involved.

Depending on the selected countermeasures, you will be required to fill in one or more crash data tables, for one or a combination of the five crash types. For example, if two countermeasures are utilized in a group – “Install flashing beacons as advance warning” (Countermeasure S10) and “Add intersection lighting” (Countermeasure S01), two crash data tables are required, one for all crashes (for S10) and the other for night crashes (for S01).

Crash Data Table

A Crash Data Table is a summary table of crash data for all the locations included in the project, with one row for one location and one column for a severity. Below is the structure of a Crash Data Table for Ped&Bike crashes.

Example: **Crash Data Table for Crash Type: Pedestrians and Bicyclists Involved**

Location	Fatality	Severe Injury	Injury - Other Visible	Injury - Complaint of Pain	Property Damage Only	Total
Intersection of A St. & B St.	0	1	0	2	4	**7**
Intersection of A St. & C St.	1	1	1	5	4	**12**
Intersection of A St. & D St.	0	2	1	2	10	**15**
Total	1	4	2	9	18	**34**

Safety countermeasures available for use in HSIP Analyzer

The available countermeasures are broken down into three groups (Signalized Intersection, Non-signalized Intersection, and Roadway Segment). The Appendix of this document provides a complete list of the countermeasures. Review **Section 4.0 and Appendix B of the California Local Roadway Safety Manual** before making the final selection of countermeasures to utilize in the BCR calculations. The detailed description of the countermeasures and guidance on how they can be applied will help applicants ensure they are utilizing the most appropriate countermeasures for their projects.

Any single project may use up to three countermeasures. When a countermeasure of a major safety improvement is selected, other incidental elements of the major countermeasure should be not used together with the major one. For example: A project proposing a new signal shall not include countermeasures for lighting, signing, striping, or minor median improvements as they are incidental elements of the new signal and do not represent stand-alone improvements.

Specific rules for some particular countermeasures

Please pay attention to the specific rules and requirements pertaining to CMs NS03, NS14, NS23PB, R08 and R14 (Refer to Appendix B of the California Local Roadway Safety Manual for more details):

1) **NS03, Install signals:**

   All new signals must meet CA MUTCD "safety" warrants: 4, 5 or 7;
   No other intersection CMs can be applied to the intersection crashes in conjunction with this CM.

2) **NS14, Install raised median on approaches (NS.I.)**
   R08, Install raised median

   All new raised medians must not include the removal of the existing roadway structural section and must be doweled into the existing roadway surface.

3) **NS23PB, Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK)):**

   For HAWK or other pedestrian signals, the justification may be Warrant 4, 5 and/or 7, or passing the test in Figure 4F-1/4F-2 in Chapter 4F of CA MUTCD. Please refer to Chapter 4F of CA MUTCD for more details.

4) **R14, Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes):**

   "Intersection" crashes can only be applied when they resulted from turning movements that had no designated turn lanes/phases in the existing condition and the Road Diet will provide turn lanes/phases for these movements. This CM does not apply to roadway sections that already included left turn lanes or two way left turn lanes before the lane reductions. New bike lanes are also expected to be part of these projects. Pre-approval from the HSIP program manager is needed for: 1) the use of this CM without removing a

travel lane in each direction and/or without adding new bike lanes; and/or 2) if any pavement is planned to be removed for the purpose of adding landscaping, planter-boxes, or other non-roadway user features.

Crash Data

1) Crash data time period:

   The crash data time period must be **a minimum of 3 years and a maximum of 5 years** and the most recent available crash data must be used.

2) Multiple crash data tables may be needed for a group. Depending on the selected countermeasure(s), different categories of the crash data are required. Each table is for one of the 5 categories (dataset/sub-datasets): All; Night; Ped & Bike; Emergency Vehicle; and Animal.

3) There are three sub-severities of injury crashes: "Severe Injury", "Injury – Other Visible" and "Injury – Complaint of Paint". **If the injury crashes in your agency's crash database do not have more detailed sub-severities, all of the injury crashes must be entered as "Injury – Other Visible".**

4) Every occurrence of crash applied to the countermeasures is be counted as one crash, regardless of the number of vehicles and the number of people involved in the crash. For example, if there is one crash which involved three vehicles and caused two injuries and one fatality, the crash would be tracked in the application as 1 fatal crash.

5) Collision Diagrams and Collision lists:

   Applicants are required to provide Collision Diagrams and Collision Lists as supporting documents (attachments) to the application. The Collision Diagrams and the Collision Lists should be organized so application reviewers can easily identify the collision data and their corresponding project locations.

6) **All crashes applied to a given countermeasure must be within the countermeasures influence-area.** The following are some general criteria to guide the applicants in determining appropriate influence-areas for countermeasures. Before applying these general criteria, it is the applicant's responsibility to ensure that they are reasonable for their particular application. (More guidance relating to each specific countermeasure is included in Section 4 and Appendix B of the California Local Roadway Safety Manual).

   a) New Traffic Signals: All crashes within 250 feet of the new signal.

   b) For intersection improvements, collisions that occurred within 250 feet of the intersection in all directions affected by the improvement may be used. If the distance to the nearest intersection is less than 500 feet, only those collisions that occurred from mid-block may be used.

   c) Longitudinal Improvements (guardrail, raised median, turn pockets, etc): All crashes potentially effected by and within the limits of the improvement.

   d) Signage, striping, delineators, or other warning devices: All crashes potentially effected by and/or within the limits of the driver's potential reaction to the improvements.

   e) The influence-area may be extended beyond the physical improvements and/or the limits above if standard traffic engineering principles, as documented in Caltrans, American Association of State Highway and Transportation Officials (AASHTO) or FHWA publications, suggest it would be appropriate to do so. When the influence-area of the project is not obvious and judgment has been used in identifying the influence-area, it is the applicant's responsibility to provide additional documentation showing the reasonableness of the judgment.

