



O. Climate Change Vulnerability Exercise

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GLAC-IRWMP

Climate Change Vulnerability Exercise



The GLAC IRWM Climate Change Subcommittee conducted an exercise to answer vulnerability questions taken from Box 4-1 of the *Climate Change Handbook* and associated the answers with potential water management issues/vulnerabilities. Table 1 summarizes the analysis. Qualitative vulnerability questions are framed to help assess resource sensitivity to climate change and prioritization of climate change vulnerabilities within a region. Answers to vulnerability questions are given for the GLAC Region with local examples provided as justification for the answer.

Table 1: Climate Change Vulnerability Indicator Questions

Vulnerability Question	Answer	Justification	Vulnerability Issue
Water Demand			
Are there major industries that require cooling/process water in your planning region?	N	Oil companies in southern harbor areas primarily use recycled water for cooling. Scattergood plus other OTC power plants use ocean water for cooling but OTC Policy moving plants off OTC. Aerospace industry needs cooling water, but is considered to be downsizing its presence in the Region.	Industrial demand would increase: increased cooling needs due to higher temperatures
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?	Y	There are some small-scale farming plots but no major agriculture. Nurseries may be vulnerable, but uncertain if decreasing in size.	Agricultural demand would increase: evapotranspiration will increase per unit of biomass due to higher temperatures



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Do groundwater supplies in your region lack resiliency after drought events?	N	Groundwater basins are relatively large in size and have replenishment requirements. During the last drought, however, Main San Gabriel Basin levels were in their lower range, but still had opportunity to recharge. The recharge potential of the Region's basins has not been fully realized and it is critical to further increase recharge so as to offset imported supply and provide longer term and seasonal storage.	Lack of groundwater storage: to buffer drought conditions
Are water use curtailment measures effective in your region?	Y	Demand has decreased as a result of conservation programs. Region is already concerned about meeting 20% by 2020 potable use reduction, even without climate change effects.	Decrease ability to meet conservation goals: due to saturation conservation programming or inability to conserve further
Does water use vary by more than 50% seasonally in parts of your region?	Y	Current climate requires a strong peak in summer demand for irrigation.	Limited ability to meet higher peaks in demand (both seasonally and annually): infrastructure sized to only existing demand peaks.
Are some in-stream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?	N	The Regional Board requires Tapia WRF to discharge to Malibu Creek when minimum flow criteria are met to provide sufficient aquatic habitat. However, climate change may increase vulnerability.	Habitat demand would increase: exacerbated by decreased flows, which are already challenging
No specific question called out in handbook – but vulnerability issue was identified independently.	Y	Increasing population in areas of Region that will have higher temperatures and lower precipitation as a result of climate change. Older development is in cooler and drier parts of the region while more recent development and current development pressure is in hotter and drier areas.	Municipal demand would increase: exacerbated by distribution of population increases
Water Supply			
Does a portion of the water supply in your region come from snowmelt?	Y	Some local supply comes from snowmelt in the San Gabriel Mountains.	Decrease in local surface supply: Due to decrease in local snowpack



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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?	Y	Large portion of the Region's supply comes from imported water (both direct uses and replenishment).	Decrease in imported supply: Due to decreases in SWP and Colorado supplies
Would your region have difficulty in storing carryover supply surpluses from year to year?	Y	Large system of groundwater basins allows the Region to store seasonal and annual supply in basins, but can only capture so much from storms given limited recharge facility area available. Other parts of the Region without groundwater basins have limited or no capacity to carry over supply surpluses.	Decrease in seasonal water reliability: given recharge facilities and decreases in local and imported surface supply
Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?	Y	Santa Monica and West Coast Basins have salt water intrusion issues. Seawater intrusion barriers have operated since 1950s to mitigate these impacts, however SLR will further exacerbate the current situation.	Decrease in coastal groundwater supply: due to sea level rise increasing intrusion
Has your region faced a drought in the past during which it failed to meet local water demands?	Y	There have been droughts in the Region where normal demands were not able to be met so drought management plans were implemented to reduce demands to be more in-line with available supplies. In this way demands were met.	Reduced resiliency to drought: Increased need for rationing and other drought response
Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?	Y	Arundo, quagga mussels (aqueducts) have been detected and could increase -already decreasing infrastructure reliability as well as alter flood regimes and alter wildfire regimes.	Invasives can reduce supply available: Increased invasives leads to increased water consumption (and flood and wildfire regimes)
Water Quality			
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?	Y	The 2009 Station fire and others caused great damage and sedimentation issues from large increases in erosion.	Increased erosion and sedimentation: leads to decreased water quality, available supply



