GAZOS CREEK

Gazos Creek

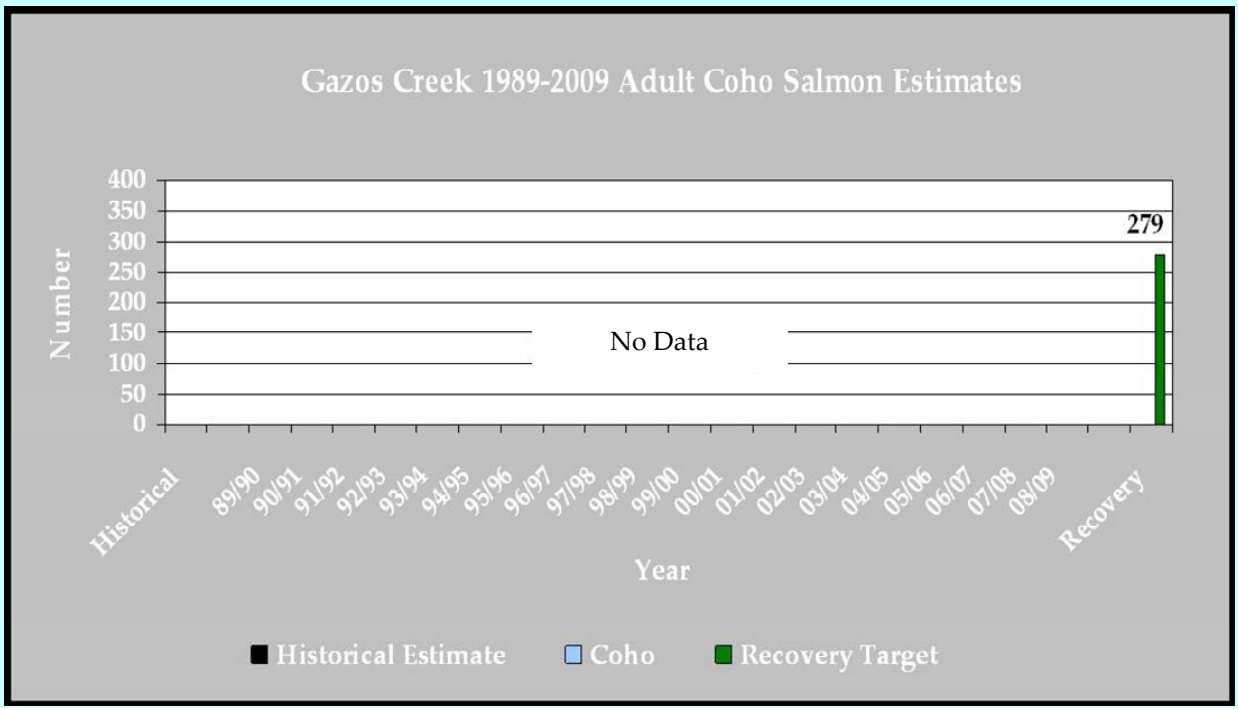
Dependent Population
8.2 IP-km of potential coho salmon habitat
Coho salmon extirpated and steelhead present

Gazos Creek drains approximately 12 square miles of the Santa Cruz Mountains in western San Mateo and Santa Cruz Counties. Gazos Creek enters the Pacific Ocean about 25 miles north of Santa Cruz. About 65 percent of the Gazos Creek watershed is redwood coniferous forest and about 24 percent of the watershed is shrubland. Gazos Creek flows through deep canyons developed in "chalk rock" – fractured mudstones of the Santa Cruz formation. Streams draining the chalk rock are sustained by seepage of cool, low-salinity, slightly alkaline waters, rich in naturally occurring phosphates and other nutrients. Sustained seepage continues to emanate from the deep fractures through multi-year droughts. The unusual setting of the "chalks" offers a more resilient environment for salmonids than do the sandy or decomposed granite watersheds elsewhere in the Santa Cruz Mountains. In the lower watershed, the landscape includes rolling grassland hills, coastal shrub and agricultural lands. A coastal lagoon with public access is present at the mouth of the creek. (CWC 2003).

Gazos Creek
Photo © USGS

The Watershed at a Glance

Spawning Quantity & Quality	**FAIR to GOOD**
Summer Water Temperatures	**FAIR**
Depth & Shelter of Pools	**FAIR**
Large Wood Frequency	**POOR to GOOD**
Riparian Canopy	**GOOD**
Off channel/Floodplain Quality	**POOR**
Estuary Function	**POOR**



Gazos Creek

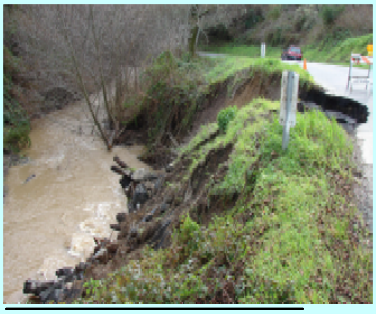
Recovery Target: 279 Adult Coho Salmon

Increasing the survival of coho salmon requires **protecting** all individuals from threats that are jeopardizing coho salmon. The highest ranked threats are:

- Roads and Railroads
- Disease, Predation, Competition

Preventing the extinction of coho salmon means **restoring** many key habitat attributes within the Gazos Creek watershed that are in poor condition. The highest priorities for restoration are to:

- Increase spawning habitat
- Improve and increase frequency of pools
- Increase the amount of large wood in streams
- Increase the number of off channel habitats
- Enhance hydrologic connectivity
- Decrease the number of roads near the stream and reduce impacts from remaining roads



Road failure adjacent to Gazos Creek
Photo by Jerry Smith, SJSU

Advancing recovery of coho salmon in Gazos Creek requires these priority **recovery actions:**

- Maintain instream structures to preserve woody debris material
- Promote and continue implementation, via technical assistance and/or regulatory actions for the reduction of roads and railroads near streams

. . . **throughout** the Gazos Creek watershed.