7) Do not include collisions unreported by law enforcement. Collision summary reports that corroborate the collision numbers must be attached to the application. Do not attach the actual collision reports prepared by the law enforcement officer. For applicants using TIMS Query & Map tool to analyze and summarize SWITRS crash data, applicants may find it necessary to add in known crashes that were not included in the TIMS summaries. These crashes may be added manually as long as the agency's safety managers include supporting documentation and a comment and/or signature attesting to the source of these crashes and the accuracy of the total crash data.

8) The safety countermeasures constructed by the projects will not eliminate 100% of the safety risks and future crashes. This is especially true for lower-cost systemic improvements, such as signing and striping projects. Based on this, it is often reasonable for an agency to construct follow-up improvements along a corridor or at a location that has already had an HSIP project constructed. (Example: an agency has completed a striping upgrade project on a corridor. In a later HSIP cycle, the agency proposes a signing project on the same corridor based on an overlapping set of crashes.) For this reason, Caltrans allows agencies to reuse crashes in a current call for projects that have been used in a prior call for projects. It is the agency's responsibility to verify this and document it in the application in the Narrative Questions or separate backup documentation.

Section IV: Calculation and Results

Click the button Calculate to perform the calculation of the benefit and the BCR.

If errors are detected, the calculation will stop, and a table will display the errors. The errors must be fixed prior to the next calculation attempt.

The possible errors are:

- No location type (S/NS/R) is provided.
- No CMs are available for the location type.
- CMs S08 and S02 should not be used together.

  The work of S02 ("Improve signal hardware") is considered as part of CM S08 ("Convert signal to mast arm").
- CM NS3 should not be used with any other CM.

  CM NS3 ("Install signals") should cover any other intersection improvements.
- Roundabout, when selected, should be the only CM.

  The benefit calculation for a roundabout is unique. It is not allowed to have a roundabout and other safety countermeasures in the same project.
- Roundabout is the proposed work but roundabout information is not provided.
- Crash data period is not between 3 and 5 years.
- Num of crashes in a sub-dataset > the num in All dataset.

  For at least one of the severities, the number of crashes in a subset ("Night", "Ped & Bike", "Emergency Vehicle", or "Animal") is more than the corresponding severity in "All" crashes.

After the errors are fixed and the calculation is successfully performed, the results are presented in two tables: "Benefit Summar" and "BCR and other key information". Please transfer the "Total Project Cost" , "HSIP Funds Requested" and the BCR to Page 2 of the HSIP Application Form.

Appendix: List of Countermeasures
(From Local Roadway Safety Manual – Section 4.2)

The list of countermeasures is from Section 4.2 of the Local Roadway Safety Manual. It is provided here for your convenience.

The countermeasures listed in the following three tables have been sorted into 3 categories: Signalized Intersection (S), Non-Signalized Intersection (NS), and Roadway Segment (R). Pedestrian and bicycle related countermeasures have been included in each of these categories, as the consideration of non-motorized travel is important for all roadway classifications and locations. The countermeasures included in these tables are used in the HSIP Analyzer. When selecting countermeasures and CRFs to apply to their specific safety needs, local agency safety practitioners should consider the **availability, applicability**, and **quality** of CMFs, as discussed in section 4.1 of the Local Roadway Safety Manual.

Only Crash Types, CRFs, Expected Lives, and Funding Eligibility of the countermeasures for use in Caltrans local HSIP program are provided. Fields in the countermeasure tables are:

- **Crash Types -** "All", "P & B" (Pedestrian and Bicycle), "Night", "Emergency Vehicle", or "Animal".
- **CRF -** Crash Reduction Factor used for HSIP calls-for-projects.
- **Expected Life -** 10 years or 20 years.
- **Funding Eligibility –** the maximum HSIP funding reimbursement ratio.
    - Forty (45) countermeasures: 100%
    - Thirty-five (36) countermeasures: 90%
    - One (1) countermeasure: 50% (CM No. S03: Improve signal timing, as this CM will improve the signal operation rather than merely the safety.)
- **Systemic Approach Opportunity -** Opportunity to Implement Using a Systemic Approach: "Very High", "High", "Medium" or "Low".

Table 1. Countermeasures for Signalized Intersections

No.	Type	Countermeasure Name	Crash Type	CRF	Expected Life (Years)	HSIP Funding Eligibility	Systemic Approach Opportunity?
S01	Lighting	Add intersection lighting (S.I.)	Night	40%	20	100%	Medium
S02	Signal Mod.	Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number	All	15%	10	100%	Very High
S03	Signal Mod.	Improve signal timing (coordination, phases, red, yellow, or operation)	All	15%	10	50%	Very High
S04	Signal Mod.	Provide Advanced Dilemma Zone Detection for high speed approaches	All	40%	10	100%	High
S05	Signal Mod.	Install emergency vehicle pre-emption systems	Emergency Vehicle	70%	10	100%	High
S06	Signal Mod.	Install left-turn lane and add turn phase (signal has no left-turn lane or phase before)	All	55%	20	90%	Low
S07	Signal Mod.	Provide protected left turn phase (left turn lane already exists)	All	30%	20	100%	High
S08	Signal Mod.	Convert signal to mast arm (from pedestal-mounted)	All	30%	20	100%	Medium
S09	Operation/ Warning	Install raised pavement markers and striping (Through Intersection)	All	10%	10	100%	Very High
S10	Operation/ Warning	Install flashing beacons as advance warning (S.I.)	All	30%	10	100%	Medium
S11	Operation/ Warning	Improve pavement friction (High Friction Surface Treatments)	All	55%	10	100%	Medium
S12	Geometric Mod.	Install raised median on approaches (S.I.)	All	25%	20	90%	Medium
S13PB	Geometric Mod.	Install pedestrian median fencing on approaches	P & B	35%	20	90%	Low
S14	Geometric Mod.	Create directional median openings to allow (and restrict) left-turns and u-turns (S.I.)	All	50%	20	90%	Medium
S15	Geometric Mod.	Reduced Left-Turn Conflict Intersections (S.I.)	All	50%	20	90%	Medium
S16	Geometric Mod.	Convert intersection to roundabout (from signal)	All	Varies	20	100%	Low
S17PB	Ped and Bike	Install pedestrian countdown signal heads	P & B	25%	20	100%	Very High
S18PB	Ped and Bike	Install pedestrian crossing (S.I.)	P & B	25%	20	100%	High
S19PB	Ped and Bike	Pedestrian Scramble	P & B	40%	20	100%	High
S20PB	Ped and Bike	Install advance stop bar before crosswalk (Bicycle Box)	P & B	15%	10	100%	Very High
S21PB	Ped and Bike	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)	P & B	60%	10	100%	Very High

