

REMINDER: Please return completed worksheet by the end of the workshop.

IRWM Climate Change Workshop Climate Change Vulnerability Assessment Worksheet

Name: _____

Organization/Affiliation: _____

City/Town: _____

The draft answers in this handout come from a draft technical memo prepared by County of San Luis Obispo Public Works staff in collaboration with Water Systems Consulting, Inc (WSC) to develop the climate change vulnerability assessment for the 2018 IRWM Plan update.

This document is designed for the IRWM Climate Change Workshop to collect comments/responses from stakeholders. Copies of this handout will be available at the workshop.

Water Demand

1. Are there major industries that require cooling/process water in your planning region?

Several prominent industries in San Luis Obispo County require water for their operations. Notable industries include wineries, breweries, hospitals, energy production, and education. Additionally, agriculture is a major industry throughout the County and has a significant water demand for irrigation and other processes.

North Coast Subregion

Cuesta College requires water to maintain operations and serve its students and staff. Similarly, the California Men's Colony requires water to serve its residents and maintain operations. Wineries along the North Coast also contribute to the industrial water demand in the subregion.

North County Subregion

Wineries and vineyards throughout the North County have large water demands for growing and wine production. Another major industrial water use in the subregion is process water required by breweries. The Atascadero State Hospital and other hospitals are notable industrial water users in the subregion.

South County Subregion

The Diablo Canyon Power Plant requires cooling and process water for its operations. The Santa Maria Refinery in Nipomo is a major industrial water user. Cal Poly San Luis Obispo has a significant water demand to maintain operations and serve its students and staff. There are also several breweries throughout the South County Subregion that require water for the brewing process. Hospitals, including Sierra Vista Regional Medical Center and French Hospital Medical Center, are another prominent industry in the subregion that requires process water.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you agree think should be included in the final responses to the indicator questions.

- The hotel industry is major water user requiring water for laundry facilities.
- The Arroyo Grande Oil Field uses large amounts of water during oil pumping.

- Details about the agricultural water use in each subregion should be added.
- Mission Linen, Culligan, and Casa de Flores are notable industrial water users in Morro Bay.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Does water use vary by more than 50% seasonally in parts of your region?

North Coast Subregion

Seasonal water use is affected by tourism and agriculture in the North Coast Subregion. San Simeon CSD and Cambria CSD both have a noticeably higher water demand from June to October.

North County Subregion

Seasonal water use is affected by agriculture in the North County Subregion. Templeton CSD, Atascadero MWC, and the City of Paso Robles all have significantly lower water demands during winter months.

South County Subregion

Seasonal water use is affected by agriculture and tourism in the South County Subregion. The City of Pismo Beach, City of Arroyo Grande, and Oceano CSD all have significantly lower water demands during winter months. In the City of San Luis Obispo, seasonal water demand is impacted by the fluctuating student population at Cal Poly.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Nipomo CSD has a significantly lower water demand in winter months.
- Arroyo Grande has less than a 15% difference in water use between summer and winter.
- San Simeon CSD water usage varies by 50% or more seasonally due to tourism.
- Los Osos CSD has a significant difference in seasonal water demand, but it is not more than 50%.
- During the summer, the City of San Luis Obispo experiences an increase in irrigation water use but a decrease in domestic water use with the absence of Cal Poly students. Overall, seasonal water use does not vary by more than 50%.
- As a whole, water use in the North County Subregion is significantly lower during the winter season.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?

The highest ranked crops by dollar amount are grapes/wine, vegetables, strawberries, avocados, broccoli, and cattle/calves, all which are climate sensitive. The total value of agricultural production in 2016 was over \$900 million. A report by the USDA determined San Luis Obispo County had a high crop vulnerability ranking.

- While grapes are relatively drought tolerant crops, they are sensitive to temperature and other climate-related factors. The quality of wine grapes is especially sensitive to climate, and increased temperatures could significantly reduce the quality and economic value of wine grapes.
- Cattle production decreased 36% from 2015 to 2016 due largely to the decrease in rangeland caused by the drought.
- Strawberries are extremely sensitive to soil salinity. Increasing salt levels in soil would decrease growth rate and fruit yield of strawberries as well as increase irrigation demands for soil leaching. Additionally, strawberries are sensitive to fungal diseases and unusually warm temperatures.
- Broccoli is moderately climate sensitive. Broccoli has a narrow temperature range of 60 to 65°F and is harmed by temperatures exceeding 80°F. The vegetable is also sensitive to invertebrate pests and bacterial and fungal diseases, which are likely to pose a greater risk with increased temperatures.
- Avocados are a highly climate sensitive crop requiring wet conditions. Avocados need large amounts of water and frequent irrigation, and their sensitivity to soil salinity could increase this already high water demand. The fruit is sensitive to cold weather and can die during a freeze, but increased fall temperatures could also decrease avocado yields.

