CALTRANS

Adaptation Priorities

REPORT

DISTRICT 1

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., sea level rise). The terms are used interchangeably to refer to 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]

[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. District 1 is already experiencing the impacts of climate change as higher than anticipated sea levels and extreme flood events damage bridges and flood roadways, rapidly moving wildfires present profound challenges to timely evacuations, and higher than anticipated temperatures can cause pavement damage over broad areas. The district is already experiencing cliff erosion impacts along US 101 and is faced with identifying adaptation responses within the coastal zone. 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 1, identified stretches of the State Highway System within the district that are exposed to different climate stressors. 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 1 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 1. 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 1 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 1

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 1. 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).

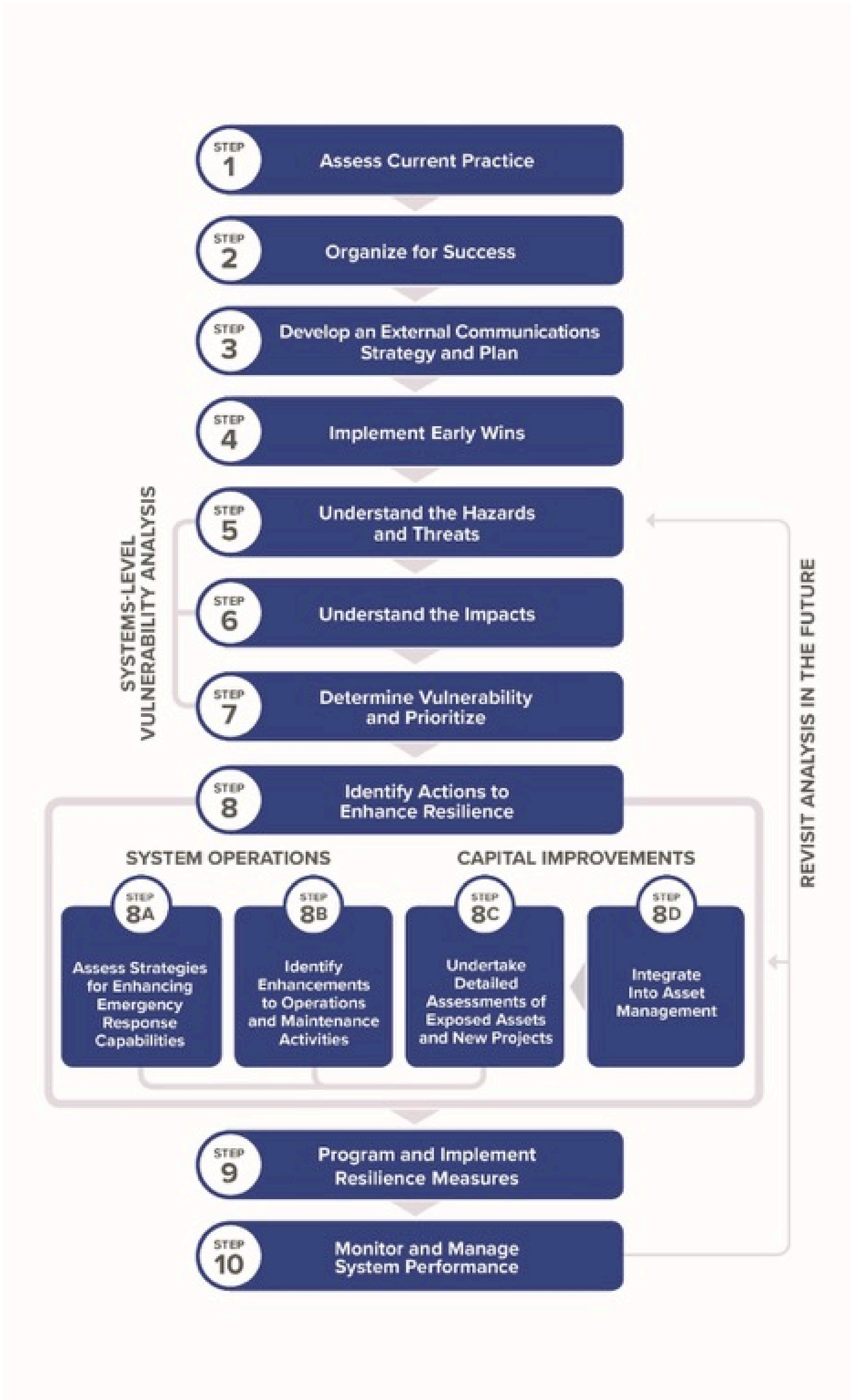

FIGURE 1: CALTRANS' CLIMATE ADAPTATION FRAMEWORK (FEAR NAHT FRAMEWORK)

The work undertaken for this study, the District 1 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 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 an "indicators approach." The indicators approach involves collecting data on multiple 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 that are determined potentially exposed to a climate hazard are included in this analysis. Assets that were determined to have no exposure to the hazards studied in the Caltrans Climate Change Vulnerability Assessment are not included in this study.

MUDSLIDE MENDOCINO COUNTY

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 (or 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

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 1 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 1 Climate Change Vulnerability Assessment Report. As in the district vulnerability assessment, assets on the State Highway System were the primary focus for this prioritization analysis. 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 1 and marks with an "X" the hazards that were evaluated for each in the analysis.

TABLE 1: ASSET-HAZARD COMBINATIONS STUDIED

	Sea Level Rise	Storm Surge	Coastal Cliff Retreat	Wildfire	Temperature	Riverine Flooding
Pavement Binder Grade					X	
At-Grade Roadways	X	X	X			
Bridges	X	X	X			X
Large Culverts[6]	X	X	X			X
Small Culverts[7]	X	X	X	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.

- **Bridge exposure to riverine flooding:** Bridges are sensitive to higher flood levels and river flows. With climate change, large precipitation events are generally expected to become more intense in District 1 leading to higher flows in 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 1 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

[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.

posed to bridges in District 1, 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 (2010-2039, 2040-2069, 2070-2099, or Beyond 2099). 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 the culvert inspection program (CIP). 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 (2010-2039, 2040-2069, 2070-2099, or Beyond 2099). This analysis was only conducted for small culverts because information on culvert construction materials was not available for large culverts.

- **At-grade roadway exposure to sea level rise:** Sea level rise, caused by the warming of ocean waters and the melting of land-based glaciers, is a prominent hazard brought on by climate change. In low-lying coastal areas, at-grade roads (defined here as those portions of the road network that are not elevated on a bridge) may become subject to regular inundation at high tides as sea levels rise. In low-lying areas like those around Humboldt Bay, at-grade roads may become subject to regular inundation as sea levels rise. This can lead to frequent road closures that disrupt travel and accessibility. In some locations with regular inundation, premature degradation of the pavement may also occur.

- **Bridge exposure to sea level rise:** There are several ways in which sea level rise may adversely affect bridges. For very low bridges, a rise in sea levels may result in water overtopping the deck and impeding travel. It is important to recognize, however, that serious impacts to bridges can still occur from sea level rise even if water does not overtop the deck. For example, on some bridge designs, if sea levels rise just enough to result in waves contacting the bottom of the deck, the uplifting forces may be enough to separate the deck from the rest of the structure.

Even bridges whose decks are well above projected water levels may be impacted by sea level rise. For example, waves may contact piers at a higher elevation than they were designed for leading to more rapid corrosion of bridge components and unexpected strain being put on the bridge structure. The bridge abutments may also be adversely impacted by waves regularly hitting higher than initially designed and eroding the approach embankments. Furthermore, the navigability of shipping channels or deltas may be impeded by reduced ship clearances under bridges as sea levels rise.

- **Large and small culvert exposure to sea level rise:** Culverts are primarily used to convey streams and stormwater underneath roadways. Some are also used in tidally influenced environments. If sea levels rise enough for sea water to reach the culvert, this can change the hydraulic performance of the culvert leading to more frequent overtopping of the roadway. For culverts that were not designed for a tidal setting, the frequent unanticipated presence of saltwater can also lead to corrosion and other maintenance issues that may decrease the anticipated lifespan of the asset.

- **At-grade roadway exposure to storm surge:** Storm surge refers to the elevating of coastal waters during major storm events. When strong winds blow onshore during such events, this can cause the water to pile up and reach levels much greater than during the normal tidal cycle. Sea level rise can cause the water to reach even higher during major storm events and increase the frequency of inundation. Inundation of at-grade roadways from storm surge may require the road to be closed, disrupting travel. Also, the surge and associated wave action often associated with storm events can cause erosion of the roadway embankment.

- **Bridge exposure to storm surge:** Storm surge presents many threats to bridges that may not have been fully anticipated if sea level rise was not considered during the design. Some low bridges may be overtopped by the surge and others may be affected by uplifting forces from wave action hitting the bottom of the deck. Either situation is likely to lead to the closure of the bridge and introduce the potential for serious structural damage. Even if the water is not high enough to reach the bridge deck, the elevated water levels and associated wave action can cause erosion around the bridge approaches. Furthermore, if the surge approaches or recedes at a high enough velocity, scouring of soils can occur around bridge piers and abutments weakening the structure and potentially compromising the bridge's integrity. This is a particularly acute threat for surge-impacted bridges built over other roadways or

FLOODING RUSSIAN RIVER SOUTH OF HOPLAND

railroads (as opposed to over water) because scour may not have been considered during their initial designs.

- **Large and small culvert exposure to storm surge:** Storm surge can overtop culverts impeding travel. If the velocity of the surge is great enough, a culvert can also be damaged by the hydraulic forcing of excessive water through too small an opening. Water overtopping the roadway embankment on top of the culvert may also cause erosion resulting in damages to the roadway and the culvert itself.

- **At-grade roadway exposure to coastal cliff retreat:** Cliff retreat refers to the erosion of coastal cliff faces. This process can be accelerated by sea level rise since higher water levels may mean more frequent instances of wave action reaching the base of the cliff and causing erosion. At-grade roadways that are immediately along the coast can be a total loss if erosion encroaches upon them. Caltrans has had to relocate several roads already, often at significant expense, to avoid retreating coastal cliff faces.

- **Bridge exposure to coastal cliff retreat:** Any bridges in the vicinity of coastal cliff faces are at risk of a total loss should the cliff retreat towards the bridge abutment. Should the abutment of the bridge be compromised by erosion, the structural stability of the bridge will be lost and the bridge no longer usable.

- **Large and small culvert exposure to coastal cliff retreat:** As with bridges and at-grade roadways, any culverts along a segment of road exposed to coastal cliff retreat are at risk of becoming a total loss. The erosion might compromise their stability causing them, and the roadway above them, to fall away. Depending on the small culvert material it can also compromise the alignment of the existing system leading to, joint separation, culvert clogging and overtopping during high storm events.

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 the data available. 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 2 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.

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

	Sea Level Rise				Storm Surge				Coastal Cliff Retreat				Wildfire	Tempera-ture	Riverine Flooding		
Metrics	**At-Grade Roadways**	**Bridges**	**Large Culverts**	**Small Culverts**	**At-Grade Roadways**	**Bridges**	**Large Culverts**	**Small Culverts**	**At-Grade Roadways**	**Bridges**	**Large Culverts**	**Small Culverts**	**Small Culverts**	**Pavement Binder Grade**	**Bridges**	**Large Culverts**	**Small Culverts**
Exposure																	
Past natural hazard impacts	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
Lowest impactful sea level rise (SLR) increment	X	X	X	X													
Percent of road segment exposed to 7 ft. of SLR	X																
Lowest impactful SLR increment with 100-year storm surge					X	X	X	X									
Percent of road segment exposed to a 100-year storm with 4.6 ft. of SLR					X												
Hazard level of coastal cliff retreat that results in damage (low, moderate, critical)									X	X	X	X					
Percent of road segment exposed to coastal cliff retreat									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									X		
Channel and channel protection condition rating															X	X	
Culvert condition rating							X	X								X	X
Culvert material				X									X				
Scour rating						X									X		
Average annual daily traffic (AADT)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Average annual daily truck traffic (AADTT)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Incremental travel distance to detour around the asset													X		X	X	X
Incremental travel distance to detour around the asset for the lowest impactful SLR increment	X	X	X	X	X	X	X	X	X	X	X	X					
Incremental travel distance to detour around the asset under the maximum increment of SLR (7 feet of SLR alone and 4.6 feet of SLR with a 100-year storm.[9]	X	X	X	X	X	X	X	X	X	X	X	X					

[9] Both sea level rise and storm surge datasets were applied when calculating detour routes. Data applied came from two different models, which use different methodologies and assumptions. As such, the model results did not match up across the same flood extents. In the detour analysis, if a road was exposed to sea level rise but not surge due to differing model extents, then the detour would assume the roadway was exposed to sea level rise AND surge.

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 condition 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.

3.3.1. Exposure Metrics

The following metrics were used to assess asset exposure in District 1:

- **Past natural hazard impacts:** Assets that have experienced sea level rise, cliff retreat, weather, 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 1 maintenance staff were surveyed and asked to identify any at-grade roadways, bridges, large culverts, or small culverts that had experienced sea level rise, storm surge, or coastal cliff retreat issues in the past. Staff was also asked to document past riverine flooding impacts for all these asset types except at-grade roadways. In addition, staff was also asked if any small culverts were damaged directly by fire and replaced with culverts of the same material. Any asset that was identified as previously impacted by either cliff retreat, flooding, or fire was flagged, and that asset was given a higher priority for adaptation.

FALLEN TREES BLOCKING ROADWAY IN MENDOCINO COUNTY

- **Lowest impactful sea level rise increment:** Assets that are likely to be impacted by sea level rise sooner should receive higher priority for detailed facility level assessments. To consider this in the asset scoring, a metric was developed that captured the lowest (first) increment of sea level rise[10] to potentially impact each at-grade roadway, bridge[11], large culvert, and small culvert. This metric made use of the sea level rise data used on the District 1 Climate Change

[10] Sea level rise areas hydrologically connected to the sea and hydrologically disconnected low-lying areas potentially vulnerable to sea level rise inundation were both used for this assessment.

[11] For bridges already over coastal waters or channels, potential impacts were assumed to occur at the lowest available increment of sea level rise. No analyses were performed to compare the elevations of the bottoms of the bridge decks to the underlying water elevations. The analysis was set up this way in recognition of the impacts possible at bridges from sea level rise before water touches the deck (i.e., enhanced corrosion and structural stability, erosion, and navigability concerns).

Vulnerability Assessment Report. Sea level rise data came from a model developed by the National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management.[12] NOAA data is available in GIS shapefiles for sea level rise in one foot increments from 1 to 10 feet above mean higher high water (MHHW).[13] The lower the sea level rise increment that first impacts the asset, the higher priority it will receive.

- **Percent of road segment exposed to 7 ft. of sea level rise:** For at-grade roadway segments[14], not only is the timing of sea level rise impacts an important factor in prioritization, but also the extensiveness of the impacts. All else being equal, a segment of road that is impacted over a large proportion of its length should receive higher priority than one impacted over only a small proportion. The 7 feet increment from the NOAA sea level rise model mentioned above was used for this metric to provide an indicator of potential impacts at the end of the century under a high sea level rise scenario. 7 feet of sea level rise is projected to occur in Crescent City as soon as 2090 under a very extreme scenario or as late as 2130 under a low probability (0.5 %) and low emissions scenario.[15]

- **Lowest impactful sea level rise increment with 100-year storm surge:** As with sea level rise, assets that are likely to be impacted by storm surge sooner should receive higher priority for detailed facility level assessments. To factor this into the analysis, this metric captures the lowest (first) sea level rise increment at which the 100-year storm surge could potentially impact each at-grade roadway, bridge[16], large culvert, and small culvert. The CalFloD-3D model was used for this exercise and in the District 1 Climate Change Vulnerability Assessment storm surge assessment.[17] CalFloD-3D modeled a more limited set of future sea level rise increments than the NOAA model. The analysis used sea level rise heights of 0.0, 1.6, 3.3, and 4.6 feet with a 100-year storm event.

- **Percent of road segment exposed to a 100-year storm surge with 4.6 feet of sea level rise:** This metric measures the proportion of each at-grade roadway segment exposed to a 100-year storm surge. The highest CalFloD-3D model sea level rise and storm surge increment of 4.6 feet was applied. Sea level rise of 4.6 feet is representative of 2090 projections under a lower probability (0.5 %) and high emissions scenario in Crescent City.[18] All else being equal, the greater the proportion of roadway length exposed to storm surge, the higher the priority of that segment.

- **Hazard level of coastal cliff retreat that results in damage (low, moderate, critical):** At-grade roadways, bridges, large culverts, and small culverts that are exposed to coastal cliff retreat

[12] NOAA, Sea Level Rise Viewer, Accessed December 24, 2020 from https://coast.noaa.gov/slr/

[13] See the District 1 Climate Change Vulnerability Assessment Summary or Technical Reports for more information on the model used: https://dot.ca.gov/programs/transportation-planning/2019-climate-change-vulnerability-assessments

[14] At-grade roadways are segmented at intersections with other roads thereby matching the segmentation used for the pavement binder grade analysis.

[15] See the Ocean Protection Council California Sea Level Rise Guidance (2018 Update) for sea level rise projections in Crescent City: https://opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

[16] As with sea level rise, no analyses were performed to compare the elevations of the bottoms of the bridge decks to the underlying water elevations. The analysis was set up this way in recognition of the impacts possible at bridges from sea level rise before water touches the deck (i.e., enhanced corrosion and structural stability, erosion, and navigability concerns).

[17] See the District 1 Climate Change Vulnerability Assessment Summary or Technical Reports for more information on the model used: https://dot.ca.gov/programs/transportation-planning/2019-climate-change-vulnerability-assessments

[18] See the Ocean Protection Council California Sea Level Rise Guidance (2018 Update) for sea level rise projections in Crescent City: https://opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

sooner should receive higher priority for facility level adaptation assessments. As in the District 1 Caltrans Climate Change Vulnerability Assessment, this study relied upon a coastal cliff retreat assessment of Caltrans assets in Northern California performed by Dr. Nicholas Sitar of the University of California, Berkeley.[19] Dr. Sitar's study did not directly link different sea level rise increments to roadway exposure. Instead, it provided a qualitative exposure rating (low, moderate, or critical) of Caltrans roadways near the coast. Assets assigned a critical exposure designation in Dr. Sitar's work were given the same prioritization as assets exposed to the 1-foot sea level rise increment in NOAA. Assets with a moderate exposure rating were prioritized the same as those exposed to 4 feet of sea level rise. Lastly, assets with a low exposure rating were prioritized the same as those exposed to 7 feet of sea level rise.