Conservation Highlights

- Annual juvenile abundance surveys conducted by San Jose State University faculty and students provides important population data on coho salmon in the Waddell Creek watershed.

We Need Your Photo Here

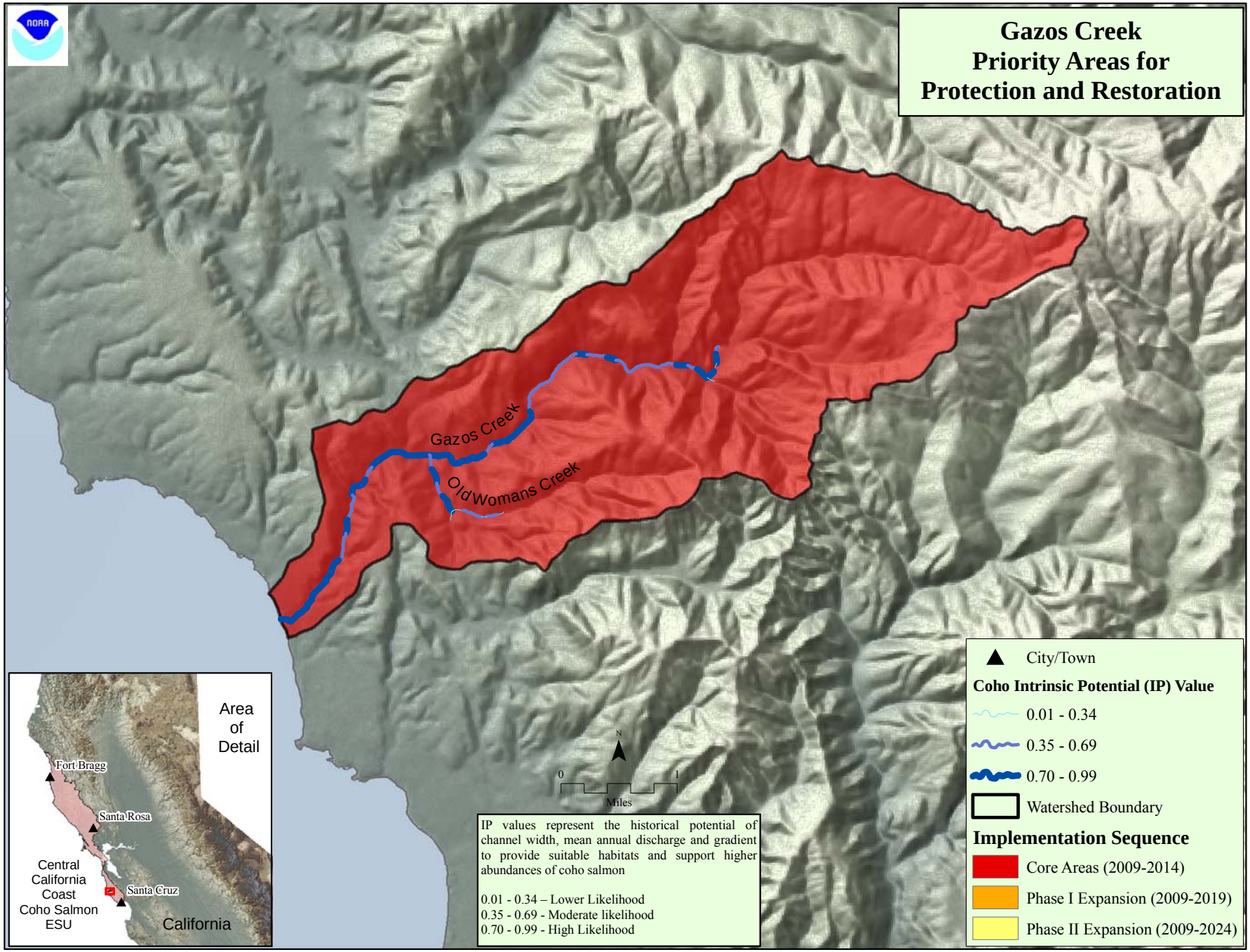
Gazos Creek
Photo © your name, AFFIL

Recovery Partners

NPS
San Mateo RCD
San Jose State Univ.
DFG
San Mateo County

Immediate Needs

Maintain current instream LWD √
Repair roads in Old Woman's Creek √


Gazos Creek
Priority Areas for
Protection and Restoration
Gazos Creek
Old Womans Creek
Area
of
Detail
Fort Bragg
Santa Rosa
Santa Cruz
Central
California
Coast
Coho Salmon
ESU
California
N
0
1
Miles
IP values represent the historical potential of channel width, mean annual discharge and gradient to provide suitable habitats and support higher abundances of coho salmon
0.01 - 0.34 – Lower Likelihood
0.35 - 0.69 - Moderate likelihood
0.70 - 0.99 - High Likelihood
City/Town
Coho Intrinsic Potential (IP) Value
0.01 - 0.34
0.35 - 0.69
0.70 - 0.99
Watershed Boundary
Implementation Sequence
Core Areas (2009-2014)
Phase I Expansion (2009-2019)
Phase II Expansion (2009-2024)