Table 2. Countermeasures for Non-Signalized Intersections

No.	Type	Countermeasure Name	Crash Type	CRF	Expected Life (Years)	HSIP Funding Eligibility	Systemic Approach Opportunity?
NS01	Lighting	Add intersection lighting (NS.I.)	Night	40%	20	100%	Medium
NS02	Control	Convert to all-way STOP control (from 2-way or Yield control)	All	50%	10	100%	High
NS03	Control	Install signals	All	30%	20	100%	Low
NS04	Control	Convert intersection to roundabout (from all way stop)	All	Varies	20	100%	Low
NS05	Control	Convert intersection to roundabout (from stop or yield control on minor road)	All	Varies	20	100%	Low
NS06	Operation/ Warning	Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs	All	15%	10	100%	Very High
NS07	Operation/ Warning	Upgrade intersection pavement markings (NS.I.)	All	25%	10	100%	Very High
NS08	Operation/ Warning	Install Flashing Beacons at Stop-Controlled Intersections	All	15%	10	100%	High
NS09	Operation/ Warning	Install flashing beacons as advance warning (NS.I.)	All	30%	10	100%	High
NS10	Operation/ Warning	Install transverse rumble strips on approaches	All	20%	10	90%	High
NS11	Operation/ Warning	Improve sight distance to intersection (Clear Sight Triangles)	All	20%	10	90%	High
NS12	Operation/ Warning	Improve pavement friction (High Friction Surface Treatments)	All	55%	10	100%	Medium
NS13	Geometric Mod.	Install splitter-islands on the minor road approaches	All	40%	20	90%	Medium
NS14	Geometric Mod.	Install raised median on approaches (NS.I.)	All	25%	20	90%	Medium
NS15	Geometric Mod.	Create directional median openings to allow (and restrict) left-turns and u-turns (NS.I.)	All	50%	20	90%	Medium
NS16	Geometric Mod.	Reduced Left-Turn Conflict Intersections (NS.I.)	All	50%	20	90%	Medium
NS17	Geometric Mod.	Install right-turn lane (NS.I.)	All	20%	20	90%	Low
NS18	Geometric Mod.	Install left-turn lane (where no left-turn lane exists)	All	35%	20	90%	Low
NS19PB	Ped and Bike	Install raised medians / refuge islands (NS.I.)	Ped and Bike	45%	20	90%	Medium
NS20PB	Ped and Bike	Install pedestrian crossing at uncontrolled locations (new signs and markings only)	Ped and Bike	25%	10	100%	High
NS21PB	Ped and Bike	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)	Ped and Bike	35%	20	100%	Medium
NS22PB	Ped and Bike	Install Rectangular Rapid Flashing Beacon (RRFB)	Ped and Bike	35%	20	100%	Medium
NS23PB	Ped and Bike	Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK))	Ped and Bike	55%	20	100%	Low