- **Percent of road segment exposed to coastal cliff retreat:** This metric captures the proportion of each at-grade roadway segment that is exposed to long term coastal cliff retreat. The greater the proportion of roadway length exposed to coastal cliff retreat using the UC Berkeley low, moderate, and critical exposure projections, the higher the priority of that segment.
- **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 1 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.[20] 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.

WILDFIRE IN MENDOCINO COUNTY

- **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 1 Climate Change

[19] See the District 1 Climate Change Vulnerability Assessment Summary or Technical Reports for more information on the model used: https://dot.ca.gov/programs/transportation-planning/2019-climate-change-vulnerability-assessments
[20] Ibid.

Vulnerability Assessment classified fire risk into five levels of concern (very low, low, moderate, high, and very high) at various future time periods. 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.[21]

- **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.

- **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 network sensitivity to loss of the asset:

- **Bridge substructure condition rating:** Poor bridge substructure condition can contribute to failure during riverine flooding and storm surge 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.

[21] See the District 1 Climate Change Vulnerability Assessment Summary or Technical Reports for more information on the model used: https://dot.ca.gov/programs/transportation-planning/2019-climate-change-vulnerability-assessments

- **Culvert condition rating:** Poor culvert condition can contribute to failure during storm surge and 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 and material degradation due to sea level rise. Caltrans includes material data in its CIP databases on small culverts (no equivalent information exists for large culverts in the NBI). Possible culvert materials include HDPE (high density polyethylene [plastic]), PVC (polyvinyl chloride [plastic]), corrugated steel pipe, welded steel pipe, composite, wood, masonry, and concrete. HDPE, PVC, steel pipe, composite, and wood culverts are all more sensitive to wildfire. Any small culverts made from these materials that are exposed to an elevated risk from wildfire were prioritized for adaptation. Likewise, corrugated steel pipe and concrete are more sensitive to regular saltwater inundation and any small culverts made from these materials that are exposed to sea level rise were assigned a higher priority.

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- **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 storm surge and 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 and sea level rise-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.

ROADWAY EROSION CAUSES DETOURS

- **Average annual daily truck traffic (AADTT):** AADTT is a measure of the 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 and sea level rise-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 for adaptation.

- **Incremental travel distance to detour around the asset:** This metric measures the degree of network redundancy around each asset. A detour routing tool was developed for this project that can find the shortest path detour around a segment of road, bridge, large culvert, or small culvert and calculate the additional travel distance that would be required to take that detour.[22] A simplified version of the tool that did not consider whether the detour routes would be passible during a flood event was run for each of the bridge and culvert assets studied that were exposed to riverine flooding.[23] Assets that had very long detour routes were given greater priority for adaptation.

- **Incremental travel distance to detour around the asset for the lowest impactful SLR increment/nearest term cliff retreat:** A more complex version of the detour routing tool was used to determine the shortest detour for the lowest impactful sea level rise increment that would result in sea level rise, storm surge, and coastal cliff retreat affecting each asset. This provides an indication of the initial network redundancy issues that may be created by impacts in coastal areas. For these hazards, the detour tool considered the inundation/erosion throughout the roadway network for each increment of sea level rise evaluated. This ensured that detours were not routed onto roads that would also be inundated or eroded under the same amount of sea level rise.[24] In other words, when run for assets exposed to sea level rise or coastal cliff retreat, the detour routing algorithm ensured that no road affected by either sea level rise or coastal cliff retreat[25] at that same increment of sea level rise could be considered a detour route. When run for assets exposed to storm surge, the detour routing algorithm ensured that no road affected by either sea level rise, coastal cliff retreat, or storm surge at the same increment of sea level rise could be considered a detour route. As with the riverine flooding detours, assets that had very long detour routes were given greater priority for adaptation.

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[22] The detour routes for this and other related metrics in this study did not allow unpaved roads to be used as detours. That said, there are some errors in the database regarding paving status such that it is possible that unpaved roads may be shown as detour routes in some cases.

[23] The exposure of detour routes to flooding was not able to be determined within the resources of this project since no future riverine flooding floodplains with climate change were available at the time of publication.

[24] An exception was made for Caltrans bridges impacted by sea level rise or storm surge within District 1. These assets were assumed to remain passible for such hazards. This assumption was made because, as noted above, exposure for bridges was assumed to occur for sea level rise and storm surge even if the deck was never touched by water (to reflect concerns over corrosion, navigability, etc.). If the deck was not touched by water, it is likely that the bridge would remain open as a detour route and adaptation/repair work could be done while the asset was still in service. Since most Caltrans bridges shown as exposed in the analysis would not actually be touched by water, it was assumed all would remain passible under these hazards lest excessively long and inaccurate detours be generated. That said, the detour metrics will be inaccurate for the few cases where detour routes traverse a Caltrans bridge whose deck would be touched by water and the bridge shut down. In these cases, the detour algorithm will have incorrectly assumed that the bridge would remain open and return a shorter detour length than would be the case. Note that this exception does not apply to non-Caltrans owned bridges. All non-Caltrans bridges were assumed to be impassible as a detour route if inundation was shown to be underneath them for any of the sea level rise or storm surge scenarios.

[25] As described previously, the only coastal cliff retreat exposure data that was available in this area was from UC Berkeley. UC Berkeley's study only evaluated the exposure of the Caltrans State Highway System, not the exposure of other non-Caltrans roadways that may serve as detour routes. Detour routes in this area could erroneously traverse roadways that would be eroded by coastal cliff retreat under the sea level rise increment being evaluated. In such cases, the detour metric included in the analysis would underestimate the actual detour length.

- **Incremental travel distance to detour around the asset under the maximum extent of SLR (7 feet of SLR and 4.6 feet of SLR with a 100-year storm):** This metric captures the level of network redundancy around exposed at-grade roadways, bridges, large culverts, and small culverts under 7 feet of SLR and 4.6 feet of SLR and a 100-year storm surge. As in the sea level rise and surge metrics, the NOAA model was used for sea level rise on its own and the CalFloD-3D model was used to identify potential roadway closures from sea level rise and surge. The detour values for this metric were calculated the same way as was done for the lowest impactful sea level rise increment detour metrics described above. Likewise, assets that had very long detour routes under this sea level rise and surge increment conditions were given greater priority for adaptation.

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 districtwide 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 or the sea level rise increments, 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 1. 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

Metric	Percentage Weights by Asset Class																
	Sea Level Rise				Storm Surge				Cliff Retreat				Wildfire	Tempera-ture	Riverine Flooding		
	At-Grade Roadways	Bridges	Large Culverts	Small Culverts	At-Grade Roadways	Bridges	Large Culverts	Small Culverts	At-Grade Roadways	Bridges	Large Culverts	Small Culverts	Small Culverts	Pavement Binder Grade	Bridges	Large Culverts	Small Culverts
Exposure																	
Past natural hazard impacts	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	-	20%	20%	20%
Lowest impactful sea level rise (SLR) increment	22.5%	45%	45%	40%	-	-	-	-	-	-	-	-	-	-	-	-	-
Percent of road segment exposed to 7 ft. of SLR	22.5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lowest impactful SLR increment with 100-year storm surge	-	-	-	-	22.5%	45%	45%	45%	-	-	-	-	-	-	-	-	-
Percent of road segment exposed to a 100-year storm with 4.6 ft. of SLR	-	-	-	-	22.5%	-	-	-	-	-	-	-	-	-	-	-	-
Hazard level of coastal cliff retreat that results in damage (low, moderate, critical)	-	-	-	-	-	-	-	-	22.5%	45%	45%	45%	-	-	-	-	-
Percent of road segment exposed to coastal cliff retreat	-	-	-	-	-	-	-	-	22.5%	-	-	-	-	-	-	-	-
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	-	-	-	-	-	1.5%	-	-	-	-	-	-	-	-	1%	-	-
Channel and channel protection condition rating	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5%	2.5%	-
Culvert condition rating	-	-	-	-	-	-	5%	5%	-	-	-	-	-	-	-	2.5%	5%
Culvert material	-	-	-	15%	-	-	-	-	-	-	-	-	20%	-	-	-	-
Scour rating	-	-	-	-	-	8.5%	-	-	-	-	-	-	-	-	6.5%	-	-
Average annual daily traffic (AADT)	10%	10%	10%	7%	10%	7%	7%	7%	10%	10%	10%	10%	7%	13%	7%	10%	10%
Average annual daily truck traffic	5%	5%	5%	3%	5%	3%	3%	3%	5%	5%	5%	5%	3%	27%	3%	5%	5%
Incremental travel distance to detour around the asset	-	-	-	-	-	-	-	-	-	-	-	-	15%	-	15%	15%	15%
Incremental travel distance to detour around the asset for the lowest impactful SLR increment	10%	10%	10%	7.5%	10%	7.5%	10%	10%	10%	10%	10%	10%	-	-	-	-	-
Incremental travel distance to detour around the asset under the maximum increment of SLR (7 feet of SLR alone and 4.6 feet of SLR with a 100-year storm).[26]	10%	10%	10%	7.5%	10%	7.5%	10%	10%	10%	10%	10%	10%	-	-	-	-	-
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[26] Both sea level rise and storm surge datasets were applied when calculating detour routes. Data applied came from two different models which use different methodologies and assumptions (NOAA and CalFloD-3D). As such, the model results did not match up across the same flood extents. In the detour analysis, if a road was exposed to sea level rise but not surge due to differing model extents, then the detour would assume the roadway was exposed to sea level rise AND surge. See the District 1 Climate Change Vulnerability Assessment Summary and/or Technical Reports for more information about the sea level rise and surge models applied: https://dot.ca.gov/programs/transportation-planning/2019-climate-change-vulnerability-assessments

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.[27] 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.[28]

An exception to some of the logic noted above can be found with small culvert exposure to wildfire and sea level rise. For these assets, nearly as much weight is given to the culvert material variable as to the AADT and detour route variables collectively. This is because the very nature of the threat to small culverts from wildfire and sea level rise is highly related to the material of the culvert. For example, if the culvert is plastic or wood, it is much more susceptible to fire damage than, say, a concrete culvert. Since they are less likely to be adversely affected by fire in the first place, one would not want to give high priority to concrete culverts for wildfire just because they convey a high AADT or have long detour routes. That is why more weight is placed on the material metric for this asset-hazard combination.

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

[27] 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.

[28] Within the traffic volume related metrics, note that slightly more weight is given to AADT as opposed to truck AADT given that most 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.

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 District 1 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

A preliminary set of prioritization scores was calculated for District 1 bridges, culverts, and roadways following this methodology. A workshop was held with the district to explain the scoring methodology and go over the preliminary results. District 1 staff could then make recommendations on adjusting asset priorities based upon the district's in-depth knowledge about asset conditions, projects underway, and past impacts. District 1 reviewed the preliminary prioritization scores and decided to adjust the weights for many of the assets.

Due to District 1 being a remote district with low network redundancy, the district decided to prioritize the most critical routes (e.g., US 101) that have also experienced past impacts. The district noted that when cut off, closures to primary routes can cause long detours or even completely stop the flow of traffic until repairs are made and roadways are re-opened. District 1 staff also noted funding concerns and that there is limited budget available to address impacts across all assets, and there is a need to prioritize certain routes above others. The district lowered the priority of segments of roadway on lower priority routes including State Routes 200, 222, and 255, in favor of increasing the priority of State Routes 96, 162, and US 101. Similar changes were made across other asset types, where priorities were lowered for less critical routes. These prioritization changes are reflected in the prioritization scoring tables below and in the Appendix.

District staff also noted that some bridges that received higher scores are being replaced, including Jacoby Creek Bridge (04 0023L), Smith River (01 0020), Hunter Creek (01 0003), Russian River (10 0182), and Mc Coy Creek Bridge (10 0036).[29]

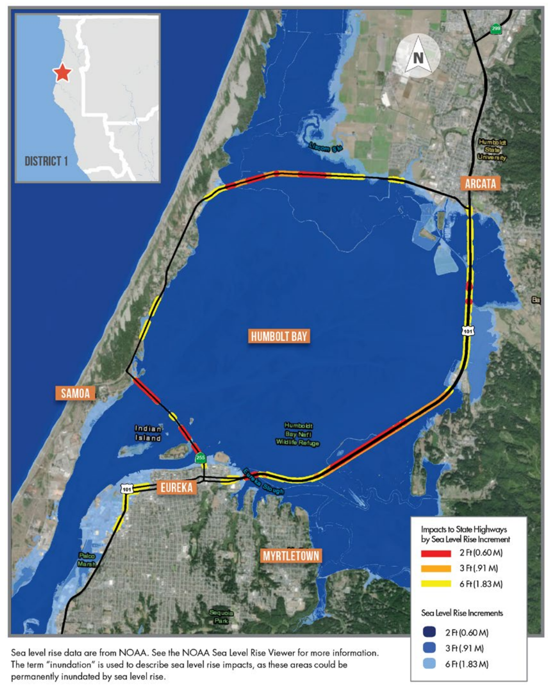
[29] Mc Coy Creek Bridge has been replaced already.

4. DISTRICT ADAPTATION PRIORITIES

Climate change is predicted to intensify overtime and increasing hazards and risks to infrastructure. Sea level rise is one of the predominant hazards associated with climate change and a primary concern for District 1. Increases in sea level rise presents the highest risk to the assets along the California coastline. Higher sea levels will impact coastal assets, inundate low-lying sections, damage substructures. The long coastline in District 1 is subject to increases in flooding, storm surge, and coastal cliff erosion impacting the bridges, roadways, and culverts along its shorelines. Some of the district's most important roadways fall in the California Coastal Zone. There are major state roads that act as the designated principal arterials in District, which are vulnerable to sea level rise, storm surge, and cliff retreat, including US 101 and State Route (SR) 1.

Among the most vulnerable areas in District 1 is Humboldt Bay. Humboldt Bay, a deep-water bay located in Humboldt County along U.S. Highway 101, is an area identified as high risk for sea level rise. One of the most vulnerable sections of the Bay is where SR 255 and U.S. Highway 101 surround and traverse Humboldt Bay.[30] Humboldt County has conducted regional studies to further investigate the projected impacts of sea level rise on Humboldt Bay and the surrounding communities.[31] These studies found that even a moderate flooding event, which took place in 2005, overwhelmed U.S. Highway 101, requiring temporary closures and causing permanent damage.[32]

MODELED SEA LEVEL RISE INUNDATION AROUND HUMBOLDT BAY



CALTRANS CLIMATE CHANGE VULNERABILITY ASSESMENT- MAP OF HUMBOLDT BAY SEA LEVEL RISE

This chapter presents Caltrans' priorities for undertaking detailed adaptation assessments of assets exposed to climate change in District 1, including areas vulnerable to sea level rise. The material presented in this chapter reflects the results of the technical analysis and the coordination with District 1 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.

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30 Caltrans Climate Change Vulnerability Assessment Report, District 1 Technical Report, WSP (2019) https://digitalcommons.humboldt.edu/cgi/viewcontent.cgi?article=1014&context=hsuslri_state

31 Humboldt County's Sea Level Rise Adaptation Plan for Humboldt Bay/Eureka Slough Area (2018-2020), https://humboldtgov.org/2487/Sea-Level-Rise

32 Caltrans, City of Eureka, Humboldt County, Humboldt County Association of Governments, Sea Level Rise Adaptation Plan for Transportation Infrastructure in the Eureka Slough Hydrographic Area, Humboldt Bay Working Draft (July 2020) https://humboldtgov.org/DocumentCenter/View/87563/DRAFT-HBSLR-REPORT-070120

4.1. Bridges

A total of 241 bridges were assessed for vulnerability to sea level rise, storm surge, coastal cliff retreat, and enhanced riverine flooding associated with climate change. All these bridges 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.

FLOODING AT FERNBRIDGE

Figure 2 provides a map of all the bridges assessed in the district. 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. District 1 has 43 Priority 1 bridges, located along State Routes 1, 20, 36, 255, 211, 254, 128, and US 101. Several of these high priority bridges are along the coastline making them subject to sea-level rise and other coastal hazards. The bridge on SR-1 over the Gualala River is the highest priority bridge as it has experienced past impacts, is exposed to near-term sea level rise, storm surge, and riverine flooding, and has a long detour route to get around if out of service. The bridges over the Wilson Creek on US 101, Big River on SR 1 are also high priority as they have long or no detours around the assets under high sea level rise and storm surge increments. After reviewing the priority levels of the bridges, District 1 staff adjusted the prioritization of some of the bridges denoted in the Priority Override column of Table 4. The priority of the US 101 bridge over SR 169 and Hoppow Creek was increased to a Priority 1.

