CALTRANS
Adaptation Priorities
REPORT

DISTRICT 9

February
2021

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Term and Definitions

- **Adaptation:** The steps taken to prepare a community or modify a targeted asset prior to a weather or climate-related disruption to minimize or avoid the impacts of that event. An example would be elevating assets in areas likely to experience increased flooding in the future.
- **Exposure:** The presence of infrastructure in places and settings where it could be adversely affected by hazards and threats, for example, a road in a floodplain**.**[1]
- **Hazards and Stressors:** Stresses on transportation system performance and condition. Whether such impacts occur today (e.g., riverine flooding that closes major highways) or whether they are part of a long- term trend (e.g., flooding), mainstreaming resilience efforts into an agency's functions requires an understanding of their nature, scope, and magnitude. The terms are used interchangeably to refer to transportation impacts originating primarily from natural causes (e.g., flooding or wildfire hazards).
- **Resilience:** The characteristic of a system that allows it to absorb, recover from, or more successfully adapt to adverse events.
- **Risk***:* "A combination of the likelihood that an asset will experience a particular climate impact and the severity or consequence of that impact."[2]
- **Sensitivity:** Per the Federal Highway Administration, "refers to how an asset or system responds to, or is affected by, exposure to a climate change stressor. A highly sensitive asset will experience a large degree of impact if the climate varies even a small amount, where as a less sensitive asset could withstand high levels of climate variation before exhibiting any response."[3]
- **Uncertainty:** The degree to which a future condition or system performance cannot be forecast. Both human-caused and natural disruptions, especially for longer-term climate changes, are by their very nature uncertain events (as no one knows for sure exactly when and where and with what intensity they will occur). Sensitivity tests using multiple plausible scenarios of future conditions can help one understand the range of uncertainty and its implications. This approach is used routinely when working with climate projections to help understand the range of possible conditions given different future greenhouse gas emission scenarios.
- **Vulnerability:** Per the Federal Highway Administration, "the degree to which a system is susceptible to or unable to cope with adverse effects of climate change or extreme weather events."[4]

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[1] This definition is adopted from the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report. 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, 151 pp.
[2] FHWA. 2017. "Vulnerability Assessment and Adaptation Framework: Third Edition." Retrieved September 25, 2020 from https://www.fhwa.dot.gov/environment/sustainability/resilience/adaptation_framework/climate_adaptation.pdf
[3] Ibid.
[4] FHWA. 2014. "FHWA Order 5520. "Transportation System Preparedness and Resilience to Climate Change and Extreme Weather Events." Dec. 15. Retrieved June 30, 2020 from https://www.fhwa.dot.gov/legsregs/directives/orders/5520.cfm

1. INTRODUCTION

California's climate is changing. Temperatures are warming, sea levels are rising, wet years are becoming wetter, dry years are becoming drier, and wildfires are becoming more intense. Most scientists attribute these changes to the unprecedented amounts of greenhouse gases in the atmosphere. Given that global emissions of these gases continue at record rates, further changes in California's climate are, unfortunately, very likely.

The hazards brought on by climate change pose a serious threat to California's transportation infrastructure. Higher than anticipated sea levels can regularly inundate roadways, extreme floods can severely damage bridges and culverts, rapidly moving wildfires present profound challenges to timely evacuations, and higher than anticipated temperatures can cause expensive pavement damage over a broad area. As Caltrans' assets such as bridges and culverts age, they will be forced to weather increasingly severe conditions that they were not designed to handle, adding to agency expenses and putting the safety and economic vitality of California communities at risk.

Recognizing this, Caltrans has initiated a major agency-wide effort to adapt their infrastructure so that it can withstand future conditions. The effort began by determining which assets are most likely to be adversely impacted by climate change in each Caltrans district. That assessment, described in the Caltrans Climate Change Vulnerability Assessment Report for District 9, identified stretches of the State Highway System within the district that are potentially at risk. This Adaptation Priorities Report picks up where the vulnerability assessment left off and considers the implications of those impacts on Caltrans and the traveling public, so that facilities with the greatest potential risk receive the highest priority for adaptation. District 9 anticipates that planning for, and adapting to, climate change will continue to evolve subsequent to this report's release as more data and experience is gained.

1.1. Purpose of Report

The purpose of this report is to prioritize the order in which assets found to be exposed to climate hazards will undergo detailed asset-level climate assessments. Since there are many potentially exposed assets in the district, detailed assessments will need to be done sequentially according to their priority level. The prioritization considers, amongst other things, the timing of the climate impacts, their severity and extensiveness, the condition of each asset (a measure of the sensitivity of the asset to damage), the number of system users affected, and the level of network redundancy in the area. Prioritization scores are generated for each potentially exposed asset based on these factors and used to rank them.

1.2. Report Organization

The main feature of this report is the prioritized list of potentially exposed assets within District 9. Per above, this information will inform the timing of the detailed adaptation assessments of each asset, which is the next phase of Caltrans' adaptation work. The final prioritized list of assets for District 9 can be found in Chapter 4 of this document. The interim chapters provide important background information on the prioritization process. For example, those interested in learning more about Caltrans' overall adaptation efforts, and how the prioritization fits into that, should refer to Chapter 2. Likewise, those who are interested in learning more about how the prioritization was determined should refer to Chapter 3.

2. CALTRANS' CLIMATE ADAPTATION FRAMEWORK

Enhancing Caltrans' capability to consider adaptation in all its activities requires an agency-wide perspective and a multi-step process to make Caltrans more resilient to future climate changes. The process for doing so will take place over many years and will, undoubtedly, evolve over time as everyone learns more about climate hazards, better data is collected, and experience shows which techniques are most effective. Researchers have just started examining what steps an overarching adaptation framework for a department of transportation should entail. Figure 1 provides a graphical illustration of one such path called the Framework for Enhancing Agency Resiliency to Natural and Anthropogenic Hazards and Threats (FEAR-NAHT).[5] This framework, developed through the National Cooperative Highway Research program (NCHRP), has been adopted by Caltrans as part of its long-term plan for incorporating adaptation into its activities (hereafter referred to as the Caltrans Climate Adaptation Framework or "Framework").

Steps 1 through 4 of the Framework represent activities that are currently underway at Caltrans Headquarters to effectively manage its new climate adaptation program and develop policies that will help jumpstart adaptation actions throughout the organization. Step 1, *Assess Current Practice*, and Step 4, *Implement Early Wins*, are both addressed within a document called the Caltrans Climate Adaptation Strategy Report. The Adaptation Strategy Report undertook a comprehensive review of all climate adaptation policies and activities currently in place or underway at Caltrans. The report also includes numerous no-regrets adaptation actions ("early wins") that can be taken in the near-term to enhance agency resiliency. Several of these strategies also touch on elements of Step 2, *Organize for Success*, and Step 3, *Develop an External Communications Strategy and Plan*. In addition to this, a comprehensive adaptation communications strategy and plan for climate change is being developed as part of a Caltrans pilot project with the Federal Highway Administration.

COVER OF THE CALTRANS
CLIMATE CHANGE VULNERABILITY ASSESSMENT
SUMMARY REPORT FOR DISTRICT 9

Step 5, *Understand the Hazards and Threats*, is the first step where detailed technical analyses are performed, and in this case, identify assets potentially exposed to various climate stressors. This step has been completed for a subset of the assets and hazards in District and the results are presented in the Caltrans Climate Change Vulnerability Assessment Report for District 9. The exposure information generated in the Vulnerability Assessment Report is used as an input to this study.

[5] This framework and related guidance for state DOTs is being developed as part of NCHRP 20-117, Deploying Transportation Resilience Practices in State DOTs (expected completion in early 2021).

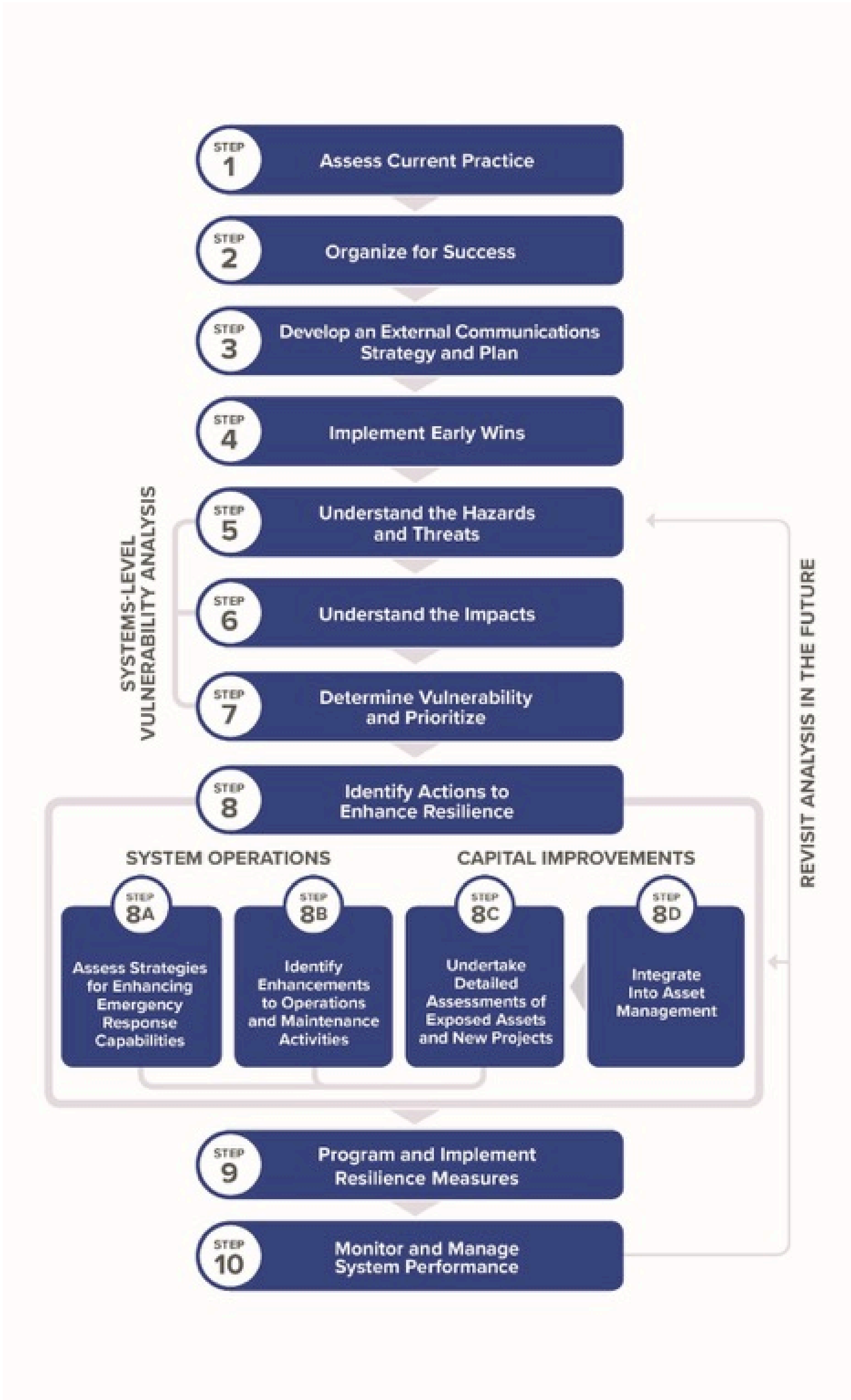

FIGURE 1: CALTRANS' CLIMATE ADAPTATION FRAMEWORK (FEAR-NAHT FRAMEWORK)

The work undertaken for this study, the District 9 Adaptation Priorities Report covers both Steps 6 and 7 in the Framework. Step 6, *Understand the Impacts*, is focused on the implications of the exposure identified in Step 5. This includes understanding the sensitivity of the asset to damage from the climate stressor(s) it is potentially exposed to and understanding the criticality of the asset to the functioning of the transportation network and the communities it serves. Developing an understanding of these considerations is part of the prioritization methodology described in the next chapter.

Step 7, *Determine Vulnerability and Prioritize*, focuses on creating and implementing a prioritization approach that considers both the nature of the exposure identified in Step 5 (its severity, extensiveness, and timing) and the consequence information developed in Step 6. The goal of the prioritization is to identify which assets should undergo detailed adaptation assessments first, because resource constraints will prevent all assets from undergoing detailed study simultaneously.

After Step 7, the Framework divides into two parallel tracks, one focused on operational measures to enhance resiliency and the consideration of adaptation (Steps 8A and 8B) and the other on identifying adaptation-enhancing capital improvement projects (Steps 8C and 8D). Collectively, these represent the next steps that should be undertaken using the information from this report. On the operations track, the results of this assessment should be reviewed for opportunities to enhance emergency response (Step 8A) and operations and maintenance (Step 8C). Caltrans' next step on the capital improvement track should be to undertake detailed assessments of the exposed facilities (Step 8C). The prioritization information generated as part of this assessment should also be integrated into the state's asset management system (Step 8D). All projects recommended through the asset management process should also undergo detailed adaptation assessments (hence the arrow from Step 8D to 8C).

Thus, there will be two parallel pathways for existing assets to get to detailed facility level adaptation assessments. The first is through this prioritization analysis, which is driven primarily by the exposure to climate hazards with asset condition as a secondary consideration. The second is through the existing asset management process. which is driven primarily by asset condition and will have vulnerability to climate hazards as a secondary consideration.

The detailed adaptation assessments in Step 8C will involve engineering-based analyses to verify asset exposure to pertinent climate hazards (some exposed assets featured in this report will not be exposed after closer inspection). Then, if exposure is verified, Step 8C includes the development and evaluation of adaptive measures to mitigate the risk. The highest priority assets from this study will be evaluated first and lower priority assets will be evaluated later. Once specific adaptation measures have been identified, be they operational measures or capital improvements, these projects can then be programmed (Step 9). Step 10 then focuses on continuous monitoring of system performance to track progress towards enhancing resiliency. Note the feedback loops from Step 10 to Steps 5 and 8. The arrow back to Step 5 indicates that the exposure analysis should be revisited in the future as new climate projections are developed. The arrow back to Step 8 indicates how one can learn from the performance indicators and use this data to modify the actions being undertaken to enhance resilience.

3. PRIORITIZATION METHODOLOGY

3.1. General Description of the Methodology

The methodology used to prioritize assets exposed to climate hazards draws upon both technical analyses and the on-the-ground knowledge of all district staff. The technical analysis component was undertaken first to provide an initial indication of adaptation priorities. These initial priorities were then reviewed with district staff at a workshop and, if necessary, adjusted to reflect local knowledge and recommendations. These adjustments are embedded in the final priorities shown in Chapter 4.

With respect to the technical analysis, there are a few different approaches for prioritizing assets based on their vulnerability to climate hazards. The approach selected for this study is known as the indicators approach. The indicators approach involves collecting data on a variety of variables that are determined to be important factors for prioritization. These are then put on a common scale, weighted, and used to create a score for each asset. The scores collectively account for all the variables of interest and can be ranked to determine priorities.

It is important to note that, since the prioritization process is focused on determining the order in which detailed adaptation assessments are conducted, only assets determined potentially exposed to a climate hazard are included in this analysis. Assets that were determined to have no exposure to the hazards studied are not included in this study.

The remainder of this chapter describes the prioritization methodology in detail. Section 3.2 begins by describing the asset types and hazards studied. Next, Section 3.3 discusses the individual prioritization metrics (factors) that were used in the technical analysis. Following this, Section 3.4 describes how those individual factors were brought together into an initial prioritization score for each asset. Lastly, Section 3.5 describes how the initial prioritization was adjusted with input from district staff.