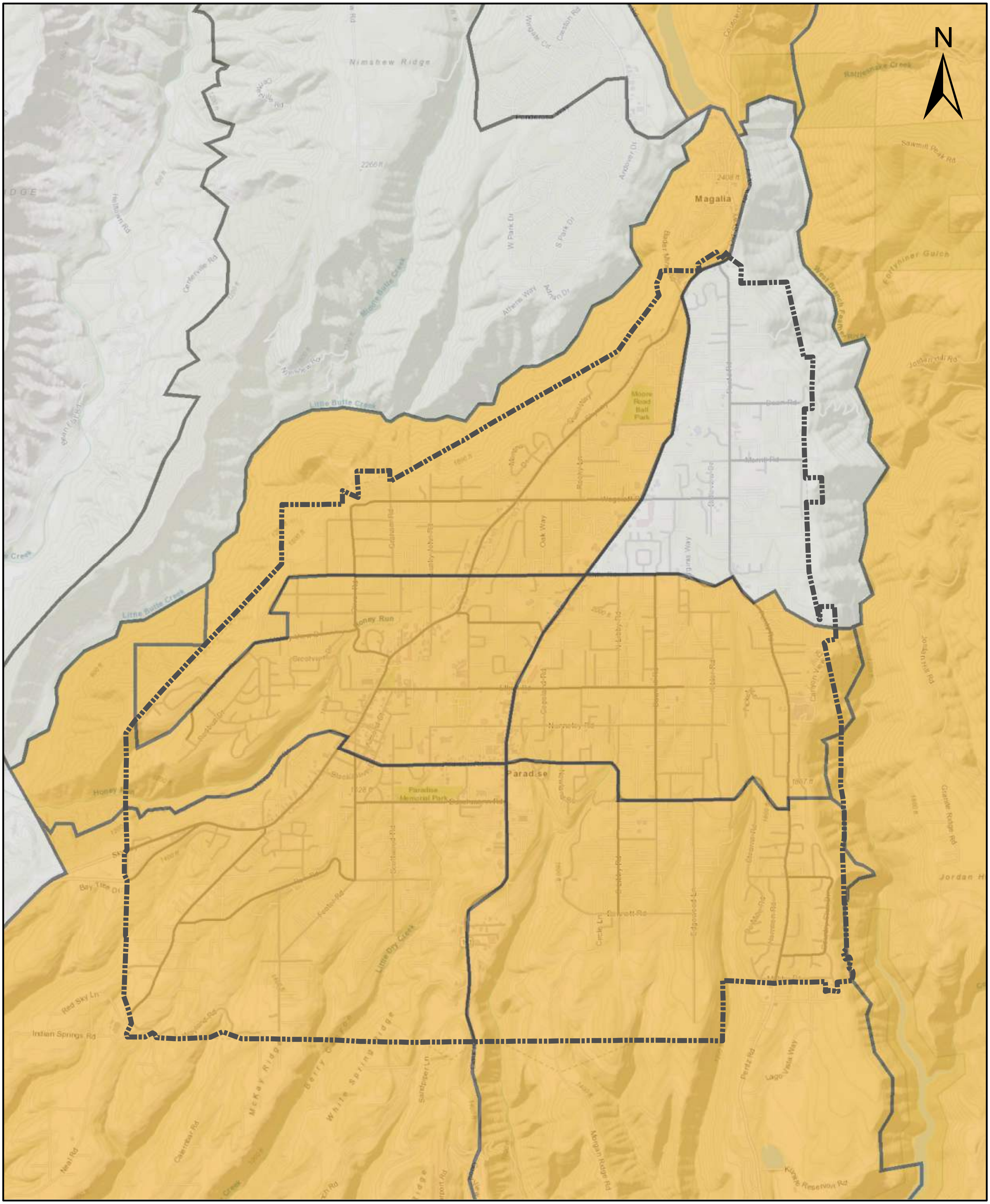
Table 3. Countermeasures for Roadways

No.	Type	Countermeasure Name	Crash Type	CRF	Expected Life (Years)	HSIP Funding Eligibility	Systemic Approach Opportunity?
R01	Lighting	Add segment lighting	Night	35%	20	100%	Medium
R02	Remove/ Shield Obstacles	Remove or relocate fixed objects outside of Clear Recovery Zone	All	35%	20	90%	High
R03	Remove/ Shield Obstacles	Install Median Barrier	All	25%	20	100%	Medium
R04	Remove/ Shield Obstacles	Install Guardrail	All	25%	20	100%	High
R05	Remove/ Shield Obstacles	Install impact attenuators	All	25%	10	100%	High
R06	Remove/ Shield Obstacles	Flatten side slopes	All	30%	20	90%	Medium
R07	Remove/ Shield Obstacles	Flatten side slopes and remove guardrail	All	40%	20	90%	Medium
R08	Geometric Mod.	Install raised median	All	25%	20	90%	Medium
R09	Geometric Mod.	Install median (flush)	All	15%	20	90%	Medium
R10PB	Geometric Mod.	Install pedestrian median fencing on approaches	P & B	35%	20	90%	Low
R11	Geometric Mod.	Install acceleration/ deceleration lanes	All	25%	20	90%	Low
R12	Geometric Mod.	Widen lane (initially less than 10 ft)	All	25%	20	90%	Medium
R13	Geometric Mod.	Add two-way left-turn lane (without reducing travel lanes)	All	30%	20	90%	Medium
R14	Geometric Mod.	Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes)	All	30%	20	90%	Medium
R15	Geometric Mod.	Widen shoulder	All	30%	20	90%	Medium
R16	Geometric Mod.	Curve Shoulder widening (Outside Only)	All	45%	20	90%	Medium
R17	Geometric Mod.	Improve horizontal alignment (flatten curves)	All	50%	20	90%	Low
R18	Geometric Mod.	Flatten crest vertical curve	All	25%	20	90%	Low
R19	Geometric Mod.	Improve curve superelevation	All	45%	20	90%	Medium
R20	Geometric Mod.	Convert from two-way to one-way traffic	All	35%	20	90%	Medium
R21	Geometric Mod.	Improve pavement friction (High Friction Surface Treatments)	All	55%	10	100%	High

Table 3. Countermeasures for Roadways (Continued)