Table 4 presents a summary of all the Priority 1 bridges in District 1 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[33]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	10 0181	MEN	STATE ROUTE 1	GUALALA RIVER	0.01	100.00	
1	01 0005	DN	U.S. HIGHWAY 101	WILSON CREEK	12.64	97.08	
1	10 0146	MEN	STATE ROUTE 1	BIG RIVER	50.17	89.90	
1	04 0022L	HUM	US HIGHWAY 101 SB	EUREKA SLOUGH	79.78	68.85	
1	10 0130	MEN	STATE ROUTE 1	NAVARRO RIVER	40.18	67.53	
1	04 0134	HUM	STATE ROUTE 211	EEL RIVER	78.1	64.19	
1	04 0021L	HUM	US HIGHWAY 101 SB	ELK RIVER	74.6	64.17	
1	04 0022R	HUM	US HIGHWAY 101 NB	EUREKA SLOUGH	79.78	63.82	
1	04 0024L	HUM	US HIGHWAY 101 SB	GANNON SLOUGH	84.7	61.58	
1	04 0228	HUM	STATE ROUTE 255	SAMOA CHANNEL	1.37	61.31	
1	04 0021R	HUM	US HIGHWAY 101 NB	ELK RIVER	74.6	60.47	
1	10 0298	MEN	STATE ROUTE 001	NOYO RIVER & HARBOR DR	60.23	59.98	
1	04 0024R	HUM	US HIGHWAY 101 NB	GANNON SLOUGH	84.7	58.73	
1	10 0113	MEN	STATE ROUTE 1	GARCIA RIVER	18.5	58.32	
1	04 0023L	HUM	US HIGHWAY 101 SB	JACOBY CREEK	84.5	58.21	
1	04 0023R	HUM	US HIGHWAY 101 NB	JACOBY CREEK	84.5	58.10	
1	01 0028	DN	U.S. HIGHWAY 101	KLAMATH RIVER	R4.04	56.49	
1	04 0026	HUM	U.S. HIGHWAY 101	LITTLE RIVER	R97.46	55.59	
1	10 0178	MEN	STATE ROUTE 1	LITTLE RIVER	48.05	51.26	
1	10 0274	MEN	STATE ROUTE 1	TEN MILE RIVER	69.65	50.09	
1	10 0120	MEN	STATE ROUTE 1	ELK CREEK	31.35	49.60	
1	10 0151	MEN	STATE ROUTE 1	RUSSIAN GULCH	52.64	43.85	
1	10 0109	MEN	STATE ROUTE 1	MOAT CREEK	12.88	40.92	
1	10 0124	MEN	STATE ROUTE 1 SB	OCEANSIDE BLUFF	3.81	38.05	
1	04 0067L	HUM	US HIGHWAY 101 SB	KING SALMON AVE	72.88	36.78	
1	04 0027	HUM	U.S. HIGHWAY 101	BIG LAGOON	109.17	35.12	
1	10 0136	MEN	STATE ROUTE 1	ALBION RIVER	43.74	34.79	
1	10 0140	MEN	STATE ROUTE 1	JUAN CREEK	82.91	31.80	
1	10 0138	MEN	STATE ROUTE 1	DE HAVEN CREEK	R79.22	31.68	
1	14 0004	LAK	STATE ROUTE 20	MORRISON CREEK	16.81	29.67	
1	10 0154	MEN	STATE ROUTE 1	JUG HANDLE CREEK	56.74	24.76	
1	10 0166	MEN	STATE ROUTE 1	BLUE SLIDE GULCH	75	23.37	
1	01 0021	DN	U.S. HIGHWAY 101	ELK CREEK	26.15	22.30	
1	04 0079R	HUM	US HIGHWAY 101 NB	WEST END RD, CREEK,	87.84	21.99	

[33] DN = Del Norte, HUM = Humboldt, LAK = Lake, MEN = Mendocino

Priority	Bridge Number	County[33]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
				NCRRA			
1	10 0271	MEN	STATE ROUTE 1	HILLSIDE	83.54	21.84	
1	10 0295	MEN	STATE ROUTE 1	OCEANSIDE BLUFF	82.05	21.84	
1	10 0067	MEN	STATE ROUTE 128	INDIAN CREEK	23.34	21.57	
1	04 0116	HUM	STATE ROUTE 36	BUTTE CREEK	34.52	20.47	
1	01 0020	DN	U.S. HIGHWAY 101	SMITH RIV, SOUTH BANK RD	36.06	20.41	
1	04 0036R	HUM	STATE ROUTE 299	MAD RIVER	R1.55	20.16	
1	10 0116	MEN	STATE ROUTE 1	ALDER CREEK	22.73	19.41	
1	04 0049	HUM	SR 255	U.S. HIGHWAY 101	8.77	19.16	
1	01 0026	DN	U.S. HIGHWAY 101	SR 169 & HOPPOW CREEK	R4.64	6.37	Yes

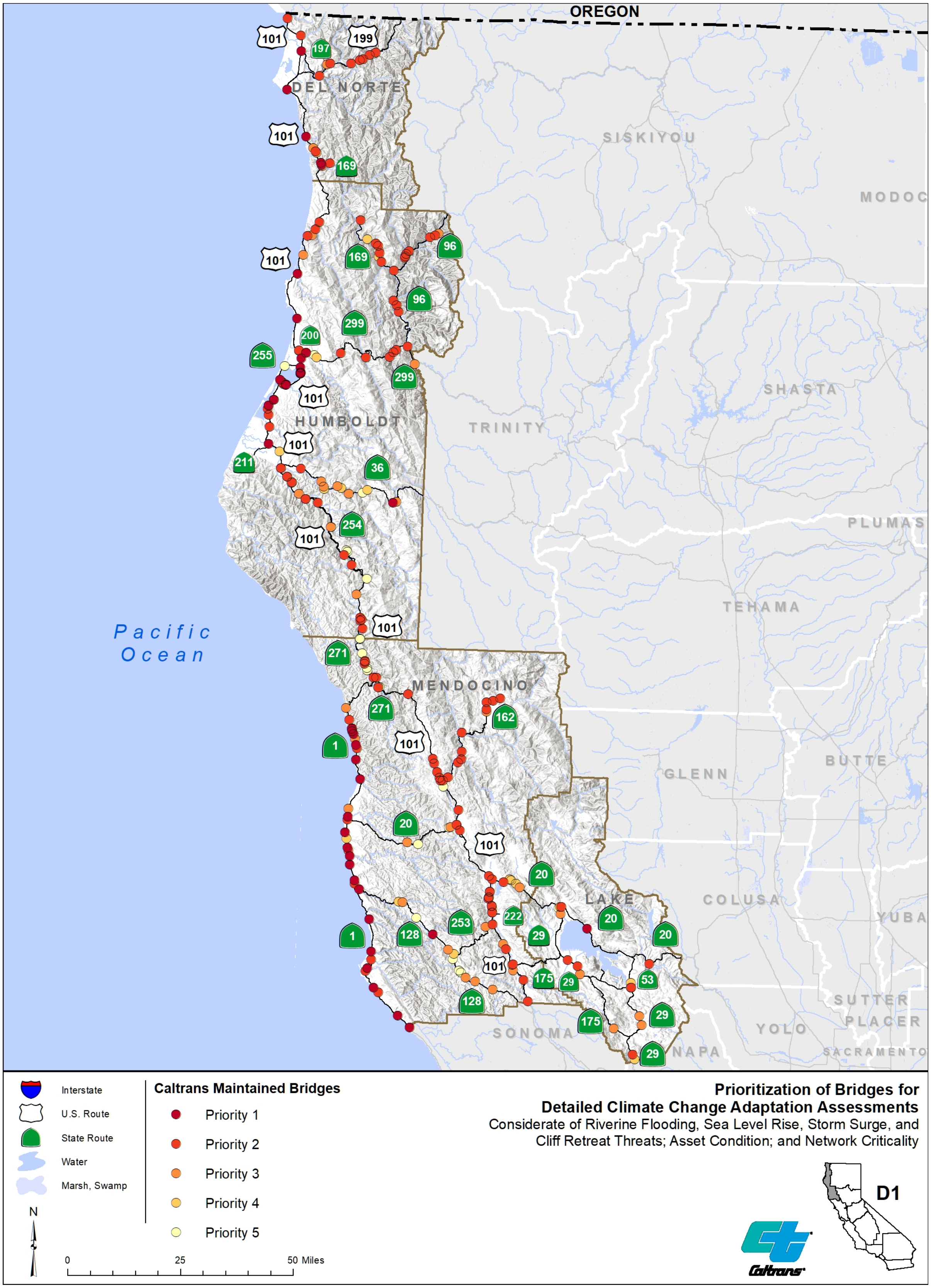

FIGURE 2: PRIORITIZATION OF BRIDGES FOR DETAILED ADAPTATION ASSESSMENTS

4.2. Large Culverts

A total of 9 large culverts were assessed for vulnerability to sea level rise, storm surge, coastal cliff retreat, and more severe riverine flooding associated with climate change. Figure 3 provides a map of all the large culverts potentially vulnerable to these climate hazards in the district, colored by their priority level. There are 2 large culverts with the highest priority rating in District 1. The highest priority locations are in Mendocino County on U.S. Highway 101 over Baker Creek and on SR 1 over Mill Creek. The district updated the priority of these locations.

Table 5 presents the final cross-hazard prioritization scores for these Priority 1 large culverts. A complete listing of all large culverts priorities appears in Table 9 in the appendix.

TABLE 5: PRIORITY 1 LARGE CULVERTS

Priority	Bridge Number	County[34]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	10 0160	MEN	U.S. HIGHWAY 101	BAKER CREEK	R33.52	73.03	Yes
1	10 0291	MEN	STATE ROUTE 1	MILL CREEK	R64.96	0.00	Yes

[34] MEN = Mendocino

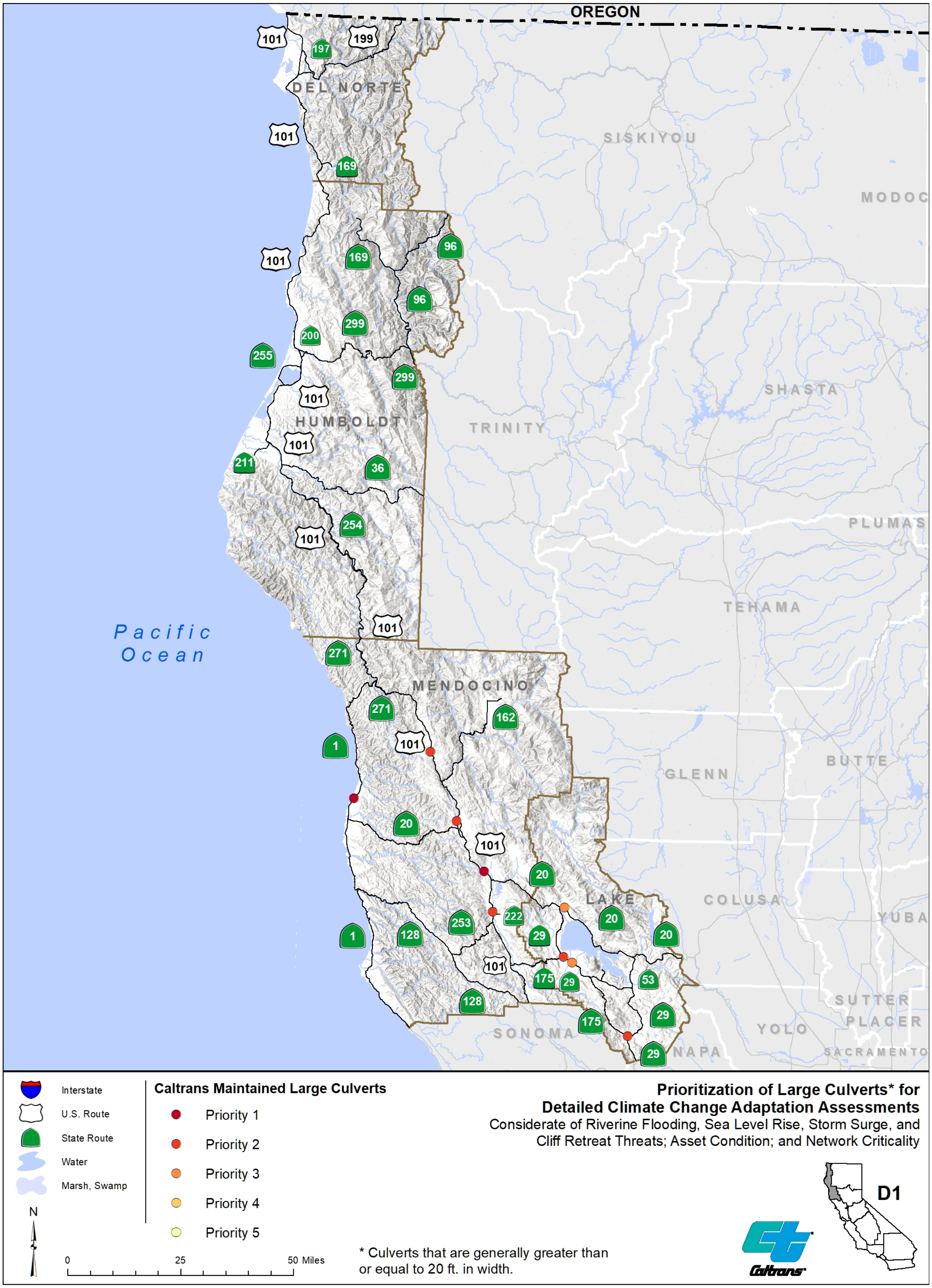

FIGURE 3: PRIORITIZATION OF LARGE CULVERTS FOR DETAILED ADAPTATION ASSESSMENTS

4.3. Small Culverts

A total of 528 small culverts were assessed for vulnerability to sea level rise, storm surge, coastal cliff retreat, more severe riverine flooding, and wildfires associated with climate change. Figure 4 provides a map of all the small culverts potentially exposed to these stressors in the district. The small culverts are colored according to their priority level.

There are 96 Priority 1 small culverts in District 1. The map indicates many clusters of high priority small culverts. Notable groupings of high priority culverts can be found along US 101, SR 20, SR 197, SR 128, and SR 253. The highest priority small culvert is on US 101 in Humboldt County and is exposed to near-term sea level rise and storm surge and received a high riverine flooding score. In addition, significant clusters of small culverts are inland, where they are exposed to wildfire and flooding and have limited detour routes. After reviewing the priority levels of the small culverts, District 1 staff adjusted the prioritization of some of the small culverts (lower than Priority 1), which is denoted in the Priority Override column of Table 10.

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

TABLE 6: PRIORITY 1 SMALL CULVERTS

Priority	Culvert System Number	County [35]	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	41010007010	HUM	101	70.1	100.00	
1	11970000615	DN	197	6.15	77.81	
1	141754002222	LAK	175	22.22	73.18	
1	141750002300	LAK	175	23	65.97	
1	101010003613	MEN	101	36.13	61.27	
1	101284000430	MEN	128	4.3	58.63	
1	140204004309	LAK	20	43.09	58.12	
1	140204004300	LAK	20	43	58.07	
1	101284003584	MEN	128	35.84	57.36	
1	102530001247	MEN	253	12.47	54.55	
1	102534000425	MEN	253	4.25	54.24	
1	102534000497	MEN	253	4.97	53.67	
1	41010000603	HUM	101	6.03	53.17	
1	140290001573	LAK	29	15.73	53.03	
1	101014008318	MEN	101	83.18	52.91	
1	41010001294	HUM	101	12.94	52.43	
1	41010001253	HUM	101	12.53	52.25	
1	102710000001	MEN	271	0.01	52.04	
1	101010000308	MEN	101	3.08	51.50	

[35] DN = Del Norte, HUM = Humboldt, LAK = Lake, MEN = Mendocino

Priority	Culvert System Number	County 35	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	100204004185	MEN	20	41.85	51.32	
1	101620000906	MEN	162	9.06	50.73	
1	101624001767	MEN	162	17.67	50.67	
1	140294001330	LAK	29	13.3	50.62	
1	41010001487	HUM	101	14.87	50.57	
1	140204004456	LAK	20	44.56	50.56	
1	101620001295	MEN	162	12.95	50.41	
1	101284002754	MEN	128	27.54	50.40	
1	101620001342	MEN	162	13.42	50.06	
1	140204000695	LAK	20	6.95	49.99	
1	101624001583	MEN	162	15.83	49.47	
1	41014002319	HUM	101	23.19	49.08	
1	101010008568	MEN	101	85.68	48.93	
1	101620000172	MEN	162	1.72	48.57	
1	101620000800	MEN	162	8	48.44	
1	41694002653	HUM	169	26.53	48.44	
1	101620001192	MEN	162	11.92	48.37	
1	41014002183	HUM	101	21.83	48.35	
1	41010005038	HUM	101	50.38	48.22	
1	101620001086	MEN	162	10.86	48.18	
1	101010008146	MEN	101	81.46	47.98	
1	40364004342	HUM	36	43.42	47.92	
1	101010009124	MEN	101	91.24	47.86	
1	101284003306	MEN	128	33.06	47.82	
1	140294000815	LAK	29	8.15	47.66	
1	41010001307	HUM	101	13.07	47.47	
1	140204004049	LAK	20	40.49	47.31	
1	101284003663	MEN	128	36.63	47.24	
1	101624002106	MEN	162	21.06	47.15	
1	101624002055	MEN	162	20.55	47.14	
1	41014002578	HUM	101	25.78	47.13	
1	101620000304	MEN	162	3.04	47.11	
1	41014002609	HUM	101	26.09	46.88	
1	41014004700	HUM	101	47	46.76	
1	101624001753	MEN	162	17.53	46.74	
1	141754001667	LAK	175	16.67	46.67	
1	100014010334	MEN	1	103.34	46.63	
1	140294004727	LAK	29	47.27	46.59	
1	140204001722	LAK	20	17.22	46.52	
1	141754000750	LAK	175	7.5	46.33	
1	41014001837	HUM	101	18.37	46.32	
1	101284002616	MEN	128	26.16	45.89	

Priority	Culvert System Number	County [35]	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	41014004035	HUM	101	40.35	45.82	
1	141750002584	LAK	175	25.84	44.93	
1	42994000654	HUM	299	6.54	44.30	
1	141750000431	LAK	175	4.31	43.73	
1	101624002059	MEN	162	20.59	43.48	
1	140294001607	LAK	29	16.07	42.42	
1	140294001596	LAK	29	15.96	42.40	
1	101014001957	MEN	101	19.57	40.86	
1	42994000942	HUM	299	9.42	40.50	
1	42990001907	HUM	299	19.07	40.49	
1	101010000681	MEN	101	6.81	40.47	
1	140204003786	LAK	20	37.86	40.39	
1	100010000060	MEN	1	0.6	40.13	
1	100010000230	MEN	1	2.3	39.52	
1	140204004250	LAK	20	42.5	39.35	
1	40964000646	HUM	96	6.46	39.31	
1	102534000386	MEN	253	3.86	39.27	
1	42994001058	HUM	299	10.58	38.97	
1	101280003937	MEN	128	39.37	38.64	
1	101010009269	MEN	101	92.69	38.44	
1	140200004346	LAK	20	43.46	38.35	
1	40964003545	HUM	96	35.45	38.35	
1	140204004237	LAK	20	42.37	38.33	
1	42994001233	HUM	299	12.33	38.27	
1	42994000936	HUM	299	9.36	38.05	
1	140204004215	LAK	20	42.15	37.95	
1	40964000600	HUM	96	6	37.89	
1	40360003647	HUM	36	36.47	37.79	
1	101284004112	MEN	128	41.12	37.77	
1	101010007570	MEN	101	75.7	37.60	
1	40964003662	HUM	96	36.62	37.21	
1	40964003509	HUM	96	35.09	37.16	
1	40964003605	HUM	96	36.05	36.89	
1	101010008117	MEN	101	81.17	36.86	
1	40964000347	HUM	96	3.47	36.86	