3.2. Asset Types and Hazards Studied

FLASHFLOOD AND MUDSLIDE BURIES MUTIPLE VEHICLES ON SR-58

Caltrans is responsible for maintaining dozens of different asset types (bridges, culverts, roadway pavement, buildings, etc.). Each of these asset types is uniquely vulnerable to a different set of climate stressors. Resource constraints only allowed this study to investigate a subset of the asset types owned by Caltrans in District 9 and, for those, only a subset of the climate stressors that could impact them. Additional exposure and prioritization analyses are needed in the future to gain a fuller understanding of Caltrans' adaptation needs.

The subset of asset types and hazards included in this study generally mirror those that were included in the District Climate Change Vulnerability Assessment Report. That said, exposure to two additional hazards was included as part of this study: (1) riverine flooding impacts to bridges and culverts and (2) temperature impacts to pavement binder grade. Table 1 shows all the asset types included in this study for District 9 and marks with an "X" the hazards that were evaluated for each in the exposure analysis.

TABLE 1: ASSET-HAZARD COMBINATIONS STUDIED

	Wildfire	Temperature	Riverine Flooding
Pavement Binder Grade		X	
Bridges			X
Large Culverts[6]			X
Small Culverts[7]	X		X

The various asset-hazard combinations include:

- **Pavement binder grade exposure to temperature changes:** Binder can be thought of as the glue that holds the various aggregate materials in asphalt together. Binder is sensitive to temperature. If temperatures become too hot, the binder can become pliable and deform under the weight of traffic. On the other hand, if temperatures are too cold, the binder can shrink causing cracking of the pavement. There are various types (grades) of binder, each suited to a different temperature regime. This study considered how climate change will influence high and low temperatures and how this, in turn, could affect pavement binder grade performance.

  Assumptions were made that (1) all roadways are currently (or could be in the future) asphalt and (2) the binder grade currently in place on each segment[8] of roadway matches the specifications in the Caltrans Highway Design Manual. From here, the allowable temperature ranges of each binder grade were compared to projected temperatures prior to 2010, 2010-2039, 2040-2069, or 2070-2099. If the temperature parameters exceeded the design tolerance of the assumed binder grade, that segment of roadway was deemed potentially exposed.

SINK HOLE NEAR MONO CRATERS

- **Bridge exposure to riverine flooding:** Bridges are sensitive to higher flood levels and river flows. With climate change, precipitation is generally expected to become more intense in District 9

[6] Culverts 20 feet or greater in width.
[7] Culverts less than 20 feet in width.
[8] Roadway are segmented at intersections with other roads.

leading to increased flooding on rivers and streams. These higher flows could exceed the design tolerances of bridges. In addition, wildfires are also expected to become more prevalent in District 9 with climate change. After a wildfire burns, the ground can become hard and less capable of absorbing water. As a result, flood flows can increase substantially in the aftermath of a fire, which could further exacerbate the risks to bridges. To better understand the threat posed to bridges in District 9, a flood exposure index was developed and calculated for each bridge that crosses a river or stream. The index considered both the changes in precipitation and wildfire likelihood in the area draining to the bridge in the early, mid, and late century timeframes. The index also considers the capacity of the bridge to handle higher flows using waterway adequacy information from the National Bridge Inventory (NBI). A higher score on the index indicates bridges at relatively greater risk due to a combination of higher projected flows and lower capacity.

- **Large culvert exposure to riverine flooding:** A distinction is made in the analysis between large and small culverts due to different data being available for each. Large culverts are included in the NBI and are generally 20 feet or greater in width. Small culverts are generally shorter than 20 feet in width and covered through a different inventory/inspection program. Large culverts, like bridges, are sensitive to increased flood flows. Thus, a flood exposure index was calculated for each large culvert in the same manner as was done for bridges.

- **Small culvert exposure to riverine flooding:** Small culverts (those less than 20 feet in width) are, like bridges and large culverts, also sensitive to higher flood flows. Hence, a flood exposure index like the one for bridges and large culverts was calculated for this asset type. The one difference is that the capacity component of the index for small culverts used the actual dimensions of the culvert, information that was not available for bridges and large culverts. Although the actual dimensions of small culverts were available, due to resource and data constraints, no hydraulic analyses were performed to determine overtopping potential. Instead, the size was simply used as a factor in the riverine flood exposure index.

- **Small culvert exposure to wildfire:** In addition to the higher post-fire flood flows captured in the flood exposure analysis, culverts can also be sensitive to the direct impacts of fire on the structure. Certain culvert materials (e.g. wood and plastic) can easily burn or be deformed during a fire. Thus, an assessment was made to determine the likelihood of a wildfire directly impacting each small culvert in the early, mid, and late century timeframes. This analysis was only conducted for small culverts because information on culvert construction materials was not available for large culverts.

3.3. Prioritization Metrics

Metrics are the individual variables used to calculate a prioritization score for each asset. These can be thought of as the individual factors that, collectively, help determine the asset's priority for adaptation. Each of the asset-hazard combinations described in the previous section has its own unique set of factors that are used in the prioritization. The metrics were selected based on their relevancy to each asset-hazard combination and data availability. For example, the condition rating of a culvert is a very relevant metric for prioritizing culverts exposed to riverine flooding, however, it is not at all relevant to prioritizing bridges exposed to the same hazard. Table 1 provides an overview of all the metrics included in this study and denotes with an "X" their application to the various asset-hazard combinations studied.

The metrics included in this study fall into two categories: exposure metrics and consequence metrics. Exposure metrics capture the extensiveness, severity, and timing of a hazard's projected impact on an asset. Assets that have more extensive, more severe, and sooner exposure are given a higher priority. Consequence metrics provide an indication of how sensitive an exposed asset is to damage using information on the asset's condition. Consequence metrics also indicate how sensitive the overall transportation network may be to the loss of that asset should it be taken out of service by a hazard. The poorer the initial conditions of the potentially exposed asset and the more critical it is to the functioning of the transportation network, the higher the priority given. The specific metrics that are included within each of these categories are described in the sections that follow.

STRONG WINDS BLOWS TREES AND DEBRIS
ONTO U.S. HIGHWAY I39 NEAR WALKER

TABLE 2: METRICS INCLUDED FOR EACH ASSET-HAZARD COMBINATION STUDIED

	Wildfire	Tempera-ture	Riverine Flooding		
Metrics	**Small Culverts**	**Pavement Binder Grade**	**Bridges**	**Large Culverts**	**Small Culverts**
Exposure					
Past natural hazard impacts	X		X	X	X
Initial timeframe for elevated level of concern for wildfire	X				
Highest projected wildfire level of concern	X				
Initial timeframe when asphalt binder grade needs to change		X			
Maximum riverine flooding exposure score for the 2010-2039 timeframe			X	X	X
Maximum riverine flooding exposure score			X	X	X
Consequences					
Bridge substructure condition rating			X		
Channel and channel protection condition rating			X	X	
Culvert condition rating				X	X
Culvert material	X				
Scour rating			X		
Average annual daily traffic (AADT)	X	X	X	X	X
Average annual daily truck traffic (AADTT)	X	X	X	X	X
Incremental travel distance to detour around the asset	X		X	X	X

3.3.1. Exposure Metrics

The following metrics were used to assess asset exposure in District 9:

- **Past natural hazard impacts:** Assets that have experienced flooding or fire-related impacts in the past are likely to experience more issues in the future as climate changes and should be prioritized. To obtain information on past impacts, District 9 maintenance staff were surveyed and asked to identify any bridges, large culverts, or small culverts that had experienced flooding issues in the past (and/or wildfires, for small culverts). Care was taken to ensure that these impacts occurred on assets that had not been replaced with a more resilient design after the event occurred. In addition, staff was also asked if any small culverts damaged by fire were replaced with culverts of the same or different material. Any asset that was identified as previously impacted by either flooding or fire was flagged and that asset was given a higher priority for adaptation.

CHRIS FIRE NEAR BRIDGEPORT

- **Initial timeframe for elevated level of concern from wildfire:** Assets that are more likely to be impacted by wildfire sooner should be prioritized first. Using the future wildfire projections developed for the District 9 Climate Change Vulnerability Assessment Report, the initial timeframe (2010-2039, 2040-2069, 2070-2099, or Beyond 2099) for heightened wildfire risk was determined for each small culvert.[9] The most recent timeframe across the range of available climate scenarios was chosen. Assets that were impacted sooner were given a higher priority for adaptation.

- **Highest projected wildfire level of concern:** Assets that are exposed to a greater wildfire risk should be prioritized. The wildfire modeling conducted for the District 9 Climate Change Vulnerability Assessment Report classified fire risk into five levels of concern (very low, low, moderate, high, and very high) at various future time periods.[10] Using this data, the highest level of concern was determined for each small culvert between now and 2100 and across all climate scenarios. Assets with higher levels of concern were given a higher priority for adaptation.[11]

[9] See the District 9 Climate Change Vulnerability Assessment Summary and/or Technical Reports for more information: https://dot.ca.gov/programs/transportation-planning/2019-climate-change-vulnerability-assessments
[10] Ibid.
[11] Ibid.

- **Initial timeframe when asphalt binder grade needs to change:** Roadway segments that are more likely to need binder grade changes sooner should be prioritized. Using the assumptions and data from the pavement binder grade exposure analysis described above, the initial timeframe (prior to 2010, 2010-2039, 2040-2069, or 2070-2099) for binder grade change was determined. Roadway segments that were found to need binder grade changes sooner were given a higher priority for detailed adaptation assessments.

REPAIR IN REDS MEDOW NEAR SR-203

- **Maximum riverine flooding exposure score for the 2010-2039 timeframe**: Assets that have relatively higher exposure to riverine flooding in the near-term should be prioritized. Using the riverine flood exposure index values calculated using the process described above, the highest score for the near-term (2010-2039) period was determined for each bridge, large culvert, and small culvert considering all climate scenarios and the range of outputs from all climate and wildfire models. Assets with the highest overall riverine flooding scores in this initial period received a higher priority for adaptation.

- **Maximum riverine flooding exposure score:** In addition to understanding the most pressing near-term needs for dealing with riverine flooding, assets that have relatively higher exposure to riverine flooding at any point over their lifespans should also be prioritized. To calculate this metric, the highest riverine flooding exposure score was determined for each asset considering all time periods (from now through 2100), all climate scenarios, and all climate and wildfire models. Assets with the highest overall riverine flooding scores received a higher priority for adaptation.

3.3.2. Consequence Metrics

The following metrics were used to understand the consequences of each asset's exposure, considering both asset sensitivity to damage and the network sensitivity to loss of the asset:

- **Bridge substructure condition rating:** Poor bridge substructure condition can contribute to failure during flood events. The NBI assigns a substructure condition rating to each bridge. Values range from nine to two with lower values indicating poorer condition. Bridges with poor substructure condition ratings were given higher priority for adaptation assessments.

- **Channel and channel protection condition rating:** Poor channel conditions or inadequate channel protection measures can contribute to failure during riverine flooding events. The NBI assigns a channel and channel protection condition rating to each bridge and large culvert. Values range from nine to two with lower values indicating poorer condition. Bridges and large culverts with poor channel or channel protection ratings were given higher priority for adaptation assessments.

- **Culvert condition rating:** Poor culvert condition can contribute to failure during riverine flooding events. The NBI assigns a culvert condition rating to each large culvert. Values range from nine to two with lower values indicating poorer condition. Caltrans has developed their own culvert condition rating system for small culverts. Possible ratings in the Caltrans system include good, fair, critical, and poor. Large and small culverts with poorer condition ratings in either system were prioritized.

- **Culvert material:** Culvert material determines the sensitivity of culverts to direct damage from wildfires. Caltrans includes material data in its databases on small culverts (no equivalent information exists for large culverts). Possible culvert materials include HDPE (high density polyethylene [plastic]), PVC (polyvinyl chloride [plastic]), corrugated steel pipe, composite, wood, masonry, and concrete. HDPE, PVC, corrugated steel pipe, composite, and wood culverts are all more sensitive to wildfire and any small culverts made from these materials that are exposed to an elevated risk from wildfire were prioritized for adaptation.

- **Scour rating:** Scour is a condition where water has eroded the soil around bridge piers and abutments. Excessive scour of bridge foundations makes bridges more prone to failure, especially during riverine flooding events. The NBI assigns a scour condition rating to each bridge. Values range from eight to two with lower values indicating greater scour concern. Bridges with lower scour values (higher scour concern) were given higher priority for adaptation assessments.

- **Average annual daily traffic (AADT):** AADT is a measure of the average traffic volume on a roadway. The consequences of weather-related failures/disruptions/maintenance are greater for assets that convey a higher volume of traffic. Disruptions on higher volume roads affect a greater proportion of the traveling public and there is a greater chance of congestion ripple effects throughout the network because alternate routes are less likely to be able to absorb the diverted traffic. AADT data was obtained from Caltrans databases and assigned to all the asset types included in this study. Exposed assets with higher AADT values were given greater priority for adaptation assessments.

- **Average annual daily truck traffic (AADTT):** AADTT is a measure of the

ROCKSLIDE ON SR-178

average truck volumes on a roadway. Efficient goods movement is important for maintaining economic resiliency and for providing relief supplies after a disaster. The consequences of weather-related failures/disruptions/maintenance are greater for assets that are a critical link in supply chains. AADTT data was obtained from Caltrans databases and assigned to all the asset types included in this study. Potentially exposed assets with higher AADTT values were given greater priority.

- **Incremental travel distance to detour around the asset due to wildfire or riverine flooding closures:** This metric measures the degree of network redundancy around each asset, which may be out of service due to a wildfire or riverine flood impacts. A detour routing tool was developed for this project that can find the shortest path detour around a bridge, large culvert, or small culvert and calculate the additional travel distance that would be required to take that detour. The tool was run for each of the assets studied. Assets that had very long detour routes were given greater priority for detailed assessments.

3.4. Calculation of Initial Prioritization Scores

Once all the metrics had been gathered/developed, the next step was to combine them and calculate an initial prioritization score for each asset. Calculating prioritization scores is a multi-step process that was conducted using Microsoft Excel. The primary steps are as follows:

1. **Scale the raw metrics:** Several of the metrics described in the previous section have different units of measurement. For example, the AADT metric is measured in vehicles per day whereas the incremental travel time to detour around the asset is measured in minutes. There is a need to put each metric on a common scale to be able to integrate them into one scoring system. For this study, it was decided to use a scale ranging from zero to 100 with zero indicating a value for a metric that would result in the lowest possible priority level and 100 indicating a value for a metric that would result in the highest possible priority level. The district-wide minimum and maximum values for each metric were used to set that metric's zero and 100 values. The past weather/fire impacts metric (which had binary values) was assigned a zero if the condition was false (i.e., there were no previous weather/fire impacts reported) and 100 if the condition was true. Categorized or incremental values, like the various condition rating metrics, were generally parsed out evenly between zero and 100 (e.g., if there were seven condition rating values, the minimum and maximum values were coded as zero and 100, respectively, with the five remaining categories assigned values at intervals of 20). The remaining metrics with continuous values were allowed to fall at their proportional location within the re-scaled zero to 100 range.

2. **Apply weights:** Some metrics have been determined by Caltrans to be more important than others for determining priorities. Therefore, the relative importance of each metric was adjusted by multiplying the scaled score by a weighting factor. Metrics deemed more important to prioritization were multiplied by a larger weight. For consistency, Caltrans Headquarters staff harmonized the weights to be used in all districts based on national best practices and input from the districts. Table 3 shows the weighting schema applied to the asset-hazard combinations in District 9. The weights are percentage based and add to 100% for all the metrics within a given asset-hazard combination (column).

In general, higher weights were assigned to the future exposure metrics (including those considering both the hazard timing and severity) as they are the primary drivers of adaptation need. This helps ensure adaptations are considered proactively before the hazards affect the assets. It also focuses the first detailed assessments on those assets that are projected most severely affected by climate change.