North Coast Subregion

Avocados, grapes, and berries are all grown in the North Coast Subregion.

North County Subregion

The primary crop in the North Coast Subregion is wine grapes. The cattle industry is also prominent in this subregion.

South County Subregion

Strawberries and grapes are some of the major crops grown in the South County Subregion.

Note: Some members of the San Luis Obispo County Farm Bureau reviewed this draft answer and generally considered it to be sufficient, including some of the comments below.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Grapes are extremely sensitive to frost and cold temperatures.
- Changes in air temperature and decreased humidity can cause respiratory problems for cattle.
- Avocados should be included as a prominent crop in the South County Subregion.
- While other changes could be stressful, increased air temperature could be beneficial for avocados.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Do groundwater supplies in your region lack resiliency after drought events?

North Coast Subregion

Multiple groundwater basins in the subregion (some of the largest/highest yield and storage capacity basins) have a Level I (2 basins) or Level III (2 basins) severity rating as assigned by the SLO County Planning Department. These basins experience reduced recharge and ability to meet demand during drought conditions. About 50% of the North Coast’s urban water supply is from groundwater (2014 IRWMP).

North County Subregion

The Paso Robles Basin, the largest and highest yielding basin in the subregion, is a critically over-drafted basin. The groundwater basins in this subregion have low storage and difficulty meeting demands especially during drought events (2014 IRWMP). About 70% of the North County water supply is from groundwater (2014 IRWMP).

South County Subregion

The Cuyama Valley Basin is a critically over-drafted basin, and the Santa Maria Valley Basin is a high priority basin (DWR). Droughts reduce basin recharging and the ability of the basin to meet demand. About 30% of the South County water demand is supplied by groundwater (2014 IRWMP).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Drought conditions make groundwater basins more susceptible to salt water intrusion and often result in increased chloride levels. This has been witnessed in groundwater wells in Los Osos.
- Nipomo CSD is unique in that it obtains 50-100% of its water supply from groundwater.
- San Simeon CSD is dependent on a single creek basin, which is susceptible to adverse effects of drought events.
- The City of San Luis Obispo does not rely heavily upon groundwater to meet water demand.

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Are water curtailment measures effective in your region?

A local drought emergency was enacted in SLO County from 2014 through 2017 that restricted water usage and required acquiring alternate water sources while reservoir levels were allowed to recover. *More information is needed about curtailment measures and their results.*

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- While curtailment measures in Nipomo were successful in reducing groundwater pumping by 50%, they did not result in a significant increase in the groundwater level.
- The US-LT RCD developed the Agricultural Water Offset program, which limited the establishment of new irrigated lands in Paso Robles Groundwater Basin, but this did not necessarily prevent new groundwater pumping operations outside of the basin boundary.
- Efforts in the City of Paso Robles during the recent drought were effective in reducing per capita water use.
- Los Osos CSD implemented a Water Shortage Contingency Plan during the recent drought, and water usage dropped to 50 gallons per day per capita.
- Restrictions on outdoor water use in the City of San Luis Obispo have been effective at reducing the city's water consumption.
- The City of Arroyo Grande successfully curtailed water use by 35% from 2013 to 2016.

Please provide any additional suggestions to revise, add to, or update the draft response:

6. Are some instream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?

A study completed by Stillwater Sciences in 2014 determined the minimum instream seasonal flow requirements needed to sustain basic aquatic systems for stream systems throughout the County. Central coast steelhead trout were used as the indicator species for this study. Based on a 2017 report by the Central Coast Salmon Enhancement, there are streams within all three subregions that did not meet these minimum flow requirements in the past two years. In 2016, only 14 percent of the sites measured met spring flow requirements, and only 17 percent of measured sites met summer flow requirements (CCSE).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Some river and stream systems experience extended periods of no surface flow making steelhead swimming and spawning impossible. An alternate method for determining instream flow requirements may need to be developed for these water bodies.
- Instream flow conditions could be doubly impacted by climate change as streamflow is affected by changes in precipitation patterns as well as by changes in water use.