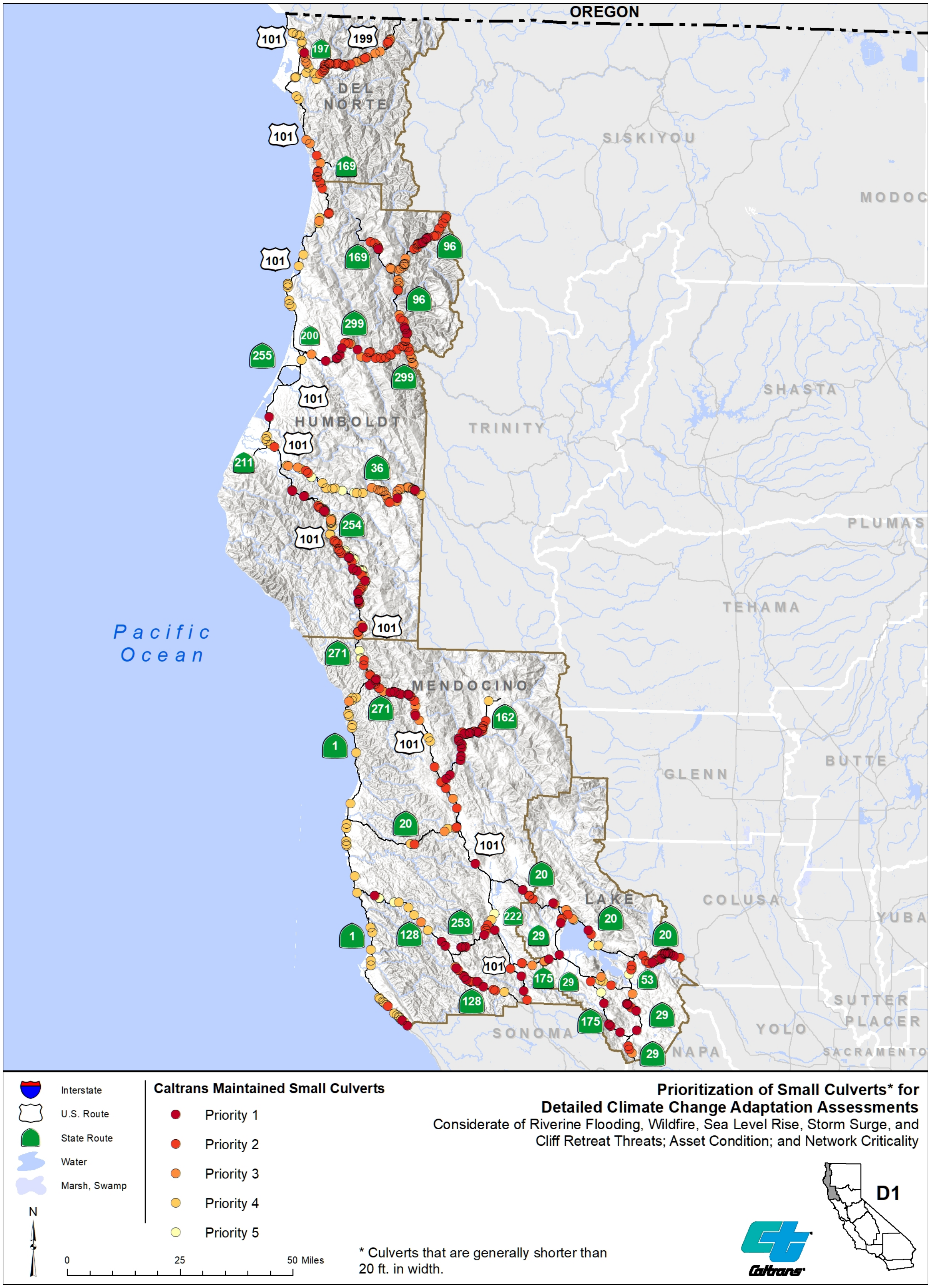

FIGURE 4: PRIORITIZATION OF SMALL CULVERTS FOR DETAILED ADAPTATION ASSESSMENTS

4.4. Roadways

PAVEMENT CRACKING HIGHWAY 101 NORTH OF LEGGETT

A total of 1,218 roadway segments were assessed for vulnerability to sea level rise, storm surge, coastal cliff retreat, and 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 process brings the total prioritized roadway segments to 253.

Figure 5 provides a map of the prioritized roadway segments assessed in District 1. Each segment of roadway is colored by priority level. The map and Table 7 show that roadways along US 101, SR 1, SR 255, and SR 128 have high prioritization scores due to exposure to coastal hazards and some past damages recorded by the district. Other high priority routes include SR 20, SR 29, SR 222, and SR 162.

There are 52 Priority 1 roadways and the vulnerability of these roadways is primarily driven by sea level rise, storm surge, and cliff retreat along the coast. SR 128, SR 255, and US 101 are among the most vulnerable. These routes are also highly trafficked and would present greater consequences to users if they were closed. Inland segments of highway including US 101 and SR 222 in Mendocino County receive high priority scores as well due to near term pavement binder impacts from temperature rise. After reviewing the roadways priority levels, District 1 staff adjusted the prioritization of some of the roadways, which is denoted in the Priority Override column of Table 7.

Table 7 presents a summary of all the Priority 1 roadways in District 1 sorted by their cross-hazard/district 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	Route	Carriageway[36]	From County & Postmile / To County & Postmile[37]	Average Cross-Hazard Prioritization Score[38]	Priority Override
1	255	P	HUM 255 8.641 / HUM 255 8.792	64.01	
1	128	P	MEN 128 0 / MEN 128 4.404	60.16	
1	101	S	DN 101 12.404 / DN 101 13.265	55.49	
1	101	S	DN 101 25.181 / DN 101 25.508	55.49	
1	101	S	DN 101 25.845 / DN 101 26.395L	55.49	
1	101	S	DN 101 45.392 / DN 101 45.873	55.49	
1	101	S	HUM 101 108.772 / HUM 101 109.275	55.49	
1	101	S	HUM 101 68.207 / HUM 101 70.674	55.49	
1	101	S	HUM 101 70.681 / HUM 101 72.036	55.49	
1	101	S	HUM 101 72.656 / HUM 101 73.724	55.49	
1	101	S	HUM 101 73.738 / HUM 101 75.74	55.49	
1	101	S	HUM 101 77.395 / HUM 101 78.337L	55.49	
1	101	S	HUM 101 79.522L / HUM 101 85.832	55.49	
1	101	S	HUM 101 R95.487 / HUM 101 98.08	55.49	
1	101	S	MEN 101 R22.188 / MEN 101 27.416	55.49	
1	101	P	DN 101 11.938 / DN 101 13.265	52.32	
1	101	P	DN 101 25.181 / DN 101 25.507	52.32	
1	101	P	DN 101 25.839 / DN 101 26.435R	52.32	
1	101	P	DN 101 45.392 / DN 101 45.87	52.32	
1	101	P	HUM 101 109.275 / HUM 101 112.537	52.32	
1	101	P	HUM 101 119.584 / HUM 101 119.92	52.32	
1	101	P	HUM 101 68.209 / HUM 101 70.658	52.32	
1	101	P	HUM 101 72.664 / HUM 101 73.508	52.32	
1	101	P	HUM 101 73.719 / HUM 101 75.291	52.32	
1	101	P	HUM 101 77.399 / HUM 101 78.228R	52.32	
1	101	P	HUM 101 79.405R / HUM 101 85.826	52.32	
1	101	P	HUM 101 R95.628 / HUM 101 98.079	52.32	
1	101	P	MEN 101 10.765 / MEN 101 10.805	52.32	
1	101	P	MEN 101 11.164 / MEN 101 17.438	52.32	
1	101	P	MEN 101 9.07 / MEN 101 10.637	52.32	
1	101	P	MEN 101 R22.2 / MEN 101 27.417	52.32	
1	222	P	MEN 222 L0.52 / MEN 222 R0.155	45.49	
1	1	P	MEN 1 17.038 / MEN 1 18.703	42.06	
1	1	P	MEN 1 32.011 / MEN 1 33.215	42.06	

[36] 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".
[37] DN = Del Norte, HUM = Humboldt, LAK = Lake, MEN = Mendocino
[38] These values represent 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	Route	Carriageway[36]	From County & Postmile / To County & Postmile[37]	Average Cross-Hazard Prioritization Score[38]	Priority Override
1	1	P	MEN 1 35.245 / MEN 1 36.723	42.06	
1	1	P	MEN 1 37.065 / MEN 1 42.708	42.06	
1	1	P	MEN 1 48.001 / MEN 1 48.301	42.06	
1	1	P	MEN 1 72.311 / MEN 1 77.124	42.06	
1	1	P	MEN 1 77.549 / MEN 1 78.116	42.06	
1	1	P	MEN 1 78.382 / MEN 1 84.657	42.06	
1	1	P	MEN 1 R49.445 / MEN 1 50.376	42.06	
1	29	P	LAK 29 R37.526 / LAK 29 R43.752	40.98	
1	29	S	LAK 29 R38.294 / LAK 29 R38.852	39.39	
1	29	S	LAK 29 R40.655 / LAK 29 R43.738	39.39	
1	175	P	LAK 175 6.83 / LAK 175 R8.193	32.86	
1	53	P	LAK 53 2.778 / LAK 53 3.582	32.66	
1	20	P	LAK 20 30.681 / LAK 20 32.089	32.42	
1	20	P	MEN 20 33.217 / MEN 20 36.481	32.42	
1	20	P	MEN 20 36.588 / MEN 20 R37.39	32.42	
1	20	P	MEN 20 R38.218 / MEN 20 42.54	32.42	
1	162	P	MEN 162 23.856 / MEN 162 30.68	25.30	Yes
1	162	P	MEN 162 31.498 / MEN 162 34.045	25.30	Yes

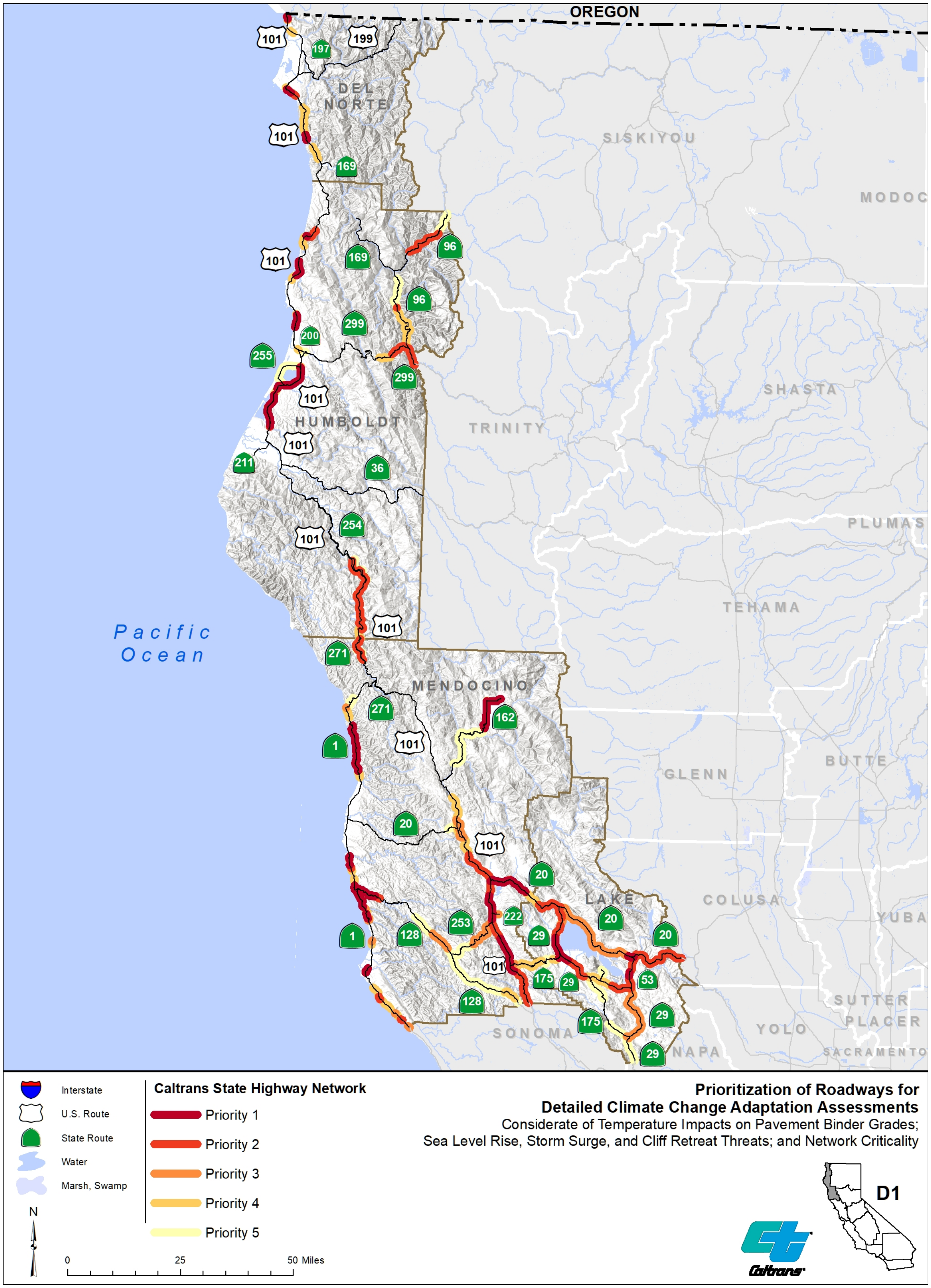

FIGURE 5: PRIORITIZATION OF ROADWAYS FOR DETAILED ADAPTATION ASSESSMENTS

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 1 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 adaptation 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.

FALLEN TREES AND DEBRIS ON STATE ROUTE 96

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 [39]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	10 0181	MEN	STATE ROUTE 1	GUALALA RIVER	0.01	100.00	
1	01 0005	DN	U.S. HIGHWAY 101	WILSON CREEK	12.64	97.08	
1	10 0146	MEN	STATE ROUTE 1	BIG RIVER	50.17	89.90	
1	04 0022L	HUM	US HIGHWAY 101 SB	EUREKA SLOUGH	79.78	68.85	
1	10 0130	MEN	STATE ROUTE 1	NAVARRO RIVER	40.18	67.53	
1	04 0134	HUM	STATE ROUTE 211	EEL RIVER	78.1	64.19	
1	04 0021L	HUM	US HIGHWAY 101 SB	ELK RIVER	74.6	64.17	
1	04 0022R	HUM	US HIGHWAY 101 NB	EUREKA SLOUGH	79.78	63.82	
1	04 0024L	HUM	US HIGHWAY 101 SB	GANNON SLOUGH	84.7	61.58	
1	04 0228	HUM	STATE ROUTE 255	SAMOA CHANNEL	1.37	61.31	
1	04 0021R	HUM	US HIGHWAY 101 NB	ELK RIVER	74.6	60.47	
1	10 0298	MEN	STATE ROUTE 001	NOYO RIVER & HARBOR DR	60.23	59.98	
1	04 0024R	HUM	US HIGHWAY 101 NB	GANNON SLOUGH	84.7	58.73	
1	10 0113	MEN	STATE ROUTE 1	GARCIA RIVER	18.5	58.32	
1	04 0023L	HUM	US HIGHWAY 101 SB	JACOBY CREEK	84.5	58.21	
1	04 0023R	HUM	US HIGHWAY 101 NB	JACOBY CREEK	84.5	58.10	
1	01 0028	DN	U.S. HIGHWAY 101	KLAMATH RIVER	R4.04	56.49	
1	04 0026	HUM	U.S. HIGHWAY 101	LITTLE RIVER	R97.46	55.59	
1	10 0178	MEN	STATE ROUTE 1	LITTLE RIVER	48.05	51.26	
1	10 0274	MEN	STATE ROUTE 1	TEN MILE RIVER	69.65	50.09	
1	10 0120	MEN	STATE ROUTE 1	ELK CREEK	31.35	49.60	
1	10 0151	MEN	STATE ROUTE 1	RUSSIAN GULCH	52.64	43.85	
1	10 0109	MEN	STATE ROUTE 1	MOAT CREEK	12.88	40.92	
1	10 0124	MEN	STATE ROUTE 1 SB	OCEANSIDE BLUFF	3.81	38.05	
1	04 0067L	HUM	US HIGHWAY 101 SB	KING SALMON AVE	72.88	36.78	
1	04 0027	HUM	U.S. HIGHWAY 101	BIG LAGOON	109.17	35.12	

[39] DN = Del Norte, HUM = Humboldt, LAK = Lake, MEN = Mendocino

Priority	Bridge Number	County [39]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	10 0136	MEN	STATE ROUTE 1	ALBION RIVER	43.74	34.79	
1	10 0140	MEN	STATE ROUTE 1	JUAN CREEK	82.91	31.80	
1	10 0138	MEN	STATE ROUTE 1	DE HAVEN CREEK	R79.22	31.68	
1	14 0004	LAK	STATE ROUTE 20	MORRISON CREEK	16.81	29.67	
1	10 0154	MEN	STATE ROUTE 1	JUG HANDLE CREEK	56.74	24.76	
1	10 0166	MEN	STATE ROUTE 1	BLUE SLIDE GULCH	75	23.37	
1	01 0021	DN	U.S. HIGHWAY 101	ELK CREEK	26.15	22.30	
1	04 0079R	HUM	US HIGHWAY 101 NB	WEST END RD,CREEK, NCRRA	87.84	21.99	
1	10 0271	MEN	STATE ROUTE 1	HILLSIDE	83.54	21.84	
1	10 0295	MEN	STATE ROUTE 1	OCEANSIDE BLUFF	82.05	21.84	
1	10 0067	MEN	STATE ROUTE 128	INDIAN CREEK	23.34	21.57	
1	04 0116	HUM	STATE ROUTE 36	BUTTE CREEK	34.52	20.47	
1	01 0020	DN	U.S. HIGHWAY 101	SMITH RIV, SOUTH BANK RD	36.06	20.41	
1	04 0036R	HUM	STATE ROUTE 299	MAD RIVER	R1.55	20.16	
1	10 0116	MEN	STATE ROUTE 1	ALDER CREEK	22.73	19.41	
1	04 0049	HUM	SR 255	U.S. HIGHWAY 101	8.77	19.16	
1	01 0026	DN	U.S. HIGHWAY 101	SR 169 & HOPPOW CREEK	R4.64	6.37	Yes
2	04 0229	HUM	STATE ROUTE 255	MIDDLE CHANNEL	0.67	70.95	Yes
2	04 0230	HUM	STATE ROUTE 255	EUREKA CHANNEL	0.2	67.22	Yes
2	10 0184	MEN	STATE ROUTE 20	EAST FORK RUSSIAN RIVER	36.36	18.82	
2	04 0089	HUM	STATE ROUTE 36	YAGER CREEK	4.86	18.82	
2	10 0115	MEN	STATE ROUTE 1	BRUSH CREEK	20.83	17.11	
2	04 0190	HUM	STATE ROUTE 169	PECWAN CREEK	14.46	16.85	
2	04 0144	HUM	STATE ROUTE 96	KLAMATH RIVER	22.95	15.72	
2	04 0115	HUM	STATE ROUTE 299	EAST FORK WILLOW CREEK	33.21	15.47	
2	04 0311L	HUM	US HIGHWAY 101 SB	MAD RIVER	89.63	15.47	
2	04 0199	HUM	U.S. HIGHWAY 101	BEAR CREEK	R42.99	14.90	
2	04 0123	HUM	U.S. HIGHWAY 101	SOUTH FORK EEL RIVER	27.71	14.16	
2	04 0059	HUM	STATE ROUTE 96	AIKENS CREEK	28.07	13.95	
2	04 0066	HUM	STATE ROUTE 96	CAMP CREEK	R37.25	13.33	
2	04 0016R	HUM	US HIGHWAY 101 NB	EEL RIVER	M53.91	13.23	
2	04 0016L	HUM	US HIGHWAY 101 SB	EEL RIVER	M53.97	12.90	
2	01 0024	DN	U.S. HIGHWAY 101	GILBERT CREEK	45.3	12.75	