TABLE 3: WEIGHTS BY METRIC FOR EACH ASSET-HAZARD COMBINATION STUDIED

	Percentage Weights by Asset Type				
	Wildfire	**Tempera-ture**	**Riverine Flooding**		
Metrics	**Small Culverts**	**Pavement Binder Grade**	**Bridges**	**Large Culverts**	**Small Culverts**
Exposure					
Past natural hazard impacts	20%	-	20%	20%	20%
Initial timeframe for elevated level of concern for wildfire	17.5%	-	-	-	-
Highest projected wildfire level of concern	17.5%	-	-	-	-
Initial timeframe when asphalt binder grade needs to change	-	60%	-	-	-
Maximum riverine flooding exposure score for the 2010-2039 timeframe	-	-	22.5%	22.5%	22.5%
Maximum riverine flooding exposure score	-	-	22.5%	22.5%	22.5%
Consequences					
Bridge substructure condition rating	-	-	1%	-	-
Channel and channel protection condition rating	-	-	2.5%	2.5%	-
Culvert condition rating	-	-	-	2.5%	5%
Culvert material	20%	-	-	-	-
Scour rating	-	-	6.5%	-	-
Average annual daily traffic (AADT)	7%	13%	7%	10%	10%
Average annual daily truck traffic (AADTT)	3%	27%	3%	5%	5%
Incremental travel distance to detour around the asset	15%	-	15%	15%	15%
TOTAL	100%	100%	100%	100%	100%

Amongst the consequence metrics, more weight is given to the AADT and detour route variables relative to the condition rating related variables (bridge substructure condition rating, channel and channel protection condition rating, culvert condition rating, and scour rating). The logic for this is as follows. First, except for the scour rating, the connection between asset condition and asset failure during a hazard event is not always straightforward. Where there is less confidence in a metric, it is weighted less.[12] Second, other prioritization systems used by Caltrans, namely the asset management system, focus on condition to prioritize assets. Thus, poor condition assets will already be prioritized through that program and, per Caltrans' Climate Adaptation Framework shown in Figure 1 will also undergo detailed adaptation assessments before upgrades are made. There is little value in duplicating that prioritization system for this report; instead this effort puts more priority on assets based on their exposure to climate change-related hazards. Lastly, the traffic volume and detour length variables are the primary measures by which impacts to users of the system are captured and, given the importance of mobility to the functioning of the state, were weighted higher.[13]

3. **Calculate prioritization scores for each hazard**: After the weights were applied, the next step was to calculate prioritization scores for each individual hazard. This was done by first summing the products of the weights and scaled values for all the metrics relevant to the particular asset-hazard combination being studied (i.e., summing up the products for each column in Table 3). Since there are different numbers of metrics used to calculate the score for each asset-hazard combination, these values were then re-scaled to range from zero to 100 with zero representing the lowest priority asset and 100 the highest priority asset. These interim scores provide useful information for understanding asset vulnerability to each specific hazard.

4. **Calculate cross-hazard prioritization scores:** While the prioritization scores for each hazard provide useful information, they do not provide the full picture on the threats posed to each asset. It was decided that the final scores used as the basis for prioritization need to look holistically across all the hazards analyzed. This cross-hazard perspective provides a better view of the collective threats faced by each asset and a better basis for prioritization. To calculate the cross-hazard scores, the scores for each hazard analyzed for the asset were summed. These were then re-scaled yet again to a zero to 100 scale since different asset types have different numbers of hazards. As before, the higher the score, the higher the adaptation priority of that asset. These cross-hazard scores represent the final scores calculated for each asset during the technical assessment portion of the methodology.

5. **Assign priority levels**: The final step in the technical assessment was to group together assets into different priority levels based on their cross-hazard scores. This was done to make the outputs more oriented to future actions, decrease the tendency to read too much into minor differences in the cross-hazard scores, and better facilitate dialogue at the workshop with

[12] Note that the scour rating metric is weighted somewhat higher than the other condition related assets because of its more direct connection to asset failure.

[13] Within the traffic volume related metrics, note that slightly more weight is given to AADT as opposed to truck AADT given that most of the traffic on a roadway is non-truck. Thus, it was reasoned that the total volume should factor in somewhat more heavily than the truck volume. One exception to this was for temperature impacts to pavement. This asset-hazard combination is unique in that the traffic volume information is not just an indicator of how many users may be affected by necessary pavement repairs but also an indicator of how much damage may occur to the pavement should temperatures exceed binder grade design thresholds. Given that, for this asset-hazard combination, more weight is given to truck volumes since trucks do disproportionately more damage to temperature-weakened pavement.

District 9 staff. Five priority levels were developed (Priority 1, 2, 3, 4, and 5) and assets were assigned to those groups on a district-wide basis. An equal number of assets were assigned to each priority level to help facilitate administration of the facility-level adaptation assessments that will follow this study.

3.5. Adjustments to Prioritization

District adjustments to the prioritization may be needed for a variety of reasons. First, there could be errors in the databases themselves; rarely are large databases entirely free of errors. Second, errors may have been introduced during the GIS processing of some of the datasets. For example, a small culvert may have been inadvertently associated with the wrong stream during the geoprocessing step, leading to it receiving an inaccurate riverine flooding exposure score. Lastly, district staff, which possesses an intimate knowledge of their assets, may have knowledge about the assets or their environmental context that is not easily captured in an indicator-based scoring methodology.

After the initial prioritization scores were calculated, a workshop was held with the district to explain the scoring methodology and go over the preliminary results, then District 9 staff could make recommendations on adjusting asset priorities. District 9 decided not to change any of the final prioritization scores.

4. DISTRICT ADAPTATION PRIORITIES

This chapter presents Caltrans' priorities for undertaking detailed adaptation assessments of assets exposed to climate change in District 9. The material presented in this chapter reflects the results of the technical analysis and the coordination with District 9 staff described in the previous chapter. The information is broken out by asset type with priorities for bridges discussed in the first section, followed by those for large culverts, small culverts, and roadways.

4.1. Bridges

A total of 45 bridges were assessed for vulnerability to future flooding associated with climate change. All bridges assessed and assigned a priority should eventually undergo detailed adaptation assessments. However, due to resource limitations, this will not be possible to do all at once. Instead, the bridges will be analyzed over time according to the priorities presented here.

Figure 2 provides a map of all the bridges assessed for exposure to riverine flooding. The color of the points corresponds to the priority assigned to each bridge; darker red colors indicate higher priority assets. The map shows that high priority bridges are scattered throughout the district. That said, there are a few clusters of areas that have several high priority bridges. The top nine Priority 1 bridges with the highest cross-hazard prioritization scores are in Mono, Kern, and Inyo Counties. Eight out of the nine Priority 1 bridges experienced past flood-related damages as reported by District 9. The highest priority bridge is on US Highway 395 over the East Walker River, which receives the highest riverine flooding exposure score out of all bridges assessed. The SR 58 bridge over La Rose Creek is another Priority 1 because of past flood impacts, riverine flood exposure, combined with high AADT and a long detour route around the bridge. Other notable clusters of high priority bridges are located along U.S. Highway 395 in Mono and Inyo Counties, in a valley between mountain ranges where there is heightened risk for flooding.

Table 4 presents a summary of all the Priority 1 bridges in District 9 sorted by their cross-hazard prioritization scores. A complete listing of all bridges ranked by their prioritization scores appears in Table 8 in the appendix.

TABLE 4: PRIORITY 1 BRIDGES

Priority	Bridge Number	County[14]	Route	Postmile	Feature Crossed	Cross-Hazard Prioritization Score
1	47 0013	MNO	395	76.31	EAST WALKER RIVER	100.00
1	50 0139	KER	58	103.44	LA ROSE CREEK	85.29
1	48 0038	INY	6	6.46	LOWER MCNALLY CANAL	68.29
1	47 0016	MNO	108	9.45	WOLF CREEK	64.48
1	50 0014	KER	14	56.35	FREEMAN GULCH	56.11
1	47 0011	MNO	395	96	WEST WALKER RIVER	47.96
1	48 0069R	INY	395 NB	44	COTTONWOOD CREEK	47.20
1	50 0173	KER	58	88.57	BRANCH TEHACHAPI CREEK	46.41
1	48 0046R	INY	395 NB	5.12	FIVE MILE CYN	45.99

[14] INY = Inyo; KER = Kern; MNO = Mono

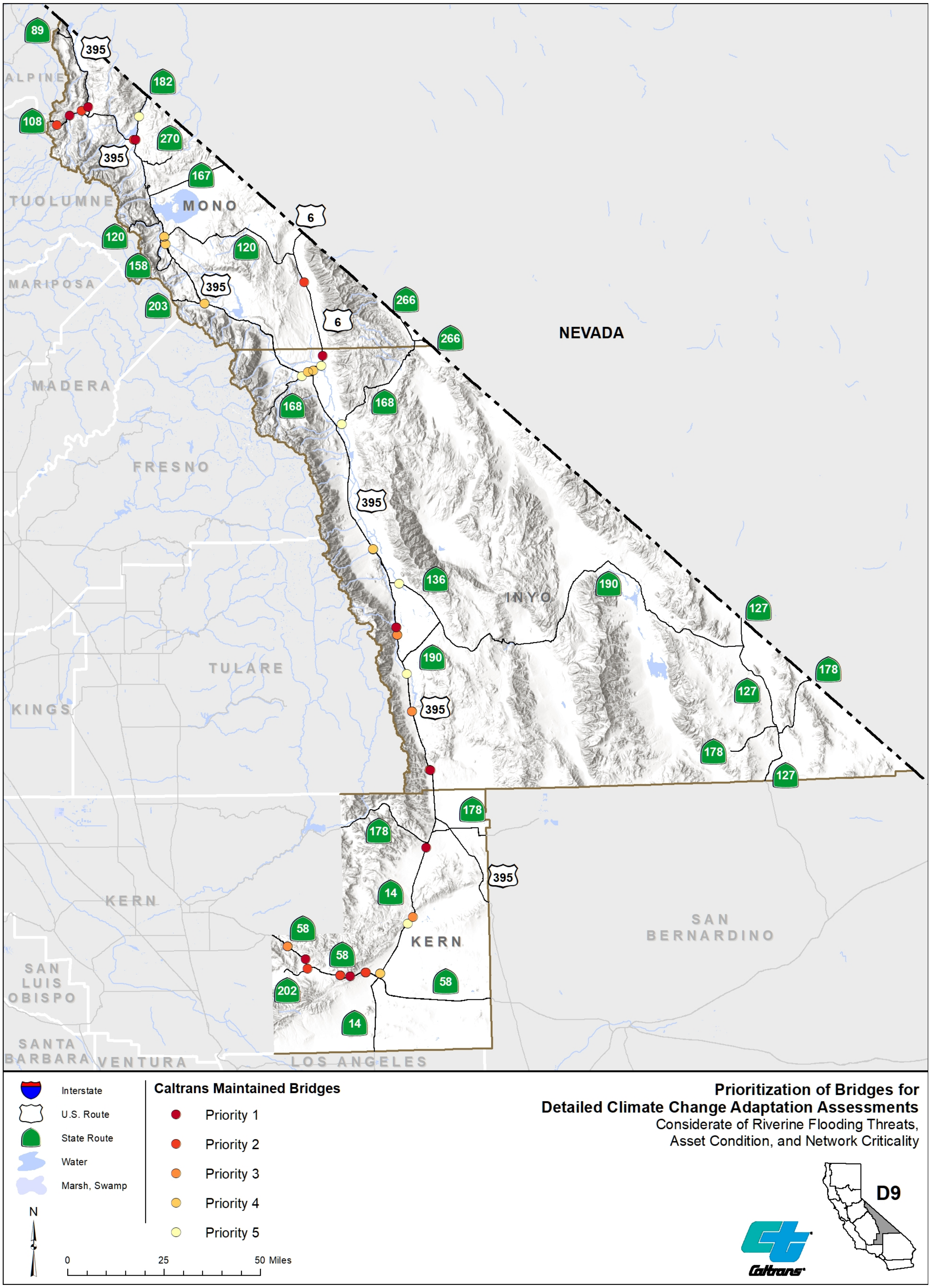

FIGURE 2: PRIORITIZATION OF BRIDGES FOR DETAILED ADAPTATION ASSESSMENTS

4.2. Large Culverts

A total of 21 large culverts were assessed for vulnerability to more severe riverine flooding associated with climate change. Figure 3 provides a map of all the large culverts potentially exposed to changes in heavy precipitation and associated flooding in the district, evaluated as well for their condition rating and relative network redundancy. Large culverts are colored according to their priority level. Given the limited number of large culverts assessed in District 9, it is hard to draw spatial patterns to the vulnerabilities. Two of the Priority 1 large culverts with the highest cross-prioritization hazard scores are on US 395 in Mono County. These culverts received high scores primarily due to past flood damages as reported by the district and high riverine flood exposure scores. The large culvert on SR 58 received a high score due to riverine flood exposure and high traffic volumes. And the other Priority 1 US 395 culvert that crosses the North Branch Robinson Creek received a high priority due to past flood damages, riverine flood exposure, and a relatively long detour route. The remaining exposed large culverts are distributed throughout District 9.

Table 5 presents a summary of the four Priority 1 large culverts in District 9 sorted by their cross-hazard prioritization scores. A complete listing of all large culverts ranked by their prioritization scores appears in Table 9 in the appendix.

TABLE 5: PRIORITY 1 LARGE CULVERTS

Priority	Culvert System Number	County[15]	Route	Postmile	Feature Crossed	Cross-Hazard Prioritization Score
1	47 0036	MNO	395	79.38	MIDDLE BRANCH BUCKEYE CR	100.00
1	47 0032	MNO	395	79.03	SOUTH BRANCH ROBINSON CR	82.12
1	50 0413	KER	58	96.67	MONOLITH DRAIN #1	77.48
1	47 0033	MNO	395	79.17	NORTH BRANCH ROBINSON CR	72.31

[15] KER = Kern; MNO = Mono

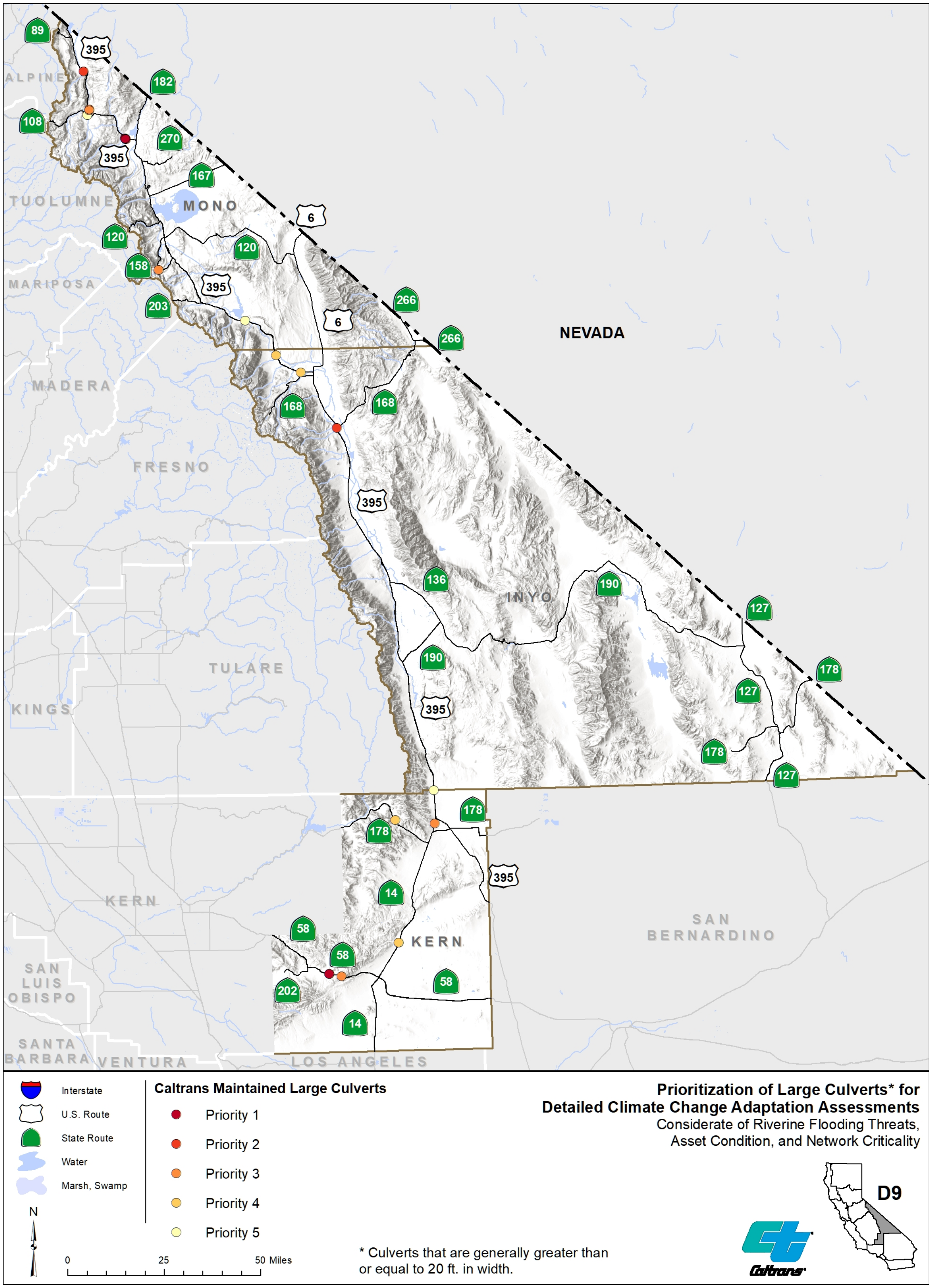

FIGURE 3: PRIORITIZATION OF LARGE CULVERTS FOR DETAILED ADAPTATION ASSESSMENTS

4.3. Small Culverts

A total of 748 small culverts were assessed for vulnerability to severe riverine flooding and wildfire associated with climate change. Figure 4**Error! Reference source not found.** provides a map of all the small culverts potentially exposed to these stressors in the district. The small culverts are colored by their priority level.