CCC Coho Salmon
Gazos Creek
CAP Viability Table Results

Analyst	Source	Result	Rating	Target	Habitat Attribute	Indicator	Poor	Fair	Good	Very Good
Flow Panel	Decision Matrix	50	Good	Spawning Adults	Hydrology	Passage Flows	>75 (score)	51-75	35-50	<35
SEC	PSMFC Database	91%	Very Good	Spawning Adults	Passage	Physical Barriers	<50% of IP-km	50-70% of IP-km	70-90% of IP-km	>90% of IP-km
NCWAP	Decision Matrix	60-90 days	Good	Spawning Adults	Passage	Passage at Mouth	<30 days	30-60 days	60-90 days	>90 days
SEC	CDFG HAB 8	100-400 m^2	Fair	Spawning Adults	Sediment	Amount of Gravel*	<100 m^2	100-400 m^2	400-800 m^2	>800 m^2
NMFS	Best Prof. judgment	<5%	Good	Spawning Adults	Viability	Freshwater Harvest	>10% of pop.	5-10%	<5%	
Flow Panel	Decision Matrix	<35	Very Good	Eggs	Hydrology	Instantaneous Condition	>75 (score)	51-75	35-50	<35
Flow Panel	Decision Matrix	67	Fair	Eggs	Hydrology	Redd Scour	>75 (score)	51-75	35-50	<35
SEC	Many Sources	NA	Fair	Eggs	Sediment	Gravel Quality	>17% 0.85mm and or >30% 6.3mm	15-17% 0.85	12-14% 0.85mm and or <30% 6.3mm	<12% 0.85
SEC	CDFG HAB 8	NA	NA	Eggs	Sediment	Gravel Quality (Embeddedness)	<25% of scores 1s&2s	25-50% of scores 1s&2s	>50% of scores 1s&2s	
Flow Panel	Decision Matrix	42	Good	Summer Rearing	Hydrology	Baseflow	>75 (score)	51-75	35-50	<35
SEC	CDFG HAB 8	60-80	Fair	Summer Rearing	Pool Habitat	Shelter Rating	<60 avg. rating	60-80	80-100	>100
SEC	CDFG HAB 8	<60 avg. rating	Fair	Summer Rearing	Pool Habitat	Primary Pools	<30% pools by length	30-40%	40-50%	>50%
SEC/NMFS	Many Sources	NA	Fair	Summer Rearing	Water Quality	Temperature	>30% of IP > 17 C MWMT	Does not meet Good or Very Good	30-60% of IP < 15C MWMT	>60% of IP < 15C MWMT
SEC	CDFG HAB 8	Poor	Poor	Winter Rearing	Floodplain	Complex Habitat**	<50% Connected	50-80% connected	>80% connected	
NMFS	NCWAP	Poor	Poor	Smolts	Estuary	Estuary				
Flow Panel	Decision Matrix	58	Fair	Smolts	Hydrology	Passage Flows	>75 (score)	51-75	35-50	<35
SEC	SWRCB	17.16/10 IP-km	Poor	Smolts	Passage	# of Diversions**	>5 / 10 IP km	1.1-5	0.01-1	0
SEC	CDFG HAB 8	<60 avg. rating	Poor	Multiple Life Stages	Pool Habitat	Shelter Rating	<60 avg. rating	60-80	80-100	>100
NMFS	Best Prof. judgment	<50%	Poor	Multiple Life Stages	Floodplain	Floodplain Connectivity	<50%	50-80%	>80%	not defined
NMFS	CDF CWHR	68%	Good	Multiple Life Stages	Hydrology	Stand Age			>40 years old	
SEC	NLCDB	0.18%	Very Good	Multiple Life Stages	Hydrology	Impervious Surfaces	>12.01% of WS by area	7.01-12%	3.01-7%	0-3%
SEC	FMMP	1.59%	Good	Multiple Life Stages	Land disturbance	Agriculture	>30% of WS by area	10-30%	0.1-10%	<0.1%
NMFS	CDF THP Dataset	3%	Very Good	Multiple Life Stages	Land disturbance	Timber Harvest	>35% of WS by area	25 - 35%	10 - 25%	<10%
SEC	Best Prof. judgment	NA	Good	Multiple Life Stages	Pool Habitat	LWD Freq. (BFW 0-10)	<4key pcs/100m	4-6/100m	6-11/100m	>11/100m
SEC	Many Sources	8.8	Poor	Multiple Life Stages	Pool Habitat	LWD Freq. (BFW 10-100)	<1/100m	1-1.3/100m	1.3-4/100m	>4/100m
NMFS	CDF CWHR	>50%	Good	Multiple Life Stages	Riparian Veg.	Species Composition	<25%	25-50%	>50%	Historical Conditions
NMFS	CDF CWHR	73%	Good	Multiple Life Stages	Riparian Veg.	DBH	<39% Class 5 and 6	40-54%	55-69%	>69%
SEC	CDFG HAB 8	70-80%	Good	Multiple Life Stages	Riparian Veg.	Canopy Cover	≤ 69% density "D" across IP-km	70 -79%	> 80%	
NMFS	CDF THP Dataset	2 mi/sq.mi.	Good	Multiple Life Stages	Sediment Transport	Road Density	>3 miles/sq. mile	3 to 2.5	2.5 to 1.6	<1.6
NMFS	CDF THP Dataset	3.7 mi/sq.mi.	Poor	Multiple Life Stages	Sediment Transport	Road density 100	>1 miles/sq. mile	1-0.5	0.5-0.1	<0.1
NMFS	Many Sources	Fair	Fair	Multiple Life Stages	Water Quality	Toxicity	Acute	Sublethal or Chronic	No Acute or Chronic	No evidence of toxins or Contaminants
NMFS	Best Prof. judgment	<1 per IP-km	Poor	Spawning Adults	Viability	Adult Density	<1 per IP-km	1-20 per IP-km	20-40 per IP-km	>40 per IP-km
NMFS	Best Prof. judgment	< 0.2 fish/m^2	Poor	Summer Rearing	Viability	Juvenile Density	< 0.2 fish/m^2	0.2-0.5 fish/m^2	0.5-1.0 fish/m^2	>1.0 fish/m^2
NMFS	Best Prof. judgment	<20% IP-km occupied	Fair	Summer Rearing	Viability	Juvenile Distribution	<20% IP-km occupied	20-34%	35-50%	>50%