Priority	Bridge Number	County [39]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
2	04 0042	HUM	STATE ROUTE 299	REDWOOD CREEK	R22.33	12.14	
2	01 0003	DN	U.S. HIGHWAY 101	HUNTER CREEK	8.51	11.70	
2	04 0135	HUM	STATE ROUTE 96	WILLOW CREEK	0.24	11.54	
2	10 0111	MEN	STATE ROUTE 1	SCHOONER GULCH	11.28	11.16	
2	04 0176	HUM	U.S. HIGHWAY 101	MAPLE HILL RD,SALMON CRK	23.89	10.96	
2	04 0030	HUM	U.S. HIGHWAY 101	LOST MAN CREEK	124.71	10.92	
2	14 0064	LAK	STATE ROUTE 29	KELSEY CREEK	R34.97	10.90	
2	10 0190L	MEN	US 101 SB	DOOLIN CREEK	R23.59	10.85	
2	10 0190R	MEN	US 101 NB	DOOLIN CREEK	R23.59	10.82	
2	10 0300	MEN	U.S. HIGHWAY 101	SOUTH FORK EEL RIVER	R100.02	10.66	
2	10 0194L	MEN	US HIGHWAY 101 SB	ORRS CREEK	R25.01	10.46	
2	10 0194R	MEN	US HIGHWAY 101 NB	ORRS CREEK	R25.01	10.42	
2	04 0017L	HUM	US HIGHWAY 101 SB	VAN DUZEN RIVER	56.84	10.31	
2	10 0015	MEN	U.S. HIGHWAY 101	WILLITS CREEK (MILL CRK)	47.15	10.30	
2	10 0133	MEN	U.S. HIGHWAY 101	PIETA CREEK	R5.94	10.03	
2	14 0053	LAK	STATE ROUTE 29	SAINT HELENA CREEK	1.26	9.96	
2	04 0162	HUM	STATE ROUTE 299	WILLOW CREEK	34.56	9.93	
2	04 0163	HUM	STATE ROUTE 299	WILLOW CREEK	35.55	9.93	
2	14 0012	LAK	STATE ROUTE 20	NORTH FORK CACHE CREEK	37.07	9.89	
2	14 0054	LAK	STATE ROUTE 53	SEIGLER CREEK	0.02	9.81	
2	10 0182	MEN	STATE ROUTE 20	RUSSIAN RIV, NCRA/NWP RR	33.63	9.73	
2	14 0065	LAK	STATE ROUTE 29	ADOBE CREEK	R37.57	9.50	
2	10 0299	MEN	U.S. HIGHWAY 101	SOUTH FORK EEL RIVER	R99.51	9.45	
2	04 0061	HUM	STATE ROUTE 96	SLATE CREEK	29.92	9.20	
2	10 0046	MEN	STATE ROUTE 175	DOOLEY CREEK	0.82	9.12	
2	10 0094	MEN	STATE ROUTE 162	TOWN CREEK	28.74	9.09	
2	10 0168	MEN	U.S. HIGHWAY 101	CRAWFORD CREEK	14.62	9.05	
2	04 0020	HUM	U.S. HIGHWAY 101	SALMON CREEK	67.87	8.94	
2	04 0305	HUM	ROUTE 169	MAWAH CREEK	24.98	7.76	Yes
2	04 0039	HUM	U.S. HIGHWAY 101	E BRANCH S FRK EEL RIV	R8.8	7.67	Yes
2	04 0069	HUM	STATE ROUTE 96	KLAMATH RIVER (ORLEANS)	38.57	7.57	Yes
2	01 0077	DN	STATE ROUTE 169	TERWER CREEK	2.58	7.54	Yes
2	01 0023	DN	U.S. HIGHWAY 101	ROWDY CREEK	39.63	7.38	Yes

Priority	Bridge Number	County 39	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
2	10 0005L	MEN	U.S. HIGHWAY 101	ROBINSON CREEK	20.91	7.37	Yes
2	10 0199L	MEN	US HIGHWAY 101 SB	ACKERMAN CREEK	26.66	7.05	Yes
2	04 0208L	HUM	US HIGHWAY 101 SB	JORDAN CREEK	R46.19	6.99	Yes
2	04 0208R	HUM	US HIGHWAY 101 NB	JORDAN CREEK	R46.19	6.99	Yes
2	04 0155	HUM	U.S. HIGHWAY 101	SOUTH FORK EEL RIVER	R7.87	6.97	Yes
2	04 0241	HUM	U.S. HIGHWAY 101	BENBOW DR & S FK EEL RIV	R5.63	6.95	Yes
2	04 0017R	HUM	US HIGHWAY 101 NB	VAN DUZEN RIVER	56.84	6.74	Yes
2	10 0098	MEN	U.S. HIGHWAY 101	LONG VALLEY CREEK	63.47	6.58	Yes
2	14 0003	LAK	STATE ROUTE 20	CLOVER CREEK	8.89	6.49	Yes
2	01 0007	DN	U.S. HIGHWAY 199	MYRTLE CREEK	7.09	6.47	Yes
2	04 0221R	HUM	US HIGHWAY 101 NB	EEL RIV,EDWARDS DR,NCRRA	R51.99	6.23	Yes
2	10 0269	MEN	U.S. HIGHWAY 101	FORSYTHE CREEK	R31.88	6.22	Yes
2	10 0141	MEN	STATE ROUTE 1	HARDY CREEK	83.78	6.13	Yes
2	10 0273	MEN	U.S. HIGHWAY 101	RUSSIAN,NCRA/NWP,GEYSERS	R.48	6.10	Yes
2	10 0099	MEN	U.S. HIGHWAY 101	LONG VALLEY CREEK	64.71	5.91	Yes
2	10 0203L	MEN	US 101 SB	YORK CREEK	28.26	5.85	Yes
2	10 0203R	MEN	US 101 NB	YORK CREEK	28.26	5.82	Yes
2	04 0219	HUM	STATE ROUTE 169	COON CREEK	25.81	5.75	Yes
2	04 0136	HUM	STATE ROUTE 96	SUPPLY CREEK	11.62	5.70	Yes
2	10 0252	MEN	STATE ROUTE 162	MIDDLE FORK EEL RIVER	15.14	5.36	Yes
2	10 0106	MEN	STATE ROUTE 162	LITTLE SLOUGH	32.14	5.32	Yes
2	04 0029	HUM	U.S. HIGHWAY 101	PRAIRIE CREEK	122.86	5.18	Yes
2	04 0122	HUM	U.S. HIGHWAY 101	ORCHARD AVE	72.03	5.18	Yes
2	04 0212	HUM	U.S. HIGHWAY 101	SOUTH FORK EEL RIVER	R8.3	5.13	Yes
2	10 0013	MEN	U.S. HIGHWAY 101	BAECHTEL CREEK	45.89	5.12	Yes
2	04 0067R	HUM	US HIGHWAY 101 NB	KING SALMON AVE	72.88	5.09	Yes
2	04 0307	HUM	ROUTE 169	MARTINS FERRY SCHOOL CRK	29.95	5.05	Yes
2	04 0063	HUM	STATE ROUTE 96	BLUFF CREEK	28.27	5.03	Yes
2	04 0139	HUM	STATE ROUTE 96	MILL CREEK	R14.55	4.94	Yes
2	10 0200L	MEN	US 101 SB	HENSLEY CR,HENSLEY CR RD	27	4.74	Yes
2	10 0200R	MEN	US 101 NB	HENSLEY CR,HENSLEY CR RD	27	4.71	Yes

Priority	Bridge Number	County 39	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
2	04 0215	HUM	STATE ROUTE 169	RUBE CREEK	27.57	4.69	Yes
2	10 0293	MEN	STATE ROUTE 162	LONG VALLEY CREEK	R.03	4.51	Yes
2	01 0009	DN	U.S. HIGHWAY 199	SMITH RIVER	R11.95	4.48	Yes
2	04 0034	HUM	U.S. HIGHWAY 101	REDWOOD CREEK OVERFLOW	120.02	4.47	Yes
2	10 0119	MEN	STATE ROUTE 162	SHORT CREEK	34.03	4.35	Yes
2	10 0236	MEN	STATE ROUTE 162	EEL RIVER	8.25	4.22	Yes
2	04 0194	HUM	STATE ROUTE 299	NORTH FORK MAD RIVER	R11.02	4.18	Yes
2	10 0142	MEN	STATE ROUTE 1	SOUTH FORK COTTONEVA CRK	87.82	4.03	Yes
2	10 0150	MEN	STATE ROUTE 1	JACK PETERS CREEK	51.87	3.43	Yes
2	10 0234	MEN	STATE ROUTE 162	CORRAL CREEK	2.21	3.19	Yes
2	10 0053	MEN	U.S. HIGHWAY 101	JITNEY GULCH	93.01	3.09	Yes
2	10 0016	MEN	U.S. HIGHWAY 101	OUTLET CREEK	50.66	3.04	Yes
2	10 0233	MEN	STATE ROUTE 162	OUTLET CREEK	0.7	3.00	Yes
2	10 0134	MEN	STATE ROUTE 1	SALMON CREEK	43	2.95	Yes
2	10 0137	MEN	STATE ROUTE 1	WAGES CREEK	78.3	2.84	Yes
2	04 0225	HUM	STATE ROUTE 96	BLUFF CREEK	R28.91	2.81	Yes
2	10 0237	MEN	STATE ROUTE 162	RODEO CREEK	10.08	2.66	Yes
2	01 0016	DN	U.S. HIGHWAY 199	MIDDLE FORK SMITH RIVER	R24.88	2.62	Yes
2	10 0180	MEN	U.S. HIGHWAY 101	LONG VALLEY CREEK	59.9	2.59	Yes
2	04 0036L	HUM	STATE ROUTE 299	MAD RIVER	R1.56	2.56	Yes
2	10 0097	MEN	U.S. HIGHWAY 101	LONG VALLEY CREEK	61.32	2.39	Yes
2	10 0235	MEN	STATE ROUTE 162	BLOODY RUN CREEK	7.13	2.36	Yes
2	10 0027	MEN	U.S. HIGHWAY 101	RATTLESNAKE CREEK	81.43	2.34	Yes
2	10 0096	MEN	STATE ROUTE 162	MILL CREEK	30.33	2.25	Yes
2	10 0175	MEN	STATE ROUTE 1	HARE CREEK	59.67	1.82	Yes
2	01 0012	DN	U.S. HIGHWAY 199	MIDDLE FORK SMITH RIVER	R19.22	1.79	Yes
2	10 0035	MEN	U.S. HIGHWAY 101	RED MOUNTAIN CREEK	M100.46	1.72	Yes
2	01 0044	DN	U.S. HIGHWAY 199	MIDDLE FORK SMITH RIVER	R17.06	1.65	Yes
2	01 0019	DN	U.S. HIGHWAY 199	MIDDLE FORK SMITH RIVER	19.99	1.62	Yes
2	10 0226	MEN	U.S. HIGHWAY 101	CEDAR CREEK	R89.24	1.53	Yes
2	04 0294	HUM	STATE ROUTE 96	HOSTLER CREEK	R13.26	1.34	Yes
2	10 0126	MEN	U.S. HIGHWAY 101	ROCK CREEK	93.71	1.14	Yes
2	10 0294	MEN	STATE ROUTE 1	HATHAWAY CREEK	17.67	0.86	Yes
2	01 0014	DN	U.S. HIGHWAY 199	PATRICK CREEK	R22.07	0.70	Yes

Priority	Bridge Number	County [39]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
2	04 0121	HUM	U.S. HIGHWAY 101	US 101 ON&OFF RAMP,NCRRA	70.61	0.00	Yes
3	04 0092	HUM	STATE ROUTE 36	HELY CREEK	11.46	13.22	Yes
3	04 0096	HUM	STATE ROUTE 36	GRIZZLY CREEK	16.94	13.01	Yes
3	04 0093	HUM	STATE ROUTE 36	VAN DUZEN RIVER	12.78	12.00	Yes
3	04 0098	HUM	STATE ROUTE 36	VAN DUZEN RIVER	20.21	11.74	Yes
3	10 0253	MEN	STATE ROUTE 162	GRIST CREEK	28.3	8.94	
3	04 0256	HUM	U.S. HIGHWAY 101	MCDONALD CREEK	114.54	8.80	
3	10 0192L	MEN	US 101 SB	GIBSON CREEK	R24.32	8.71	
3	04 0119	HUM	STATE ROUTE 36	SOUTH FORK VAN DUZEN RIV	35.37	8.71	
3	04 0028	HUM	U.S. HIGHWAY 101	REDWOOD CREEK	121.09	8.64	
3	04 0240	HUM	STATE ROUTE 96	PEARCH CREEK	R39.48	8.64	
3	10 0004	MEN	U.S. HIGHWAY 101	MCNAB CREEK	15.94	8.63	
3	04 0014	HUM	U.S. HIGHWAY 101	EEL RIVER & NCRRA	R48.69	8.47	
3	14 0014	LAK	STATE ROUTE 29	PUTAH CREEK	9.74	8.14	
3	04 0050	HUM	STATE ROUTE 299	SOUTH FORK TRINITY RIVER	42.95	8.03	
3	01 0040	DN	U.S. HIGHWAY 199	HARDSCRABBLE CREEK	11.01	7.92	
3	14 0002	LAK	STATE ROUTE 20	MIDDLE CREEK	8.56	7.88	
3	10 0078	MEN	STATE ROUTE 128	NORTH FORK NAVARRO RIVER	12.68	7.88	
3	10 0158	MEN	STATE ROUTE 1	PUDDING CREEK	62.12	7.84	
3	10 0139	MEN	STATE ROUTE 1	HOWARD CREEK	R80.55	7.84	
3	01 0004	DN	U.S. HIGHWAY 101	HIGH PRAIRIE CREEK	9.39	7.82	
3	01 0002	DN	U.S. HIGHWAY 101	MINOT CREEK	8.14	7.81	
3	10 0231	MEN	STATE ROUTE 253	ROBINSON CREEK	15.06	7.71	
3	14 0030	LAK	STATE ROUTE 29	ROBINSON CREEK	50.82	7.52	
3	14 0059	LAK	STATE ROUTE 29	COLE CREEK	32.91	7.45	
3	14 0051	LAK	STATE ROUTE 29	COYOTE CREEK	11.89	7.44	
3	10 0131	MEN	STATE ROUTE 128	DRY CREEK	43.44	7.41	
3	10 0147	MEN	STATE ROUTE 1	COTTONEVA CREEK	90.6	7.40	
3	10 0045	MEN	STATE ROUTE 175	RUSSIAN RIVER	0.45	7.35	
3	04 0076	HUM	U.S. HIGHWAY 101	SFK EEL RIVER,MATTOLE RD	35.75	7.29	
3	14 0080	LAK	STATE ROUTE 175	PUTAH CREEK	R24	7.08	
3	10 0052	MEN	STATE ROUTE 128	BEEBE CREEK	38.8	6.99	
3	10 0101	MEN	STATE ROUTE 20	CHAMBERLAIN CREEK	17.29	6.82	
3	10 0132	MEN	STATE ROUTE 128	ANDERSON CREEK	28.29	6.61	
3	10 0055	MEN	STATE ROUTE 128	MAPLE CREEK	36.15	6.55	

Priority	Bridge Number	County [39]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
3	10 0107	MEN	STATE ROUTE 20	BROADDUS CREEK	31.56	6.05	Yes
3	04 0006	HUM	U.S. HIGHWAY 101	DEAN CRK RD & DEAN CREEK	R14.31	5.65	Yes
3	10 0082	MEN	U.S. HIGHWAY 101	RUSSIAN RIVER	9.24	5.61	Yes
3	10 0044	MEN	STATE ROUTE 20	COLD CREEK	R40.85	4.34	Yes
4	04 0284	HUM	STATE ROUTE 36	VAN DUZEN RIVER	17.94	8.47	Yes
4	04 0102	HUM	STATE ROUTE 36	LITTLE LARABEE CREEK	25.27	8.36	Yes
4	04 0094	HUM	STATE ROUTE 36	VAN DUZEN RIVER	13.37	8.30	Yes
4	04 0221L	HUM	US HIGHWAY 101 SB	EEL RIV,EDWARDS DR,NCRRA	R51.99	6.33	
4	14 0052	LAK	STATE ROUTE 29	SAINT HELENA CREEK	0.17	6.27	
4	04 0108	HUM	U.S. HIGHWAY 101	ROHNER CREEK	60.67	6.23	
4	14 0078L	LAK	SR 53	CACHE CREEK	1.1	6.22	
4	10 0040	MEN	STATE ROUTE 20	COLD CREEK	R37.9	6.16	
4	14 0058	LAK	STATE ROUTE 29	SEIGLER CREEK	20.37	6.11	
4	10 0041	MEN	STATE ROUTE 20	COLD CREEK	R38.31	5.86	
4	10 0153	MEN	STATE ROUTE 1	CASPAR CREEK	R54.71	5.81	
4	10 0043	MEN	STATE ROUTE 20	COLD CREEK	R39.65	5.72	
4	04 0311R	HUM	00101	MAD RIVER	89.63	5.30	
4	04 0304	HUM	ROUTE 169	CAPPELL CREEK	22.37	5.20	
4	04 0306	HUM	ROUTE 169	RUBE RANCH CREEK	28.49	5.09	
4	04 0188	HUM	STATE ROUTE 299	MILL CREEK	R4.21	5.06	
4	10 0225	MEN	STATE ROUTE 253	ANDERSON CREEK	0.54	4.41	
4	10 0079	MEN	STATE ROUTE 128	FLYNN CREEK	11.63	4.32	
4	01 0032	DN	U.S. HIGHWAY 101	KLAMATH BCH RD,WAUKELL C	R3.77	4.30	
5	04 0257	HUM	STATE ROUTE 255	MAD RIVER SLOUGH	R5.13	70.85	Yes
5	04 0009	HUM	STATE ROUTE 254	BRIDGE CREEK	10.8	22.90	Yes
5	10 0037	MEN	STATE ROUTE 271	SOUTH FORK EEL RIVER	22.57	21.05	Yes
5	04 0015	HUM	STATE ROUTE 283	EEL RIVER & NWP RR	0.12	18.86	Yes
5	04 0010	HUM	STATE ROUTE 254	SOUTH FORK EEL RIVER	20.64	18.54	Yes
5	04 0008	HUM	STATE ROUTE 254	ELK CREEK	10.43	15.32	Yes
5	04 0007	HUM	STATE ROUTE 254	OHMAN CREEK	0.88	8.77	Yes
5	04 0281	HUM	STATE ROUTE 255	MARINA ROAD	0.66	6.32	Yes
5	04 0299	HUM	STATE ROUTE 169	MINERS CREEK	26.97	4.15	
5	10 0059	MEN	STATE ROUTE 128	SHEARING CREEK	34.49	3.80	
5	10 0063	MEN	STATE ROUTE 128	ROBINSON CREEK	30.66	3.65	
5	10 0060	MEN	STATE ROUTE 128	ORNBAUN CREEK	33.89	3.43	
5	04 0293	HUM	STATE ROUTE 36	VAN DUZEN RIVER	R23.91	3.28	
5	10 0218	MEN	U.S. HIGHWAY 101	CO RD,SOUTH FORK EEL RIV	R106.57	2.97	
5	04 0187	HUM	ROUTE 299	LINDSAY CR,FIELDBROOK RD	R3.5	2.84	