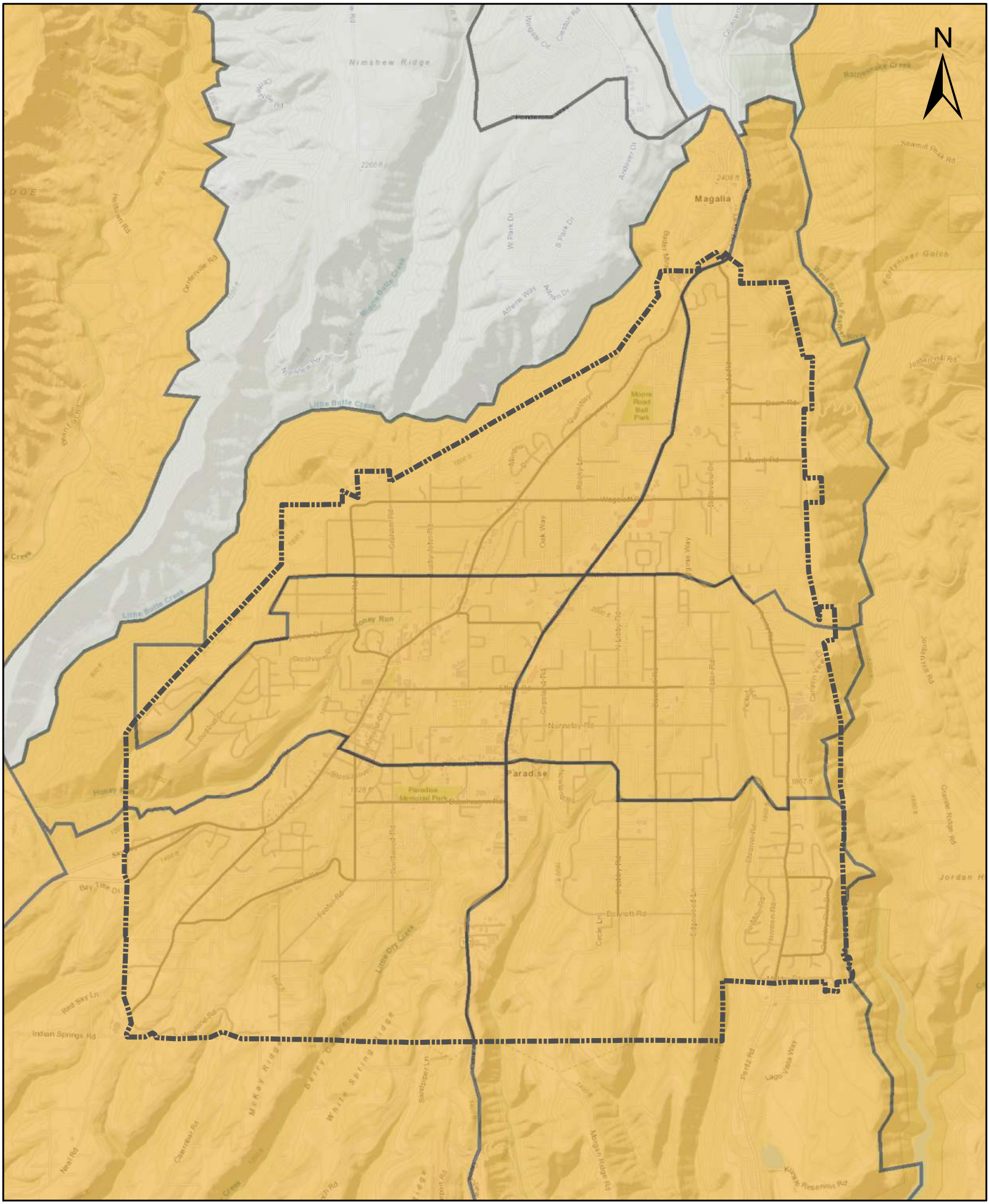
No.	Type	Countermeasure Name	Crash Type	CRF	Expected Life (Years)	HSIP Funding Eligibility	Systemic Approach Opportunity?
R22	Operation/ Warning	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)	All	15%	10	100%	Very High
R23	Operation/ Warning	Install chevron signs on horizontal curves	All	40%	10	100%	Very High
R24	Operation/ Warning	Install curve advance warning signs	All	25%	10	100%	Very High
R25	Operation/ Warning	Install curve advance warning signs (flashing beacon)	All	30%	10	100%	High
R26	Operation/ Warning	Install dynamic/variable speed warning signs	All	30%	10	100%	High
R27	Operation/ Warning	Install delineators, reflectors and/or object markers	All	15%	10	100%	Very High
R28	Operation/ Warning	Install edge-lines and centerlines	All	25%	10	100%	Very High
R29	Operation/ Warning	Install no-passing line	All	45%	10	100%	Very High
R30	Operation/ Warning	Install centerline rumble strips/stripes	All	20%	10	100%	High
R31	Operation/ Warning	Install edgeline rumble strips/stripes	All	15%	10	100%	High
R32PB	Ped and Bike	Install bike lanes	P & B	35%	20	90%	High
R33PB	Ped and Bike	Install Separated Bike Lanes	P & B	45%	20	90%	High
R34PB	Ped and Bike	Install sidewalk/pathway (to avoid walking along roadway)	P & B	80%	20	90%	Medium
R35PB	Ped & Bike	Install/upgrade pedestrian crossing (with enhanced safety features)	P & B	35%	20	90%	Medium
R36PB	Ped and Bike	Install raised pedestrian crossing	P & B	35%	20	90%	Medium
R37PB	Ped and Bike	Install Rectangular Rapid Flashing Beacon (RRFB)	P & B	35%	20	100%	Medium
R38	Animal	Install animal fencing	Animal	80%	20	90%	Medium