See Appendix C for a full description of the analysis methods for the Viability Table Reports

* = watershed specific numbers

** = Ratings defined by the distribution of results

Gazos Creek Threats Across Targets		Spawning Adults	Eggs	Summer Rearing Juveniles	Winter Rearing Juveniles	Smolts	Multiple Life Stages			Overall Threat Rank
Project-specific threats		1	2	3	4	5	6	7	8	
1	Roads and Railroads	Medium	High	Medium	High	High	High			High
2	Disease, Predation, and Competition	High	-	Medium	-	High	-			High
3	Droughts	Medium	Low	Medium	Medium	High	Medium			Medium
4	Fire and Fuel Management	Medium	Medium	Medium	Medium	Medium	Medium			Medium
5	Residential and Commercial Development	Medium	Medium	Medium	Medium	Medium	Medium			Medium
6	Agricultural Practices	Medium	Low	Medium	Medium	Medium	Medium			Medium
7	Channel Modification	Medium	Low	Medium	Medium	Medium	Medium			Medium
8	Climate Change	Medium	Medium	Medium	Medium	Medium	Low			Medium
9	Logging and Wood Harvesting	Low	Medium	Medium	Medium	Medium	Medium			Medium
10	Recreational Areas and Activities	Medium	Low	Medium	Medium	Medium	Medium			Medium
11	Storms and Flooding	Low	Medium	Medium	Medium	Medium	Medium			Medium
12	Water Diversion and Impoundment	Medium	Low	Medium	Medium	Medium	Medium			Medium
13	Livestock Farming and Ranching	Low	Low	Medium	Medium	Medium	Medium			Medium
14	Fishing and Collecting	-	-	-	Low	Medium	-			Low
15	Hatcheries and Aquaculture	-	-	-	Low	Low	-			Low
16	Mining	-	Low	-	-	-	-			Low
Threat Status for Targets and Project		High	High	High	High	High	High	-	-	Very High

