

Effects Pathway Matrix – Sample for Angie Creek Bridge Reconstruction Project

Action Deconstruction				Exposure		Biology Deconstruction			Consequences and Determination					
Project	Activity	Activity	Structure	DIRECT Interaction <i>(vehicle strike, crushing, trampling, etc.)</i>	Indirect interaction <i>A change in the environment that results in a resource quantity or quality change (negative, neutral, positive)</i>	Resource or Individuals Directly Exposed	Life stage affected <i>(of the species)</i>	Resource Functions of the Resource <i>(Breeding, Feeding, Sheltering, Migration/Dispersal)</i>	Responses of individuals to interaction and exposure	Effects to individuals <i>(negative, neutral, positive)</i>	Effects to population	Avoidance Minimization Mitigation	Effects remaining	Determination
Bridge Replacement	Clearing the construction site	Mechanical removal of vegetation	(None)	Crushing foraging frogs		Individual frogs	Juveniles Adults		Individual frogs killed	Reduced survivorship (mortality)	Reduction in numbers	Qualified biologist surveys ahead of clearing and grubbing and moves frogs to suitable riparian habitat	Stress to individuals from handling Introduction of individuals into competitor territories	
					Decrease in insects (negative)	Insect prey	Juveniles Adults	Feeding	Abandonment Displacement Reduced feeding success	Reduced fitness	Reduction in numbers Reduction in distribution	Revegetation of area impacted (post-project)	Short-term loss of prey; long-term improvement in prey availability	
					Loss of vegetative cover (negative)	Riparian and emergent vegetation	Larva	Feeding Sheltering	Abandonment Displacement Reduced feeding success	Reduced growth rate Reduced survivorship	Reduction in numbers Reduction in distribution	Avoid removing vegetation between April 1 and July 31	none	
				Juveniles Adults			Sheltering Migration/Dispersal	Abandonment Displacement	Reduced survivorship	Reduction in numbers Reduction in distribution	Revegetation of area impacted (post-project)	Short-term loss of plant cover; long-term improvement in vegetation		
				Overhanging willows		Juveniles Adults	Sheltering Migration/Dispersal	Abandonment Displacement	Reduced survivorship	Reduction in numbers Reduction in distribution	Obtain and restore 1 acre adjacent to dispersal corridor	Short-term loss of woodies; long-term improvement in suitable habitat size		
					Increase in water temperature (negative)	Cool oxygenated water (temperature x to x)	Juveniles Adults	Sheltering Migration/Dispersal	Abandonment Displacement	Reduced survivorship	Reduction in numbers Reduction in distribution	Obtain and restore 1 acre adjacent to dispersal corridor	Short-term loss of woodies; long-term improvement in suitable habitat size	
				Eggs			Sheltering	Individuals killed	Reduced survivorship (mortality)	Reduction in numbers	Avoid removing vegetation between April 1 and July 31	none		
				Larva			Sheltering	Abandonment Displacement Increased respiration	Reduced growth rate	Reduction in numbers	Avoid removing vegetation between April 1 and July 31	none		
				Juveniles			Sheltering	Abandonment Displacement Increased respiration Increased disease	Reduced growth rate Reduced survivorship	Reduction in numbers	Qualified biologist surveys ahead of clearing and grubbing and moves frogs to riparian habitat	Stress to individuals from handling Introduction of individuals into competitor territories		
							Adults	Sheltering	Abandonment Displacement Increased respiration Increased disease	Reduced growth rate Reduced survivorship	Reduction in numbers	Qualified biologist surveys ahead of clearing and grubbing and moves frogs to riparian habitat	Stress to individuals from handling Introduction of individuals into competitor territories	
	Grading	Cleared, compacted soils	Crushing foraging frogs											
	Post-construction work	revegetation	Native riparian plantings		Increase in vegetative cover (positive)	Individual frogs	Juveniles Adults	Sheltering Migration/Dispersal	Decreased displacement	Increased survivorship	Increase in numbers Increased distribution		Improved population stability in the project area	
					Increase in insects (positive)	Insect prey	Juveniles Adults	Feeding	Increased feeding success	Increased growth rate	Increase in numbers		Long-term improvement in prey availability	
					Decrease in water temperature (positive)	Individual frogs	Juveniles Adults Larvae Eggs	Sheltering Migration/Dispersal	Decreased disease Optimal development	Increased growth rate Increased survivorship	Increase in numbers		Reduced stress to individuals improved population stability	