Appendix C
Historically Disadvantaged Community Data



No
Yes
Town of Paradise

Figure C-1
Town of Paradise
Economy Disadvantaged Community

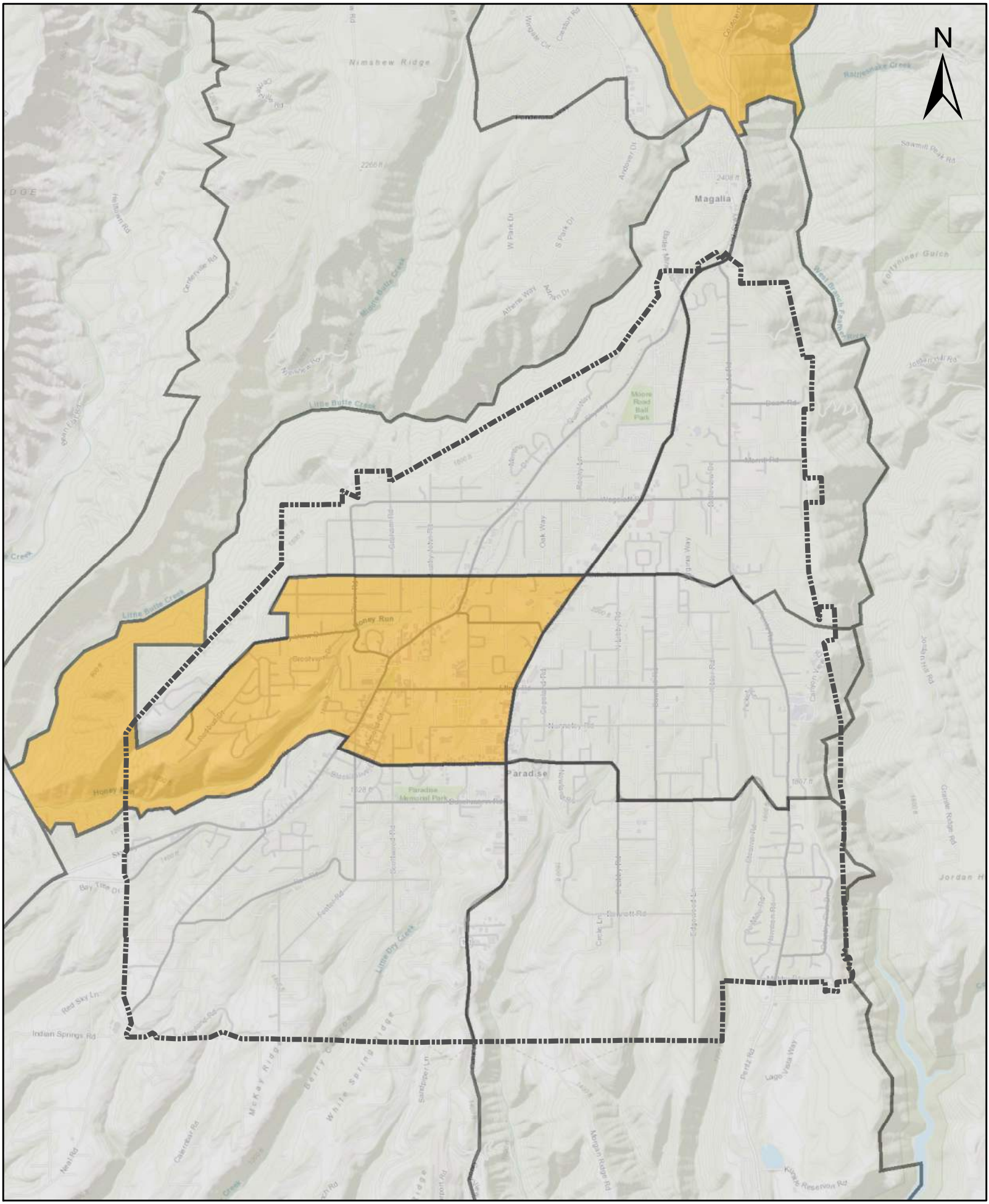


HEADWAY TRANSPORTATION

Figure C-2

Town of Paradise

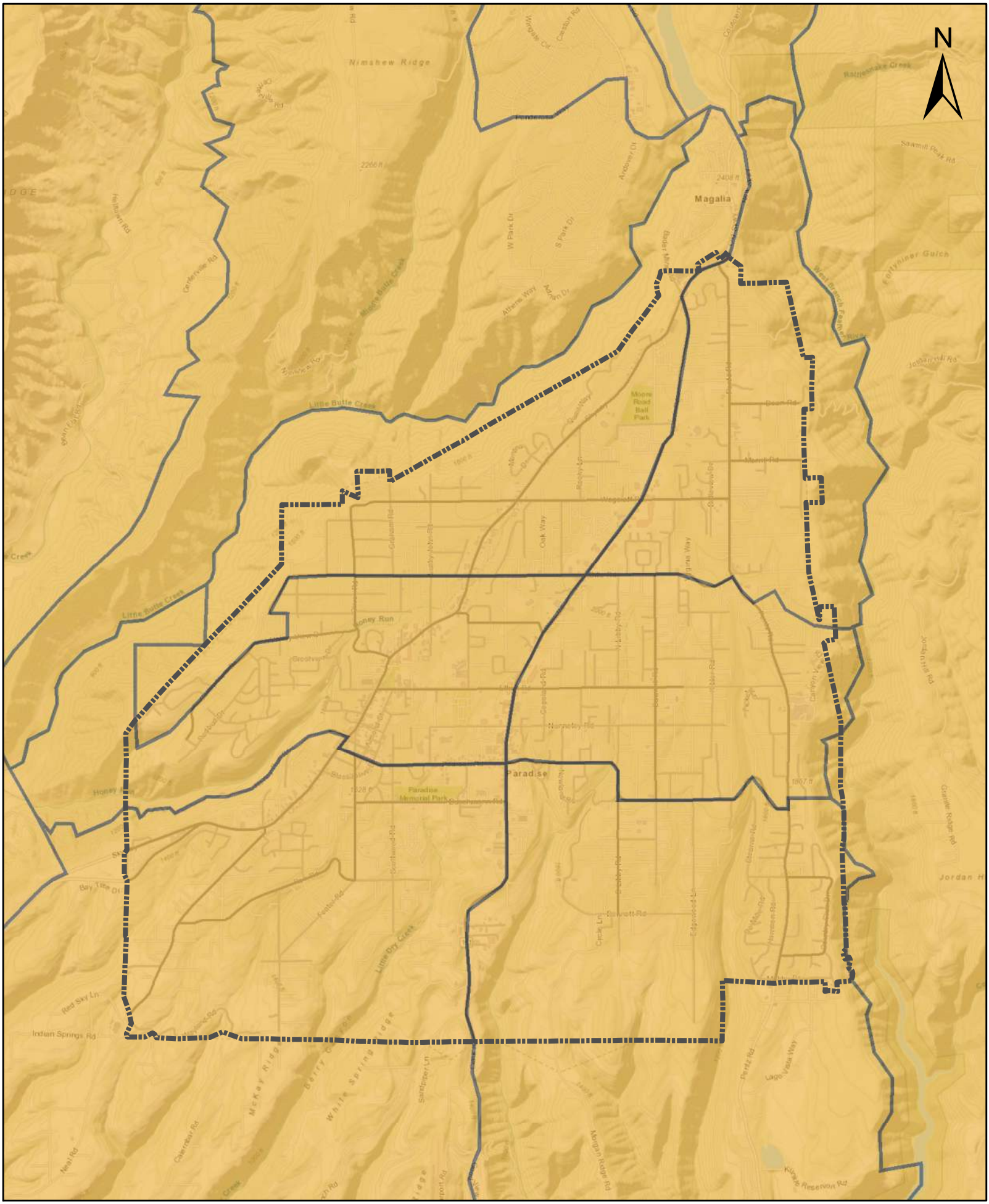
Enviromental Disadvantaged Community