Gazos Creek (Santa Cruz Mountains) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
GaC-A-1.1	Objective	Estuary	Restore and enhance estuary habitat in the watershed.										
GaC-A-1.1.1	Recovery Action	Estuary	Develop Estuary Protection and Enhancement Guidelines to maintain estuary function and provide information for estuary restoration.										
GaC-A-1.1.1.1	Action Step	Estuary	Restore estuarine habitat and the associated wetlands and sloughs by providing fully functioning habitat (DFG 2004).	3	20	California Coastal Conservancy, CalTrans, County of San Mateo, NOAA RC, State Parks						TBD	Lower priority for coho, but will benefit smolt transition and adult upmigration.
GaC-A-1.1.1.2	Action Step	Estuary	Post durable and attractive signs to discourage lagoon breaching.	3	5	State Parks	0.08	0.08	0.08	0.08	0.08	0	This action will directly benefit listed steelhead rearing in the lagoon.
GaC-A-1.1.1.3	Action Step	Estuary	Address water quality problems in the estuary.	3	10	CDFG, County of San Mateo						TBD	This action will directly benefit listed steelhead rearing conditions. Benefits to coho are likely to be indirect. When the sandbar is in place the raised lagoon levels are believed to inundate a local septic system.
GaC-A-2.1	Objective	Floodplain	Improve over-winter survival by increasing the frequency and functionality of off-channel habitats.										
GaC-A-2.1.1	Recovery Action	Floodplain	Promote restoration projects designed to create or restore alcove, backchannel, ephemeral tributary, or seasonal pond habitats.	2	15	California Coastal Conservancy, CDFG, County of San Mateo, NOAA RC, Private Landowners, San Mateo RCD						TBD	Gazos has more instream wood than many streams south of San Francisco Bay that could be readily manipulated to create refuge habitats. Costs will vary depending on access and site specific conditions. Actual floodplain habitat is limited due to slope confinement and the presence of the County road. Better floodplain habitat is generally restricted to the channel downstream of road mile 2.3 above Highway 1 (downstream of Old Woman's Creek).
GaC-A-3.1	Objective	Hydrology	Improve survival at all life stages by restoring the historical spatial and temporal pattern of surface flows throughout spawning, rearing, and migration areas.										
GaC-A-3.1.1	Recovery Action	Hydrology	Work with SWRCB and landowners to improve over summer survival of juveniles by re-establishing summer baseflows (from July 1 to October 1) in rearing reaches that are currently impacted by water use.										
GaC-A-3.1.1.1	Action Step	Hydrology	Promote, via technical assistance and/or regulatory action, the reduction of water use affecting the natural hydrograph, development of alternative water sources, and implementation of diversion regimes protective of the natural hydrograph.	2	20	CDFG, County of San Mateo, NMFS, Private Landowners, SWRCB						TBD	Costs cannot be estimated until an overall strategy to address diversions and their relative impact to salmonids is developed. This effort should focus on lower reaches in the watershed where the majority of problematic diversions are located.
GaC-A-3.1.1.2	Action Step	Hydrology	Promote conjunctive use of water through strategies that include off-channel storage as a method to reduce impacts of legal water diversion (e.g. storage tanks for rural residential users).	2	20	CDFG, Farm Bureau, Private Landowners, SWRCB, Trout Unlimited							Costs cannot be estimated at this time. A water budget for the watershed will need to be developed. Costs will vary depending on diversion strategy, infrastructure constraints, and landowner participation.
GaC-A-3.1.2	Recovery Action	Hydrology	Reduce water use affecting the natural hydrograph and support development of alternative water sources protective of the natural hydrograph.	2	10							TBD	Development of alternative sources may be costly, but depend on numbers and types of alternatives implemented.
GaC-A-3.1.3	Recovery Action	Hydrology	Improve compliance with existing water resource regulations via monitoring and enforcement.										
GaC-A-3.1.3.1	Action Step	Hydrology	Identify and eliminate depletion of summer base flows from unauthorized water uses.	1	3	Alnus Ecological, CDFG, CDFG Law Enforcement, NMFS OLE, Private Landowners, SWRCB	33.33	33.33	33.33			100	Costs are estimated to include staff time from DFG 1600 staff, DFG Law Enforcement, and/or NMFS OLE.
GaC-A-3.1.3.2	Action Step	Hydrology	Encourage compliance with the most recent update of NMFS' Water Diversion Guidelines.	1	60	CDFG, NMFS HCD, Private Landowners, SWRCB						0	This is a general recommendation and costs of providing these updates to the SWRCB is expected to be minimal.

Gazos Creek (Santa Cruz Mountains) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
GaC-A-3.1.4	Recovery Action	Hydrology	Monitor, identify problems, and prioritize need for changes to water diversion on current or potential coho streams (DFG 2004).										
GaC-A-3.1.4.1	Action Step	Hydrology	Establish a comprehensive stream flow evaluation program to determine instream flow needs for coho salmon.	2	2	CDFG, NMFS HCD, Private Consultants	25.00	25.00				50	Cost may be less if existing information from Gazos is leveraged and is incorporated into the flow evaluation program.
GaC-A-3.1.4.2	Action Step	Hydrology	Request that SWRCB review and/or modify water use based on the needs of coho salmon and authorized diverters (DFG 2004).	2	60	CDFG, NMFS HCD, SWRCB						TBD	Costs cannot be determined until a watershed specific evaluation is completed. Until such a time, the expense and financial impact of potential restrictions is speculative.
GaC-A-3.1.4.3	Action Step	Hydrology	Continue streamflow gauging to determine the level of impairment to natural flow.	2	5	Private Consultants, USACE, USGS	15.00	15.00	15.00	15.00	15.00	75	The gage in Gazos was installed and is currently maintained by Balance Hydrologics. Gauging should continue into the foreseeable future and funding should continue until a range of natural flow conditions are obtained for the watershed.
GaC-A-3.1.5	Recovery Action	Hydrology	Provide incentives to water rights holders willing to convert some or all of their water right to instream use via petition change of use and §1707 (DFG 2004).	3	60	California Coastal Conservancy, CDFG, NOAA RC, SWRCB						TBD	The aggregate fiscal cost of water acquisition will depend on the quantity of want and whether water rights will be permanently transferred or purchased for single periods. This information is currently unavailable for the Gazos Creek watershed.
GaC-A-6.1	Objective	Pool Habitat	Improve summer rearing, winter rearing, and smolt survival by increasing instream channel complexity in potential rearing and migration reaches. Additionally, improve egg survival by reducing redd scour in streams characterized by high bedload mobility.										
GaC-A-6.1.1	Recovery Action	Pool Habitat	Encourage the development and implementation of large woody debris supplementation programs to increase stream complexity and gravel retention, and improve pool frequency and depth (DFG 2004).										
GaC-A-6.1.1.1	Action Step	Pool Habitat	Improvement of in-channel LWD densities, and associated habitat benefits, could be most easily accomplished by the addition of large (>2 diameter and or 20' length) conifer tree trunks and root wads. It is recommended that this be achieved by cutting large trees and dropping them into the channel, or preferably by pulling them partially into the channel complete with rootwad, at appropriate upstream locations. Downed logs may be transported to proper location to be placed in the stream.	1	10	California Coastal Conservancy, CDFG, County of San Mateo, NOAA RC, Private Landowners, RWQCB, San Mateo RCD						TBD	Costs will vary depending on whether the LWD is secured and anchored, or whether the material is simply felled and placed into the creek. Due to infrastructure, most streams in the Santa Cruz Mountains Diversity Stratum will likely require cabling which increases overall project costs. However, it is conceivable that at least a portion of the structures in Gazos could simply be placed into the stream without cabling or anchoring, which would reduce costs. Gazos has relatively little infrastructure that would be potentially impacted by a potential LWD jam.
GaC-A-6.1.1.2	Action Step	Pool Habitat	Do not remove woody material from the stream channel without consultation and approval from a fishery biologist with experience working in small, Central California Coastal streams.	1	60	CDFG, NMFS PRD, Private Consultants	0.83	0.83	0.83	0.83	0.83	50	This recommendation estimates the expense of periodically having an experienced fisheries biologist evaluate LWD removal projects from Gazos. It is anticipated that these requests will occur infrequently.
GaC-A-6.1.1.3	Action Step	Pool Habitat	Leave wood clusters as beneficial sediment traps, even if they pose passage difficulties for migrating salmonids.	2	60	California Coastal Conservancy, CDFG, County of San Mateo, NMFS PRD, NOAA RC, POST, Private Consultants, Private Landowners, San Mateo RCD, USACE, USFWS						0	
GaC-A-6.1.1.4	Action Step	Pool Habitat	After large floods, tree seedlings should be allowed to regenerate on exposed bars.	3	60	County of San Mateo, Private Landowners						0	