Please provide any additional suggestions to revise, add to, or update the draft response:

Water Supply

1. Does a portion of the water supply in your region come from snowmelt? Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?

North Coast Subregion

The City of Morro Bay, California Men’s Colony, Cuesta College, and County Operations Center all receive water from the State Water Project (SWP).

North County Subregion

Shandon has a water service amount of 100 AFY from the SWP.

South County Subregion

The City of Pismo Beach, Oceano CSD, Avila Beach CSD, Avila Valley MWC, San Miguelito MWC, and San Luis Coastal USD all receive water from the SWP.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?

North Coast Subregion

The Pico Creek Valley, San Simeon Valley, Chorro Valley, Morro Valley, and Los Osos Valley Basins have all encountered sea water intrusion and are water supply sources for the subregion (SLO 2014 IRWMP).

North County Subregion

There are no coastal aquifers in this subregion.

South County Subregion

The Avila Valley Sub-basin and Santa Maria Valley Basin have both experienced sea water intrusion and serve as water supply sources for the subregion (SLO 2014 IRWMP).

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Would your region have difficulty storing carryover supply surpluses from year to year?

Surplus supplies of State Water can be stored via San Luis Reservoir, which is operated by DWR and the Central Valley Project. State water contracts limit the quantity of water allowed to be stored by each contractor, and stored water is subject to spills based on the amount of water in the SWP system.

North County Subregion

The Salinas Reservoir, overseen by the City of San Luis Obispo, is limited in its ability to store new inflow due to criteria set forth by the SWRCB which only allow for new inflow to be stored when there is a live stream in the Salinas River. Monterey County operates and maintains the Nacimiento Reservoir. The District and the contractors of Nacimiento Water have contracts for water but no rights to storage.

South County Subregion

It is possible to store carryover supplies in Lopez Reservoir but only when the water level reaches 40.5% capacity (20,000 AF). The Low Reservoir Response Plan (LRRP) allows agencies to carryover any of their unused annual entitlement for future use when reservoir levels are low. The LRRP allows for reduced entitlement deliveries as well as reduced downstream releases to preserve or stretch out supplies for up to 2-3 years. When the LRRP is not in effect, agencies occasionally have access to surplus water but can only use it in that same year; they cannot store it for use in future years.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- San Simeon has no way of carrying over supply surpluses.
- Supply surpluses in Shandon are stored in San Luis Reservoir and experience significant losses through evaporation.
- Groundwater storage is the only possible storage option in Nipomo.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Has your region faced a drought in the past during which it failed to meet local water demands?

During water years 2014 and 2015, due to statewide drought conditions, the State Water Resources Control Board (SWRCB) curtailed post-1914 tributary water rights to the Sacramento-San Joaquin Delta. A local drought emergency was in effect from 2014-2017 during which time alternate water sources were needed.

More information is needed about sub-regional drought impacts.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Even during droughts, San Simeon has never exceeded 70% of our available Pico Creek Basin capacity.
- In Nipomo, recent drought conditions have contributed to groundwater levels at record lows.
- State Water Project water has experienced increased salt levels during drought conditions, which resulted in violation of water quality standards in the Chorro Valley Water System.
- To ensure water demand could be met during drought conditions, the City of San Luis Obispo has added water sources and long-standing water conservation programs.

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?

The 2014 San Luis Obispo County Watersheds Management Plan determined that invasive species identification and assessment as a county-wide priority data gap. The California Invasive Plant Council has recognized areas of spreading invasive species in all three of the County’s subregions. Yellow star thistle, veldt grass, and arundo are three invasive species with notable management issues in San Luis Obispo County. Mitigation sites are especially vulnerable to invasive species management issues. *More information about invasive species management is currently being obtained from the County of SLO Environmental Division.*

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- There has been a significant increase in the overall size of acres covered by invasive species in local watersheds.
- Chorro Reservoir is at risk of arundo management issues.
- Invasive mussels in reservoirs are a concern.
- Cape Ivy in the Morro Bay watershed has been an invasive species of special concern.

Please provide any additional suggestions to revise, add to, or update the draft response:

Water Quality

1. Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?

According to the Cal-Adapt Wildfire: Fire Risk Map, the SLO County IRWM Planning Region may experience a slight increase in annual mean hectares burned by wildfire (Cal Fire).