The map indicates several clusters of high priority small culverts. These can be found along several different roadways in Inyo, Kern, and Mono Counties, which are noted for their mountainous terrain where there is higher wildfire risk. Specifically, small culverts with high cross-hazard prioritization scores include those on U.S. Highway 395 in Inyo and Mono Counties, State Route 120 in Mono County, and State Route 58 in Kern County. Several of these assets also entail long detour routes to get around if closed.

Table 6 presents a summary of all the Priority 1 small culverts in District 9 sorted by their cross-hazard prioritization scores. A complete listing of all small culverts ranked by their prioritization scores appears in Table 10 in the appendix.

TABLE 6: PRIORITY 1 SMALL CULVERTS

Priority	Culvert System Number	County[16]	Route	Postmile	Cross-Hazard Prioritization Score
1	471204100558	MNO	120	5.58	100.00
1	471204100701	MNO	120	7.01	95.21
1	473954009718	MNO	395	97.18	93.54
1	473954010923	MNO	395	109.23	92.80
1	473950010991	MNO	395	109.91	90.91
1	473954009725	MNO	395	97.25	90.71
1	472030100146	MNO	203	1.46	89.73
1	473950011188	MNO	395	111.88	89.58
1	471204100441	MNO	120	4.41	87.48
1	471204100449	MNO	120	4.49	87.38
1	473954111376	MNO	395	113.76	85.28
1	473954104772	MNO	395	47.72	83.26
1	473954104772	MNO	395	47.72	83.26
1	473954004917	MNO	395	49.17	77.06
1	473954004921	MNO	395	49.21	77.06
1	473954003809	MNO	395	38.09	76.72
1	471584001358	MNO	158	13.58	76.32
1	473950003471	MNO	395	34.71	76.09
1	473950003480	MNO	395	34.8	76.08
1	473950006168	MNO	395	61.68	75.28
1	473950006131	MNO	395	61.31	75.28
1	473954006101	MNO	395	61.01	75.23

[16] INY = Inyo; KER = Kern; MNO = Mono

Priority	Culvert System Number	County[16]	Route	Postmile	Cross-Hazard Prioritization Score
1	500584110276	KER	58	102.76	74.72
1	470890000322	MNO	89	3.22	74.41
1	472704000952	MNO	270	9.52	74.10
1	473950006583	MNO	395	65.83	74.00
1	471084001022	MNO	108	10.22	73.88
1	473950006179	MNO	395	61.79	72.97
1	473954005995	MNO	395	59.95	72.49
1	473954006056	MNO	395	60.56	72.37
1	473950006523	MNO	395	65.23	72.11
1	473950006575	MNO	395	65.75	72.10
1	471080001358	MNO	108	13.58	71.45
1	471200002472	MNO	120	24.72	71.43
1	473954005450	MNO	395	54.5	70.38
1	473954104686	MNO	395	46.86	69.96
1	473954104686	MNO	395	46.86	69.96
1	471584001367	MNO	158	13.67	69.87
1	473954005996	MNO	395	59.96	69.85
1	502020100599	KER	202	5.99	69.39
1	473954005440	MNO	395	54.4	68.50
1	472030100047	MNO	203	0.47	68.21
1	472704000528	MNO	270	5.28	68.20
1	473954105405	MNO	395	54.05	68.09
1	471204002936	MNO	120	29.36	66.47
1	471204002989	MNO	120	29.89	66.47
1	472700000642	MNO	270	6.42	66.32
1	472700000576	MNO	270	5.76	66.30
1	473954105396	MNO	395	53.96	66.21
1	500580108112	KER	58	81.12	66.18
1	473954101798	MNO	395	17.98	65.76
1	473954101755	MNO	395	17.55	65.37
1	471084000163	MNO	108	1.63	65.22
1	471204100662	MNO	120	6.62	64.86
1	473954012013	MNO	395	120.13	64.12
1	473954101792	MNO	395	17.92	63.90
1	473954101789	MNO	395	17.89	63.88
1	500584108902	KER	58	89.02	63.33
1	500580108120	KER	58	81.2	63.31
1	473954012006	MNO	395	120.06	63.16
1	471584000755	MNO	158	7.55	62.88
1	502024100373	KER	202	3.73	62.53
1	502024100322	KER	202	3.22	62.42

Priority	Culvert System Number	County[16]	Route	Postmile	Cross-Hazard Prioritization Score
1	473954009643	MNO	395	96.43	62.34
1	471084000158	MNO	108	1.58	62.31
1	500584108912	KER	58	89.12	61.73
1	501780005752	KER	178	57.52	61.54
1	473954012028	MNO	395	120.28	61.33
1	473954005864	MNO	395	58.64	60.27
1	473950007459	MNO	395	74.59	59.90
1	500586008194	KER	58	81.94	59.61
1	473954010920	MNO	395	109.2	59.26
1	473950007459	MNO	395	74.59	58.03
1	471080000055	MNO	108	0.55	58.01
1	500580108117	KER	58	81.17	57.35
1	500580108109	KER	58	81.09	57.35
1	500584108946	KER	58	89.46	57.21
1	470890000421	MNO	89	4.21	57.17
1	473954011820	MNO	395	118.2	57.14
1	473954011842	MNO	395	118.42	57.14
1	473954011830	MNO	395	118.3	57.13
1	473954011846	MNO	395	118.46	57.12
1	483952002563	INY	395	25.63	57.08
1	483954002565	INY	395	25.65	57.00
1	473954100316	MNO	395	3.16	56.84
1	471824000720	MNO	182	7.2	56.82
1	473954005095	MNO	395	50.95	56.81
1	471200100190	MNO	120	1.9	56.14
1	471200100187	MNO	120	1.87	56.11
1	471084000041	MNO	108	0.41	56.10
1	471080000052	MNO	108	0.52	56.03
1	500584108619	KER	58	86.19	55.89
1	483954002430	INY	395	24.3	55.87
1	501780007764	KER	178	77.64	55.40
1	501784007804	KER	178	78.04	55.40
1	470890000421	MNO	89	4.21	55.28
1	470890000421	MNO	89	4.21	55.23
1	470890000421	MNO	89	4.21	55.23
1	471824000710	MNO	182	7.1	54.92
1	471820000461	MNO	182	4.61	54.92
1	471820000470	MNO	182	4.7	54.92
1	471824000719	MNO	182	7.19	54.92
1	473954010923	MNO	395	109.23	54.69
1	483952002430	INY	395	24.3	54.55

Priority	Culvert System Number	County[16]	Route	Postmile	Cross-Hazard Prioritization Score
1	471084000091	MNO	108	0.91	54.38
1	483952002475	INY	395	24.75	54.27
1	483952002515	INY	395	25.15	54.27
1	483952002469	INY	395	24.69	54.27
1	483954002469	INY	395	24.69	54.27
1	483952002420	INY	395	24.2	54.27
1	500584008330	KER	58	83.3	54.16
1	500584008332	KER	58	83.32	54.13
1	501784007760	KER	178	77.6	53.50
1	473954011877	MNO	395	118.77	53.49
1	501780007879	KER	178	78.79	53.49
1	501780007880	KER	178	78.8	53.49
1	471084000120	MNO	108	1.2	53.48
1	500584110156	KER	58	101.56	52.98
1	473950000918	MNO	395	9.18	52.88
1	473954101322	MNO	395	13.22	52.48
1	473954002367	MNO	395	23.67	52.10
1	473954101856	MNO	395	18.56	52.02
1	473954004939	MNO	395	49.39	51.85
1	473954004939	MNO	395	49.39	51.85
1	473954007944	MNO	395	79.44	51.75
1	471084000106	MNO	108	1.06	51.57
1	471084000113	MNO	108	1.13	51.50
1	500584108625	KER	58	86.25	51.50
1	471204100228	MNO	120	2.28	50.37
1	483950010580	INY	395	105.8	50.28
1	473954104753	MNO	395	47.53	49.95
1	500584008475	KER	58	84.75	49.81
1	500584008408	KER	58	84.08	49.76
1	500584008622	KER	58	86.22	49.51
1	483954007289	INY	395	72.89	49.20
1	483954010720	INY	395	107.2	49.02
1	483954010729	INY	395	107.29	49.02
1	483954010730	INY	395	107.3	48.97
1	472034100506	MNO	203	5.06	48.89
1	483955907461	INY	395	74.61	48.70
1	473950009157	MNO	395	91.57	48.43
1	500584008408	KER	58	84.08	48.20
1	470064000880	MNO	6	8.8	48.06
1	500584110345	KER	58	103.45	47.81
1	471820000180	MNO	182	1.8	47.79

Priority	Culvert System Number	County[16]	Route	Postmile	Cross-Hazard Prioritization Score
1	481684100283	INY	168	2.83	47.61
1	481684100291	INY	168	2.91	47.61
1	481274002723	INY	127	27.23	47.33
1	481684101021	INY	168	10.21	47.28

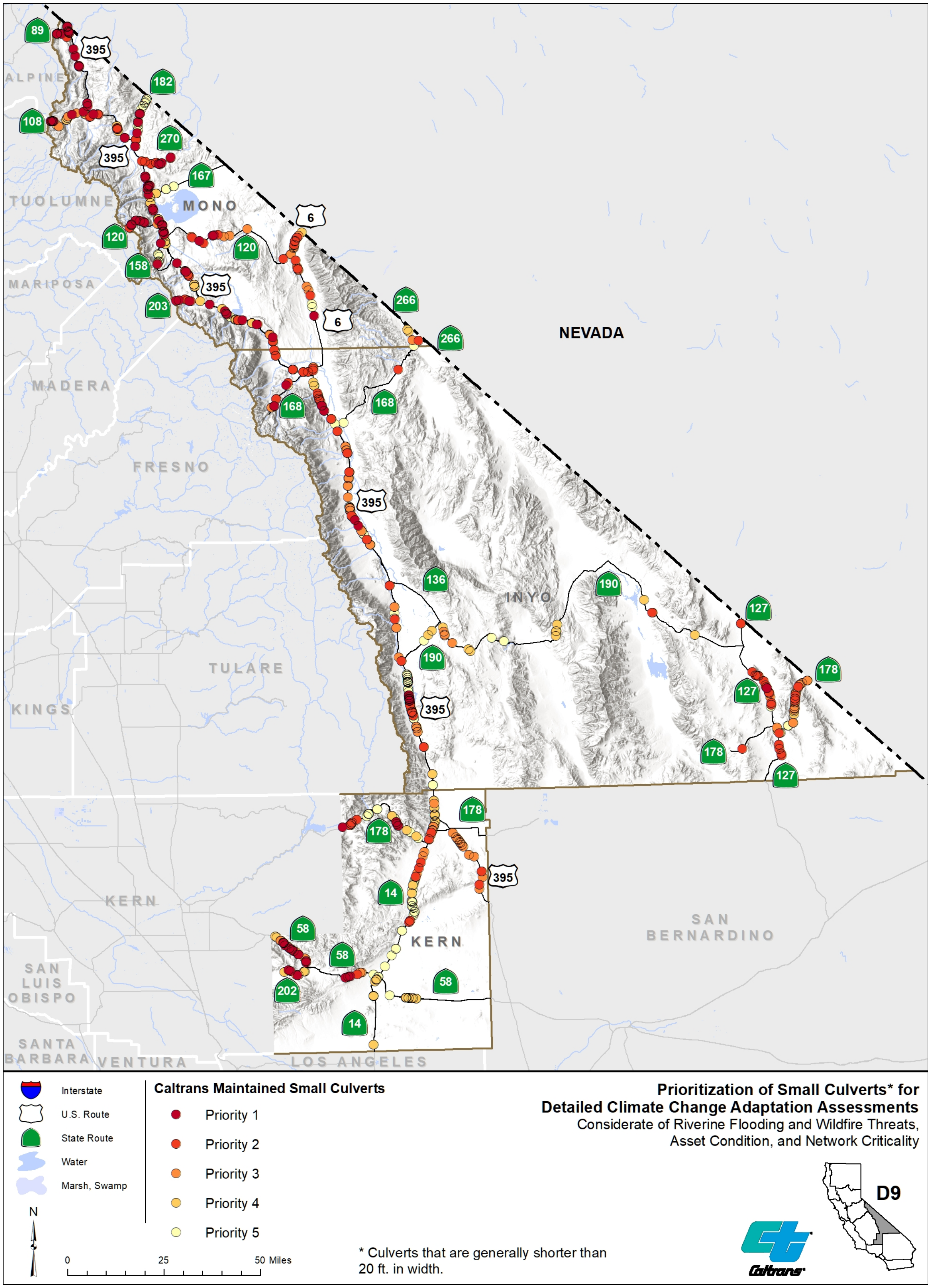

FIGURE 4: PRIORITIZATION OF SMALL CULVERTS FOR DETAILED ADAPTATION ASSESSMENTS

4.4. Roadways

A total of 1,166 roadway segments were assessed for vulnerability to temperature changes that affect pavement performance. To make the analysis as detailed as possible, the original segments were short with beginning and end points at intersections with other streets (including smaller local streets) in the roadway network. Once the processing of vulnerability scores was complete, smaller segments sharing the same priority score as their neighbors on the same route were consolidated into longer segments to simplify the presentation of the results. This brought the number of roadway segments compiled and prioritized to 138.

Figure 5 provides a map of all consolidated roadway segments potentially exposed to pavement degrading temperature changes in the district. Each segment of roadway is colored by priority level. The 28 Priority 1 roadway segments receiving the highest cross-hazard prioritization scores are in Inyo and Kern Counties. U.S. Highway 395 in Inyo County has the highest cross-hazard priority score because this highway is also a high traffic route.

Table 7 presents a summary of all the Priority 1 roadways in District 9 sorted by their cross-hazard prioritization scores. A complete listing of all roadways ranked by their prioritization scores appears in Table 11 in the appendix.