Priority	Bridge Number	County [39]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
5	10 0104	MEN	STATE ROUTE 20	BROADDUS CREEK	31.2	2.64	
5	14 0050	LAK	STATE ROUTE 29	SCOTTS CREEK	52.11	2.63	
5	10 0073	MEN	STATE ROUTE 128	MILL CREEK	17.88	2.28	
5	01 0015	DN	U.S. HIGHWAY 199	MIDDLE FORK SMITH RIVER	24.08	2.23	
5	10 0179	MEN	U.S. HIGHWAY 101	OUTLET CRK & NCRA/NWP RR	57.67	2.09	
5	10 0264	MEN	U.S. HIGHWAY 101	DORA CREEK	96.49	2.04	
5	10 0033	MEN	U.S. HIGHWAY 101	BRIDGES CREEK	97.47	1.95	
5	10 0102	MEN	STATE ROUTE 20	JAMES CREEK	20	1.85	
5	10 0030	MEN	STATE ROUTE 271	BIG DANN CREEK	4.92	1.57	
5	10 0031	MEN	STATE ROUTE 271	CEDAR CREEK	5.22	1.53	
5	10 0036	MEN	STATE ROUTE 271	MC COY CREEK	17.88	1.38	

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

Priority	Bridge Number	County[40]	Route	Feature Crossed	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	10 0160	MEN	U.S. HIGHWAY 101	BAKER CREEK	R33.52	73.03	Yes
1	10 0291	MEN	STATE ROUTE 1	MILL CREEK	R64.96	0.00	Yes
2	14 0020	LAK	STATE ROUTE 175	DRY CREEK	27.48	100.00	Yes
2	14 0067	LAK	STATE ROUTE 29	MANNING CREEK	R38.91	65.85	
2	10 0224	MEN	U.S. HIGHWAY 101	AUSTIN CREEK	R23.82	62.36	Yes
2	10 0024	MEN	U.S. HIGHWAY 101	TEN MILE CREEK	66.5	40.64	Yes
2	10 0070	MEN	U.S. HIGHWAY 101	UPP CREEK	48.14	29.07	Yes
3	14 0066	LAK	STATE ROUTE 29	HILL CREEK	R36.56	30.67	Yes
3	14 0034	LAK	STATE ROUTE 20	POLK JONES CATTLEPASS	9.41	14.81	Yes

[40] DN = Del Norte, HUM = Humboldt, LAK = Lake, MEN = Mendocino

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

Priority	Culvert System Number	County [41]	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	41010007010	HUM	101	70.1	100.00	
1	11970000615	DN	197	6.15	77.81	
1	141754002222	LAK	175	22.22	73.18	
1	141750002300	LAK	175	23	65.97	
1	101010003613	MEN	101	36.13	61.27	
1	101284000430	MEN	128	4.3	58.63	
1	140204004309	LAK	20	43.09	58.12	
1	140204004300	LAK	20	43	58.07	
1	101284003584	MEN	128	35.84	57.36	
1	102530001247	MEN	253	12.47	54.55	
1	102534000425	MEN	253	4.25	54.24	
1	102534000497	MEN	253	4.97	53.67	
1	41010000603	HUM	101	6.03	53.17	
1	140290001573	LAK	29	15.73	53.03	
1	101014008318	MEN	101	83.18	52.91	
1	41010001294	HUM	101	12.94	52.43	
1	41010001253	HUM	101	12.53	52.25	
1	102710000001	MEN	271	0.01	52.04	
1	101010000308	MEN	101	3.08	51.50	
1	100204004185	MEN	20	41.85	51.32	
1	101620000906	MEN	162	9.06	50.73	
1	101624001767	MEN	162	17.67	50.67	
1	140294001330	LAK	29	13.3	50.62	
1	41010001487	HUM	101	14.87	50.57	
1	140204004456	LAK	20	44.56	50.56	
1	101620001295	MEN	162	12.95	50.41	
1	101284002754	MEN	128	27.54	50.40	
1	101620001342	MEN	162	13.42	50.06	
1	140204000695	LAK	20	6.95	49.99	
1	101624001583	MEN	162	15.83	49.47	
1	41014002319	HUM	101	23.19	49.08	
1	101010008568	MEN	101	85.68	48.93	
1	101620000172	MEN	162	1.72	48.57	
1	101620000800	MEN	162	8	48.44	
1	41694002653	HUM	169	26.53	48.44	
1	101620001192	MEN	162	11.92	48.37	
1	41014002183	HUM	101	21.83	48.35	
1	41010005038	HUM	101	50.38	48.22	

[41] DN = Del Norte, HUM = Humboldt, LAK = Lake, MEN = Mendocino

Priority	Culvert System Number	County[41]	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	101620001086	MEN	162	10.86	48.18	
1	101010008146	MEN	101	81.46	47.98	
1	40364004342	HUM	36	43.42	47.92	
1	101010009124	MEN	101	91.24	47.86	
1	101284003306	MEN	128	33.06	47.82	
1	140294000815	LAK	29	8.15	47.66	
1	41010001307	HUM	101	13.07	47.47	
1	140204004049	LAK	20	40.49	47.31	
1	101284003663	MEN	128	36.63	47.24	
1	101624002106	MEN	162	21.06	47.15	
1	101624002055	MEN	162	20.55	47.14	
1	41014002578	HUM	101	25.78	47.13	
1	101620000304	MEN	162	3.04	47.11	
1	41014002609	HUM	101	26.09	46.88	
1	41014004700	HUM	101	47	46.76	
1	101624001753	MEN	162	17.53	46.74	
1	141754001667	LAK	175	16.67	46.67	
1	100014010334	MEN	1	103.34	46.63	
1	140294004727	LAK	29	47.27	46.59	
1	140204001722	LAK	20	17.22	46.52	
1	141754000750	LAK	175	7.5	46.33	
1	41014001837	HUM	101	18.37	46.32	
1	101284002616	MEN	128	26.16	45.89	
1	41014004035	HUM	101	40.35	45.82	
1	141750002584	LAK	175	25.84	44.93	
1	42994000654	HUM	299	6.54	44.30	
1	141750000431	LAK	175	4.31	43.73	
1	101624002059	MEN	162	20.59	43.48	
1	140294001607	LAK	29	16.07	42.42	
1	140294001596	LAK	29	15.96	42.40	
1	101014001957	MEN	101	19.57	40.86	
1	42994000942	HUM	299	9.42	40.50	
1	42990001907	HUM	299	19.07	40.49	
1	101010000681	MEN	101	6.81	40.47	
1	140204003786	LAK	20	37.86	40.39	
1	100010000060	MEN	1	0.6	40.13	
1	100010000230	MEN	1	2.3	39.52	
1	140204004250	LAK	20	42.5	39.35	
1	40964000646	HUM	96	6.46	39.31	
1	102534000386	MEN	253	3.86	39.27	
1	42994001058	HUM	299	10.58	38.97	
1	101280003937	MEN	128	39.37	38.64	

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
1	101010009269	MEN	101	92.69	38.44	
1	140200004346	LAK	20	43.46	38.35	
1	40964003545	HUM	96	35.45	38.35	
1	140204004237	LAK	20	42.37	38.33	
1	42994001233	HUM	299	12.33	38.27	
1	42994000936	HUM	299	9.36	38.05	
1	140204004215	LAK	20	42.15	37.95	
1	40964000600	HUM	96	6	37.89	
1	40360003647	HUM	36	36.47	37.79	
1	101284004112	MEN	128	41.12	37.77	
1	101010007570	MEN	101	75.7	37.60	
1	40964003662	HUM	96	36.62	37.21	
1	40964003509	HUM	96	35.09	37.16	
1	40964003605	HUM	96	36.05	36.89	
1	101010008117	MEN	101	81.17	36.86	
1	40964000347	HUM	96	3.47	36.86	
2	11994000909	DN	199	9.09	36.72	
2	140204003985	LAK	20	39.85	36.72	
2	11990001217	DN	199	12.17	36.46	
2	140294002516	LAK	29	25.16	36.25	
2	101284003744	MEN	128	37.44	36.20	
2	101014001006	MEN	101	10.06	36.15	
2	102534001462	MEN	253	14.62	36.11	
2	140200004337	LAK	20	43.37	36.02	
2	100204004184	MEN	20	41.84	35.96	
2	140204004617	LAK	20	46.17	35.93	
2	140204004218	LAK	20	42.18	35.88	
2	100204004372	MEN	20	43.72	35.80	
2	40964003322	HUM	96	33.22	35.80	
2	140200003469	LAK	20	34.69	35.75	
2	100200004384	MEN	20	43.84	35.72	
2	101010000076	MEN	101	0.76	35.67	
2	140204003856	LAK	20	38.56	35.53	
2	140204003908	LAK	20	39.08	35.50	
2	101284004367	MEN	128	43.67	35.44	
2	101284003838	MEN	128	38.38	35.44	
2	40964003231	HUM	96	32.31	35.33	
2	101284003988	MEN	128	39.88	35.22	
2	101284003792	MEN	128	37.92	35.21	
2	101010008080	MEN	101	80.8	35.03	
2	140530000434	LAK	53	4.34	34.85	
2	42990003973	HUM	299	39.73	34.81	

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
2	42994002684	HUM	299	26.84	34.65	
2	40960000024	HUM	96	0.24	34.60	
2	40964003834	HUM	96	38.34	34.51	
2	11994001175	DN	199	11.75	34.40	
2	11994001057	DN	199	10.57	34.39	
2	11994000955	DN	199	9.55	34.39	
2	11994000841	DN	199	8.41	34.39	
2	11994000998	DN	199	9.98	34.38	
2	140290001475	LAK	29	14.75	34.37	
2	101010005676	MEN	101	56.76	34.34	
2	42994002968	HUM	299	29.68	34.29	
2	40964003132	HUM	96	31.32	34.23	
2	101014008377	MEN	101	83.77	34.22	
2	101014006262	MEN	101	62.62	34.16	
2	11994001181	DN	199	11.81	34.06	
2	140204001850	LAK	20	18.5	34.01	
2	101284003561	MEN	128	35.61	33.98	
2	140204004146	LAK	20	41.46	33.94	
2	101010005117	MEN	101	51.17	33.90	
2	40964003685	HUM	96	36.85	33.83	
2	101010007616	MEN	101	76.16	33.80	
2	101010004664	MEN	101	46.64	33.77	
2	101010009107	MEN	101	91.07	33.67	
2	101010009051	MEN	101	90.51	33.64	
2	42994001538	HUM	299	15.38	33.55	
2	41010000592	HUM	101	5.92	33.54	
2	41014000178	HUM	101	1.78	33.43	
2	42994001455	HUM	299	14.55	33.26	
2	140200003698	LAK	20	36.98	33.23	
2	140204003848	LAK	20	38.48	33.20	
2	11994002988	DN	199	29.88	33.16	
2	140294000348	LAK	29	3.48	33.14	
2	140204003822	LAK	20	38.22	33.14	
2	11994002943	DN	199	29.43	33.09	
2	140204000099	LAK	20	0.99	33.07	
2	42990002266	HUM	299	22.66	33.03	
2	42990002434	HUM	299	24.34	33.03	
2	40964003393	HUM	96	33.93	32.95	
2	40964003349	HUM	96	33.49	32.94	
2	101010009466	MEN	101	94.66	32.90	
2	40960001742	HUM	96	17.42	32.85	
2	140294004833	LAK	29	48.33	32.76	

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
2	40360003378	HUM	36	33.78	32.71	
2	42990003794	HUM	299	37.94	32.70	
2	140204001138	LAK	20	11.38	32.69	
2	101284003378	MEN	128	33.78	32.69	
2	11994002057	DN	199	20.57	32.69	
2	11994002058	DN	199	20.58	32.69	
2	42990003588	HUM	299	35.88	32.65	
2	40960001744	HUM	96	17.44	32.63	
2	40960003889	HUM	96	38.89	32.60	
2	102534001578	MEN	253	15.78	32.60	
2	140294000274	LAK	29	2.74	32.59	
2	101284004414	MEN	128	44.14	32.55	
2	40960004094	HUM	96	40.94	32.51	
2	140200003612	LAK	20	36.12	32.48	
2	41014004184	HUM	101	41.84	32.44	
2	42990003107	HUM	299	31.07	32.43	
2	140534000523	LAK	53	5.23	32.35	
2	101754000318	MEN	175	3.18	32.28	
2	40964000165	HUM	96	1.65	32.21	
2	40964000187	HUM	96	1.87	32.21	
2	40964000370	HUM	96	3.7	32.16	
2	102534001420	MEN	253	14.2	32.12	
2	42990003357	HUM	299	33.57	32.09	
2	141750000966	LAK	175	9.66	32.07	
2	42990003231	HUM	299	32.31	32.06	
2	101010008885	MEN	101	88.85	32.04	
2	101624002304	MEN	162	23.04	32.02	
2	42990003394	HUM	299	33.94	32.01	
2	101624002422	MEN	162	24.22	31.04	Yes
2	101624001633	MEN	162	16.33	31.00	Yes
2	101624002243	MEN	162	22.43	30.92	Yes
2	101624002316	MEN	162	23.16	30.82	Yes
2	41010012835	HUM	101	128.35	29.21	Yes
2	101010009461	MEN	101	94.61	29.20	Yes
2	40960004229	HUM	96	42.29	29.20	Yes
2	41010012854	HUM	101	128.54	29.11	Yes
2	101014005886	MEN	101	58.86	29.09	Yes
2	40960004389	HUM	96	43.89	29.00	Yes
2	42990003729	HUM	299	37.29	28.97	Yes
2	40964003290	HUM	96	32.9	28.83	Yes
2	41014004145	HUM	101	41.45	28.75	Yes
2	41694002620	HUM	169	26.2	28.74	Yes

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
2	41014004018	HUM	101	40.18	28.73	Yes
2	101624001683	MEN	162	16.83	28.66	Yes
2	101010008074	MEN	101	80.74	28.62	Yes
2	41014004234	HUM	101	42.34	28.62	Yes
2	11010000759	DN	101	7.59	28.61	Yes
2	41694002615	HUM	169	26.15	28.57	Yes
2	101624001994	MEN	162	19.94	28.57	Yes
2	101624001649	MEN	162	16.49	28.57	Yes
2	41010001614	HUM	101	16.14	28.55	Yes
2	41010001568	HUM	101	15.68	28.54	Yes
2	41694002348	HUM	169	23.48	28.52	Yes
2	40364000700	HUM	36	7	28.50	Yes
2	40364000625	HUM	36	6.25	28.50	Yes
2	41010001534	HUM	101	15.34	28.47	Yes
2	101624001986	MEN	162	19.86	28.35	Yes
2	41010005054	HUM	101	50.54	28.35	Yes
2	101624002629	MEN	162	26.29	28.32	Yes
2	41694002466	HUM	169	24.66	28.03	Yes
2	100014010440	MEN	1	104.4	28.01	Yes
2	40964001019	HUM	96	10.19	27.61	Yes
2	40964000933	HUM	96	9.33	27.59	Yes
2	41014000161	HUM	101	1.61	27.51	Yes
2	101014007907	MEN	101	79.07	27.46	Yes
2	41010003187	HUM	101	31.87	27.07	Yes
2	101010009901	MEN	101	99.01	27.06	Yes
2	101010008515	MEN	101	85.15	26.98	Yes
2	41014013518	HUM	101	135.18	26.76	Yes
2	41010003125	HUM	101	31.25	26.73	Yes
2	41010002966	HUM	101	29.66	26.66	Yes
2	11990001687	DN	199	16.87	26.59	Yes
2	101624001548	MEN	162	15.48	26.57	Yes
2	101010008403	MEN	101	84.03	26.50	Yes
2	100204001924	MEN	20	19.24	26.49	Yes
2	41014004700	HUM	101	47	26.26	Yes
2	41014002280	HUM	101	22.8	26.23	Yes
2	11990001386	DN	199	13.86	26.16	Yes
2	11990001320	DN	199	13.2	26.04	Yes
2	41014002455	HUM	101	24.55	25.75	Yes
2	11014000249	DN	101	2.49	25.74	Yes
2	11014000095	DN	101	0.95	25.67	Yes
2	41014013674	HUM	101	136.74	25.67	Yes
2	100010000728	MEN	1	7.28	25.49	Yes