North Coast Subregion

The risk of wildfires near Whale Rock Reservoir are a significant contamination risk to the water supply (“Whale Rock” 18). The major source of contamination for the water body is sedimentation from erosion, which would be exacerbated by wildfires in the nearby area (“Whale Rock” 1).

North County Subregion

The Nacimiento Reservoir is in an area with a high risk of wildfires, and possible wildfires pose a threat to the water quality in the reservoir (“Nacimiento Reservoir” 1). Similarly, wildfires are a risk in the nearby areas of the Salinas Reservoir and threaten water quality (Cal Fire).

South County Subregion

Large amounts of dry brush have been noted throughout the Lopez Lake watershed and contribute to the significant risk of potential contamination due to wildfires (“Lopez Lake” 2). Wildfires would lead to increased sedimentation and add stress to other water quality concerns within the reservoir.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Dead trees and large areas of dry bush create a wildfire threat to water bodies throughout the North Coast Subregion – not just Whale Rock Reservoir.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?

North Coast Subregion

The San Simeon, Cayucos Creek, and Morro Bay Watersheds all have low dissolved oxygen, among other water quality issues (SLO 2014 IRWMP). Cattle grazing in the Whale Rock Reservoir watershed has been linked to increased turbidity and nutrient levels in the area’s water bodies (“Whale Rock” 1). These conditions encourage algal blooms and are worsened in times of drought and high temperatures.

North County Subregion

Middle Salinas-Atascadero and Cholame Creek Watersheds have low dissolved oxygen (SLO 2014 IRWMP). The Nacimiento Reservoir has a recent trend of high algal levels in summer months. Increased

erosion, drought conditions, and high temperatures all contribute to harmful levels of algae growth in the reservoir (“Nacimiento Reservoir” 27-28). Similarly, the recent drought conditions resulted in record high levels of nutrients in the Salinas Reservoir, which has contributed to a trend of high algae levels in warm summer and fall months (“Salinas Reservoir” 12).

South County Subregion

San Luis Obispo Creek and Pismo Creek Watersheds have low dissolved oxygen. San Luis Obispo Creek and Santa Maria River have chlorpyrifos and other water quality issues (SLO 2014 IRWMP). The Lopez Lake Reservoir experienced harmful algal blooms during the recent drought conditions and has a recorded trend of algae spikes during warm summer months (“Lopez Lake” 14).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Bacteria impairment can be exacerbated by warm temperatures, which accelerates the growth of bacteria. Water bodies with bacteria impairment include Morro bay estuary, Chorro Creek, Los Osos Creek and Warden Creek.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Are seasonal low flows decreasing for some water bodies in your region? If so, are the reduced low flows limiting the water bodies' assimilative capacity?

More information is needed about assimilative capacity.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- There is a declining trend in seasonal low flows throughout the County. During these low flow periods, water quality and ecosystem processes are highly sensitive to minor alterations.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?

Beneficial uses are identified by the Watershed Management Planning Project Report for all but one of the watersheds in the region. It is unclear if these beneficial uses are unable to be met due to water quality issues (SLO 2014 IRWMP).

More information is needed about any disruptions to beneficial uses.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Swimming and oyster harvesting in the back bay of the Morro Bay watershed have been limited in the past due to bacteria levels.

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?

Runoff into Whale Rock Reservoir (Cayucos Water Treatment Plant) and Lopez Lake (Lopez Water Treatment Plant) brings sediment into the reservoirs causing turbidity levels to rise. This can dramatically affect the treatability of the water source and increase the risk of exposure to water borne illnesses due to Cryptosporidium, Giardia, and E. Coli as chlorine and filtration demands are elevated during these times. It typically takes several big storms to see such a result in water quality at the water treatment plants, and it can take days for the turbid water to reach the end of the reservoir where water is distributed to the water treatment plants. Fortunately, County facilities can handle these changes to the water source and have not had a violation because of turbidity breakthrough or low chlorine after such rain events.

Storm runoff similarly affects Nacimiento Lake and Salinas Reservoir and treatment facilities in the City of Paso Robles and City of San Luis Obispo, respectively, must respond to the water quality shifts.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Heavy rains in San Simeon led to the addition of a filtration system to handle increased contamination.

Please provide any additional suggestions to revise, add to, or update the draft response:

Sea Level Rise

1. Has coastal erosion already been observed in your region?

North Coast Subregion

Coastal erosion has been observed within the North Coast Subregion; however, the shoreline trends vary across the region and over time. A USGS study found that in the short-term over 80% of the subregion is experiencing net erosion (Hapke 50).