HEADWAY TRANSPORTATION

No
Yes
Town of Paradise

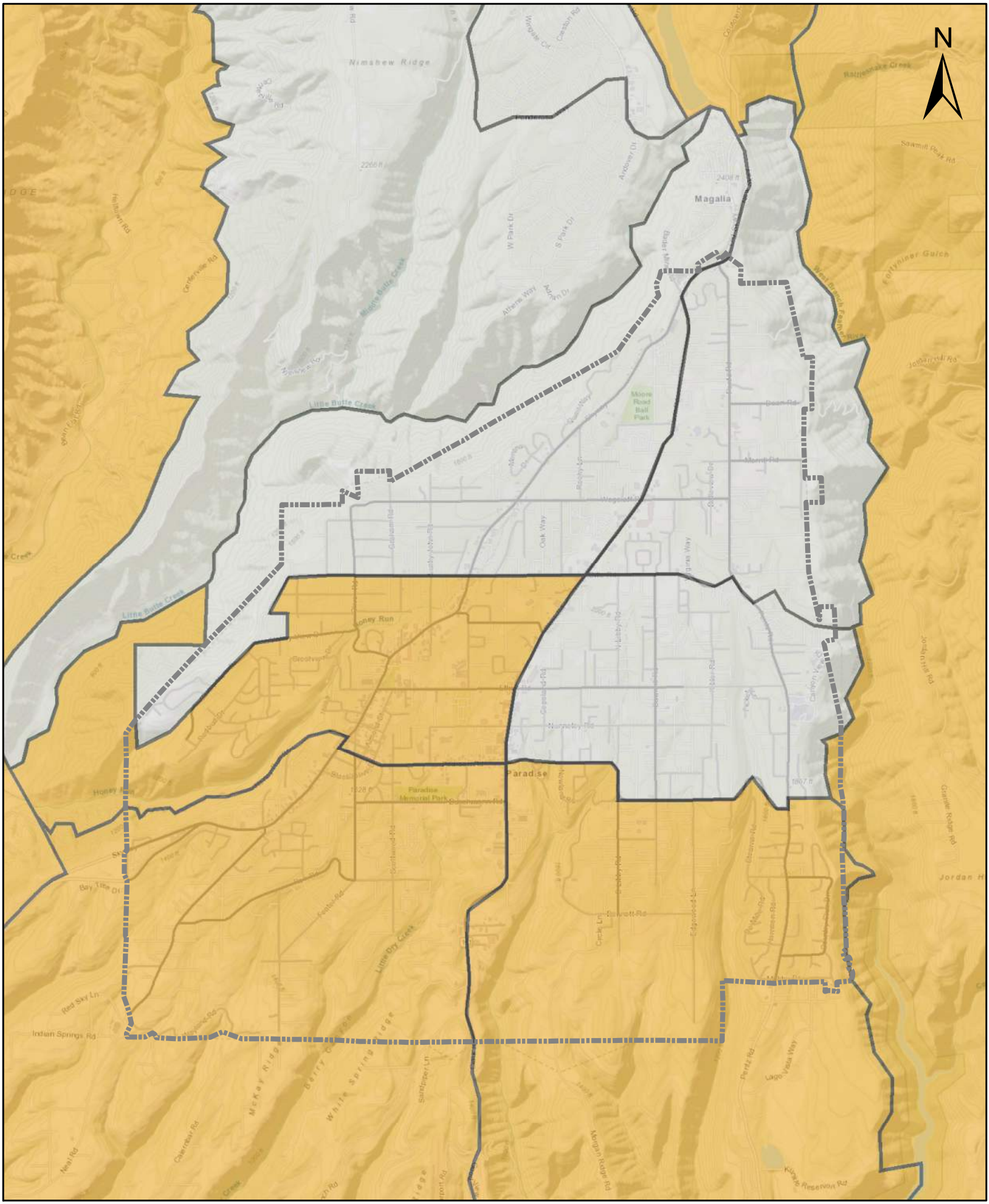
Figure C-3
Town of Paradise
Equity Disadvantaged Community



HEADWAY TRANSPORTATION

No
Yes
Town of Paradise

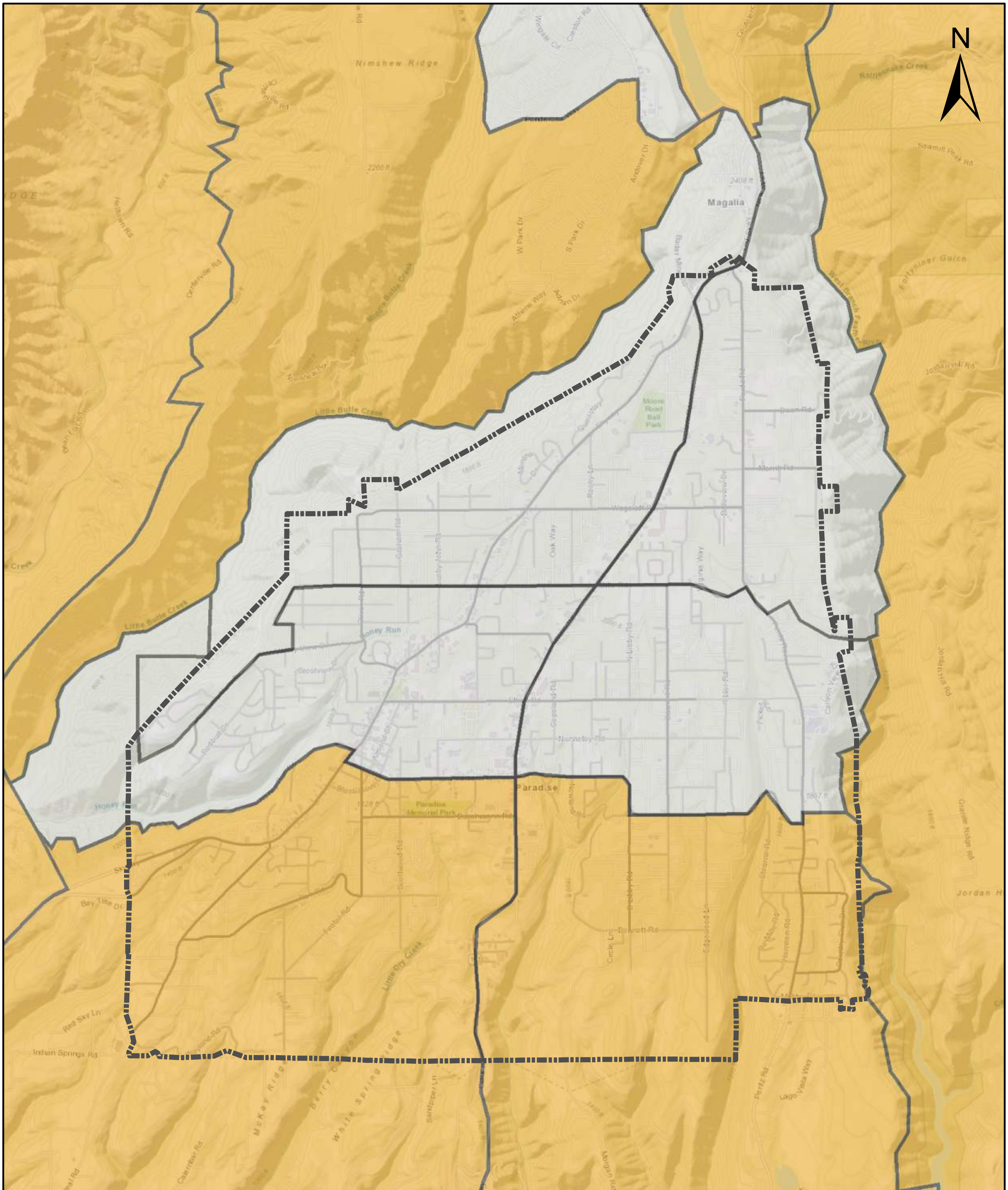
Figure C-4
Town of Paradise
Health Disadvantaged Community