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
2	41014002011	HUM	101	20.11	25.18	Yes
2	41014004067	HUM	101	40.67	25.14	Yes
2	11014000222	DN	101	2.22	24.97	Yes
2	41010006223	HUM	101	62.23	24.93	Yes
2	11990001500	DN	199	15	24.88	Yes
2	11990001542	DN	199	15.42	24.83	Yes
2	41010003226	HUM	101	32.26	24.70	Yes
2	11990001558	DN	199	15.58	24.67	Yes
2	41010002855	HUM	101	28.55	24.43	Yes
2	41010002922	HUM	101	29.22	24.42	Yes
2	101010010069	MEN	101	100.69	24.40	Yes
2	41010002918	HUM	101	29.18	24.39	Yes
3	40360003760	HUM	36	37.6	33.88	Yes
3	40364003019	HUM	36	30.19	32.30	Yes
3	40364003066	HUM	36	30.66	32.28	Yes
3	40364002985	HUM	36	29.85	32.26	Yes
3	40364002915	HUM	36	29.15	32.26	Yes
3	40360003356	HUM	36	33.56	32.22	Yes
3	40364002761	HUM	36	27.61	32.05	Yes
3	101010008773	MEN	101	87.73	32.01	
3	140204001277	LAK	20	12.77	31.98	
3	42994000297	HUM	299	2.97	31.97	
3	42990002120	HUM	299	21.2	31.95	
3	40964002508	HUM	96	25.08	31.95	
3	40960004315	HUM	96	43.15	31.94	
3	42994003036	HUM	299	30.36	31.91	
3	42990003223	HUM	299	32.23	31.91	
3	41010001723	HUM	101	17.23	31.90	
3	40964002651	HUM	96	26.51	31.90	
3	41694003302	HUM	169	33.02	31.79	
3	40964002577	HUM	96	25.77	31.71	
3	41694003274	HUM	169	32.74	31.67	
3	40364004282	HUM	36	42.82	31.66	
3	101010007795	MEN	101	77.95	31.64	
3	11994000766	DN	199	7.66	31.63	
3	41010001675	HUM	101	16.75	31.63	
3	101014005391	MEN	101	53.91	31.62	
3	40364004362	HUM	36	43.62	31.61	
3	40964002425	HUM	96	24.25	31.54	
3	140294000162	LAK	29	1.62	31.53	
3	40960002051	HUM	96	20.51	31.53	
3	40960004146	HUM	96	41.46	31.52	

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
3	40960001783	HUM	96	17.83	31.52	
3	40960001943	HUM	96	19.43	31.51	
3	42990004139	HUM	299	41.39	31.48	
3	40360003941	HUM	36	39.41	31.48	
3	101010007426	MEN	101	74.26	31.44	
3	101620001155	MEN	162	11.55	31.43	
3	41010001228	HUM	101	12.28	31.42	
3	42990004287	HUM	299	42.87	31.41	
3	40360003843	HUM	36	38.43	31.41	
3	42994001585	HUM	299	15.85	31.35	
3	100014009290	MEN	1	92.9	31.28	
3	41010012513	HUM	101	125.13	31.21	
3	41010000665	HUM	101	6.65	31.17	
3	140204000718	LAK	20	7.18	31.13	
3	42990004248	HUM	299	42.48	31.09	
3	40960001881	HUM	96	18.81	30.97	
3	42994001528	HUM	299	15.28	30.90	
3	40964002792	HUM	96	27.92	30.85	
3	40964002622	HUM	96	26.22	30.84	
3	11994002606	DN	199	26.06	30.83	
3	11994002957	DN	199	29.57	30.82	
3	101754000332	MEN	175	3.32	30.82	
3	42990003123	HUM	299	31.23	30.80	
3	40964002607	HUM	96	26.07	30.80	
3	140530000508	LAK	53	5.08	30.77	
3	100010010530	MEN	1	105.3	30.77	
3	11994002924	DN	199	29.24	30.74	
3	11994002949	DN	199	29.49	30.74	
3	11994000897	DN	199	8.97	30.73	
3	11994001004	DN	199	10.04	30.73	
3	40964000883	HUM	96	8.83	30.69	
3	40964000316	HUM	96	3.16	30.65	
3	40360003553	HUM	36	35.53	30.54	
3	11994003033	DN	199	30.33	30.51	
3	140294004843	LAK	29	48.43	30.47	
3	40960004030	HUM	96	40.3	30.38	
3	11994002133	DN	199	21.33	30.36	
3	40960003999	HUM	96	39.99	30.34	
3	40960004003	HUM	96	40.03	30.34	
3	40964001098	HUM	96	10.98	30.30	
3	41010001211	HUM	101	12.11	30.29	
3	11990002473	DN	199	24.73	30.25	

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
3	142810001600	LAK	281	16	30.18	
3	100014010482	MEN	1	104.82	30.17	
3	11994003056	DN	199	30.56	30.08	
3	42990003919	HUM	299	39.19	30.08	
3	100204002977	MEN	20	29.77	30.06	
3	40360003289	HUM	36	32.89	30.04	
3	40364003186	HUM	36	31.86	30.02	
3	11970000404	DN	197	4.04	30.01	
3	11970000327	DN	197	3.27	30.01	
3	42990004127	HUM	299	41.27	29.95	
3	41694002665	HUM	169	26.65	29.90	
3	11970000500	DN	197	5	29.90	
3	41694002547	HUM	169	25.47	29.89	
3	42990004030	HUM	299	40.3	29.85	
3	40364000399	HUM	36	3.99	29.79	
3	140204001027	LAK	20	10.27	29.65	
3	40960004439	HUM	96	44.39	29.65	
3	140294001889	LAK	29	18.89	29.64	
3	40960004409	HUM	96	44.09	29.62	
3	40960004275	HUM	96	42.75	29.62	
3	101280001936	MEN	128	19.36	29.61	
3	101754000568	MEN	175	5.68	29.57	
3	140204003744	LAK	20	37.44	29.56	
3	41014001968	HUM	101	19.68	29.49	
3	41014000088	HUM	101	0.88	29.44	
3	40364004298	HUM	36	42.98	29.34	
3	40364004166	HUM	36	41.66	29.30	
3	101284003285	MEN	128	32.85	29.29	
3	40364004319	HUM	36	43.19	29.28	
3	101010009501	MEN	101	95.01	29.28	
3	141754000253	LAK	175	2.53	29.17	
3	141754000268	LAK	175	2.68	29.13	
3	100200003284	MEN	20	32.84	24.36	Yes
3	11990001589	DN	199	15.89	24.29	Yes
3	11994001857	DN	199	18.57	24.29	Yes
3	11994001831	DN	199	18.31	24.28	Yes
3	11990001609	DN	199	16.09	24.27	Yes
3	40364000162	HUM	36	1.62	24.23	Yes
3	41014013638	HUM	101	136.38	24.17	Yes
3	11990001644	DN	199	16.44	24.14	Yes
3	11010001065	DN	101	10.65	24.05	Yes
3	11990001966	DN	199	19.66	23.91	Yes

Priority	Culvert System Number	County [41]	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
3	41014003768	HUM	101	37.68	23.05	Yes
3	41010003046	HUM	101	30.46	22.84	Yes
3	11010001192	DN	101	11.92	22.27	Yes
3	11011400090	DN	101	0.99	22.16	Yes
3	11690000002	DN	169	0.02	17.47	Yes
4	141750000300	LAK	175	3	29.12	
4	40360003981	HUM	36	39.81	29.09	
4	101284002180	MEN	128	21.8	28.89	
4	140530000455	LAK	53	4.55	28.85	
4	101284004658	MEN	128	46.58	28.29	
4	142814001693	LAK	281	16.93	28.11	
4	40364004527	HUM	36	45.27	27.69	
4	11970000222	DN	197	2.22	27.41	
4	40364004137	HUM	36	41.37	27.12	
4	100204003087	MEN	20	30.87	26.89	
4	100204001823	MEN	20	18.23	26.66	
4	40364001418	HUM	36	14.18	26.25	
4	40360002411	HUM	36	24.11	25.93	
4	40364004201	HUM	36	42.01	25.72	
4	40364004176	HUM	36	41.76	25.69	
4	101284001711	MEN	128	17.11	25.65	
4	40364004145	HUM	36	41.45	25.55	
4	101284001480	MEN	128	14.8	25.53	
4	101010008897	MEN	101	88.97	25.37	
4	11990001403	DN	199	14.03	25.29	
4	40364001190	HUM	36	11.9	25.04	
4	40364001560	HUM	36	15.6	24.83	
4	40364001621	HUM	36	16.21	24.79	
4	40364000518	HUM	36	5.18	23.70	
4	101284001178	MEN	128	11.78	23.40	
4	11994000583	DN	199	5.83	22.30	
4	40364000137	HUM	36	1.37	22.30	
4	40364002250	HUM	36	22.5	22.28	
4	41010003403	HUM	101	34.03	21.95	Yes
4	100010009602	MEN	1	96.02	21.87	Yes
4	41014013638	HUM	101	136.38	21.87	Yes
4	100010003913	MEN	1	39.13	21.85	Yes
4	41014013638	HUM	101	136.38	21.71	Yes
4	100014009497	MEN	1	94.97	21.48	Yes
4	100014009410	MEN	1	94.1	21.22	Yes
4	41010006568	HUM	101	65.68	20.37	Yes
4	41014003804	HUM	101	38.04	19.75	Yes

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
4	41014003709	HUM	101	37.09	19.58	Yes
4	41014003735	HUM	101	37.35	19.51	Yes
4	140204002263	LAK	20	22.63	19.29	Yes
4	41010006496	HUM	101	64.96	19.22	Yes
4	11010003978	DN	101	39.78	18.61	Yes
4	11010003012	DN	101	30.12	18.46	Yes
4	11990000256	DN	199	2.56	18.21	Yes
4	41014003615	HUM	101	36.15	17.54	Yes
4	11010003825	DN	101	38.25	17.35	Yes
4	11010003789	DN	101	37.89	17.21	Yes
4	41014003717	HUM	101	37.17	17.06	Yes
4	41010011126	HUM	101	111.26	17.02	Yes
4	11010002269	DN	101	22.69	16.75	Yes
4	11970000036	DN	197	0.36	16.62	Yes
4	101010006880	MEN	101	68.8	16.23	Yes
4	41010012450	HUM	101	124.5	16.16	Yes
4	140204001300	LAK	20	13	16.15	Yes
4	41014006304	HUM	101	63.04	15.58	Yes
4	41014003732	HUM	101	37.32	15.23	Yes
4	140294002723	LAK	29	27.23	14.56	Yes
4	11970000683	DN	197	6.83	14.45	Yes
4	100014008469	MEN	1	84.69	14.07	Yes
4	41010010479	HUM	101	104.79	13.99	Yes
4	41010012593	HUM	101	125.93	13.61	Yes
4	41014006434	HUM	101	64.34	13.56	Yes
4	100010000265	MEN	1	2.65	13.33	Yes
4	100010007710	MEN	1	77.1	13.22	Yes
4	100010000174	MEN	1	1.74	13.15	Yes
4	100010000322	MEN	1	3.22	13.07	Yes
4	100010002775	MEN	1	27.75	12.80	Yes
4	100010008920	MEN	1	89.2	12.38	Yes
4	41010008755	HUM	101	87.55	12.36	Yes
4	41010008755	HUM	101	87.55	12.34	Yes
4	101014002184	MEN	101	21.84	11.96	Yes
4	41010011471	HUM	101	114.71	10.77	Yes
4	100010008871	MEN	1	88.71	10.47	Yes
4	11010002364	DN	101	23.64	9.90	Yes
4	11010003017	DN	101	30.17	9.87	Yes
4	11010002997	DN	101	29.97	9.79	Yes
4	11010004166	DN	101	41.66	9.57	Yes
4	11010004141	DN	101	41.41	9.46	Yes
4	101624003127	MEN	162	31.27	9.37	Yes

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
4	100010002062	MEN	1	20.62	9.20	Yes
4	100010002317	MEN	1	23.17	9.15	Yes
4	41010010186	HUM	101	101.86	9.14	Yes
4	101010006986	MEN	101	69.86	8.89	Yes
4	140204001045	LAK	20	10.45	8.14	Yes
4	100014008385	MEN	1	83.85	8.10	Yes
4	41014010094	HUM	101	100.94	7.53	Yes
4	100010000733	MEN	1	7.33	7.16	Yes
4	100010005419	MEN	1	54.19	6.30	Yes
4	100010001971	MEN	1	19.71	6.15	Yes
4	41010010536	HUM	101	105.36	5.99	Yes
4	100010002889	MEN	1	28.89	5.81	Yes
4	100010006356	MEN	1	63.56	5.54	Yes
4	100010000393	MEN	1	3.93	5.20	Yes
4	41010010018	HUM	101	100.18	4.67	Yes
4	100010005304	MEN	1	53.04	3.97	Yes
4	100010000860	MEN	1	8.6	3.67	Yes
4	100010000500	MEN	1	5	3.48	Yes
4	100010005781	MEN	1	57.81	3.19	Yes
4	100010004498	MEN	1	44.98	2.95	Yes
4	100010005878	MEN	1	58.78	2.86	Yes
4	11010004058	DN	101	40.58	2.35	Yes
4	100010000971	MEN	1	9.71	2.18	Yes
4	41010010555	HUM	101	105.55	1.98	Yes
4	100010005341	MEN	1	53.41	1.61	Yes
4	41010010555	HUM	101	105.55	1.38	Yes
4	100010000333	MEN	1	3.33	0.12	Yes
4	100010000894	MEN	1	8.94	0.11	Yes
4	100010001008	MEN	1	10.08	0.00	Yes
5	42540004006	HUM	254	40.06	49.52	Yes
5	102710000001	MEN	271	0.01	48.04	Yes
5	42540000001	HUM	254	0.01	43.42	Yes
5	42540000042	HUM	254	0.42	42.87	Yes
5	42540000317	HUM	254	3.17	41.98	Yes
5	42544004081	HUM	254	40.81	40.96	Yes
5	42540001641	HUM	254	16.41	39.75	Yes
5	42540000004	HUM	254	0.04	39.39	Yes
5	42540001570	HUM	254	15.7	39.21	Yes
5	42540001870	HUM	254	18.7	34.34	Yes
5	42544002249	HUM	254	22.49	33.34	Yes
5	102710000348	MEN	271	3.48	32.78	Yes
5	102710001670	MEN	271	16.7	30.34	Yes

Priority	Culvert System Number	County 41	Route	Postmile	Cross-Hazard Prioritization Score	Priority Override
5	102710000676	MEN	271	6.76	29.22	Yes
5	102710001885	MEN	271	18.85	27.19	Yes
5	42540001113	HUM	254	11.13	25.91	Yes
5	42540001294	HUM	254	12.94	24.08	Yes
5	42544000813	HUM	254	8.13	23.27	Yes
5	42540000182	HUM	254	1.82	22.11	
5	42540000332	HUM	254	3.32	21.36	
5	42540001150	HUM	254	11.5	21.27	
5	101284001026	MEN	128	10.26	21.07	
5	42540001675	HUM	254	16.75	20.82	
5	101284000547	MEN	128	5.47	20.65	
5	42540001407	HUM	254	14.07	20.50	
5	42544004272	HUM	254	42.72	20.04	
5	42540000418	HUM	254	4.18	19.83	
5	42540000769	HUM	254	7.69	19.70	
5	101284000568	MEN	128	5.68	19.24	
5	40360001862	HUM	36	18.62	18.92	
5	140530000307	LAK	53	3.07	18.65	
5	40364002198	HUM	36	21.98	18.63	
5	42544002287	HUM	254	22.87	18.39	
5	140204002107	LAK	20	21.07	17.82	
5	40364000815	HUM	36	8.15	17.63	
5	42540000934	HUM	254	9.34	17.41	
5	42540004050	HUM	254	40.5	16.58	
5	42544004188	HUM	254	41.88	16.50	
5	141754001332	LAK	175	13.32	15.91	
5	42544002201	HUM	254	22.01	14.80	
5	102224000113	MEN	222	1.13	4.28	

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

Priority	Route	Carriageway[42]	From County & Postmile / To County & Postmile[43]	Average Cross-Hazard Prioritization Score[44]	Priority Override
1	255	P	HUM 255 8.641 / HUM 255 8.792	64.01	
1	128	P	MEN 128 0 / MEN 128 4.404	60.16	
1	101	S	DN 101 12.404 / DN 101 13.265	55.49	
1	101	S	DN 101 25.181 / DN 101 25.508	55.49	
1	101	S	DN 101 25.845 / DN 101 26.395L	55.49	
1	101	S	DN 101 45.392 / DN 101 45.873	55.49	
1	101	S	HUM 101 108.772 / HUM 101 109.275	55.49	
1	101	S	HUM 101 68.207 / HUM 101 70.674	55.49	
1	101	S	HUM 101 70.681 / HUM 101 72.036	55.49	
1	101	S	HUM 101 72.656 / HUM 101 73.724	55.49	
1	101	S	HUM 101 73.738 / HUM 101 75.74	55.49	
1	101	S	HUM 101 77.395 / HUM 101 78.337L	55.49	
1	101	S	HUM 101 79.522L / HUM 101 85.832	55.49	
1	101	S	HUM 101 R95.487 / HUM 101 98.08	55.49	
1	101	S	MEN 101 R22.188 / MEN 101 27.416	55.49	
1	101	P	DN 101 11.938 / DN 101 13.265	52.32	
1	101	P	DN 101 25.181 / DN 101 25.507	52.32	
1	101	P	DN 101 25.839 / DN 101 26.435R	52.32	
1	101	P	DN 101 45.392 / DN 101 45.87	52.32	
1	101	P	HUM 101 109.275 / HUM 101 112.537	52.32	
1	101	P	HUM 101 119.584 / HUM 101 119.92	52.32	
1	101	P	HUM 101 68.209 / HUM 101 70.658	52.32	
1	101	P	HUM 101 72.664 / HUM 101 73.508	52.32	
1	101	P	HUM 101 73.719 / HUM 101 75.291	52.32	
1	101	P	HUM 101 77.399 / HUM 101 78.228R	52.32	
1	101	P	HUM 101 79.405R / HUM 101 85.826	52.32	
1	101	P	HUM 101 R95.628 / HUM 101 98.079	52.32	
1	101	P	MEN 101 10.765 / MEN 101 10.805	52.32	
1	101	P	MEN 101 11.164 / MEN 101 17.438	52.32	
1	101	P	MEN 101 9.07 / MEN 101 10.637	52.32	
1	101	P	MEN 101 R22.2 / MEN 101 27.417	52.32	
1	222	P	MEN 222 L0.52 / MEN 222 R0.155	45.49	