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

The South County Subregion has experienced notable coastal erosion. Coastal bluffs in Pismo Beach are experiencing erosion rates of six to eight inches per year, which resulted in the construction of a sea wall in 2017 (LA District US Army Corps of Engineers 17). Avila Beach is also using a sea wall to protect roads and infrastructure from coastal erosion (Wallace Group).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- San Simeon has been forced to add armoring to the shoreline to protect beach access and the waste water treatment plant.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Are there coastal structures, such as levees or breakwaters, in your region?

North Coast Subregion

Coastal structures along the North Coast include the San Simeon Pier, Cayucos Pier, and Morro Bay breakwaters.

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

The Arroyo Grande Creek Channel Levee located in the South County Subregion is intended to mitigate flooding. Other notable coastal structures along the South Coast include the Port San Luis breakwater, Harford Pier, Unocal Pier, Avila Beach Pier, and Pismo Beach Pier.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Is there significant coastal infrastructure, such as residences, recreation, water and wastewater treatment, tourism, and transportation at less than six feet above mean sea level?

San Luis Obispo County Planning Department is currently working on a study that will provide information about specific infrastructure at risk from sea level rise.

North Coast Subregion

Based off the NOAA Sea Level Rise Viewer, roads and infrastructure within areas of San Simeon, San Simeon Ranch, and Los Osos would be impacted by six feet of sea level rise.

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

Based off the NOAA Sea Level Rise Viewer, roads and infrastructure near Pismo State Beach would be impacted by six feet of sea level rise.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Morro Bay harbor and Embarcadero area and Morro Bay State Park should be added to the North Coast Subregion description.
- The South SLO County Wastewater Treatment Plant and the railroad should be added to the South County Subregion description.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Are there climate-sensitive low-lying coastal habitats in your region?

North Coast Subregion

The US Fish and Wildlife Service has designated several Critical Habitats throughout the North Coast Subregion; these federally recognized areas are considered essential for the survival of an endangered or threatened species. Critical Habitats along the North Coast have been recognized for the following species: Steelhead, California red-legged frog, Banded dune snail, Western snowy plover, Morro Bay kangaroo rat, and Tidewater goby. Morro Bay Estuary, in particular, is home to multiple fully protected species and is one of 28 areas protected through the EPA's National Estuary Program.

North County Subregion

There are no coastal habitats in this region.

South County Subregion

The coastal area of the South County Subregion also contains several Critical Habitats. Endangered and threatened species dependent on coastal habitats along the South Coast include Tidewater goby, Steelhead, La Graciosa thistle, and Western snowy plover (“ECOS”). Pismo Beach is also home to a Monarch Butterfly Grove – a species which is currently under review for protection under the Endangered Species Act (“Monarch butterfly”).

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Are there areas in your region that currently flood during extreme high tides or storm surges?

More information is needed about sub-regional historic flooding.

South County Subregion

Pismo Beach experienced flooding during storm surges in 2016 that resulted in closing the pier (KSBY).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- During previous storm surges, Pico Creek lagoon has experienced salt water intrusion.
- In the past, storm events have caused flooding of the Oceano Lagoon and Highway 1 in Oceano.
- During king tides, the water level in Morro Bay is just inches below docks and waterfront restaurants. Additionally, many popular coastal areas in Morro Bay State Park are completely underwater.

Please provide any additional suggestions to revise, add to, or update the draft response:

6. Is there land subsidence in the coastal areas of your region?

The only land subsidence that has been observed in the coastal areas of San Luis Obispo County occurred in and around Oceano due to the December 2003 San Simeon Earthquake. The land subsidence was a result of liquefaction during shaking by the earthquake.

Please provide any additional suggestions to revise, add to, or update the draft response:

7. Do tidal gauges along the coastal parts of your region show an increase over the past several decades?

North County Subregion

It can be assumed that sea level trends in the North County Subregion are similar to those studied at Port San Luis and other surrounding areas. Nearby studies indicate the mean sea level is increasing along California’s central coast (“Sea Level Trends”).

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

According to NOAA’s Tides and Currents Sea Level Trends gauge for Port San Luis, the change in mean sea level is 0.84 mm/year with a 95% confidence interval. This calculation is based off data from 1945 to 2016 and is equivalent to a change of 0.28 feet in 100 years (“Sea Level Trends”).

Please provide any additional suggestions to revise, add to, or update the draft response:

Flooding

1. Does aging critical flood protection infrastructure exist in your region?

More information is needed about aging flood protection infrastructure.