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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?	Y	Many of the Region's local surface waters are 303(d) listed for nutrient issues.	Increased nutrient loading and decreased Dissolved Oxygen: leads to decreased water quality through eutrophication
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?	Y	<p>Most streams in the region are naturally ephemeral or intermittent. For example, some streams that were once intermittent are now perennial after being channelized to a depth below the summer water table. Natural streams may have decreased flow, but the only gauged streams are those with significant anthropogenic alteration in upstream watersheds. Seasonal low flows in effluent dependent water bodies are decreasing given conservation and recycled water use.</p> <p>Assimilative capacity is already compromised since normal dry season flows are low. Any amount of pollutants added to small volumes of water during low flow will have a proportionally large effect.</p>	Decreased dilution flows: to help dilute contaminants
Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?	Y	There are many beneficial uses in the Region which are not being met. For example, beach closures and fishing restrictions have occurred in the past.	Decrease in recreational opportunity: from poor water quality
Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?	Y	Some areas that treat local surface water have issues with turbidity and first flush contaminant levels during high flows. High intensity storms can also disrupt biological wastewater or stormwater treatment processes that may affect minimum standing time and discharge water quality.	Increase in source control or surface water treatment: for surface waters to meet increases in contaminants
Sea Level Rise			
Has coastal erosion already been observed in your region?	Y	Malibu, Santa Monica, and Palos Verdes areas	Decrease in land: From erosion along coasts

Greater Los Angeles County IRWM
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Are there coastal structures, such as levees or breakwaters, in your region?	Y	Marina areas and ports have breakwaters.	Damage to coastal infrastructure/recreation/ tourism: Due to sea level rise
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 in your region?	Y	Examples of areas at risk due to SLR include wastewater treatment (e.g. Hyperion, Terminal Island), stormwater outfalls at beaches, beach recreation features, also potential for planned desalination facilities. Residences (including DACs) and other non water-related infrastructure/recreation are also at risk along coastal areas of the Region.	
Is there land subsidence in the coastal areas of your region?	N	Nothing prevalent known	
Are there areas in your region that currently flood during extreme high tides or storm surges?	Y	The FEMA definition of flooding includes coastal wave uprush. There have been flooding events along the coast when high tides and storm surges coincide, generally during El Nino events.	
Are there climate-sensitive low-lying coastal habitats in your region?	Y	Ballona Wetlands and Malibu Lagoon are examples.	Damage to ecosystem/ habitat: Due to sea level rise
Do tidal gauges along the coastal parts of your region show an increase over the past several decades?	N	There have been documented increases, however, this just indicates that climate change is occurring but is not a vulnerability issue.	No issue just indicates that climate change is happening
Flooding			
Does critical (water/wastewater) infrastructure in your region lie within the 200-year floodplain?	Y	Assuming yes	Increases in inland flooding
Does aging critical flood protection infrastructure exist in your region?	Y	See Appendix G Flood Management Objectives and Targets.	
Have flood control facilities (such as impoundment structures) been insufficient in the past?	Y	Regionally there has generally been sufficient protection, but there is still some localized flooding. Debris basins have been insufficient in the past (O&M issue) and caused debris flows. Long Beach, San Pedro Sun Valley are example areas with inland flooding issues.	



Vulnerability Question	Answer	Justification	Vulnerability Issue
Are wildfires a concern in parts of your region?	Y	Annual occurrence of wildfires	Increases in flash flooding
Does part of your region lie within the Sacramento-San Joaquin Drainage District?	N	Not applicable	No issue since it is out of Region
Ecosystem and Habitat			
Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?	Y	Ballona Wetlands, and Malibu Lagoon other riparian areas	Increased impacts to habitat and flow availability for species: from various current issues and those associated with climate change
Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?	Y	Malibu Lagoon and Ballona Wetlands are examples	
Do climate-sensitive fauna or flora populations live in your region?	Y	Numerous species dependent upon the Mediterranean climate live in the Region	
Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?	Y	Los Angeles River does not yet have flow requirements but could have them in the future – however there are current stressors on aquatic life. There are minimum flow requirements to sustain steelhead trout habitat in Malibu Creek that trigger a requirement to discharge recycled water each summer.	
Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?	Y	A number of endangered and threatened species exist in the Region. The Region is the southern limit to endangered southern steelhead trout; climate change could alter their extent.	
Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?	Y	Beach tourism, creeks and lakes recreation, creek riparian habitat and river adjacent trails	
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?	Y, Y, N	The Region has natural aquatic habitat areas that are severely fragmented by channelization, impassible culverts and lost riparian areas. There are some corridors, but no new known infrastructure projects are planned that would further fragment aquatic habitat.	

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Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?	Y	Not frequent storms but there are exposed beaches and habitats that are at risk during El Nino storm events.	Decrease in habitat protection against coastal storms
Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change?	N	None listed.	
Hydropower			
Is hydropower a source of electricity in your region?	Y	Small hydropower projects	Decrease in hydropower potential
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 your region?	Y, N	No future known plans for hydropower generation.	