TABLE 7: PRIORITY 1 ROADWAYS

Priority	County[17]	Route	From Postmile / To Postmile	Carriageway[18]	Average Cross-Hazard Prioritization Score[19]
1	INY	395	395 39.721 / 395 40.285	S	91.22
1	INY	395	395 41.418 / 395 55.76	S	91.22
1	INY	395	395 55.796 / 395 56.731	S	91.22
1	INY	395	395 R13.864 / 395 31.062	S	91.22
1	INY	395	395 R58.026 / 395 65.597	S	91.22
1	INY	178	178 52.188 / 178 62.186	P	88.40
1	KER	178	178 85.81 / 178 88.26	P	88.40
1	KER	178	178 88.38 / 178 92.496	P	88.40
1	INY	395	395 115.337 / 395 115.669	P	87.01
1	INY	395	395 49.224 / 395 65.639	P	87.01
1	INY	395	395 72.744 / 395 74.247	P	87.01
1	INY	395	395 R13.876 / 395 46.638	P	87.01
1	KER	395	395 R23.481 / 395 29.379	P	87.01
1	INY	190	190 122.539 / 190 126.565	P	83.66
1	INY	190	190 127.787 / 190 133.793	P	83.66
1	INY	190	190 14.616 / 190 47.394	P	83.66
1	INY	190	190 60.03 / 190 76.51	P	83.66
1	INY	190	190 9.85 / 190 10.76	P	83.66

[17] INY = Inyo; KER = Kern; LA = Los Angeles; MNO = Mono;
[18] Caltrans' alignment codes designate the carriageway on divided roadways: "P" always represents northbound or eastbound carriageways whereas "S" always represents southbound or westbound carriageways. Undivided roadways are always indicated with a "P".
[19] The average of the cross-hazard prioritization scores amongst all the abutting small segments on the same route sharing a common priority level that were aggregated to form the longer segments listed in this table.

Priority	County[17]	Route	From Postmile / To Postmile	Carriageway[18]	Average Cross-Hazard Prioritization Score[19]
1	INY	136	136 0.009 / 136 17.73	P	83.47
1	KER	14	14 17.136 / 14 19.09	P	76.85
1	KER	14	14 52.767 / 14 64.558	P	76.85
1	KER	14	14 R14.39 / 14 L17.353	P	76.85
1	KER	58	58 R101.565 / 58 M108.643	S	76.20
1	KER	58	58 R101.719 / 58 M108.644	P	76.20
1	KER	14	14 17.232 / 14 19.085	S	71.08
1	KER	14	14 61.941 / 14 64.131	S	71.08
1	KER	14	14 R14.396 / 14 L17.383	S	71.08
1	INY	6	6 0 / 6 0.408	P	69.33

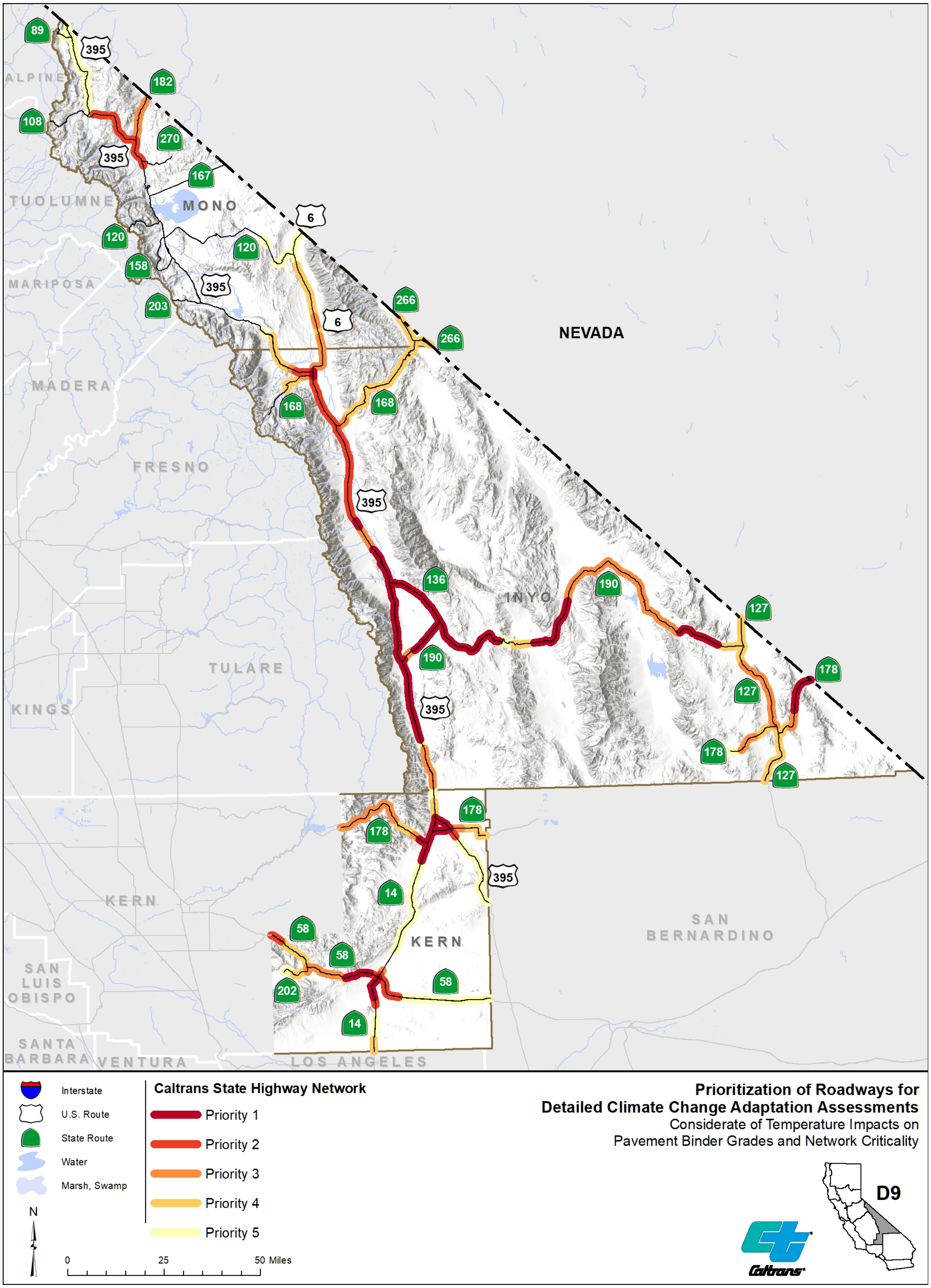

FIGURE 5: PRIORITIZATION OF ROADWAYS FOR DETAILED ADAPTATION ASSESSMENTS

5. NEXT STEPS

This report has identified the bridge, large culvert, small culvert, and roadway assets exposed to a variety of climate hazards in District 9 and assigned them priority levels for detailed assessments based on their vulnerability rating. Caltrans' next step will be to begin undertaking these detailed adaptation assessments for the identified assets starting with the highest priority (Priority 1) assets first and then proceeding to lower priority assets thereafter. These detailed adaptation assessments will take a closer look at the exposure to each asset using more localized climate projections and more detailed engineering analyses. If impacts are verified, Caltrans will develop and evaluate adaptation options for the asset to ensure that it is able to withstand future climate changes. Importantly, the detailed adaptations assessments will include coordination with key stakeholder groups whose actions affect or are affected by the asset and its adaptation.

Another next step will be to integrate the prioritization measures into the asset management system used in the district. This will ensure that climate change is a consideration in the identification of future projects alongside traditional asset condition metrics. As noted previously, assets identified for capital investments, especially those flagged as being a high priority for climate change, should then undergo detailed climate change assessments prior to project programming. Additionally, long-term maintenance plays an important part in managing and protecting these assets. When conducting facility level assessments, the district should consider any potential changes to long-term scheduled maintenance needed to preserve chosen adaptation strategies. Operations and maintenance strategies can also be evaluated instead, or in addition to, design changes. When evaluating the cost effectiveness of different adaptation strategies, operations and maintenance responses may be more cost-effective for assets with shorter useful lives.

ROCKSLIDE ON WHITNEY PORTAL ROAD

In addition, district staff can use the results of this study as a tool to facilitate discussions with various important stakeholders in the district about addressing climate change and its impacts. This may include state and federal environmental agencies regional transportation authorities, universities or academic partners, and others. Multi-agency stakeholder coordination and involvement of the private sector is also essential because the impacts from climate change, and ability to effectively address those impacts, cross both jurisdictional and ownership boundaries. For example, Caltrans could increase the size of a culvert to accommodate higher stormwater and debris flows while the more cost-effective solution may be better land management in the adjacent drainage area. The approach to climate change cannot just be Caltrans-centric. A common framework across all state agencies and key stakeholders must be established for truly effective long-term solutions to be achieved.

6. APPENDIX

TABLE 8: PRIORITIZATION OF BRIDGES FOR DETAILED CLIMATE CHANGE ADAPTATION ASSESSMENTS

Priority	Bridge Number	County[20]	Route	Postmile	Feature Crossed	Cross-Hazard Prioritization Score
1	47 0013	MNO	395	76.31	EAST WALKER RIVER	100.00
1	50 0139	KER	58	103.44	LA ROSE CREEK	85.29
1	48 0038	INY	6	6.46	LOWER MCNALLY CANAL	68.29
1	47 0016	MNO	108	9.45	WOLF CREEK	64.48
1	50 0014	KER	14	56.35	FREEMAN GULCH	56.11
1	47 0011	MNO	395	96	WEST WALKER RIVER	47.96
1	48 0069R	INY	395 NB	44	COTTONWOOD CREEK	47.20
1	50 0173	KER	58	88.57	BRANCH TEHACHAPI CREEK	46.41
1	48 0046R	INY	395 NB	5.12	FIVE MILE CYN	45.99
2	47 0062	MNO	6	17.96	SPRING CANYON CK CHANNEL	44.77
2	47 0020	MNO	108	12.93	WEST WALKER RIVER	44.45
2	48 0069L	INY	395 SB	0	COTTONWOOD CREEK	42.42
2	47 0061	MNO	108	3.05	SARDINE CREEK	41.19
2	50 0201L	KER	58	107.61	CACHE CREEK	40.76
2	47 0047	MNO	395	76.89	RICKEY DITCH OVERFLOW	40.57
2	50 0346L	KER	58 WB	99.81	CACHE CREEK	40.11
2	50 0346R	KER	58 EB	99.82	CACHE CREEK	40.11
2	50 0486	KER	202	11.51	UP RR BNSF TEHACHAPI CRK	39.84
3	50 0044R	KER	58 EB	82.64	UP RR TEHACHAPI CREEK	38.94
3	48 0051L	INY	395 SB	5.39	FIVE MILE CANYON	35.31
3	48 0015L	INY	395 SB	21.31	LOS ANGELES AQUEDUCT	35.17
3	48 0015R	INY	395 NB	21.31	LOS ANGELES AQUEDUCT	35.17
3	50 0044L	KER	58 WB	82.64	UP RR TEHACHAPI CREEK	34.57
3	50 0201R	KER	58	107.6	CACHE CREEK	31.47
3	48 0068R	INY	395 NB	42.02	ASH CREEK	25.86
3	48 0068L	INY	395	42.02	ASH CREEK	25.69
3	50 0424	KER	14	37.32	CANTIL WASH	24.24
4	47 0049R	MNO	395 NB	24.96	MAMMOTH CREEK	21.48
4	47 0059R	MNO	395 NB	46.24	S RUSH CRK CHANNEL	21.07
4	47 0059L	MNO	395 SB	46.24	S RUSH CRK CHANNEL	21.07
4	50 0501L	KER	14 SB	20.18	CACHE CREEK	20.90
4	50 0501R	KER	14 NB	20.18	CACHE CREEK	20.90
4	47 0057R	MNO	395 NB	44.21	LOS ANGELES AQUEDUCT	19.39
4	48 0016	INY	395	117.61	NORTH FORK BISHOP CREEK	19.03
4	48 0023	INY	6	0.45	BISHOP CREEK	18.33

[20] INY = Inyo; KER = Kern; MNO = Mono

Priority	Bridge Number	County[20]	Route	Postmile	Feature Crossed	Cross-Hazard Prioritization Score
4	48 0014R	KER	395 NB	65.71	LOS ANGELES AQUEDUCT	18.31
5	47 0058	MNO	182	6.2	EAST WALKER RIVER	18.28
5	48 0024	INY	6	3.73	OWENS RIVER	17.18
5	48 0025	INY	168	15.4	NORTH FORK BISHOP CREEK	13.55
5	47 0049L	MNO	395 SB	24.97	MAMMOTH CREEK	12.31
5	50 0478	KER	14	35.4	JAWBONE CANYON WASH	9.43
5	48 0061	INY	168	19.79	OWENS RIVER	9.29
5	48 0014L	INY	395 SB	65.64	LOS ANGELES AQUEDUCT	8.51
5	48 0010	INY	395	31.28	LOS ANGELES AQUEDUCT	4.35
5	48 0002	INY	136	2.67	OWENS RIVER	0.00

TABLE 9: PRIORITIZATION OF LARGE CULVERTS FOR DETAILED CLIMATE CHANGE ADAPTATION ASSESSMENTS

Priority	Culvert System Number	County[21]	Route	Postmile	Feature Crossed	Cross-Hazard Prioritization Score
1	47 0036	MNO	395	79.38	MIDDLE BRANCH BUCKEYE CR	100.00
1	47 0032	MNO	395	79.03	SOUTH BRANCH ROBINSON CR	82.12
1	50 0413	KER	58	96.67	MONOLITH DRAIN #1	77.48
1	47 0033	MNO	395	79.17	NORTH BRANCH ROBINSON CR	72.31
2	50 0414	KER	58	96.73	MONOLITH DRAIN #2	68.34
2	50 0415	KER	58	96.79	MONOLITH DRAIN #3	66.40
2	47 0046	MNO	395	107.11	MILL CREEK	66.23
2	48 0036	INY	395	100.2	BIG PINE CREEK	63.85
3	47 0035	MNO	395	95.18	LITTLE WALKER RIVER	60.91
3	47 0038	MNO	395	95.4	LITTLE WALKER RIVER	60.49
3	50 0421	KER	58	100.14	CACHE CREEK OVERFLOW #4	39.71
3	47 0055	MNO	158	5.9	RUSH CREEK	39.21
3	50 0480	KER	14	62.97	INDIAN WELLS WASH	39.07
4	50 0054	KER	178	76.98	CANE BRAKE CREEK	28.03
4	48 0063	INY	395	127.73	LOWER ROCK CREEK	20.43
4	48 0065	INY	395	119.6	BISHOP CRK OVERFLOW CHNL	17.65
4	50 0487L	KER	14 SB	29.51	PINE TREE WASH	13.92
5	50 0487R	KER	14 NB	29.51	PINE TREE WASH	13.59
5	47 0064	MNO	108	15.01	LITTLE WALKER RIVER	12.37
5	47 0052	MNO	395	12.48	CROOKED CREEK	10.44
5	50 0483	KER	395	36.7	COUNTY LINE WASH	0.00