South County Subregion

The Arroyo Grande Creek Channel Levee was constructed in 1961 to reduce flooding in the area (SLO Flood Control District). The Diablo Canyon Nuclear Power Plant located along the coast has critical flood protection infrastructure.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- The flood control gates on Oceano Lagoon are aging.
- Old and damaged drainage projects and flood protection infrastructure are present throughout the North County Subregion leaving the area vulnerable to flooding.
- Much of the City of San Luis Obispo’s downtown corridor has creeks and waterways with aging infrastructure.

- The Chorro Dam and spillway should be added to the North Coast Subregion description.
- Two 1940-era Chorro Creek bridges within the California Men’s Colony (CMC) are susceptible to collapse and/or obstruction from high water flows and flood debris leading to flooding and restricted access to the West Facility of CMC.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Have flood control facilities (such as impoundment structures) been insufficient in the past?

North Coast Subregion

Flood control and drainage studies were completed by RMC, Inc. for several communities in the North Coast Subregion in 2004. The study in Cambria revealed there were insufficient underground drainage facilities and improved organization and maintenance of the area’s flood control facilities was necessary (“Cambria” i). In Cayucos, a lack of initial drainage infrastructure when development began was identified as a major reason for the lack of necessary drainage facilities and frequent street flooding (“Cayucos” i). The study showed that the railroad in San Miguel was preventing runoff to the Salinas River and causing flooding (“San Miguel” ii). Additionally, a lack of curbs and gutter systems were contributing to road flooding (“San Miguel” i). In Santa Margarita, inadequate culverts and drainage structures blocked by sedimentation and debris resulted in flood risks (“Santa Margarita” i). Another study done in 1997 determined that development in Los Osos without rerouting of drainage facilities had led to poor flood control in the area (Engineering Development Associates ES-1).

North County Subregion

The Templeton Drainage and Flood Control Study completed in 2014 identified several insufficient flood control facilities, including culverts along Highway 101, Main Street, and Arizona Crossing as well as restricted conveyance capacity in the Toad Creek Channel due to vegetation and sedimentation (13-16).

South County Subregion

RMC, Inc. performed flood control and drainage studies in 2004 for several communities in the South County Subregion. The Nipomo study revealed Mesa area flooding was due to development locking existing runoff flow paths and flooding in Olde Towne was the result of insufficient culverts (“Nipomo” i-ii). In Oceano, the study found stormwater was not considered during the community’s initial development and that resulted in insufficient drainage facilities and frequent flooding of roads (“Oceano” i). Additionally, the Arroyo Grande Creek Channel Levee was breached in 2001 and hundreds of acres were flooded (SLO Flood Control District).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Floodplains throughout the County lack protective infrastructure and have a history of flooding.
- San Simeon lacks an adequate storm drainage system. Private storm drains currently provide most of the flood protection.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Are wildfires a concern in parts of your region?

There are areas within all three subregions determined as Very High Fire Hazard Severity Zones by Cal Fire.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- San Simeon lacks adequate fire protection for homes and businesses. There is not enough water storage nor fire flow to protect structures.
- Our community does not do a good job clearing dead trees, snags, piles of limbs, wood chips, etc.
- The West Facility of the California Men’s Colony is a 1940-era Army Hospital composed of highly flammable wooden materials and is located adjacent to areas susceptible to wildfire.

Please provide any additional suggestions to revise, add to, or update the draft response:

Ecosystems and Habitats

1. Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?

North Coast Subregion

Increased sedimentation can cause shallower and warmer water, and in some cases, loss of estuaries. Morro Bay shorebird habitats have been identified as at-risk of these disrupting effects. Many species including snowy plovers, least terns, brown pelicans, and brant are expected to lose habitat and resources (Koopman 31). Additionally, Steelhead, California red-legged frog, Morro shoulderband snail, and Morro kangaroo rat Critical Habitats in the North Coast are vulnerable to the effects of erosion and sedimentation (“ECOS”).

North County Subregion

The Salinas River has already been impacted by increased sedimentation (Koopman 31). This sedimentation has degraded riparian habitats including areas designated as a Critical Habitat for Steelhead and California red-legged frog and supports numerous other special status species (“ECOS”).