[42] 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".
[43] DN = Del Norte, HUM = Humboldt, LAK = Lake, MEN = Mendocino
[44] 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	Route	Carriageway[42]	From County & Postmile / To County & Postmile[43]	Average Cross-Hazard Prioritization Score[44]	Priority Override
1	1	P	MEN 1 17.038 / MEN 1 18.703	42.06	
1	1	P	MEN 1 32.011 / MEN 1 33.215	42.06	
1	1	P	MEN 1 35.245 / MEN 1 36.723	42.06	
1	1	P	MEN 1 37.065 / MEN 1 42.708	42.06	
1	1	P	MEN 1 48.001 / MEN 1 48.301	42.06	
1	1	P	MEN 1 72.311 / MEN 1 77.124	42.06	
1	1	P	MEN 1 77.549 / MEN 1 78.116	42.06	
1	1	P	MEN 1 78.382 / MEN 1 84.657	42.06	
1	1	P	MEN 1 R49.445 / MEN 1 50.376	42.06	
1	29	P	LAK 29 R37.526 / LAK 29 R43.752	40.98	
1	29	S	LAK 29 R38.294 / LAK 29 R38.852	39.39	
1	29	S	LAK 29 R40.655 / LAK 29 R43.738	39.39	
1	175	P	LAK 175 6.83 / LAK 175 R8.193	32.86	
1	53	P	LAK 53 2.778 / LAK 53 3.582	32.66	
1	20	P	LAK 20 30.681 / LAK 20 32.089	32.42	
1	20	P	MEN 20 33.217 / MEN 20 36.481	32.42	
1	20	P	MEN 20 36.588 / MEN 20 R37.39	32.42	
1	20	P	MEN 20 R38.218 / MEN 20 42.54	32.42	
1	162	P	MEN 162 23.856 / MEN 162 30.68	25.30	Yes
1	162	P	MEN 162 31.498 / MEN 162 34.045	25.30	Yes
2	175	P	MEN 175 0 / MEN 175 0.045	29.23	
2	1	P	MEN 1 2.346 / MEN 1 2.788	26.26	
2	1	P	MEN 1 36.723 / MEN 1 37.065	26.26	
2	1	P	MEN 1 47.194 / MEN 1 48.001	26.26	
2	1	P	MEN 1 9.756 / MEN 1 R10.546	26.26	
2	20	P	LAK 20 2.669 / LAK 20 8.692	25.81	
2	20	P	LAK 20 32.089 / LAK 20 46.474	25.81	
2	20	P	MEN 20 36.481 / MEN 20 36.588	25.81	
2	20	P	MEN 20 R37.39 / MEN 20 R38.218	25.81	
2	53	P	LAK 53 0 / LAK 53 2.778	25.63	
2	53	P	LAK 53 3.582 / LAK 53 7.445	25.63	
2	255	P	HUM 255 0.074 / HUM 255 0.11	24.73	
2	53	S	LAK 53 0 / LAK 53 2.778	24.37	
2	29	P	LAK 29 20.633 / LAK 29 25.124	23.79	
2	29	P	LAK 29 32.015 / LAK 29 R34.447	23.79	
2	29	P	LAK 29 R34.583 / LAK 29 R37.526	23.79	
2	29	P	LAK 29 R43.752 / LAK 29 R46.689	23.79	
2	29	P	LAK 29 R48.626 / LAK 29 52.518	23.79	

Priority	Route	Carriageway[42]	From County & Postmile / To County & Postmile[43]	Average Cross-Hazard Prioritization Score[44]	Priority Override
2	128	P	MEN 128 4.404 / MEN 128 5.664	23.15	
2	29	S	LAK 29 R34.447 / LAK 29 R37.526	22.92	
2	29	S	LAK 29 R43.738 / LAK 29 R46.685	22.92	
2	20	S	LAK 20 32.587 / LAK 20 32.856	21.98	
2	20	S	LAK 20 34.082 / LAK 20 34.327	21.98	
2	20	S	LAK 20 39.508 / LAK 20 39.763	21.98	
2	20	S	LAK 20 8.317 / LAK 20 8.337	21.98	
2	20	S	LAK 20 R43.592 / LAK 20 R43.664	21.98	
2	20	S	MEN 20 36.481 / MEN 20 36.588	21.98	
2	20	S	MEN 20 R37.39 / MEN 20 R38.218	21.98	
2	299	P	HUM 299 34.05 / HUM 299 38.83	21.77	
2	299	P	HUM 299 38.995 / HUM 299 40.277	21.77	
2	299	P	HUM 299 40.51 / TRI 299 0.003	21.77	
2	299	S	HUM 299 38.668 / HUM 299 38.83	20.46	
2	101	S	DN 101 25.508 / DN 101 25.845	17.68	Yes
2	101	S	DN 101 45.13 / DN 101 45.254	17.68	Yes
2	101	S	HUM 101 120.661 / HUM 101 121.082	17.68	Yes
2	101	S	HUM 101 121.135 / HUM 101 121.621	17.68	Yes
2	101	S	HUM 101 68.01 / HUM 101 68.207	17.68	Yes
2	101	S	HUM 101 73.724 / HUM 101 73.738	17.68	Yes
2	101	S	HUM 101 77.296 / HUM 101 77.395	17.68	Yes
2	101	S	HUM 101 78.337L / HUM 101 78.393L	17.68	Yes
2	101	S	HUM 101 85.832 / HUM 101 85.837	17.68	Yes
2	101	S	HUM 101 R5.41 / HUM 101 25.011	17.68	Yes
2	101	S	MEN 101 10.637 / MEN 101 10.765	17.68	Yes
2	101	S	MEN 101 10.805 / MEN 101 10.888	17.68	Yes
2	101	S	MEN 101 11.019 / MEN 101 11.164	17.68	Yes
2	101	S	MEN 101 17.438 / MEN 101 R22.188	17.68	Yes
2	101	S	MEN 101 27.416 / MEN 101 39.456	17.68	Yes
2	101	S	MEN 101 R0.112 / MEN 101 9.07	17.68	Yes
2	101	S	MEN 101 R101.071 / MEN 101 R106.696	17.68	Yes
2	101	P	DN 101 23.853 / DN 101 24.406	15.32	Yes
2	101	P	DN 101 45.254 / DN 101 45.392	15.32	Yes
2	101	P	HUM 101 119.92 / HUM 101 122.682	15.32	Yes
2	101	P	HUM 101 68.011 / HUM 101 68.209	15.32	Yes
2	101	P	HUM 101 70.662 / HUM 101 70.706	15.32	Yes
2	101	P	HUM 101 73.508 / HUM 101 73.719	15.32	Yes
2	101	P	HUM 101 85.826 / HUM 101 85.831	15.32	Yes

Priority	Route	Carriageway[42]	From County & Postmile / To County & Postmile[43]	Average Cross-Hazard Prioritization Score[44]	Priority Override
2	101	P	HUM 101 R5.41 / HUM 101 25.01	15.32	Yes
2	101	P	MEN 101 10.637 / MEN 101 10.765	15.32	Yes
2	101	P	MEN 101 10.805 / MEN 101 10.888	15.32	Yes
2	101	P	MEN 101 11.02 / MEN 101 11.164	15.32	Yes
2	101	P	MEN 101 17.438 / MEN 101 R22.2	15.32	Yes
2	101	P	MEN 101 27.417 / MEN 101 39.456	15.32	Yes
2	101	P	MEN 101 R101.068 / MEN 101 R106.696	15.32	Yes
2	101	P	MEN 101 R6.008 / MEN 101 9.07	15.32	Yes
2	101	P	SON 101 R56.219 / MEN 101 3.257	15.32	Yes
2	96	P	HUM 96 12.87 / HUM 96 12.909	0.22	Yes
2	96	P	HUM 96 29.911 / HUM 96 38.076	0.22	Yes
2	96	P	HUM 96 R38.728 / HUM 96 R39.654	0.22	Yes
2	96	S	HUM 96 12.86 / HUM 96 12.909	0.21	Yes
3	29	P	LAK 29 5.639 / LAK 29 20.633	19.28	
3	29	P	LAK 29 R34.447 / LAK 29 R34.583	19.28	
3	29	P	LAK 29 R46.689 / LAK 29 R48.626	19.28	
3	29	S	LAK 29 11.816 / LAK 29 12.155	18.63	
3	29	S	LAK 29 5.895 / LAK 29 6.041	18.63	
3	29	S	LAK 29 6.334 / LAK 29 6.522	18.63	
3	29	S	LAK 29 R46.685 / LAK 29 R48.626	18.63	
3	299	P	HUM 299 38.83 / HUM 299 38.995	18.40	
3	299	P	HUM 299 40.277 / HUM 299 40.51	18.40	
3	299	S	HUM 299 38.83 / HUM 299 38.995	18.36	
3	299	S	HUM 299 40.277 / HUM 299 40.51	18.36	
3	1	P	MEN 1 30.604 / MEN 1 32.011	18.27	
3	1	P	MEN 1 34.376 / MEN 1 35.245	18.27	
3	1	P	MEN 1 4.609 / MEN 1 4.825	18.27	
3	1	P	MEN 1 90.652 / MEN 1 90.792	18.27	
3	1	P	MEN 1 R25.271 / MEN 1 R25.525	18.27	
3	1	P	MEN 1 R49.184 / MEN 1 R49.445	18.27	
3	1	P	SON 1 58.578 / MEN 1 0.591	18.27	
3	20	P	LAK 20 12.612 / LAK 20 30.681	18.07	
3	20	P	LAK 20 8.692 / LAK 20 12.003	18.07	
3	20	P	MEN 20 R33.159 / MEN 20 R33.159	18.07	
3	222	P	MEN 222 1.56 / MEN 222 2.004	17.76	
3	20	S	LAK 20 11.001 / LAK 20 11.215	17.55	
3	20	S	LAK 20 13.359 / LAK 20 14.53	17.55	
3	20	S	LAK 20 16.829 / LAK 20 17.849	17.55	

Priority	Route	Carriageway[42]	From County & Postmile / To County & Postmile[43]	Average Cross-Hazard Prioritization Score[44]	Priority Override
3	20	S	LAK 20 27.812 / LAK 20 28.86	17.55	
3	20	S	LAK 20 29.296 / LAK 20 29.568	17.55	
3	20	S	LAK 20 8.692 / LAK 20 9.355	17.55	
3	253	P	MEN 253 7.378 / MEN 253 17.18	17.53	
3	128	P	MEN 128 23.041 / MEN 128 R28.021	17.47	
3	175	P	LAK 175 27.43 / LAK 175 28.038	17.13	
3	175	P	MEN 175 0.045 / MEN 175 1.21	17.13	
3	162	P	MEN 162 30.847 / MEN 162 31.498	17.07	
3	101	S	HUM 101 85.837 / HUM 101 86.097	7.55	Yes
3	101	S	MEN 101 10.888 / MEN 101 11.019	7.55	Yes
3	101	S	MEN 101 R43.733 / MEN 101 R44.933	7.55	Yes
3	101	P	DN 101 24.406 / DN 101 25.181	4.70	Yes
3	101	P	DN 101 25.731 / DN 101 25.839	4.70	Yes
3	101	P	MEN 101 10.888 / MEN 101 11.02	4.70	Yes
3	101	P	MEN 101 R43.718 / MEN 101 R48.438	4.70	Yes
4	96	P	HUM 96 0 / HUM 96 12.444	16.83	
4	162	P	MEN 162 30.68 / MEN 162 30.847	16.81	
4	175	P	LAK 175 R5.059 / LAK 175 6.83	16.68	
4	175	P	MEN 175 1.21 / LAK 175 0.193	16.68	
4	128	P	MEN 128 46.494 / MEN 128 49.652	16.67	
4	96	S	HUM 96 12.408 / HUM 96 12.535	16.52	
4	1	P	MEN 1 11.886 / MEN 1 R13.031	11.44	
4	1	P	MEN 1 24.547 / MEN 1 24.824	11.44	
4	1	P	MEN 1 3.643 / MEN 1 4.27	11.44	
4	1	P	MEN 1 33.215 / MEN 1 33.711	11.44	
4	1	P	MEN 1 33.911 / MEN 1 34.376	11.44	
4	1	P	MEN 1 43.548 / MEN 1 44.277	11.44	
4	1	P	MEN 1 46.512 / MEN 1 47.194	11.44	
4	1	P	MEN 1 6.483 / MEN 1 7.442	11.44	
4	1	P	MEN 1 7.718 / MEN 1 9.024	11.44	
4	1	P	MEN 1 70.346 / MEN 1 72.107	11.44	
4	1	P	MEN 1 77.188 / MEN 1 77.549	11.44	
4	1	P	MEN 1 78.116 / MEN 1 78.382	11.44	
4	1	P	MEN 1 88.421 / MEN 1 90.652	11.44	
4	1	P	MEN 1 9.119 / MEN 1 9.756	11.44	
4	1	P	MEN 1 R10.546 / MEN 1 11.421	11.44	
4	1	P	MEN 1 R25.019 / MEN 1 R25.271	11.44	
4	200	P	HUM 200 R0.009 / HUM 200 R0.366	11.37	

Priority	Route	Carriageway[42]	From County & Postmile / To County & Postmile[43]	Average Cross-Hazard Prioritization Score[44]	Priority Override
4	101	S	DN 101 44.96 / DN 101 45.13	11.02	
4	101	S	DN 101 9.684 / DN 101 9.833	11.02	
4	101	S	DN 101 R5.722 / DN 101 7.713	11.02	
4	101	S	HUM 101 72.036 / HUM 101 72.656	11.02	
4	101	S	HUM 101 75.908 / HUM 101 76.076	11.02	
4	101	S	HUM 101 76.076 / HUM 101 76.286	11.02	
4	101	S	HUM 101 76.295 / HUM 101 76.558	11.02	
4	101	S	HUM 101 76.76 / HUM 101 77.228	11.02	
4	101	S	HUM 101 78.393L / HUM 101 78.422L	11.02	
4	101	S	HUM 101 98.08 / HUM 101 98.36	11.02	
4	101	S	MEN 101 39.456 / MEN 101 R43.733	11.02	
4	101	P	DN 101 13.265 / DN 101 20.274	10.82	
4	101	P	DN 101 25.507 / DN 101 25.731	10.82	
4	101	P	DN 101 26.435R / DN 101 26.898	10.82	
4	101	P	DN 101 41.42 / DN 101 42.275	10.82	
4	101	P	DN 101 44.96 / DN 101 45.254	10.82	
4	101	P	DN 101 7.591 / DN 101 9.738	10.82	
4	101	P	HUM 101 107.258 / HUM 101 109.275	10.82	
4	101	P	HUM 101 116.872 / HUM 101 119.584	10.82	
4	101	P	HUM 101 70.904 / HUM 101 71.866	10.82	
4	101	P	HUM 101 72.215 / HUM 101 72.664	10.82	
4	101	P	HUM 101 75.99 / HUM 101 76.31	10.82	
4	101	P	HUM 101 77.137 / HUM 101 77.228	10.82	
4	101	P	HUM 101 85.831 / HUM 101 86.093	10.82	
4	101	P	MEN 101 3.257 / MEN 101 R6.008	10.82	
4	101	P	MEN 101 40.426 / MEN 101 R43.718	10.82	
4	101	P	MEN 101 R106.696 / HUM 101 R5.41	10.82	
4	101	P	MEN 101 R48.438 / MEN 101 54.313	10.82	
4	20	P	MEN 20 42.54 / LAK 20 2.669	10.30	
4	20	P	MEN 20 R33.154 / MEN 20 R33.159	10.30	
4	20	S	MEN 20 R33.159 / MEN 20 R33.159	9.38	
4	299	P	HUM 299 30.573 / HUM 299 33.351	8.71	
4	299	P	HUM 299 33.933 / HUM 299 34.05	8.71	
4	101U	S	MEN 101U 0.641 / MEN 101U 99.431	8.17	
4	101U	P	MEN 101U 0.641 / MEN 101U 99.782	8.16	
4	29	P	LAK 29 25.124 / LAK 29 32.015	8.00	
5	255	P	HUM 255 0.058 / HUM 255 0.074	48.42	Yes
5	255	P	HUM 255 0.11 / HUM 255 8.641	48.42	Yes

Priority	Route	Carriageway[42]	From County & Postmile / To County & Postmile[43]	Average Cross-Hazard Prioritization Score[44]	Priority Override
5	255	S	HUM 255 0.027 / HUM 255 0.074	36.68	Yes
5	255	S	HUM 255 4.584 / HUM 255 R5.031	36.68	Yes
5	255	S	HUM 255 7.407 / HUM 255 8.791	36.68	Yes
5	222	P	MEN 222 2.004 / MEN 222 2.153	28.13	Yes
5	222	P	MEN 222 L0.412 / MEN 222 L0.52	28.13	Yes
5	222	P	MEN 222 R0.155 / MEN 222 1.56	28.13	Yes
5	281	P	LAK 281 17 / LAK 281 14	11.18	Yes
5	200	P	HUM 200 R0.366 / HUM 200 2.19	10.99	Yes
5	299	P	HUM 299 33.351 / HUM 299 33.933	4.33	
5	299	S	HUM 299 33.351 / HUM 299 33.933	4.33	
5	29	P	NAP 29 48.579 / LAK 29 5.639	3.26	
5	20	P	LAK 20 12.003 / LAK 20 12.612	1.99	
5	20	P	MEN 20 30.826 / MEN 20 R33.159	1.99	
5	253	P	MEN 253 0 / MEN 253 7.378	1.41	
5	20	S	LAK 20 12.003 / LAK 20 12.223	1.37	
5	175	P	LAK 175 0.193 / LAK 175 R5.059	0.94	
5	175	P	LAK 175 22.089 / LAK 175 27.43	0.94	
5	175	P	LAK 175 8.254 / LAK 175 15.461	0.94	
5	128	P	MEN 128 17.44 / MEN 128 23.041	0.90	
5	128	P	MEN 128 49.652 / MEN 128 50.902	0.90	
5	128	P	MEN 128 R28.021 / MEN 128 46.494	0.90	
5	254	P	HUM 254 0 / HUM 254 7.988	0.77	
5	128	S	MEN 128 28.414 / MEN 128 R28.118	0.77	
5	96	S	HUM 96 12.535 / HUM 96 12.86	0.40	
5	96	P	HUM 96 12.444 / HUM 96 12.87	0.37	
5	96	P	HUM 96 12.909 / HUM 96 20.916	0.37	
5	96	P	HUM 96 38.076 / HUM 96 R38.728	0.37	
5	96	P	HUM 96 R39.654 / HUM 96 R44.979	0.37	
5	162	P	MEN 162 5.934 / MEN 162 23.856	0.29	
5	271	P	MEN 271 16.947 / HUM 271 T0.306	0.10	
5	1	P	MEN 1 90.792 / MEN 1 95.23	0.00	

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