[21] INY = Inyo; KER = Kern; MNO = Mono

TABLE 10: PRIORITIZATION OF SMALL CULVERTS FOR DETAILED CLIMATE CHANGE ADAPTATION ASSESSMENTS

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
1	471204100558	MNO	120	5.58	100.00
1	471204100701	MNO	120	7.01	95.21
1	473954009718	MNO	395	97.18	93.54
1	473954010923	MNO	395	109.23	92.80
1	473950010991	MNO	395	109.91	90.91
1	473954009725	MNO	395	97.25	90.71
1	472030100146	MNO	203	1.46	89.73
1	473950011188	MNO	395	111.88	89.58
1	471204100441	MNO	120	4.41	87.48
1	471204100449	MNO	120	4.49	87.38
1	473954111376	MNO	395	113.76	85.28
1	473954104772	MNO	395	47.72	83.26
1	473954104772	MNO	395	47.72	83.26
1	473954004917	MNO	395	49.17	77.06
1	473954004921	MNO	395	49.21	77.06
1	473954003809	MNO	395	38.09	76.72
1	471584001358	MNO	158	13.58	76.32
1	473950003471	MNO	395	34.71	76.09
1	473950003480	MNO	395	34.8	76.08
1	473950006168	MNO	395	61.68	75.28
1	473950006131	MNO	395	61.31	75.28
1	473954006101	MNO	395	61.01	75.23
1	500584110276	KER	58	102.76	74.72
1	470890000322	MNO	89	3.22	74.41
1	472704000952	MNO	270	9.52	74.10
1	473950006583	MNO	395	65.83	74.00
1	471084001022	MNO	108	10.22	73.88
1	473950006179	MNO	395	61.79	72.97
1	473954005995	MNO	395	59.95	72.49
1	473954006056	MNO	395	60.56	72.37
1	473950006523	MNO	395	65.23	72.11
1	473950006575	MNO	395	65.75	72.10
1	471080001358	MNO	108	13.58	71.45
1	471200002472	MNO	120	24.72	71.43
1	473954005450	MNO	395	54.5	70.38
1	473954104686	MNO	395	46.86	69.96

[22] INY = Inyo; KER = Kern; MNO = Mono

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
1	473954104686	MNO	395	46.86	69.96
1	471584001367	MNO	158	13.67	69.87
1	473954005996	MNO	395	59.96	69.85
1	502020100599	KER	202	5.99	69.39
1	473954005440	MNO	395	54.4	68.50
1	472030100047	MNO	203	0.47	68.21
1	472704000528	MNO	270	5.28	68.20
1	473954105405	MNO	395	54.05	68.09
1	471204002936	MNO	120	29.36	66.47
1	471204002989	MNO	120	29.89	66.47
1	472700000642	MNO	270	6.42	66.32
1	472700000576	MNO	270	5.76	66.30
1	473954105396	MNO	395	53.96	66.21
1	500580108112	KER	58	81.12	66.18
1	473954101798	MNO	395	17.98	65.76
1	473954101755	MNO	395	17.55	65.37
1	471084000163	MNO	108	1.63	65.22
1	471204100662	MNO	120	6.62	64.86
1	473954012013	MNO	395	120.13	64.12
1	473954101792	MNO	395	17.92	63.90
1	473954101789	MNO	395	17.89	63.88
1	500584108902	KER	58	89.02	63.33
1	500580108120	KER	58	81.2	63.31
1	473954012006	MNO	395	120.06	63.16
1	471584000755	MNO	158	7.55	62.88
1	502024100373	KER	202	3.73	62.53
1	502024100322	KER	202	3.22	62.42
1	473954009643	MNO	395	96.43	62.34
1	471084000158	MNO	108	1.58	62.31
1	500584108912	KER	58	89.12	61.73
1	501780005752	KER	178	57.52	61.54
1	473954012028	MNO	395	120.28	61.33
1	473954005864	MNO	395	58.64	60.27
1	473950007459	MNO	395	74.59	59.90
1	500586008194	KER	58	81.94	59.61
1	473954010920	MNO	395	109.2	59.26
1	473950007459	MNO	395	74.59	58.03
1	471080000055	MNO	108	0.55	58.01
1	500580108117	KER	58	81.17	57.35
1	500580108109	KER	58	81.09	57.35

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
1	500584108946	KER	58	89.46	57.21
1	470890000421	MNO	89	4.21	57.17
1	473954011820	MNO	395	118.2	57.14
1	473954011842	MNO	395	118.42	57.14
1	473954011830	MNO	395	118.3	57.13
1	473954011846	MNO	395	118.46	57.12
1	483952002563	INY	395	25.63	57.08
1	483954002565	INY	395	25.65	57.00
1	473954100316	MNO	395	3.16	56.84
1	471824000720	MNO	182	7.2	56.82
1	473954005095	MNO	395	50.95	56.81
1	471200100190	MNO	120	1.9	56.14
1	471200100187	MNO	120	1.87	56.11
1	471084000041	MNO	108	0.41	56.10
1	471080000052	MNO	108	0.52	56.03
1	500584108619	KER	58	86.19	55.89
1	483954002430	INY	395	24.3	55.87
1	501780007764	KER	178	77.64	55.40
1	501784007804	KER	178	78.04	55.40
1	470890000421	MNO	89	4.21	55.28
1	470890000421	MNO	89	4.21	55.23
1	470890000421	MNO	89	4.21	55.23
1	471824000710	MNO	182	7.1	54.92
1	471820000461	MNO	182	4.61	54.92
1	471820000470	MNO	182	4.7	54.92
1	471824000719	MNO	182	7.19	54.92
1	473954010923	MNO	395	109.23	54.69
1	483952002430	INY	395	24.3	54.55
1	471084000091	MNO	108	0.91	54.38
1	483952002475	INY	395	24.75	54.27
1	483952002515	INY	395	25.15	54.27
1	483952002469	INY	395	24.69	54.27
1	483954002469	INY	395	24.69	54.27
1	483952002420	INY	395	24.2	54.27
1	500584008330	KER	58	83.3	54.16
1	500584008332	KER	58	83.32	54.13
1	501784007760	KER	178	77.6	53.50
1	473954011877	MNO	395	118.77	53.49
1	501780007879	KER	178	78.79	53.49
1	501780007880	KER	178	78.8	53.49

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
1	471084000120	MNO	108	1.2	53.48
1	500584110156	KER	58	101.56	52.98
1	473950000918	MNO	395	9.18	52.88
1	473954101322	MNO	395	13.22	52.48
1	473954002367	MNO	395	23.67	52.10
1	473954101856	MNO	395	18.56	52.02
1	473954004939	MNO	395	49.39	51.85
1	473954004939	MNO	395	49.39	51.85
1	473954007944	MNO	395	79.44	51.75
1	471084000106	MNO	108	1.06	51.57
1	471084000113	MNO	108	1.13	51.50
1	500584108625	KER	58	86.25	51.50
1	471204100228	MNO	120	2.28	50.37
1	483950010580	INY	395	105.8	50.28
1	473954104753	MNO	395	47.53	49.95
1	500584008475	KER	58	84.75	49.81
1	500584008408	KER	58	84.08	49.76
1	500584008622	KER	58	86.22	49.51
1	483954007289	INY	395	72.89	49.20
1	483954010720	INY	395	107.2	49.02
1	483954010729	INY	395	107.29	49.02
1	483954010730	INY	395	107.3	48.97
1	472034100506	MNO	203	5.06	48.89
1	483955907461	INY	395	74.61	48.70
1	473950009157	MNO	395	91.57	48.43
1	500584008408	KER	58	84.08	48.20
1	470064000880	MNO	6	8.8	48.06
1	500584110345	KER	58	103.45	47.81
1	471820000180	MNO	182	1.8	47.79
1	481684100283	INY	168	2.83	47.61
1	481684100291	INY	168	2.91	47.61
1	481274002723	INY	127	27.23	47.33
1	481684101021	INY	168	10.21	47.28
2	483954006870	INY	395	68.7	47.28
2	483954011882	INY	395	118.82	47.27
2	483954011880	INY	395	118.8	47.25
2	481680101114	INY	168	11.14	47.17
2	483950010886	INY	395	108.86	46.76
2	483954011757	INY	395	117.57	46.68
2	481780003114	INY	178	31.14	46.66

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
2	483954012180	INY	395	121.8	46.53
2	483954012181	INY	395	121.81	46.51
2	483954012178	INY	395	121.78	46.49
2	473951909015	MNO	395	90.15	46.49
2	473955909047	MNO	395	90.47	46.45
2	473950009047	MNO	395	90.47	46.44
2	483954010573	INY	395	105.73	46.16
2	483954010834	INY	395	108.34	45.93
2	481274003348	INY	127	33.48	45.89
2	481274002767	INY	127	27.67	45.71
2	481274002727	INY	127	27.27	45.43
2	483954010735	INY	395	107.35	45.40
2	481274002811	INY	127	28.11	45.09
2	473954003335	MNO	395	33.35	44.93
2	481270003147	INY	127	31.47	44.93
2	483954012190	INY	395	121.9	44.63
2	483954012173	INY	395	121.73	44.62
2	483954010928	INY	395	109.28	44.62
2	481274003217	INY	127	32.17	44.57
2	481274003221	INY	127	32.21	44.57
2	471204100107	MNO	120	1.07	44.56
2	471204100116	MNO	120	1.16	44.56
2	471204002618	MNO	120	26.18	44.51
2	470060003024	MNO	6	30.24	44.50
2	470060003037	MNO	6	30.37	44.50
2	483950112776	INY	395	127.76	44.33
2	473954003382	MNO	395	33.82	44.25
2	483954010307	INY	395	103.07	44.17
2	473950003498	MNO	395	34.98	43.87
2	471204003147	MNO	120	31.47	43.58
2	472664000331	MNO	266	3.31	43.49
2	483954010301	INY	395	103.01	43.42
2	473950003498	MNO	395	34.98	43.32
2	470060002911	MNO	6	29.11	43.28
2	483955907589	INY	395	75.89	43.28
2	471200002268	MNO	120	22.68	43.18
2	473954007942	MNO	395	79.42	43.12
2	483958010997	INY	395	109.97	43.08
2	473954009261	MNO	395	92.61	43.07
2	481270003145	INY	127	31.45	43.03

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
2	483954102116	INY	395	21.16	42.97
2	483954010930	INY	395	109.3	42.91
2	481274002932	INY	127	29.32	42.86
2	473950000894	MNO	395	8.94	42.81
2	472034100547	MNO	203	5.47	42.74
2	472030100443	MNO	203	4.43	42.70
2	481274004791	INY	127	47.91	42.44
2	483954011067	INY	395	110.67	42.31
2	500144103606	KER	14	36.06	42.27
2	481274003187	INY	127	31.87	42.09
2	473954003335	MNO	395	33.35	42.06
2	481274002576	INY	127	25.76	42.06
2	472034100360	MNO	203	3.6	41.96
2	481275901151	INY	127	11.51	41.94
2	481274000855	INY	127	8.55	41.82
2	481275900910	INY	127	9.1	41.81
2	473954100209	MNO	395	2.09	41.81
2	481684100478	INY	168	4.78	41.75
2	481684100487	INY	168	4.87	41.73
2	483954005518	INY	395	55.18	41.64
2	483954002305	INY	395	23.05	41.59
2	501784006012	KER	178	60.12	41.57
2	481275901050	INY	127	10.5	41.55
2	483954102116	INY	395	21.16	41.48
2	470060002397	MNO	6	23.97	41.39
2	483950112936	INY	395	129.36	41.34
2	473954104753	MNO	395	47.53	41.31
2	481274002597	INY	127	25.97	41.27
2	481274002609	INY	127	26.09	41.27
2	473954003384	MNO	395	33.84	41.24
2	473954003384	MNO	395	33.84	41.24
2	472704000286	MNO	270	2.86	41.22
2	471204005521	MNO	120	55.21	41.21
2	473950009278	MNO	395	92.78	41.21
2	481270002321	INY	127	23.21	41.19
2	472704000094	MNO	270	0.94	41.18
2	481274002270	INY	127	22.7	41.16
2	483954009920	INY	395	99.2	41.15
2	481274002270	INY	127	22.7	41.15
2	470890000146	MNO	89	1.46	41.12

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
2	483954002110	INY	395	21.1	41.08
2	501784006195	KER	178	61.95	41.05
2	480064000095	INY	6	0.95	41.01
2	483954009928	INY	395	99.28	40.97
2	473950006978	MNO	395	69.78	40.96
2	503954000928	KER	395	9.28	40.85
2	500144005071	KER	14	50.71	40.68
2	473954008279	MNO	395	82.79	40.58
2	473954008243	MNO	395	82.43	40.57
2	473954008246	MNO	395	82.46	40.57
2	473954008247	MNO	395	82.47	40.57
2	481274004791	INY	127	47.91	40.52
2	481904011330	INY	190	113.3	40.49
2	500144103598	KER	14	35.98	40.46
2	481684004502	INY	168	45.02	40.45
2	500144103567	KER	14	35.67	40.39
2	470060001407	MNO	6	14.07	40.35
2	483954003480	INY	395	34.8	40.29
2	473954007641	MNO	395	76.41	40.23
2	481784004340	INY	178	43.4	40.17
2	480064000045	INY	6	0.45	40.15
2	483952002305	INY	395	23.05	40.15
2	473954101425	MNO	395	14.25	40.13
2	501780006051	KER	178	60.51	40.11
2	483954012176	INY	395	121.76	40.11
2	483954102095	INY	395	20.95	40.09
2	481780005585	INY	178	55.85	40.08
2	470060002930	MNO	6	29.3	40.07
2	481780005842	INY	178	58.42	40.03
2	501784005950	KER	178	59.5	40.02
2	500144004843	KER	14	48.43	40.01
2	483954108751	INY	395	87.51	39.99
2	500144005223	KER	14	52.23	39.97
2	483954001157	INY	395	11.57	39.94
2	483954101157	INY	395	11.57	39.92
2	483954005512	INY	395	55.12	39.88
2	483954112775	INY	395	127.75	39.88
2	471820000019	MNO	182	0.19	39.85
2	472704000458	MNO	270	4.58	39.82
2	472704000461	MNO	270	4.61	39.76

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
2	472704000918	MNO	270	9.18	39.76
2	483954104620	INY	395	46.2	39.75
2	501780006009	KER	178	60.09	39.71
2	481780005523	INY	178	55.23	39.70
2	501780006005	KER	178	60.05	39.70
2	470060002165	MNO	6	21.65	39.69
2	481780005508	INY	178	55.08	39.69
2	481780005516	INY	178	55.16	39.69
2	470060002190	MNO	6	21.9	39.68
2	500584110531	KER	58	105.31	39.68
2	501780006010	KER	178	60.1	39.67
2	483954002020	INY	395	20.2	39.66
2	483954102020	INY	395	20.2	39.66
2	470060002823	MNO	6	28.23	39.65
2	503954000549	KER	395	5.49	39.64
2	483954009292	INY	395	92.92	39.62
2	483954009298	INY	395	92.98	39.62
2	500145905868	KER	14	58.68	39.62
2	481780005466	INY	178	54.66	39.61
2	500144006039	KER	14	60.39	39.60
2	500144006040	KER	14	60.4	39.60
2	483952002115	INY	395	21.15	39.59
3	500144005962	KER	14	59.62	39.59
3	500145905967	KER	14	59.67	39.59
3	500586108020	KER	58	80.2	39.59
3	483955207129	INY	395	71.29	39.52
3	471200002233	MNO	120	22.33	39.47
3	481780005415	INY	178	54.15	39.47
3	481780005421	INY	178	54.21	39.45
3	481274002470	INY	127	24.7	39.40
3	471200101108	MNO	120	11.08	39.33
3	483954101730	INY	395	17.3	39.32
3	470064001565	MNO	6	15.65	39.30
3	472664000491	MNO	266	4.91	39.28
3	471084000895	MNO	108	8.95	39.26
3	483954101673	INY	395	16.73	39.25
3	500144005854	KER	14	58.54	39.14
3	480064000140	INY	6	1.4	39.12
3	481904011340	INY	190	113.4	39.11
3	480064000130	INY	6	1.3	39.10