Gazos Creek (Santa Cruz Mountains) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
GaC-A-6.1.1.5	Action Step	Pool Habitat	Conduct annual surveys in Gazos to ensure wood clusters do not create a complete barrier to adult passage.	2	15	CDFG, San Mateo County, San Mateo RCD	3.33	3.33	3.33	3.33	3.33	50	
GaC-A-6.1.1.6	Action Step	Pool Habitat	Educate landowners, land managers, and County and municipal staffs on the importance of LWD to coho survival and recovery, and watershed processes.	1	10	CDFG, Coastside Land Trust, Farm Bureau, FEMA, FishNet 4C, NMFS, NRCS, San Mateo RCD, State Parks	1.00	1.00	1.00	1.00	1.00	10	
GaC-A-6.1.2	Recovery Action	Pool Habitat	Encourage landowners to implement restoration projects as part of their ongoing operations in stream reaches where large woody debris is lacking.	3	60	CDFG, County of San Mateo, NRCS, POST, State Parks, USFWS, USGS						0	Costs to landowners will vary by project. This recommendation is directed at project proponents and regulatory agencies to opportunistically consider and recommend restoration opportunities to landowners.
GaC-A-7.1	Objective	Riparian Vegetation	Improve the structure and composition of riparian areas to provide shade, large woody debris input, nutrient input, bank stabilization, and other CCC coho salmon needs.										
GaC-A-7.1.1	Recovery Action	Riparian Vegetation	Promote streamside conservation measures, including conservation easements, setbacks, and riparian buffers (DFG 2004).	3	60	California Coastal Conservancy, CDFG, Coastside Land Trust, County of San Mateo, Mid Penninsula Open Space District, POST, Private Landowners, San Mateo RCD						TBD	Costs will vary depending on the conservation measure. Land owner participation is critical to implementation of this measure. Land owner willingness to participate is unknown.
GaC-A-7.1.2	Recovery Action	Riparian Vegetation	Assess riparian canopy and impacts of exotic vegetation (e.g., Arundo donax, etc.), prioritize and develop riparian habitat reclamation and enhancement programs (DFG 2004).										
GaC-A-7.1.2.1	Action Step	Riparian Vegetation	Encourage development and implementation of a program similar to the County of Santa Cruz's Integrated Vegetation Management Plan for Roads Near Perennial Waters (URS Corporation, 2008) regarding roadside maintenance activities to discourage or eliminate unwanted vegetation and promote desirable (native) vegetation.	3	10	CDFG, County of San Mateo, NMFS	1.00	1.00	1.00	1.00	1.00	10	This recommendation would likely be most effective if undertaken by the County of San Mateo. In that case, the total cost regarding contribution of the Gazos Creek population is difficult to reasonably quantify. The cost estimate is an estimate related only to Gazos and the total cost may be reduced significantly if the standards from the Santa Cruz Plan are adopted for San Mateo County.
GaC-A-7.1.2.2	Action Step	Riparian Vegetation	Target Cape Ivy in the lower portion of the watershed for removal.	3	2	California Coastal Conservancy, CDFG, NRCS, San Mateo RCD, State Parks	5.00	5.00				10	
GaC-A-8.1	Objective	Sediment	Improve habitat conditions at multiple life stages by reducing sediment inputs to the stream at the watershed scale.										
GaC-A-8.1.1	Recovery Action	Sediment	Re-establish natural sediment delivery processes by assessing sediment delivery sources at the sub-watershed scale and prioritizing sediment reduction activities.										
GaC-A-8.1.1.1	Action Step	Sediment	Repair manageable bank failures or landslide toes that are significant sources of chronic fine sediment in Gazos, Old Woman's and Bear Gulch.	1	10	CDFG, County of San Mateo, NMFS, NRCS, Private Landowners, RWQCB, USACE						TBD	Costs are unknown. DFG 2004 estimated stream bank projects cost about $125 per square foot - these costs do not include the cost of maintenance or permitting. Other estimates range between $30 and $1,000 per foot. Repairs should be completed using bioengineering techniques and material, where appropriate. Changes in water flow patterns should be made if existing flow patterns exacerbate slope failure. Habitat enhancement should be incorporated into the engineering design, where feasible. Rocks placed at the toe of the bank should be large enough to provide escape cover and scour objects.