South County Subregion

Increased sedimentation and coastal erosion could disrupt Critical Habitats for Steelhead, California red-legged frogs, Western snowy plover, and La Graciosa thistle in the South County (Koopman 31). The Pismo Beach area is especially at risk of coastal erosion and flooding.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- The Morro Bay estuary salt marsh is a critical habitat that has already been impacted by sedimentation and effects will likely be complicated by sea level rise.
- Eelgrass beds are another Morro Bay habitat that can be adversely impacted by increased sedimentation. Eelgrass beds are critical fish habitats and contribute to cleaner, clearer water in the bay.
- Chorro Reservoir’s sedimentation has impacted habitats in and near the reservoir, including the Morro Bay Estuary.

Please provide any additional suggestions to revise, add to, or update the draft response:

2. Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?

North Coast Subregion

Morro Bay Estuary is an important coastal habitat supporting a diverse community of species, many of which have special species status, and is dependent on seasonal flow patterns (US-LT RCD). Several other river and stream mouths along the North Coast are dependent on seasonal flow patterns.

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

San Luis Obispo Creek, Pismo Creek, and Arroyo Grande Creek all form estuarine habitats dependent on seasonal flows and that support federally protected species (US-LT RCD).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Non-point and point sources of watershed pollution result in fecal coliform and other forms of contamination in estuaries.
- Morro Bay estuary is impacted by changes in freshwater flow. Understanding of specific impacts is limited, but the Morro Bay National Estuary Program is currently researching and monitoring impacts on eelgrass.

Please provide any additional suggestions to revise, add to, or update the draft response:

3. Do climate-sensitive fauna or flora populations live in your region?

North Coast Subregion

The elfin forests and estuary in Morro Bay are sensitive to climate change impacts, such as changes in fog, sea level rise, sedimentation, and drought (Koopman 31). These areas support various special status species that are at great risk of climate change impacts. Pine forests and woodlands along the North Coast are at risk of changing conditions that could make current habitats unsuitable, and their isolation from other suitable areas makes them especially vulnerable (Koopman 35).

North County Subregion

Carrizo Plain supports several climate-sensitive species, such as Pronghorn and Tule elk, which are at risk of declining grassland productivity and isolation from other suitable habitats (Koopman 37). The North County Subregion is also home to various endangered and threatened species that are at great risk of climate change impacts; these species include Steelhead, California tiger salamander, California red-legged frog, Longhorn fairy shrimp, Vernal pool fairy shrimp, Purple amole, and California condor ("ECOS").

South County Subregion

Steelhead and other protected species found in the coastal areas of the subregion are at risk of various climate change impacts that threaten the conditions required for suitable habitat ("ECOS"). Additionally, climate change effects could put new species at risk. For instance, higher temperatures and poor water quality could cause sea lions to be more susceptible to diseases (Koopman 31).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- Steelhead should be added as climate-sensitive fauna in the North Coast Subregion.

Please provide any additional suggestions to revise, add to, or update the draft response:

4. Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?

North Coast Subregion

Endangered Species: Smith's butterfly, Chorro Creek bog thistle, California clapper rail, Morro Bay kangaroo rat, Morro shoulderband snail, Tidewater goby, California seablite, Indian Knob mountain-balm, Marsh sandwort, Salt marsh bird's-beak, Southern Steelhead (US-LT RCD).

Threatened Species: Steelhead, California red-legged frog, Monterey spineflower, California black rail (CA), Beach spectaclepod (CA), Morro manzanita, Western snowy plover (US-LT RCD).

North County Subregion

Endangered Species: Blunt-nosed leopard lizard, Giant kangaroo rat, San Joaquin kit fox, Camatta Canyon amole, Kern mallow, Least Bell’s vireo, California condor, California jewel-flower, San Joaquin woollythreads, Longhorn fairy shrimp, Tipton kangaroo rat, Bald Eagle (CA), Santa Lucia mint (CA) (US-LT RCD).

Threatened Species: Bank swallow (CA), Swainson’s hawk (CA), California red-legged frog, Vernal pool fairy shrimp, Spreading navarretia, Nelson’s antelope squirrel (CA), California tiger salamander, Kern primrose sphinx moth, Camatta Canyon amole, Santa Lucia purple amole (CA), Steelhead (US-LT RCD).

South County Subregion

Endangered Species: California least tern, Tidewater goby, Gambel’s water cress, La Graciosa thistle, Marsh sandwort, Nipomo Mesa lupine, Pismo clarkia, California condor, Blunt-nosed leopard lizard, Giant kangaroo rat, Longhorn fairy shrimp, San Joaquin kit fox, California jewel-flower, Kern mallow, San Joaquin woollythreads, Chorro Creek bog thistle, Indian Knob mountain-balm, Pismo clarkia (US-LT RCD).