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
3	503954001359	KER	395	13.59	39.09
3	481784005321	INY	178	53.21	39.08
3	473954100202	MNO	395	2.02	39.06
3	473952100448	MNO	395	4.48	38.97
3	503954000933	KER	395	9.33	38.95
3	470060002814	MNO	6	28.14	38.93
3	470060002761	MNO	6	27.61	38.93
3	483954108588	INY	395	85.88	38.91
3	483954108589	INY	395	85.89	38.90
3	483954108588	INY	395	85.88	38.90
3	481684000198	INY	168	1.98	38.88
3	481684100198	INY	168	1.98	38.88
3	483954002085	INY	395	20.85	38.77
3	483954102090	INY	395	20.9	38.77
3	503954103316	KER	395	33.16	38.73
3	471204005816	MNO	120	58.16	38.70
3	471204005824	MNO	120	58.24	38.70
3	502020100569	KER	202	5.69	38.61
3	470060002130	MNO	6	21.3	38.59
3	473950100417	MNO	395	4.17	38.55
3	470060002230	MNO	6	22.3	38.54
3	500144004922	KER	14	49.22	38.52
3	500144006120	KER	14	61.2	38.45
3	500144006128	KER	14	61.28	38.45
3	500144006105	KER	14	61.05	38.45
3	483954009482	INY	395	94.82	38.45
3	483958009479	INY	395	94.79	38.45
3	473954104753	MNO	395	47.53	38.43
3	483954003478	INY	395	34.78	38.40
3	483954003605	INY	395	36.05	38.40
3	483954002200	INY	395	22	38.37
3	483952002210	INY	395	22.1	38.36
3	503954000773	KER	395	7.73	38.36
3	483954002340	INY	395	23.4	38.35
3	483954002390	INY	395	23.9	38.35
3	483954002370	INY	395	23.7	38.35
3	483954002371	INY	395	23.71	38.35
3	500584110621	KER	58	106.21	38.34
3	500144005401	KER	14	54.01	38.33
3	500144005510	KER	14	55.1	38.33

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
3	483954009380	INY	395	93.8	38.29
3	483958009372	INY	395	93.72	38.29
3	483954009298	INY	395	92.98	38.26
3	483954007603	INY	395	76.03	38.26
3	483954007603	INY	395	76.03	38.26
3	483954108742	INY	395	87.42	38.21
3	483954108743	INY	395	87.43	38.21
3	470060002739	MNO	6	27.39	38.21
3	483954108742	INY	395	87.42	38.20
3	481784005215	INY	178	52.15	38.17
3	481784004885	INY	178	48.85	38.16
3	481784004880	INY	178	48.8	38.15
3	481780005977	INY	178	59.77	38.14
3	481780005654	INY	178	56.54	38.14
3	500144004822	KER	14	48.22	38.13
3	481780005888	INY	178	58.88	38.13
3	481780005915	INY	178	59.15	38.13
3	481780006130	INY	178	61.3	38.13
3	481780006135	INY	178	61.35	38.13
3	481780006138	INY	178	61.38	38.13
3	481780005835	INY	178	58.35	38.12
3	501780005952	KER	178	59.52	38.12
3	481784005265	INY	178	52.65	38.12
3	481780005659	INY	178	56.59	38.12
3	481784005246	INY	178	52.46	38.12
3	481784005249	INY	178	52.49	38.12
3	481784005629	INY	178	56.29	38.11
3	481780005797	INY	178	57.97	38.09
3	503954101968	KER	395	19.68	38.09
3	473954100202	MNO	395	2.02	38.07
3	503950101506	KER	395	15.06	38.06
3	503954101885	KER	395	18.85	38.05
3	503950000439	KER	395	4.39	38.04
3	471200004010	MNO	120	40.1	38.03
3	503954101827	KER	395	18.27	37.98
3	503954101761	KER	395	17.61	37.96
3	471820000030	MNO	182	0.3	37.95
3	503954101913	KER	395	19.13	37.95
3	500144006209	KER	14	62.09	37.95
3	471204003472	MNO	120	34.72	37.92

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
3	471820000022	MNO	182	0.22	37.90
3	500144106203	KER	14	62.03	37.86
3	471204003315	MNO	120	33.15	37.81
3	481900003125	INY	190	31.25	37.80
3	470060003099	MNO	6	30.99	37.78
3	483954108383	INY	395	83.83	37.74
3	481904002745	INY	190	27.45	37.73
3	483954108387	INY	395	83.87	37.73
3	481904002845	INY	190	28.45	37.71
3	481904002825	INY	190	28.25	37.68
3	471820000007	MNO	182	0.07	37.61
3	471084000405	MNO	108	4.05	37.61
3	483955906870	INY	395	68.7	37.61
3	500586108017	KER	58	80.17	37.59
3	483954006870	INY	395	68.7	37.59
3	483952001730	INY	395	17.3	37.42
3	483954001580	INY	395	15.8	37.35
3	483954101588	INY	395	15.88	37.35
3	483954101730	INY	395	17.3	37.35
3	483954001670	INY	395	16.7	37.35
3	500584110661	KER	58	106.61	37.33
3	483954007739	INY	395	77.39	37.33
3	483954007745	INY	395	77.45	37.33
3	471084000888	MNO	108	8.88	37.32
3	483954002090	INY	395	20.9	37.24
3	483954007826	INY	395	78.26	37.20
3	503954102206	KER	395	22.06	37.19
3	471084001137	MNO	108	11.37	37.18
3	503954102065	KER	395	20.65	37.17
3	503954102008	KER	395	20.08	37.17
3	483954104386	INY	395	43.86	37.14
3	483954104386	INY	395	43.86	37.14
3	483954007820	INY	395	78.2	37.12
3	483954108088	INY	395	80.88	37.06
3	483954009480	INY	395	94.8	37.06
3	483954007808	INY	395	78.08	37.01
3	483954007809	INY	395	78.09	37.00
3	483954007809	INY	395	78.09	37.00
3	483952002370	INY	395	23.7	36.99
3	483952002340	INY	395	23.4	36.99

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
3	483952002352	INY	395	23.52	36.98
3	483952002390	INY	395	23.9	36.98
3	483954106707	INY	395	67.07	36.96
3	483954106707	INY	395	67.07	36.96
3	483954006708	INY	395	67.08	36.90
3	483954006708	INY	395	67.08	36.89
3	483954009375	INY	395	93.75	36.78
3	481275901621	INY	127	16.21	36.76
3	483954104927	INY	395	49.27	36.70
3	500144006209	KER	14	62.09	36.67
3	473954104753	MNO	395	47.53	36.67
3	500584008822	KER	58	88.22	36.65
3	470064001664	MNO	6	16.64	36.65
4	483954007623	INY	395	76.23	36.64
4	483954007623	INY	395	76.23	36.64
4	500144106356	KER	14	63.56	36.62
4	500144106356	KER	14	63.56	36.61
4	472664000793	MNO	266	7.93	36.53
4	472664000733	MNO	266	7.33	36.52
4	471084000836	MNO	108	8.36	36.52
4	503954103198	KER	395	31.98	36.48
4	503954103198	KER	395	31.98	36.48
4	471084000842	MNO	108	8.42	36.47
4	471084000801	MNO	108	8.01	36.45
4	471084000803	MNO	108	8.03	36.44
4	471084000795	MNO	108	7.95	36.41
4	471584000777	MNO	158	7.77	36.41
4	481275901580	INY	127	15.8	36.40
4	481275901570	INY	127	15.7	36.38
4	503954103010	KER	395	30.1	36.26
4	503954103010	KER	395	30.1	36.26
4	503954103043	KER	395	30.43	36.25
4	503954103043	KER	395	30.43	36.25
4	481784005100	INY	178	51	36.21
4	502020100621	KER	202	6.21	36.19
4	502020000821	KER	202	8.21	36.03
4	500144106263	KER	14	62.63	36.03
4	500144106263	KER	14	62.63	36.03
4	502020000812	KER	202	8.12	36.01
4	470060002992	MNO	6	29.92	36.00

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
4	473954104508	MNO	395	45.08	35.91
4	473954104508	MNO	395	45.08	35.91
4	473954104502	MNO	395	45.02	35.89
4	473954104502	MNO	395	45.02	35.89
4	500580107870	KER	58	78.7	35.83
4	471084000398	MNO	108	3.98	35.81
4	471080000305	MNO	108	3.05	35.78
4	502020000796	KER	202	7.96	35.57
4	473954101434	MNO	395	14.34	35.50
4	481275901517	INY	127	15.17	35.49
4	473954101429	MNO	395	14.29	35.42
4	473954101429	MNO	395	14.29	35.41
4	481904012755	INY	190	127.55	35.17
4	483954002515	INY	395	25.15	35.13
4	500584110575	KER	58	105.75	35.08
4	500148101848	KER	14	18.48	34.86
4	500148101768	KER	14	17.68	34.82
4	481275901107	INY	127	11.07	34.60
4	473954003073	MNO	395	30.73	34.58
4	481900001993	INY	190	19.93	34.31
4	481784005183	INY	178	51.83	34.31
4	481360003671	INY	136	36.71	34.24
4	481904003602	INY	190	36.02	34.23
4	481900002148	INY	190	21.48	34.13
4	481904002635	INY	190	26.35	34.05
4	501780007555	KER	178	75.55	34.00
4	501780007558	KER	178	75.58	34.00
4	473954008313	MNO	395	83.13	33.84
4	483954108750	INY	395	87.5	33.75
4	483954108750	INY	395	87.5	33.74
4	500584112180	KER	58	121.8	33.69
4	500584112180	KER	58	121.8	33.63
4	500144101467	KER	14	14.67	33.49
4	500586108023	KER	58	80.23	33.46
4	471080001425	MNO	108	14.25	33.44
4	473954101051	MNO	395	10.51	33.35
4	473954101041	MNO	395	10.41	33.34
4	473954101043	MNO	395	10.43	33.34
4	483958108387	INY	395	83.87	33.30
4	503954101799	KER	395	17.99	33.24

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
4	473954101053	MNO	395	10.53	33.19
4	500584108533	KER	58	85.33	33.12
4	471674000185	MNO	167	1.85	33.06
4	500580108272	KER	58	82.72	32.99
4	500580108272	KER	58	82.72	32.99
4	500584112254	KER	58	122.54	32.78
4	500584110659	KER	58	106.59	32.76
4	500584112254	KER	58	122.54	32.75
4	500584112189	KER	58	121.89	32.73
4	473954003069	MNO	395	30.69	32.68
4	473954003069	MNO	395	30.69	32.66
4	473954003073	MNO	395	30.73	32.66
4	483958108387	INY	395	83.87	32.64
4	500144100180	KER	14	1.8	32.58
4	483954007129	INY	395	71.29	31.98
4	483954007129	INY	395	71.29	31.98
4	501780005950	KER	178	59.5	31.90
4	501784005945	KER	178	59.45	31.90
4	471584001583	MNO	158	15.83	31.90
4	503954103398	KER	395	33.98	31.81
4	503954103398	KER	395	33.98	31.80
4	473954008192	MNO	395	81.92	31.70
4	500584112368	KER	58	123.68	31.70
4	481904010835	INY	190	108.35	31.60
4	473954101409	MNO	395	14.09	31.59
4	473954101412	MNO	395	14.12	31.59
4	481904006660	INY	190	66.6	31.59
4	500144104596	KER	14	45.96	31.57
4	500586108023	KER	58	80.23	31.55
4	502020100153	KER	202	1.53	31.46
4	500584008822	KER	58	88.22	31.42
4	500584112454	KER	58	124.54	31.36
4	473954005774	MNO	395	57.74	31.35
4	473954102633	MNO	395	26.33	31.27
4	500144104383	KER	14	43.83	31.25
4	473954005784	MNO	395	57.84	31.20
4	500580108272	KER	58	82.72	31.10
4	500584008859	KER	58	88.59	31.08
4	470060003217	MNO	6	32.17	31.06
4	473954002026	MNO	395	20.26	30.46

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
4	500580107825	KER	58	78.25	30.30
4	500584110620	KER	58	106.2	30.29
4	473954008323	MNO	395	83.23	29.99
4	500584112331	KER	58	123.31	29.65
4	500144104589	KER	14	45.89	29.57
4	500140101474	KER	14	14.74	29.50
4	500140101474	KER	14	14.74	29.50
4	483954007732	INY	395	77.32	29.32
4	483954007735	INY	395	77.35	29.32
4	483954007736	INY	395	77.36	29.32
4	501784008178	KER	178	81.78	28.85
4	500584112189	KER	58	121.89	28.41
4	473954101494	MNO	395	14.94	28.40
4	473954101443	MNO	395	14.43	28.37
4	473954101443	MNO	395	14.43	28.36
4	483954011365	INY	395	113.65	28.31
4	473954005136	MNO	395	51.36	27.86
4	483954000406	INY	395	4.06	27.86
4	483954100406	INY	395	4.06	27.82
4	473954005150	MNO	395	51.5	27.82
4	473954005150	MNO	395	51.5	27.69
4	481904006935	INY	190	69.35	27.69
4	473954101494	MNO	395	14.94	27.52
4	483954010999	INY	395	109.99	27.51
4	483954011002	INY	395	110.02	27.51
4	500584112368	KER	58	123.68	27.37
4	473954005623	MNO	395	56.23	27.24
4	501784008473	KER	178	84.73	27.21
4	473954101507	MNO	395	15.07	27.19
4	473954005616	MNO	395	56.16	26.96
4	471080001465	MNO	108	14.65	26.85
4	471080001459	MNO	108	14.59	26.84
4	481904106775	INY	190	67.75	26.80
4	473954003018	MNO	395	30.18	26.61
4	473954003018	MNO	395	30.18	26.60
4	500148101833	KER	14	18.33	26.55
4	500148101833	KER	14	18.33	26.55
4	500148101840	KER	14	18.4	26.53
4	473954101501	MNO	395	15.01	26.50
4	500148101840	KER	14	18.4	26.49

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
4	473952104434	MNO	395	44.34	26.41
4	483954011282	INY	395	112.82	26.35
4	471674000180	MNO	167	1.8	26.32
5	500144103985	KER	14	39.85	26.27
5	483954007546	INY	395	75.46	26.24
5	483954107850	INY	395	78.5	26.21
5	500144102566	KER	14	25.66	26.19
5	473954101657	MNO	395	16.57	26.09
5	473954101416	MNO	395	14.16	26.09
5	473954101372	MNO	395	13.72	25.98
5	483954010132	INY	395	101.32	25.93
5	501784008276	KER	178	82.76	25.84
5	501780007640	KER	178	76.4	25.73
5	501780007647	KER	178	76.47	25.73
5	501780007653	KER	178	76.53	25.73
5	473954101501	MNO	395	15.01	25.62
5	471820000512	MNO	182	5.12	25.61
5	473954104437	MNO	395	44.37	25.53
5	500584112368	KER	58	123.68	25.48
5	500144103780	KER	14	37.8	25.34
5	471824000866	MNO	182	8.66	25.30
5	500144103887	KER	14	38.87	25.29
5	481904006690	INY	190	66.9	25.19
5	471824000978	MNO	182	9.78	25.14
5	500584112454	KER	58	124.54	25.13
5	501784008547	KER	178	85.47	25.01
5	471584001084	MNO	158	10.84	24.95
5	481784004343	INY	178	43.43	24.93
5	481904106790	INY	190	67.9	24.91
5	481904106780	INY	190	67.8	24.90
5	500144004755	KER	14	47.55	24.83
5	481904106755	INY	190	67.55	24.82
5	500144102252	KER	14	22.52	24.68
5	483954011270	INY	395	112.7	24.64
5	483954002651	INY	395	26.51	24.58
5	471674000470	MNO	167	4.7	24.58
5	471674000460	MNO	167	4.6	24.56
5	471674000469	MNO	167	4.69	24.56
5	471820000286	MNO	182	2.86	24.52
5	500144104383	KER	14	43.83	24.50
5	483954100125	INY	395	1.25	24.49