Gazos Creek (Santa Cruz Mountains) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
GaC-A-8.1.2	Recovery Action	Sediment	Work with landowners to assess the effectiveness of erosion control measures throughout the winter period.										
GaC-A-8.1.2.1	Action Step	Sediment	Permitting agencies (State, Federal, and local) should evaluate all authorized erosion control measures during the winter period.	2	60	CalFire, CDFG, County of San Mateo, NMFS, NRCS, RWQCB, USACE, USEPA, USFWS						0	This should be considered a standard business practice for all regulatory and oversight agencies.
GaC-A-9.1	Objective	Viability	Develop and implement a monitoring program to evaluate the performance of recovery efforts.										
GaC-A-9.1.1	Recovery Action	Viability	Measure or estimate response of key habitat attributes to recovery efforts across the watershed.										
GaC-A-9.1.1.1	Action Step	Viability	Implement standardized watershed assessments within sub-watersheds to define limiting factors specific to those areas. Encourage all major landowners to develop similar assessment methods.	3	60	CDFG, County of San Mateo, NOAA RC, NOAA SWFSC, NRCS, Private Consultants, RWQCB, San Mateo RCD						0	
GaC-A-9.1.2	Recovery Action	Viability	Evaluate feasibility of initiating adult surveys and replicating DFG's past smolt outmigration surveys.	3	9	CDFG, NMFS, Private Consultants, Private Landowners	33.33	33.33	33.33	33.33	33.33	300	Gazos is a lesser priority for adult monitoring because of its status as a Dependent Population and the existing monitoring efforts in other Dependent populations in the Santa Cruz Mountains Diversity Stratum.
GaC-A-9.1.3	Recovery Action	Viability	Continue ongoing juvenile sampling efforts in the watershed. Establish consistent reporting methods to ensure ESU-wide consistency.	2	10	CDFG, NOAA SWFSC, Private Consultants, State Parks	5.00	5.00	5.00	5.00	5.00	50	
GaC-A-14.1	Objective	Disease, Predation, and Competition	Implement regulatory, abatement, and education measures to prevent the invasion of exotic species, (including exotic plants).	3	60	California Coastal Conservancy, CDFG, County of San Mateo, Farm Bureau, FishNet 4C, NMFS PRD, NOAA RC, NRCS, Private Landowners, San Mateo RCD, USEPA						TBD	
GaC-A-24.1	Objective	Roads and Railroads	Conduct outreach and education regarding the adverse effects of roads, and the types of best management practices protective of salmonids.										
GaC-A-24.1.1	Recovery Action	Roads and Railroads	Continue education of Caltrans, County road engineers, and County maintenance staff regarding watershed processes and the adverse effects of improper road construction and maintenance on salmonids and their habitats.										
GaC-A-24.1.1.1	Action Step	Roads and Railroads	Develop a Salmon Certification Program for road maintenance staff.	2	20	CalFire, CalTrans, FishNet 4C, NRCS, POST, Private Consultants, Private Landowners, RWQCB, San Mateo County, San Mateo RCD, USACE	2.00	2.00	2.00	2.00	2.00	40	Annual training could be combined on a County-wide basis. Cost estimate represents relative Gazos contribution. Program should leverage off the FishNet4C program and training manual.
GaC-A-24.2	Objective	Roads and Railroads	Reduce road densities by 10 percent over the next 10 years, prioritizing high risk areas in historical habitats or Core CCC coho salmon watersheds.										