Effects Pathway Matrix – Critical Habitat Sample

Physical and Biological Features (Primary Constituent Element)	Baseline Condition and Quality (from Exercise 1)	Exposure to Stressors	Conservation Measures (Avoidance, Minimization, Mitigation)	Consequences		Determination (NE, NLAA, LAA)
				Short-term	Long-term	
<p><b>1. Aquatic Breeding Habitat.</b> Standing bodies of fresh water (with salinities less than 7.0 parts per thousand), including: natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and hold water for a minimum of 20 weeks in all but the driest of years.</p>	<p>There are six manmade ponds within one mile of the project site, with salinities of 6.1 6.2, 6.2, 6.0, 6.7, and 6.4. Angie Creek has two off-channel pools 20' and 75' south of the bridge replacement site that could be used for breeding. Three ephemeral pools between Yvonne Road and the Wetlands hold water until August in all but the driest of years. Angie Creek is slow-moving south of the bridge site except during heavy rain events. Suitable breeding pools are found throughout the Laurietor Wetlands, particularly at the Angie Creek confluence.</p>	<ul style="list-style-type: none"> <li>• Increase in water temperature during construction</li> <li>• Change in salinity during construction (reduction? Increase?)</li> <li>• Increase in drying of ephemeral pools when vegetation is cleared for construction and restoration</li> </ul>	<p>Avoid construction activities in breeding habitat between February 1 and April 30.</p> <p>Minimize ground disturbance within 50' of aquatic breeding habitat between February 1 and April 30.</p> <p>Qualified biologist will monitor temperature, pH, turbidity of aquatic breeding habitat in action area during construction.</p> <p>Post-construction restoration to enhance existing aquatic breeding habitat between the Yvonne Road bridge and Laurietor wetlands.</p> <p>Long-term monitoring of restoration success criteria</p>	<p>Aquatic breeding habitat will be disturbed between May and September due to construction. Salinity quality will decrease and ephemeral pools will dry as vegetation is removed. Avoidance measures will eliminate disturbance during egg deposition.</p>	<p>Existing aquatic breeding habitat will be restored and enhanced and three new pools will be incorporated into the restoration design.</p>	
<p><b>2. Non-Breeding Aquatic Habitat.</b> Freshwater and wetted riparian habitats, as described above, that may not hold water long enough for the subspecies to hatch and complete its aquatic life cycle but that do provide for shelter, foraging, predator avoidance, and aquatic dispersal for juvenile and adult California red-legged frogs. Other wetland habitats that would be considered to meet these elements include, but are not limited to: plunge pools within intermittent creeks; seeps; quiet water refugia during high water flows; and springs of sufficient flow to withstand the summer dry period.</p>						
<p><b>3. Upland Habitat.</b> Upland areas adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile in most cases and comprised of various vegetational series such as grasslands, woodlands, wetland, or riparian plant species that provide the frog shelter, forage, and predator avoidance. Upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the wetland or riparian habitat. These upland features contribute to the filling and drying of the wetland or riparian habitat and are responsible for maintaining suitable periods of pool inundation for larval frogs and their food sources, and provide breeding, non-breeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat should include structural features such as boulders, rocks and organic debris (e.g., downed trees, logs), as well as small mammal burrows and moist leaf litter.</p>						
<p><b>4. Dispersal Habitat.</b> Accessible upland or riparian dispersal habitat within designated units and between occupied locations within a minimum of 1 mile of each other that allow for movement between such sites. Dispersal habitat includes various natural habitats and altered habitats such as agricultural fields, which do not contain barriers (e.g., heavily traveled road without bridges or culverts) to dispersal. Dispersal habitat does not include moderate- to high-density urban or industrial developments with large expanses of asphalt or concrete, nor does it include large reservoirs over 50 acres in size, or other areas that do not contain those features identified in PCE's 1, 2, or 3 as essential to the conservation of the subspecies.</p>						