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
5	471674000187	MNO	167	1.87	24.47
5	471670000180	MNO	167	1.8	24.42
5	501780006564	KER	178	65.64	24.22
5	501780006569	KER	178	65.69	24.22
5	501780006490	KER	178	64.9	24.21
5	501780006570	KER	178	65.7	24.17
5	501780006576	KER	178	65.76	24.16
5	471674000675	MNO	167	6.75	24.11
5	471674006750	MNO	167	67.5	24.11
5	483954002729	INY	395	27.29	24.11
5	483954102909	INY	395	29.09	24.06
5	483954102917	INY	395	29.17	24.05
5	501780006890	KER	178	68.9	24.03
5	501780006893	KER	178	68.93	24.03
5	483954102913	INY	395	29.13	24.03
5	473954101507	MNO	395	15.07	23.99
5	500144100182	KER	14	1.82	23.95
5	481784004366	INY	178	43.66	23.90
5	483954102909	INY	395	29.09	23.80
5	483954102917	INY	395	29.17	23.79
5	483954102913	INY	395	29.13	23.77
5	500140104051	KER	14	40.51	23.77
5	471684001167	MNO	168	11.67	23.53
5	471824001162	MNO	182	11.62	23.53
5	471824001167	MNO	182	11.67	23.53
5	500144103828	KER	14	38.28	23.42
5	500144103895	KER	14	38.95	23.40
5	471824001171	MNO	182	11.71	23.34
5	500140104058	KER	14	40.58	23.05
5	500140104143	KER	14	41.43	22.96
5	500144104179	KER	14	41.79	22.96
5	500140104192	KER	14	41.92	22.96
5	471820000378	MNO	182	3.78	22.94
5	471820000382	MNO	182	3.82	22.94
5	500144004658	KER	14	46.58	22.92
5	500144004701	KER	14	47.01	22.92
5	483954011277	INY	395	112.77	22.74
5	471584000992	MNO	158	9.92	22.71
5	483954011277	INY	395	112.77	22.69
5	471824001142	MNO	182	11.42	22.37
5	471824000984	MNO	182	9.84	22.29

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
5	483952002898	INY	395	28.98	22.10
5	471584001073	MNO	158	10.73	22.10
5	483954103036	INY	395	30.36	22.08
5	483954103036	INY	395	30.36	22.08
5	471820001049	MNO	182	10.49	22.06
5	483954102967	INY	395	29.67	22.06
5	483954103027	INY	395	30.27	22.06
5	483954103027	INY	395	30.27	22.06
5	483954102154	INY	395	21.54	22.05
5	471824001072	MNO	182	10.72	22.03
5	471820000238	MNO	182	2.38	21.92
5	483954007848	INY	395	78.48	21.89
5	483954007848	INY	395	78.48	21.89
5	471584001049	MNO	158	10.49	21.88
5	483952002725	INY	395	27.25	21.87
5	483954002898	INY	395	28.98	21.85
5	481684100967	INY	168	9.67	21.82
5	483954002725	INY	395	27.25	21.80
5	483954102967	INY	395	29.67	21.80
5	483954000125	INY	395	1.25	21.66
5	483954100125	INY	395	1.25	21.65
5	483954103078	INY	395	30.78	21.50
5	483954103078	INY	395	30.78	21.49
5	500140104138	KER	14	41.38	21.12
5	500144104178	KER	14	41.78	21.12
5	471584000829	MNO	158	8.29	21.11
5	483954010307	INY	395	103.07	20.62
5	483954104637	INY	395	46.37	20.60
5	483954104767	INY	395	47.67	20.57
5	483954103108	INY	395	31.08	20.56
5	481784004653	INY	178	46.53	20.33
5	481784004661	INY	178	46.61	20.22
5	500144103278	KER	14	32.78	19.75
5	483950112855	INY	395	128.55	19.71
5	483950112855	INY	395	128.55	19.58
5	481904004501	INY	190	45.01	19.55
5	500144102779	KER	14	27.79	19.52
5	500144102779	KER	14	27.79	19.52
5	481904005080	INY	190	50.8	19.50
5	481684005465	INY	168	54.65	19.41
5	483954007037	INY	395	70.37	19.38

Priority	Culvert System Number	County[22]	Route	Postmile	Cross-Hazard Prioritization Score
5	481684100231	INY	168	2.31	19.26
5	483954002155	INY	395	21.55	19.21
5	483954102154	INY	395	21.54	19.21
5	483954102166	INY	395	21.66	19.21
5	483952002155	INY	395	21.55	19.20
5	481900001805	INY	190	18.05	18.45
5	500144104491	KER	14	44.91	18.28
5	500144104491	KER	14	44.91	18.28
5	483954101942	INY	395	19.42	17.94
5	471824001135	MNO	182	11.35	17.92
5	483954001940	INY	395	19.4	17.91
5	483954101942	INY	395	19.42	17.91
5	483954103105	INY	395	31.05	17.68
5	483954104927	INY	395	49.27	17.67
5	483954007037	INY	395	70.37	17.48
5	472664000778	MNO	266	7.78	17.34
5	470060001185	MNO	6	11.85	16.75
5	470064001113	MNO	6	11.13	16.61
5	500144106219	KER	14	62.19	16.56
5	500144106219	KER	14	62.19	16.56
5	481684002051	INY	168	20.51	16.18
5	481274002213	INY	127	22.13	16.18
5	500144101921	KER	14	19.21	16.04
5	500144101922	KER	14	19.22	10.44
5	500144101929	KER	14	19.29	2.00
5	500584111722	KER	58	117.22	1.44
5	500144103278	KER	14	32.78	0.70
5	500586110963	KER	58	109.63	0.08
5	471584000819	MNO	158	8.19	0.00

TABLE 11: PRIORITIZATION OF ROADWAYS FOR DETAILED CLIMATE CHANGE ADAPTATION ASSESSMENTS

Priority	County[23]	Route	From Postmile / To Postmile	Carriageway[24]	Average Cross-Hazard Prioritization Score[25]
1	INY	395	395 39.721 / 395 40.285	S	91.22
1	INY	395	395 41.418 / 395 55.76	S	91.22
1	INY	395	395 55.796 / 395 56.731	S	91.22
1	INY	395	395 R13.864 / 395 31.062	S	91.22
1	INY	395	395 R58.026 / 395 65.597	S	91.22
1	INY	178	178 52.188 / 178 62.186	P	88.40
1	KER	178	178 85.81 / 178 88.26	P	88.40
1	KER	178	178 88.38 / 178 92.496	P	88.40
1	INY	395	395 115.337 / 395 115.669	P	87.01
1	INY	395	395 49.224 / 395 65.639	P	87.01
1	INY	395	395 72.744 / 395 74.247	P	87.01
1	INY	395	395 R13.876 / 395 46.638	P	87.01
1	KER	395	395 R23.481 / 395 29.379	P	87.01
1	INY	190	190 122.539 / 190 126.565	P	83.66
1	INY	190	190 127.787 / 190 133.793	P	83.66
1	INY	190	190 14.616 / 190 47.394	P	83.66
1	INY	190	190 60.03 / 190 76.51	P	83.66
1	INY	190	190 9.85 / 190 10.76	P	83.66
1	INY	136	136 0.009 / 136 17.73	P	83.47
1	KER	14	14 17.136 / 14 19.09	P	76.85
1	KER	14	14 52.767 / 14 64.558	P	76.85
1	KER	14	14 R14.39 / 14 L17.353	P	76.85
1	KER	58	58 R101.565 / 58 M108.643	S	76.20
1	KER	58	58 R101.719 / 58 M108.644	P	76.20
1	KER	14	14 17.232 / 14 19.085	S	71.08
1	KER	14	14 61.941 / 14 64.131	S	71.08
1	KER	14	14 R14.396 / 14 L17.383	S	71.08
1	INY	6	6 0 / 6 0.408	P	69.33
2	KER	14	14 19.09 / 14 19.985	P	62.52
2	KER	14	14 L17.353 / 14 L17.384	P	62.52
2	KER	14	14 L17.384 / 14 17.136	P	62.52
2	KER	14	14 L17.384 / 14 L17.384	P	62.52
2	KER	14	14 L17.384 / 14 L17.384	P	62.52
2	KER	14	14 R12.149 / 14 R14.39	P	62.52

[23] INY = Inyo; KER = Kern; LA = Los Angeles; MNO = Mono; SBD = San Bernardino

[24] Caltrans' alignment codes designate the carriageway on divided roadways: "P" always represents northbound or eastbound carriageways whereas "S" always represents southbound or westbound carriageways. Undivided roadways are always indicated with a "P".

[25] The average of the cross-hazard prioritization scores amongst all the abutting small segments on the same route sharing a common priority level that were aggregated to form the longer segments listed in this table.

Priority	County[23]	Route	From Postmile / To Postmile	Carriageway[24]	Average Cross-Hazard Prioritization Score[25]
2	KER	14	14 19.085 / 14 19.978	S	62.23
2	KER	14	14 L17.383 / 14 L17.384	S	62.23
2	KER	14	14 L17.384 / 14 17.232	S	62.23
2	KER	14	14 R12.149 / 14 R14.396	S	62.23
2	INY	395	395 115.669 / 395 120.964	P	60.81
2	INY	395	395 74.247 / 395 115.337	P	60.81
2	KER	395	395 R21.06 / 395 R23.481	P	60.81
2	MNO	395	395 68.713 / 395 86.671	P	60.81
2	MNO	395	395 88.322 / 395 91.6	P	60.81
2	INY	395	395 115.669 / 395 120.961	S	60.31
2	INY	395	395 74.247 / 395 115.337	S	60.31
2	KER	58	58 77.074 / 58 80.246	P	58.63
2	KER	58	58 M108.644 / 58 R119.947	P	58.63
2	KER	58	58 77.394 / 58 80.247	S	58.61
2	KER	58	58 M108.643 / 58 R119.949	S	58.61
3	INY	395	395 120.964 / 395 R122.36	P	57.69
3	INY	395	395 46.638 / 395 49.224	P	57.69
3	INY	395	395 65.639 / 395 72.744	P	57.69
3	INY	395	395 R3.02 / 395 11.15	P	57.69
3	MNO	395	395 86.671 / 395 88.322	P	57.69
3	INY	6	6 0.408 / 6 3.352	P	57.65
3	MNO	6	6 6.155 / 6 8.579	P	57.65
3	INY	395	395 120.961 / 395 R122.363	S	57.35
3	INY	395	395 65.597 / 395 72.744	S	57.35
3	INY	395	395 R1.188 / 395 11.152	S	57.35
3	MNO	395	395 86.671 / 395 88.322	S	57.35
3	KER	14	14 19.978 / 14 21.257	S	53.92
3	KER	14	14 19.985 / 14 21.293	P	53.92
3	INY	168	168 17.789 / 168 18.308	S	53.65
3	INY	178	178 31.019 / 178 35.954	P	53.33
3	INY	178	178 47.603 / 178 52.188	P	53.33
3	KER	178	178 57.07 / 178 76.869	P	53.33
3	KER	178	178 84.017 / 178 85.81	P	53.33
3	KER	178	178 92.496 / 178 96.118	P	53.33
3	KER	178	178 R93.386 / 178 96.272	S	53.08
3	INY	168	168 15.684 / 168 18.308	P	51.75
3	INY	168	168 18.32 / 168 21.397	P	51.75
3	INY	127	127 16.805 / 127 37.119	P	51.10
3	MNO	182	182 0 / 182 11.464	P	51.04
3	INY	190	190 10.76 / 190 14.616	P	50.68
3	INY	190	190 76.51 / 190 122.539	P	50.68

Priority	County[23]	Route	From Postmile / To Postmile	Carriageway[24]	Average Cross-Hazard Prioritization Score[25]
3	KER	202	202 8.87 / 202 12.093	P	47.96
3	KER	58	58 R90.716 / 58 R99.497	P	45.69
3	KER	58	58 R90.718 / 58 R99.497	S	44.69
3	KER	202	202 8.87 / 202 R9.738	S	38.32
4	KER	58	58 80.247 / 58 R90.718	S	35.54
4	KER	58	58 R99.497 / 58 R101.565	S	35.54
4	KER	58	58 80.246 / 58 R90.716	P	35.46
4	KER	58	58 R99.497 / 58 R101.719	P	35.46
4	KER	178	178 96.272 / 178 103.852	S	34.44
4	INY	178	178 35.954 / 178 42.92	P	32.90
4	INY	178	178 42.93 / 178 47.603	P	32.90
4	KER	178	178 76.869 / 178 84.017	P	32.90
4	KER	178	178 96.118 / 178 104.621	P	32.90
4	INY	395	395 R122.36 / 395 R3.472R	P	30.89
4	KER	395	395 29.379 / 395 R33.793	P	30.89
4	MNO	6	6 3.352 / 6 6.155	P	30.89
4	MNO	6	6 8.579 / 6 22.975	P	30.89
4	INY	395	395 R122.363 / 395 R3.052L	S	30.72
4	KER	395	395 29.379 / 395 R33.793	S	30.72
4	KER	202	202 7.888 / 202 8.87	P	26.91
4	KER	202	202 R4.89 / 202 R7.353	P	26.91
4	MNO	266	266 11.721 / 266 0	P	25.77
4	INY	190	190 135.156 / 190 140.692	P	25.64
4	INY	190	190 54.204 / 190 60.03	P	25.64
4	INY	127	127 37.119 / 127 49.42	P	25.56
4	SBD	127	127 41.473 / 127 16.805	P	25.56
4	INY	168	168 21.397 / 168 31.557	P	25.42
4	INY	168	168 34.38 / 168 37.84	P	25.42
4	INY	168	168 39.548 / 168 1.45	P	25.42
4	INY	168	168 R8.493 / 168 15.684	P	25.42
4	KER	14	14 64.131 / 14 64.559	S	22.76
4	KER	14	14 R77.007 / 14 R3.022	S	22.76
4	KER	14	14 R77.007 / 14 R3.189	P	20.74
5	KER	202	202 R7.353 / 202 7.888	S	13.40
5	KER	202	202 R1.476 / 202 R4.89	P	11.19
5	KER	202	202 R7.353 / 202 7.888	P	11.19
5	INY	395	395 11.15 / 395 R13.876	P	9.47
5	KER	395	395 0 / 395 R21.06	P	9.47
5	KER	395	395 R33.793 / 395 R3.02	P	9.47
5	MNO	395	395 94.304 / 395 120.49	P	9.47
5	MNO	395	395 R3.472R / 395 R6.365R	P	9.47

Priority	County[23]	Route	From Postmile / To Postmile	Carriageway[24]	Average Cross-Hazard Prioritization Score[25]
5	KER	14	14 27.284 / 14 52.767	P	8.89
5	KER	14	14 R3.189 / 14 R8.809	P	8.89
5	KER	58	58 R119.949 / 58 R143.86	S	8.74
5	KER	58	58 R119.947 / 58 R143.86	P	8.65
5	KER	14	14 27.279 / 14 46.012	S	8.19
5	KER	14	14 51.788 / 14 52.767	S	8.19
5	KER	14	14 R3.022 / 14 R9.138	S	8.19
5	MNO	6	6 22.975 / 6 32.29	P	6.58
5	INY	395	395 11.152 / 395 R13.864	S	5.93
5	KER	395	395 0.042 / 395 0.366	S	5.93
5	KER	395	395 R0.981 / 395 R1.18	S	5.93
5	KER	395	395 R33.793 / 395 R1.188	S	5.93
5	MNO	395	395 R3.052L / 395 R6.417L	S	5.93
5	MNO	120	120 45.049 / 120 47.409	P	0.76
5	MNO	120	120 51.958 / 120 58.99	P	0.76
5	MNO	89	89 0 / 89 3.285	P	0.72
5	INY	190	190 126.565 / 190 127.787	P	0.72
5	INY	190	190 133.793 / 190 135.156	P	0.72
5	INY	190	190 47.394 / 190 54.204	P	0.72
5	INY	168	168 31.557 / 168 33.543	P	0.07
5	INY	168	168 37.84 / 168 39.548	P	0.07
5	INY	178	178 28 / 178 31.019	P	0.00

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