Gazos Creek (Santa Cruz Mountains) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
GaC-A-24.2.1	Recovery Action	Roads and Railroads	Decommission riparian road systems and/or upgrade roads (and skid trails on forestlands) that deliver sediment into adjacent watercourses (DFG 2004).	2	20	California Department of Mines and Geology, CDFG, County of San Mateo, Private Landowners, RWQCB, San Mateo County, San Mateo RCD, USACE						TBD	Costs will vary depending on scale of work identified. Costs can range between $3,000 per mile to $10,000 per mile. Estimates in the State Coho Recovery Plan indicate costs in nearby San Mateo County, in 2003 dollars, may reach $15,000 per mile. Rerouting of mainline roads will result in significantly higher costs.
GaC-A-24.3	Objective	Roads and Railroads	Conduct actions to hydrologically disconnect roads.										
GaC-A-24.3.1	Recovery Action	Roads and Railroads	Address sediment and runoff sources from road networks and other actions that deliver sediment and runoff to stream channels.										
GaC-A-24.3.1.1	Action Step	Roads and Railroads	Develop a Road Sediment Reduction Plan that prioritizes sites and outlines implementation and a timeline of necessary actions. Begin with a road survey focused on inner gorge roads followed by roads in other settings.	2	60	CDFG, FishNet 4C, Mid Penninsula Open Space District, Mines and Geology, NMFS, POST, RWQCB, San Mateo RCD, USACE, USEPA	1.00	1.00	1.00	1.00	1.00	60	Cost will vary depending on landowner participation and site specific conditions. The program should be running within ten years and continue in perpetuity.
GaC-A-24.3.1.2	Action Step	Roads and Railroads	Licensed engineering geologists should review and approve grading on inner gorge slopes.	2	60	CalFire, CalTrans, County of San Mateo, Private Landowners, RWQCB						TBD	This is a cost that is frequently absorbed into road projects. Costs will vary depending on actual amount of grading in the watershed.
GaC-A-24.3.1.3	Action Step	Roads and Railroads	Evaluate and remove roadside berms that lead to increased runoff velocities and result in increased sediment discharge.	2	10	CalFire, California Department of Mines and Geology, County of San Mateo, Farm Bureau, NRCS, Private Landowners, RWQCB						TBD	Cost of removal cannot be estimated until an evaluation of the magnitude of the problem in conducted. Cost associated with berm evaluation should be coupled with ongoing and future public and private road evaluations as a means to reduce overall expenses.
GaC-A-24.3.1.4	Action Step	Roads and Railroads	Establish adequate spoils storage sites throughout the watershed so that material from landslides and road maintenance can be stored safely away from coho streams. Coordinate these efforts with all landowners in the watershed, CalTrans, and county road maintenance staff as appropriate.	2	5	CalFire, CalTrans, CDFG, County of San Mateo, RWQCB	6.00	6.00	6.00	6.00	6.00	30	Inadequate storage sites in Gazos is a concern in the watershed. The paucity of locations for temporary storage of landslide material is a significant constraint. Sites should be identified within the duration specified and this action should be continued in perpetuity.
GaC-A-24.3.2	Recovery Action	Roads and Railroads	Limit winter use of unsurfaced roads and recreational trails by unauthorized and impacting uses to decrease fine sediment loads.										
GaC-A-24.3.2.1	Action Step	Roads and Railroads	Conduct annual inspections of all roads prior to winter. Correct conditions that are likely to deliver sediment to streams. Hydrologically disconnect roads.	1	60	CalFire, County of San Mateo, NRCS, POST, Private Landowners, Public, RWQCB, San Mateo RCD						TBD	

Gazos Creek (Santa Cruz Mountains) Threats and Associated Recovery Actions

Recovery Strategy Number	Level	Targeted Attribute or Threat	Action Description	Priority Number	Action Duration (Years)	Recovery Partners	Costs ($K)						Comments
							FY1	FY2	FY3	FY4	FY5	Entire Duration	
GaC-A-24.3.3	Recovery Action	Roads and Railroads	Use available best management practices for road construction, maintenance, management and decommissioning (e.g. Hagans & Weaver, 1994; Sommarstrom, 2002; Oregon Department of Transportation, 1999).	1	60	CalFire, CalTrans, CDFG, County of San Mateo, Farm Bureau, FEMA, FishNet 4C, Mid Penninsula Open Space District, Mines and Geology, NMFS, NRCS, POST, RWQCB, USACE, USFWS						TBD	Costs cannot be determined at this time. These standards should be adopted for all future road projects in the Gazos watershed.
GaC-A-24.3.4	Recovery Action	Roads and Railroads	Bridges associated with new roads or replacement bridges (including railroad bridges) should be free span or constructed with the minimum number of bents feasible in order to minimize drift accumulation and facilitate fish passage.	3	60	CalFire, California Coastal Conservancy, CalTrans, CDFG, County of San Mateo, Farm Bureau, FEMA, FishNet 4C, Mid Penninsula Open Space District, Mines and Geology, NMFS, NRCS, Private Consultants, Private Landowners, RPFs, RWQCB, San Mateo RCD, USACE						TBD	Replacement of culverts/bridges to NMFS standards will result in increased cost for materials and construction, but will likely result in structures that can withstand large storm events better than existing structures. Long term durability and stability will result in long-term cost savings in many circumstances.
GaC-A-24.4	Objective	Roads and Railroads	Reduce sediment sources from road networks, maintenance activities, and other actions that deliver sediment to stream channels through improved, or new, laws and policies, and/or enforcement of existing laws and policies.										
GaC-A-24.4.1	Recovery Action	Roads and Railroads	Establish a moratorium on new road construction within floodplains, riparian areas, unstable soils or other sensitive areas until a watershed specific and/or agency/company specific road management plan is created and implemented.	3	20	CalFire, County of San Mateo, RWQCB						TBD	Costs may vary significantly depending on societal pressures to build in these areas. A well designed road management plan should result in long term cost savings. However, this may be difficult to fully implement due to the multiple landowners in the watershed, the relatively small size of the watershed, and its diverse geology, which ultimately may limit the feasibility of this recommendation.
GaC-A-24.4.2	Recovery Action	Roads and Railroads	For all rural (unpaved) and seasonal dirt roads apply (at a minimum) the road standards outlined in the California Forest Practice Rules.	2	60	California Coastal Conservancy, CDFG, County of San Mateo, Farm Bureau, FishNet 4C, NOAA RC, Private Landowners, Public, RWQCB, San Mateo RCD						TBD	Costs will vary significantly depending on site specific conditions and landowner willingness to have their roads addressed and sediment sources remediated.
GaC-A-24.4.3	Recovery Action	Roads and Railroads	Continue implementation of San Mateo County's Road Maintenance Manual.	1	60	San Mateo County						0	