HEADWAY TRANSPORTATION

No
Yes
Town of Paradise

Figure C-5
Town of Paradise
Historically Disadvantaged Community



HEADWAY TRANSPORTATION

No

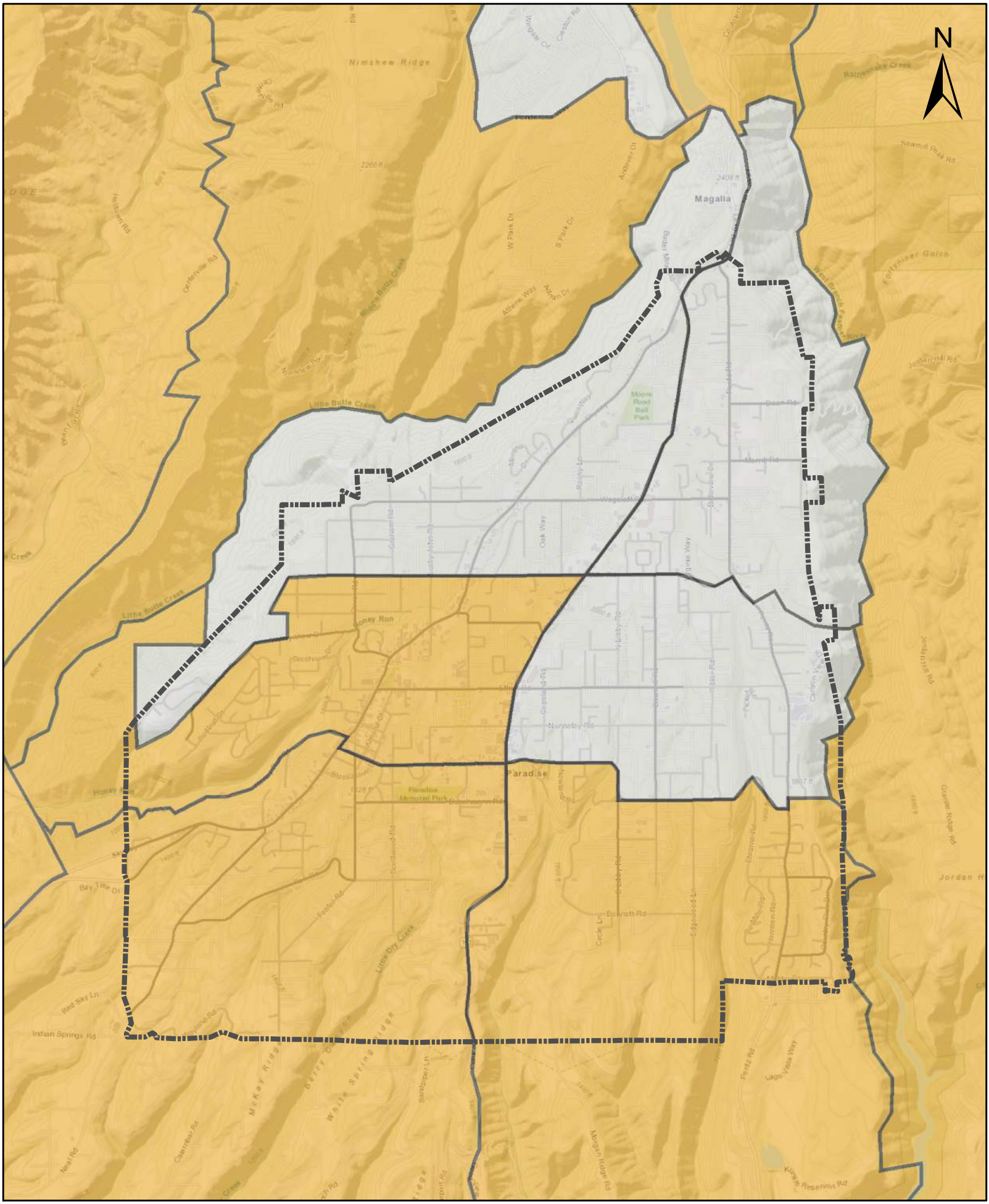
Yes

Town of Paradise

Figure C-6

Town of Paradise

Resiliance Disadvantaged Community



HEADWAY TRANSPORTATION

No
Yes
Town of Paradise

Figure C-7
Town of Paradise
Transportation Disadvantaged Community