Threatened Species: California black rail (CA), California red-legged frog, California tiger salamander, Steelhead, Western snowy plover, Beach spectaclepod (CA), Surf thistle, Kern primrose sphinx moth, Nelson’s antelope squirrel (CA), Swainson’s hawk (CA), Vernal pool fairy shrimp, Western snowy plover, Morro manzanita, Surf thistle (US-LT RCD).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- California red-legged frog and Southern sea otter should be added to the North Coast Subregion description.

Please provide any additional suggestions to revise, add to, or update the draft response:

5. Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?

In 2015, the commercial fishing industry in San Luis Obispo County had a total revenue of \$10 million (County of SLO).

More information is needed about the economic activities that depend on aquatic habitats.

North Coast Subregion

Morro Bay and Montana de Oro State Parks and other coastal areas attract tourists and support water-related recreation. Similarly, Whale Rock Reservoir supports fishing and other recreation activities.

North County Subregion

Santa Margarita Lake supports water recreation activities. The Salinas River and other riparian habitats also support tourism and water recreation.

South County Subregion

Avila Beach, Pismo Beach, Oceano Dunes, and other coastal regions in the South County have a strong tourism industry. Whale Rock Reservoir also supports water-related recreation.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- The beach access stairway in San Simeon could be impacted by rising sea levels.
- Morro Bay economic activities include oyster farming (2 oyster farms), recreational and commercial fishing, fishing-related, fish markets and restaurants that sell local fish. There are now two shops in Morro Bay dedicated to stand-up paddling, as well as numerous kayak rentals shops and three bay tour boat operators. There is a growing number charter boats that do private sailing and fishing charters. Wildlife viewing also generates economic activity, such as the Morro Bay Winter Bird Festival.
- Chorro Reservoir supports recreation and other economic activities.

Please provide any additional suggestions to revise, add to, or update the draft response:

6. Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?

Stillwater Sciences completed an evaluation in 2014 of minimum instream seasonal flows required to sustain aquatic habitats for steelhead. This study determined minimum seasonal flow values required to support Steelhead habitats at 63 different analysis points across the Region (Stillwater Sciences 23-24).

Please provide any additional suggestions to revise, add to, or update the draft response:

7. Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?

Coastal storms bringing storm surges, waterspouts, and flooding are all possible and occur somewhat regularly along the San Luis Obispo County coastline. These events are often linked to atmospheric rivers.

North Coast Subregion

Areas at risk: Estero Bluffs State Park, Morro Bay National Estuary, Morro Bay State Park, William Randolph Hearst Memorial State Beach, San Simeon State Beach, Moonstone Beach, Cayucos Beach, Cayucos State Beach, Morro Strand State Beach, Harmony Headlands State Beach (SLO 2014 IRWMP).

North County Subregion

There are no coastal areas in this subregion.

South County Subregion

Areas at risk: Montana de Oro State Park, Port San Luis Pier and Beach, Avila State Beach, Pismo State Beach, Oceano Dunes State Vehicles Recreation Area, Guadalupe-Nipomo Dunes wetland complex (SLO 2014 IRWMP).

Please provide any additional suggestions to revise, add to, or update the draft response:

8. Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?

More information is needed about the fragmentation of aquatic habitats.

North Coast Subregion

Santa Rosa Creek experiences fish passage barriers due to infrastructure changes (SLO 2014 IRWMP).

South County Subregion

Arroyo Grande Creek experiences fish passage barriers, and Nipomo-Suey Creeks have habitat fragmentation due to development (SLO 2014 IRWMP).

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- The Salinas and Estrella Rivers are important corridors for aquatic and riparian species movement.
- There are many fish passage barriers in the Morro Bay watershed, including the South Bay Boulevard bridge.
- The Chorro Reservoir Dam is a fish passage barrier impacting steelhead. There is other infrastructure throughout Chorro Creek that creates barriers to fish passage.

Please provide any additional suggestions to revise, add to, or update the draft response:

Hydropower

1. Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in you region?

More information is needed about sub-regional future energy plans.

Comments submitted through the online survey have been paraphrased and included below. Please check the box beside any comments you think should be included in the final responses to the indicator questions.

- The City of San Luis Obispo is examining options for hydropower facilities.

Please provide any additional suggestions to revise, add to, or update the draft response: