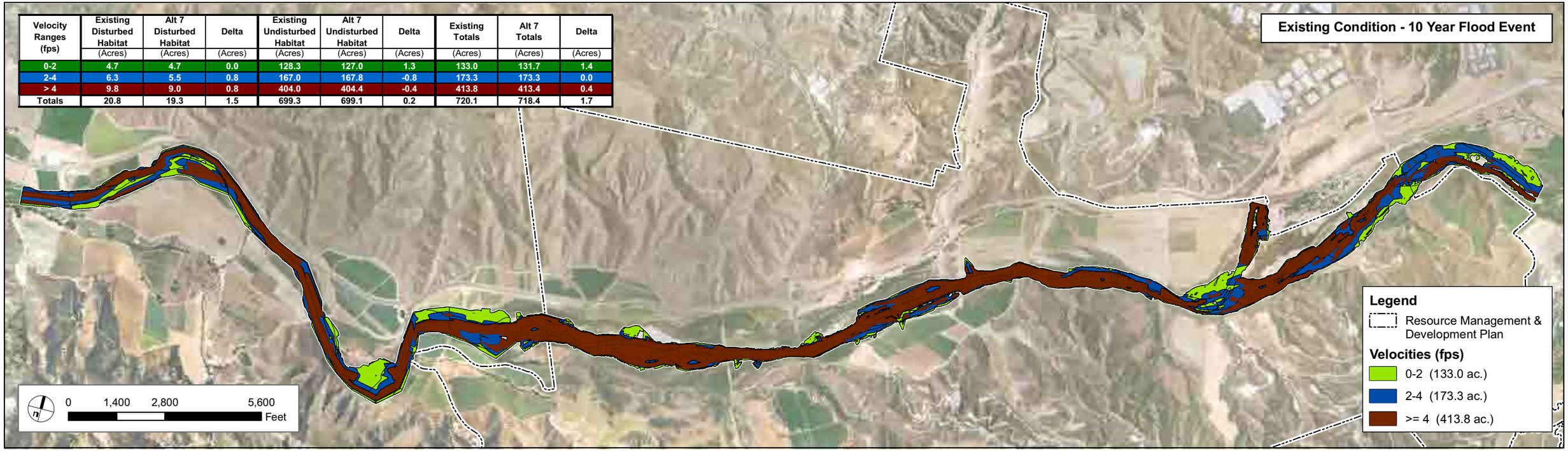
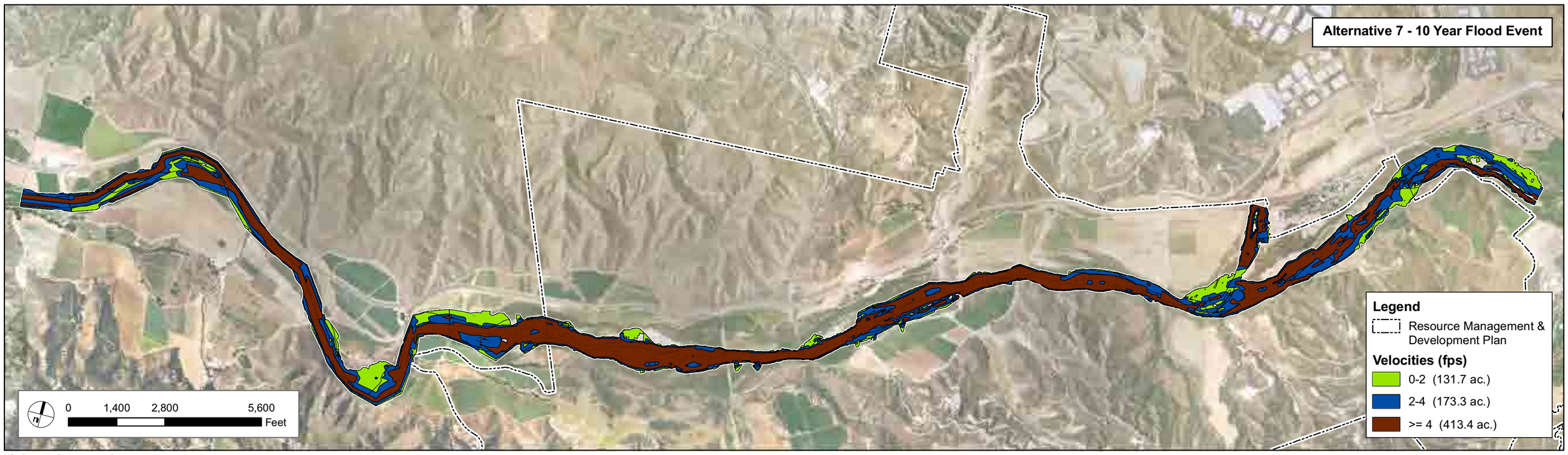
Velocity Ranges (fps)	Existing Disturbed Habitat (Acres)	Alt 7 Disturbed Habitat (Acres)	Delta (Acres)	Existing Undisturbed Habitat (Acres)	Alt 7 Undisturbed Habitat (Acres)	Delta (Acres)	Existing Totals (Acres)	Alt 7 Totals (Acres)	Delta (Acres)
0-2	4.7	4.7	0.0	128.3	127.0	1.3	133.0	131.7	1.4
2-4	6.3	5.5	0.8	167.0	167.8	-0.8	173.3	173.3	0.0
> 4	9.8	9.0	0.8	404.0	404.4	-0.4	413.8	413.4	0.4
Totals	20.8	19.3	1.5	699.3	699.1	0.2	720.1	718.4	1.7





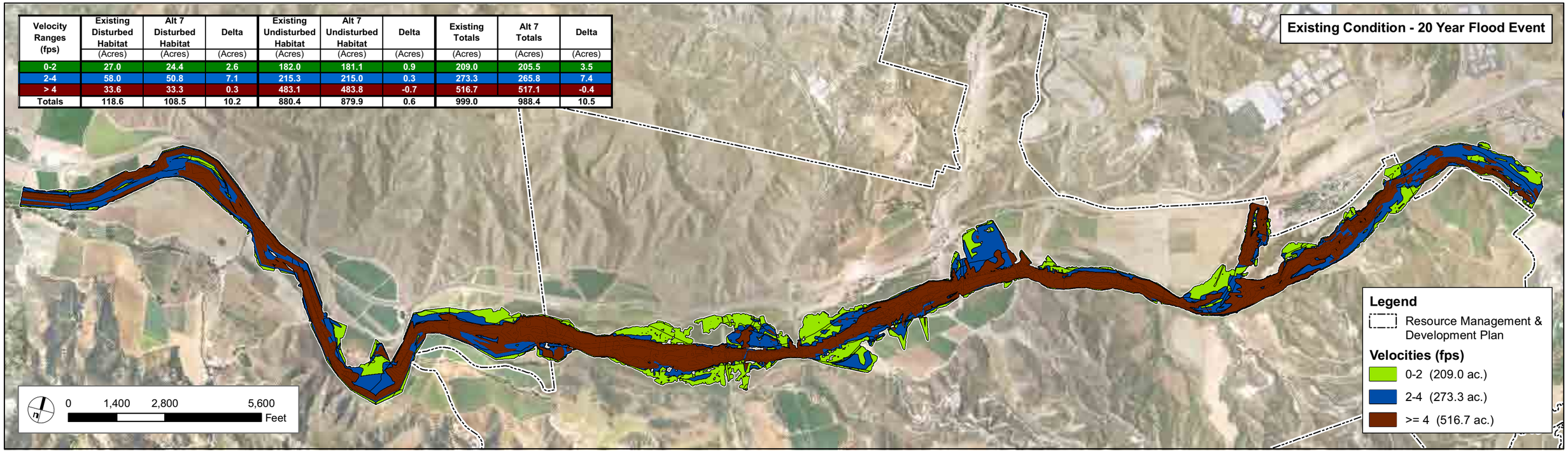
SOURCE: PACE 2008

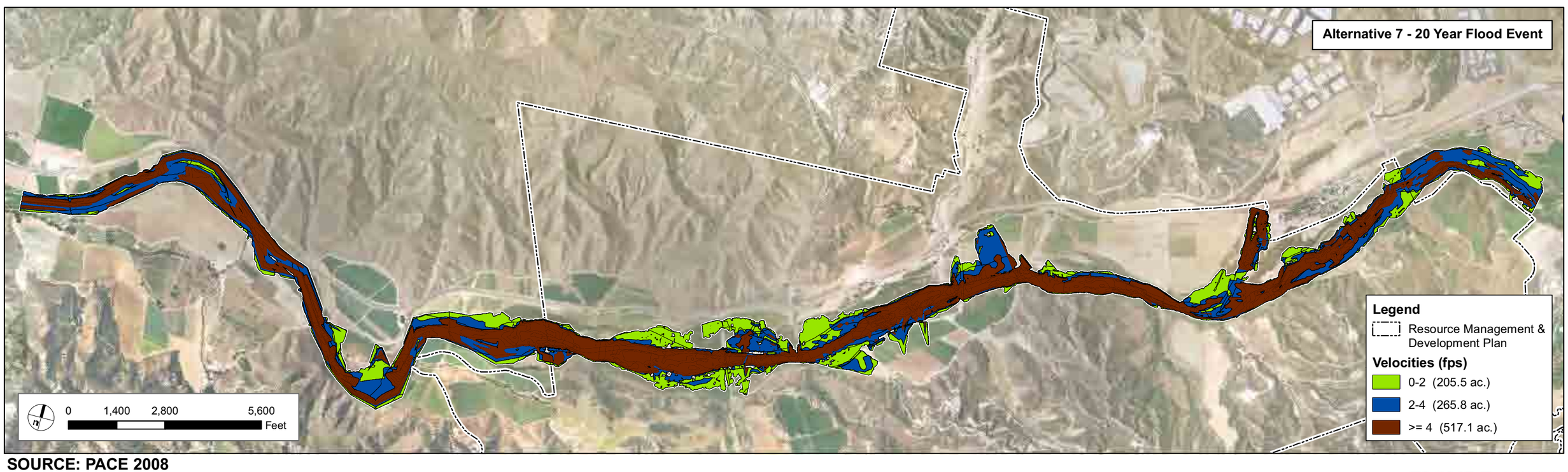
FIGURE 1.1-30

POTENTIAL REFUGIA HABITAT 10 YEAR FLOOD EVENT
EXISTING CONDITION AND ALTERNATIVE 7 VELOCITY COMPARISON

P:\8238E\GIS\mxds\EIR_2008\RefugiaAnalysis\8238E_FIGURE-1-1-30_RefugiaVelocityAnalysisAlt7_10Yr_110508.mxd

Velocity Ranges (fps)	Existing Disturbed Habitat (Acres)	Alt 7 Disturbed Habitat (Acres)	Delta (Acres)	Existing Undisturbed Habitat (Acres)	Alt 7 Undisturbed Habitat (Acres)	Delta (Acres)	Existing Totals (Acres)	Alt 7 Totals (Acres)	Delta (Acres)
0-2	27.0	24.4	2.6	182.0	181.1	0.9	209.0	205.5	3.5
2-4	58.0	50.8	7.1	215.3	215.0	0.3	273.3	265.8	7.4
> 4	33.6	33.3	0.3	483.1	483.8	-0.7	516.7	517.1	-0.4
Totals	118.6	108.5	10.2	880.4	879.9	0.6	999.0	988.4	10.5





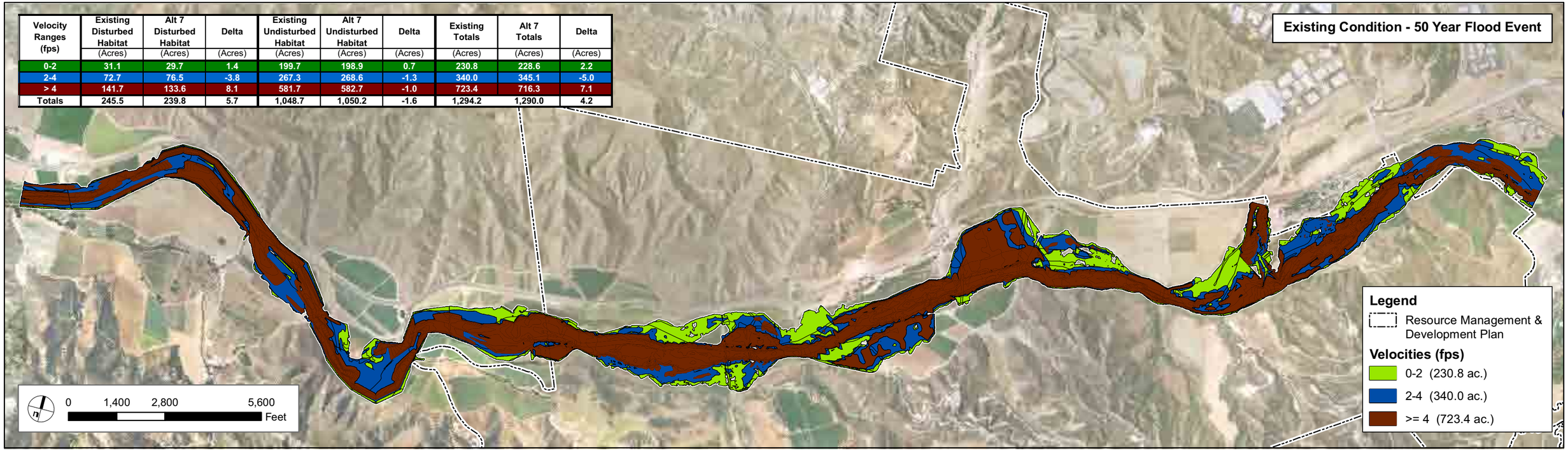
SOURCE: PACE 2008

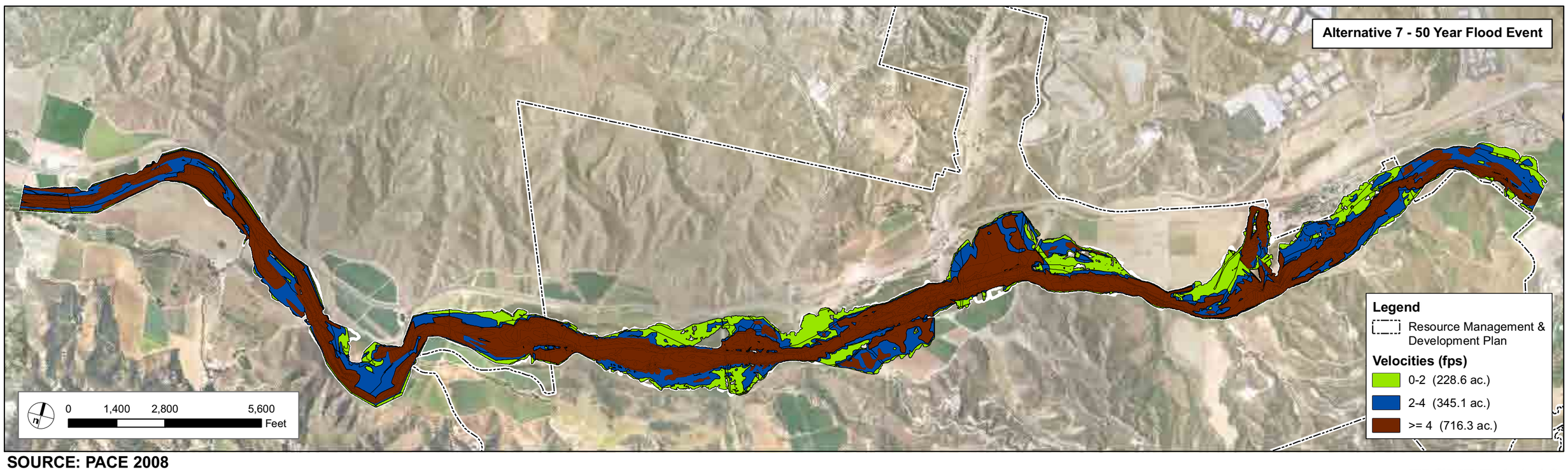
FIGURE 1.1-31

POTENTIAL REFUGIA HABITAT 20 YEAR FLOOD EVENT
EXISTING CONDITION AND ALTERNATIVE 7 VELOCITY COMPARISON

P:\8238E\GIS\mxds\EIR_2008\RefugiaAnalysis\8238E_FIGURE-1-1-31_RefugiaVelocityAnalysisAlt7_20Yr_110508.mxd

Velocity Ranges (fps)	Existing Disturbed Habitat (Acres)	Alt 7 Disturbed Habitat (Acres)	Delta (Acres)	Existing Undisturbed Habitat (Acres)	Alt 7 Undisturbed Habitat (Acres)	Delta (Acres)	Existing Totals (Acres)	Alt 7 Totals (Acres)	Delta (Acres)
0-2	31.1	29.7	1.4	199.7	198.9	0.7	230.8	228.6	2.2
2-4	72.7	76.5	-3.8	267.3	268.6	-1.3	340.0	345.1	-5.0
> 4	141.7	133.6	8.1	581.7	582.7	-1.0	723.4	716.3	7.1
Totals	245.5	239.8	5.7	1,048.7	1,050.2	-1.6	1,294.2	1,290.0	4.2





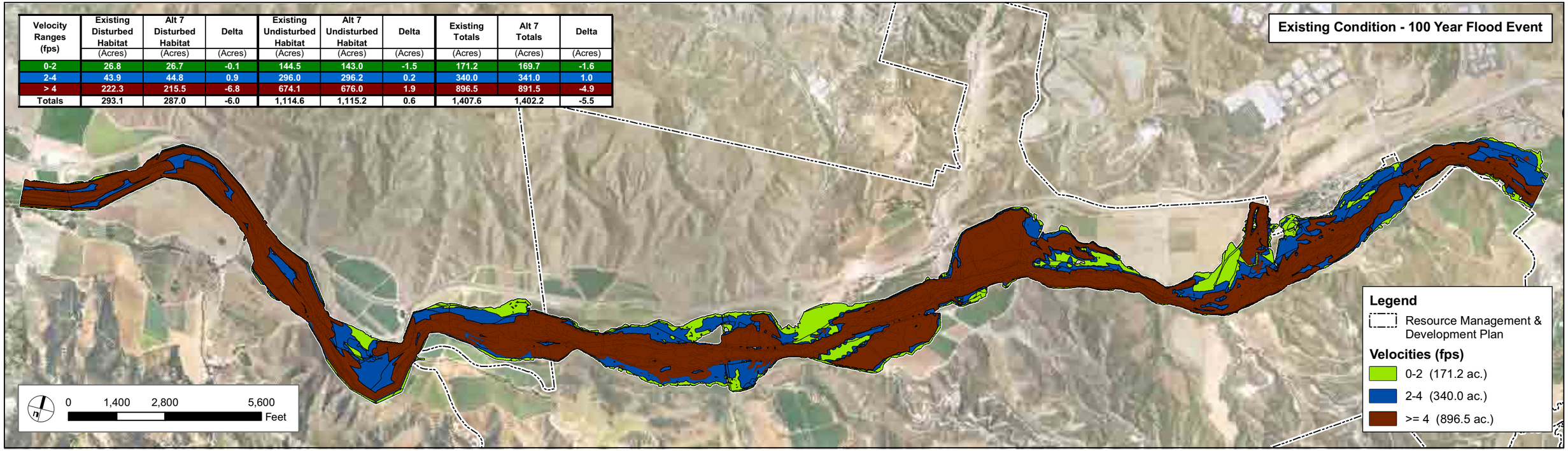
SOURCE: PACE 2008

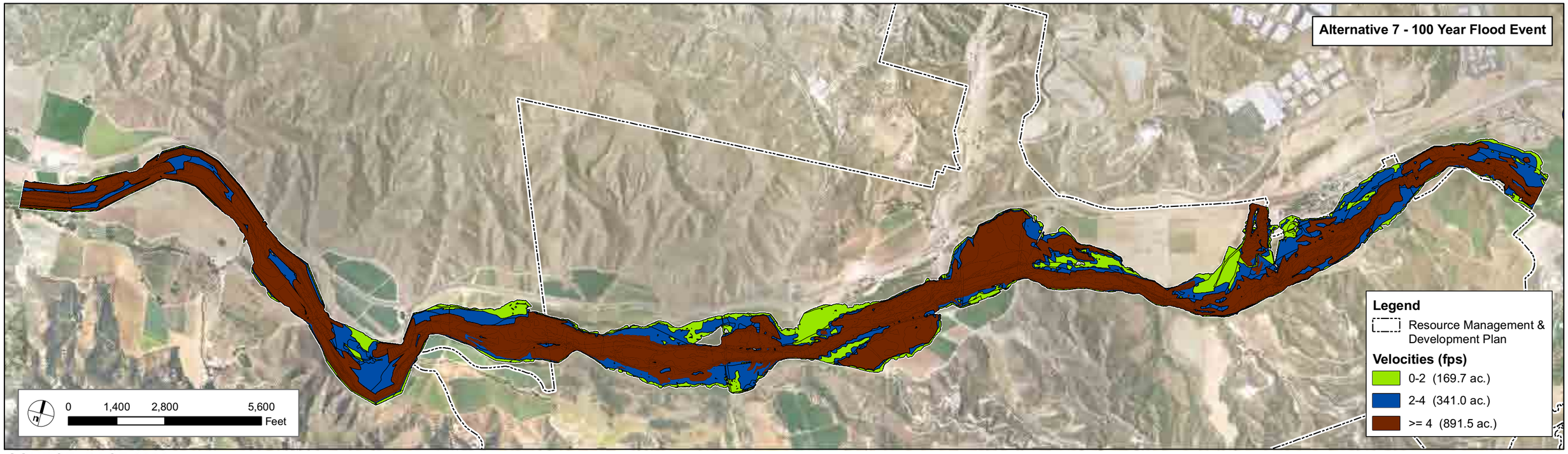
FIGURE 1.1-32

POTENTIAL REFUGIA HABITAT 50 YEAR FLOOD EVENT
EXISTING CONDITION AND ALTERNATIVE 7 VELOCITY COMPARISON

P:\8238E\GIS\mxds\EIR_2008\RefugiaAnalysis\8238E_FIGURE-1-1-32_RefugiaVelocityAnalysisAlt7_50Yr_110508.mxd

Velocity Ranges (fps)	Existing Disturbed Habitat (Acres)	Alt 7 Disturbed Habitat (Acres)	Delta (Acres)	Existing Undisturbed Habitat (Acres)	Alt 7 Undisturbed Habitat (Acres)	Delta (Acres)	Existing Totals (Acres)	Alt 7 Totals (Acres)	Delta (Acres)
0-2	26.8	26.7	-0.1	144.5	143.0	-1.5	171.2	169.7	-1.6
2-4	43.9	44.8	0.9	296.0	296.2	0.2	340.0	341.0	1.0
> 4	222.3	215.5	-6.8	674.1	676.0	1.9	896.5	891.5	-4.9
Totals	293.1	287.0	-6.0	1,114.6	1,115.2	0.6	1,407.6	1,402.2	-5.5





SOURCE: PACE 2008

FIGURE 5.6-2

POTENTIAL REFUGIA HABITAT 100 YEAR FLOOD EVENT
EXISTING CONDITION AND ALTERNATIVE 7 VELOCITY COMPARISON

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APPENDIX E

AQUATIC HABITAT SURVEY OF THE TRIBUTARIES TO THE SANTA CLARA RIVER IN THE RMDP PROJECT AREA

E N T R I X

MEMO

ENTRIX,Inc.
2140 Eastman Avenue, Suite 200
Ventura, CA 93003
(805) 644-5948

To: Matt Carpenter, Newhall Land and Farming

From: Joel Mulder
Camm Swift

Date: June 26, 2007

Re: **Aquatic Habitat Survey of the Tributaries to the Santa Clara River in the RMDP Project Area**
Los Angeles County, California

The memo has been prepared to present the results of our focused assessment of fish presence and aquatic habitat quality and quantity in the tributary drainages to the Santa Clara River located within the Newhall Ranch Resource Management and Development Plan (RMDP) project area. The field surveys were conducted on May 4, 7, and 8, and June 13 and 22, 2007, and included all tributaries entering the mainstem Santa Clara River from Salt Creek Canyon upstream to the Old Road Bridge.

The objectives of the surveys were as follows:

- To identify and evaluate current or potential aquatic habitat for State and Federally-listed unarmored threespine stickleback and other fish species including arroyo chub and Santa Ana sucker;
- To identify any barriers that may prevent upstream access to tributaries by fish during high flow periods; and,
- To classify reaches of all tributaries as ephemeral, intermittent, or perennial in nature.

The survey results are used to characterize existing aquatic habitat conditions and evaluate potential impacts to the target fish species due to implementation of the RMDP. The following sections describe the methods used during the surveys, the results of the surveys for each tributary, and a discussion of the results.

Survey Methods

The tributaries were surveyed by ENTRIX biologists, Camm Swift and Joel Mulder, and provide greater detail for areas that were partially surveyed by Glen Amadic [sic], Matt Carpenter, and Camm Swift in 2004 and Swift and Steve Howard in 2005 and 2006. Most tributaries were walked in their entirety or were walked to a point where the remainder of the drainage was easily visible. Some tributaries were partially surveyed

from a vehicle in areas where access roads were situated adjacent to the stream channel. Particular emphasis was given to the canyon mouth areas where fish could find refuge during flood events.

During the surveys, fish presence was determined by direct observation and using dip nets (4 feet long overall, opening 16 X 12 inches with one eighth inch mesh). Aquatic habitat was characterized visually. At each tributary, the first barrier to upstream fish passage from the Santa Clara River was identified and mapped. Along each tributary, reaches were classified as either ephemeral, intermittent, or perennial based on evidence such as the presence of water and thickness of riparian vegetation indicating duration of water presence. The reach classifications were based on the US Army Corp of Engineers definitions as defined in the Part 330 – Nationwide Permit Program. The definitions used are as follows:

- Ephemeral- an ephemeral stream has flowing water only during, and for a short duration after, precipitation events in a typical year. Ephemeral stream beds are located above the water table year-round. Groundwater is not a source of water for the stream. Runoff from rainfall is the primary source of water for stream flow.
- Intermittent - An intermittent stream has flowing water during certain times of the year, when groundwater provides water for stream flow. During dry periods, intermittent streams may not have flowing water. Runoff from rainfall is a supplemental source of water for stream flow.
- Perennial - A perennial stream has flowing water year-round during a typical year. The water table is located above the stream bed for most of the year. Groundwater is the primary source of water for stream flow. Runoff from rainfall is a supplemental source of water for stream flow.

Survey Results

The following provides the survey results for each tributary that was surveyed. The tributary locations and the first upstream passage barrier and the hydrologic classification (ephemeral, intermittent, or perennial) for each tributary are shown in Figure 1.

Potrero Canyon

Potrero Canyon was initially surveyed on May 4, 2007. The survey began where Potrero Creek passed under the Potrero Canyon road, just south of the river crossing. The creek flowed under the road through a six foot diameter, corrugated, metal culvert. The culvert had a half meter drop in the middle due to a junction or down-sloping bend in the corrugated pipe. The drop slope was approximately 20% with fast water flowing over debris and cobbles. The culvert represents the first barrier to upstream fish passage for UTS, chubs, and suckers. A heavy crust of mineral deposit was present along the margins of the culvert at the waterline. A small pool just below the drop inside the

culvert had two arroyo chubs present. Water temperature just downstream of the culvert was 13 Celsuis (C) at 09:30. Approximately 10 meters (m) downstream of the culvert, a southwestern pond turtle was observed basking on the stream bank.

A few meters downstream, the main channel split into two braids, and a flowing tributary channel entered the main channel on the west bank. This tributary channel leads approximately 25 m upstream to a large marshy spring area located out in the open field to the west of the main road gate. The spring begins below a dirt road as a series of boggy marsh areas comprised of sedges and algae. This marshy area was approximately 5 m wide and continued another 50 m downstream to a 1.5 m head cut. Downstream of the head cut, the marsh became an increasingly entrenched and definable channel a few meters wide. After crossing a fence line at the bottom edge of this spring area, a 1.25 m high head cut was observed and was a barrier to upstream fish passage. A small trickle of flow emerged from the base of the head cut and continued downstream, gradually increasing in volume before entering a thick willow mass and joining a braid of the main Potrero Creek. No aquatic organisms were observed in the marsh or tributary stream.

Approximately 20 meters downstream of the main channel road crossing, a pool about 30 centimeters (cm) deep, one meter wide, and 1.5 m long had 30-40 arroyo chubs and two African clawed frogs present. The vegetation downstream of the culvert, all the way to the river floodplain, consisted of very thick riparian growth comprised of willow, mulefat, and salt cedar, with occasional sedges on the banks. Canopy cover was very thick, estimated at 80-95 percent coverage. Some green algae was observed in several pools. Along this stretch, the stream was on average 5 to 10 cm deep and a half meter to a meter wide.

As the main channel reached the river flood plain, it fanned out into many very shallow braids ranging from one to several meters wide and only a few centimeters deep. This marshy area was thickly inundated with salt cedar and mulefat, and with increasing numbers of cottonwood trees, as the stream approached the main Santa Clara River floodplain. After entering the flood plain, a raised sandy berm about 50 m wide, kept the stream separated from the main river channel and directed it west such that it ran parallel to the river for about one mile. This berm area was densely covered in riparian vegetation, mostly cottonwood, willow, rose, sedges, and grasses. After making the turn westward, the stream braids began to come back together and the stream channel stayed against the cliff line, along the south edge of the river floodplain. Stream channel width was about 50 cm to 1 m wide, and depth was on average 3 to 5 cm. Riparian vegetation continued to be very thick, with large amounts of salt cedar, willow, mulefat, and cottonwoods completely obscuring much of the channel. Moving downstream, flow decreased gradually and green algae increased in the wetted areas. No fish were observed along this stretch. The creek went dry approximately one third of a mile after turning westward, just before a very small ravine enters from the south. The stream stayed dry all the way to the channel's intersection with the Santa Clara River. Near the confluence, the stream channel separates into several small braided channels which empty into the main river channel at various spots along the river bank. In the river, at

the confluence, larval arroyo chub and suckers were observed. The river temperature was 21 C at 12:20.

On June 13, 2007 the upper portions of Potrero Canyon were surveyed, beginning at the road crossing culvert barrier. Upstream of the culvert, the channel was historically relocated to the east edge of the canyon floor. Surface water flows were present immediately upstream of the road crossing and the channel had a thick canopy cover of willow for about 40 meters upstream of the crossing. After crossing a barbed wire fence line, the willows disappeared and the channel was exposed with numerous head cuts, and grass or reed covered banks with obvious grazing impact. Flow steadily decreased moving upstream to just beyond a small ranching complex where the flow emerged from a small (2 inch diameter) pipe in an open, meadow–like area with heavy salt deposits across the ground surface. Upstream of the pipe, the channel was consistently very dry, with occasional willow or mulefat patches. Oil facilities were adjacent to the channel at several locations.

At the upper end of the drainage, several small arms branching east were ephemeral and dry. The main stem remained dry as the gradient increased, and more brush and oak trees were occasionally present along the channel margins. At the top of the drainage, two forks split east and west. Both were very dry and ephemeral. The eastern fork had a small tributary canyon that branched south and which was mostly accessible by road. This canyon contained thick riparian growth such as willows, oak trees, and poison oak. At the top of the canyon, a series of small seeps were present emerging from the bedrock exposed on the canyon walls. Heavy salt deposits were present throughout this area. No pools were observed, and the small amount of flowing water present was only a few centimeters deep and approximately 8 to 12 cm wide. The flow appeared to go subsurface after only a few meters in a thick mass of riparian growth. This wet area had insufficient aquatic habitat for fish but could potentially be inhabited by amphibians such as tree frogs and slender salamanders.

Salt Canyon

Salt Canyon was initially surveyed on May 4, 2007 starting at the confluence with the Santa Clara River. No water was present in Salt Creek at the confluence, but the channel substrate was moist indicating recent flow. The channel was about 1 to 1.2 m wide in the river floodplain, and the substrate consisted primarily of fine silt with occasional cobbles. Thick willow and mulefat riparian vegetation was present at the river confluence, but then became sparse in the channel up to the first road crossing where the channel became entrenched 3 to 5 meters.

Approximately one-half mile upstream, the creek passed under an agricultural road via a six foot high, elliptical, corrugated metal culvert. The culvert does not appear to be a barrier to fish passage. Upstream of the crossing, the creek was channelized along agricultural fields, with the channel measuring approximately 5 to 8 m wide and the bankfull width measuring approximately 3 m wide. The stream remained dry up to

approximately 125 m upstream of the crossing. The flow here was very slow, with depths around 2-4 cm. The water was choked with algae and surrounded by a thick canopy of willow and mulefat. No fish were observed, but 10-12 pacific tree frog larvae were seen. Low flow and very thick riparian vegetation continued upstream for about a mile to where the creek and road turned south and crossed a cattle fence. The creek went dry just below an agricultural road that crosses the stream bed adjacent to the barbed wire cattle fence. Signs of heavy cattle grazing were obvious upstream of this fence.

For about the half mile upstream of the fence, the stream channel was very dry, with mostly sand/silt substrate interspersed with cobbles and an occasional boulder. Very little stream bank vegetation was present, likely due to heavy grazing. Low water flow was present on the surface after half a mile, just below the second set of overhead power lines spanning the creek, and continued upstream another half-mile to where the canyon and road split, near a pair of double gates on the road. At this split, a small marshy area with salt grass and reeds was present just below a 1.5 m high head cut that was the first encountered barrier to upstream fish movement. The head cut had a small flow of water trickling over it. Just above the barrier, the stream split. One arm continued up the main fork of Salt Canyon, and the other up an unnamed tributary canyon to the south. Flow from the tributary canyon was intermittent well beyond the RMDP boundary. Just upstream of the split, the main channel of Salt Creek passed under the road through a pair of 24 inch plastic corrugated culverts. Upstream of the road crossing was another broad marshy area measuring about 20 x 30 m. Upstream of this marshy area, low flow continued to be present up the main canyon along a broad, dry wash for another 100 m before going dry again.

Very little potential aquatic habitat was identified in the lower section of Salt Canyon. After the first road crossing, the creek was channelized but had good riparian cover and could potentially provide good habitat if there was increased flow. Potential aquatic habitat in the upstream reaches, between the first passage barrier and the first livestock fence, was not present due to the intermittent nature of the stream and the degraded channel as a result of heavy grazing impacts.

On June 13, 2007 the upper portion of the easternmost main arm of Salt Canyon was surveyed. The survey began at ridgeline separating the Salt Canyon drainage from Potrero Canyon drainage. The majority of the center fork of this branch was visible and was completely dry, with a steep rocky channel. No riparian vegetation was present. Following the northeastern arm of the branch downstream, the channel was also very dry, with incised dirt and cobble banks. Channel width was about 1 to 2 m wide. Just after the first branch to the south, the channel had intermittent areas of mulefat riparian growth, and a few isolated moist areas were present. No standing water was seen. Riparian growth gradually decreased downstream, until reaching the very large branch heading due south. Here the channel had increased in size to become a broad wash 10 to 12 m wide with sand, gravel and cobble substrate. The channel remained dry down to the marshy area above the first fish passage barrier observed in the May 2007 surveys. No

aquatic habitat or surface water was seen in any of the upper surveyed reaches of the eastern arm of Salt Canyon.

Unnamed Canyon A and Homestead Canyon

These drainages were surveyed on May 4, 2007. Unnamed Canyon A is located just west of Homestead Canyon. Both were small, dry, ephemeral channels that ran down small hillside ravines, north of Highway 126. Both were then artificially channeled around a small agricultural field by a concrete and dirt ditch network. The two channels joined together, before passing under Highway 126 via a concrete box culvert that was a barrier to upstream fish passage due to a 1.5 m head cut at the outlet end. This head cut had some rock riprap and plastic sheeting around it, apparently for erosion control. Downstream of the road, the stream was confined to an artificial ditch running between two agricultural fields, straight down to the river. No water and very little riparian vegetation were present in the ditch. At the river floodplain, the channel fanned out into dense riparian vegetation along the river bank. No defined stream channels were visible joining to the river. No aquatic habitat or potential aquatic habitat was observed in either of these drainage systems.

Off-Haul Canyon

Off Haul Canyon was surveyed on May 4, 2007. This small, dry, ephemeral stream emerged from a small canyon on the north side of Highway 126 and was directed into an agricultural ditch. It then passed under the highway through a double concrete box culvert, which could be a velocity barrier to upstream fish movement when flowing. Even if fish were to pass through the culvert, the agricultural drain system upstream would likely prevent any further fish movement. Downstream of the culvert, the channel consisted of a heavily scoured and incised agricultural ditch approximately 3 to 5 m wide and 3 to 5 m deep. No water and only sparse riparian vegetation were present in this channel. At the river floodplain, the channel fanned out into dense riparian vegetation along the river bank. No defined stream channels were visible joining to the river. No aquatic habitat or potential aquatic habitat was observed in the drainage.

Chiquita Canyon

Chiquita Canyon was surveyed on May 7, 2007. This small, dry, ephemeral channel emerged from a small hillside ravine north of Highway 126, where it was diverted into an agricultural ditch and ran under highway 126 through a concrete box culvert, then under an agricultural dirt road via a 6 ft diameter, corrugated, metal culvert. The agricultural road culvert had a 2 m drop at the outlet which was a fish passage barrier. No water was present in the ditch, and very little vegetation was present. Substrate in the ditch was primarily sand and silt, with dirt banks and the ditch was on average 20 m wide and 2 to 3 m deep. The ditch ran straight to the river floodplain where it fanned out just upstream of a temporary road crossing. Some isolated pools were present in this confluence area which contained arroyo chub juveniles and pacific tree frog larvae. The pools were likely

associated with the road crossing construction or backwater buildup, rather than with the Chiquita canyon stream confluence. No aquatic habitat or potential aquatic habitat was observed along the stream channel.

Chiquito Canyon

Chiquito Canyon was surveyed from the RMDP boundary downstream to the Santa Clara River confluence on May 7, 2007. Upstream of the RMDP boundary, the stream was accessed via the Lincoln Avenue stream crossing, which consists of two corrugated metal pipe culverts almost completely filled with sediment. Moving downstream, the creek was dry, with the substrate primarily consisting of sand. Thick riparian vegetation comprised of willows and mulefat was present along the banks, with cottonwoods increasing along the upper banks.

Approximately 100 m downstream of Lincoln Avenue a small spring seep was encountered in a side channel to the west of the main channel. The spring area had water emerging from a cut bank and trickling into a pool about 2 x 3 m wide and 5 to 15 cm deep. This spring appeared to likely be perennial. The pool was surrounded by thick cattails and willow growth. About 20 pacific tree frog larvae were observed in this pool. A small stream of water flowed out of the pool and joined the main creek channel about 8 m downstream. The flow continued under a dense willow canopy for approximately 70 m before going subsurface. The dense willow canopy ended just beyond this point. The flow through this area was very low, averaging only a few centimeters in depth and with a wetted width of 25 to 75 cm. the water temperature in the stream was 20 C at 12:00. The rest of the creek was dry down to the river.

Downstream of the flowing portion, the creek channel became a wide sandy wash with mostly sandy bottom mixed with occasional cobbles and boulders. The channel was down the center of Chiquito Canyon, paralleling Chiquito Canyon Road, until it crossed under the road, beneath a bridge with a concrete lined floor. A 15 to 20 cm drop at the downstream end of the bridge floor could prevent small fish, such as UTS, from passing upstream. Downstream of the bridge, the creek remained a sandy wash, passing under an old arch bridge just before passing through a triple concrete box culvert under Highway 126. Downstream of the highway, the channel ran directly to the river. Almost no riparian vegetation was present along the channel's dirt banks. This stretch of channel was on average 20 to 25 m wide and 2 to 3 m deep. At the river floodplain the channel ended and fanned out into an old, dry river channel braid. Downstream of Highway 126, no aquatic habitat or potential aquatic habitat was observed.

Mid-Martinez Canyon

Mid-Martinez Canyon was surveyed on May 7, 2007. The canyon consists of a small, dry ephemeral stream that emerges from a dry canyon in the hillside to the north of Highway 126. The stream was then diverted into an agricultural ditch. This stretch of ditch was dry with no riparian vegetation. The ditch ran through an agricultural field, to a

double concrete box culvert, under Highway 126. Downstream of the culvert, a pair of corrugated, metal, pipe culverts provides passage under an agricultural road. These culverts may create a velocity barrier to upstream movement of small fish (such as UTS) when flowing. Downstream of the culverts, the agricultural channel continues straight to the river. The channel in this reach was about 2 m wide and a meter deep, with heavy vegetation on the banks comprised of mostly willows and thistles. Upon reaching the river floodplain, the artificial ditch ends abruptly and the natural channel fans out and disappears onto a sandy flat. No water was seen anywhere in this drainage. No aquatic habitat or potential aquatic habitat was observed in this drainage.

San Martinez Grande Canyon

San Martinez Grande Canyon was surveyed form the RMDP boundary down to the river confluence on May 7, 2007. Upstream of Highway 126, the stream flowed down a large, broad canyon. The channel was primarily a sandy, steep banked gully measuring 25 to 30m wide and 2 to 3 m deep. Bottom substrate throughout was primarily sand and cobbles. At the RMDP boundary, the stream had a small amount of flow present. Water depth was only 2 to 4 cm and the wetted width was about 25 to 30cm. One small, deeper pool was about 20 cm deep and had a temperature measured at 18.5 C at the bottom and 22 C at the surface at 13:10. One pacific tree frog larvae was observed in the pool. As the flow continued downstream, a large amount of red colored algae was present on the bottom substrate. Flow was present for approximately 150 m downstream before becoming intermittent, and then going completely dry. Patches of cattails and sedges were present throughout the wetted stretch. The channel remained dry, with steep dirt banks, sandy bottom, and with consistent riparian vegetation along the margins, down to Highway 126.

Heavy salt deposits were present along the banks through much of the lower reach of channel. Just downstream of the channel's passage under the highway 126 bridge, a small drop was present over a series of boulders. The drop was about 75 cm high and would likely be a barrier to upstream movement of small fish such as UTS. From the drop, the channel continued to be a dry, sandy wash with cut dirt banks and intermittent overhanging riparian vegetation the remainder of the way to the river floodplain, where the channel joined with the active Santa Clara River channel. Very little potential aquatic habitat was observed downstream of Highway 126.

Ayres Canyon

Ayres Canyon was surveyed on May 7, 2007. At the mouth of the canyon, just before entering the river floodplain, the creek falls over the cut bank of the river floodplain. The cut bank was about 1.5 m high and is a fish passage barrier. At the base of this cut, water was seeping out into a large marshy area of watercress and cattails. A few large pools, approximately 1 x 3 m and 1 x 2 m wide were present. The deepest area was about 75 cm, and water temp in that pool was 16 C at 14:40. No fish or amphibians were observed in the pools. This wet, marshy area extended out into the river floodplain and became a

patchwork of intermittent wet areas and small shallow pools. Thick cattails, watercress and Arundo were present throughout this wet area. No defined channel was present connecting to the active river channel.

Approximately 4 m upstream of the cut bank barrier was a dirt road with a corrugated, metal, pipe culvert under it. The culvert was almost completely filled in with sediment. A small amount of water was draining from the pipe and flowed downstream for about 3 m before going subsurface just before the cut bank barrier. Upstream of the road crossing, the stream continued to have a small amount of flow. The wetted width was about 10 cm and depth was 2 to 4 cm. Upstream, the stream flowed down a small, steep canyon with very dense riparian vegetation, oak trees, and poison oak, which made it inaccessible for further survey. Due to the steep gradient of the canyon, this stream is likely not usable by fish. The large amount of thick vegetative cover, along with the consistent flow observed during the survey, suggests this stream may be perennial.

Long Canyon

Long Canyon was surveyed on May 7, 2007. The first 1000 m of channel, starting at the river floodplain, consists of a manmade agricultural ditch through agricultural fields. No vegetation was present and the channel substrate was silt and sand, with dirt banks. About 15 m upstream of the river floodplain connection, the channel was directed under a dirt road through a 48 inch corrugated plastic culvert pipe. At the upper end of the agricultural ditch, another dirt road crossing had three corrugated plastic pipe culverts with a 1m drop at the outlets, making it a fish passage barrier. Upstream of the crossing, the creek returns to its natural channel and continues up Long Canyon. The entire canyon appeared very dry, and the channel was primarily a broad, sandy, wash approximately 7 to 10 m wide. Almost no riparian vegetation was observed throughout the canyon and the channel margin vegetation was primarily upland brush. Channel substrate was uniformly sand and cobble mixture throughout the canyon. Approximately 1.5 to 2 miles upstream of the river, the main Long Canyon dirt road crosses the stream at an Arizona style crossing. Just below the concrete crossing, a large head cut with a 2 m drop presented another barrier to fish passage. The stream was surveyed all the way to the headwaters, and no aquatic habitat was present.

Humble Canyon

Humble Canyon was surveyed on May 7, 2007. The majority of the upper portion of Humble Canyon was a steep, dry ravine with no riparian vegetation. The dry channel was approximately 2 m wide, and had steep, scoured banks. Channel substrate was primarily sand and cobbles. No water was present in the upper portion of the canyon. At the lower end of the canyon, the gradient decreased considerably. Approximately 200 m upstream of the river floodplain confluence, a small side canyon enters from the west. At the intersection, the main creek passed through a large oak stand. In the center of the oak stand, about 10 m above the side canyon confluence, a 2 m high head cut presented the first barrier to upstream fish passage. At the base of the head cut, a small amount of

water was seeping out and flowing downstream. The channel from the side canyon was dry.

Downstream of the side canyon junction the channel was about 1 to 2 m wide, with mostly cobble and sandy silt substrate, and willows overhanging scoured, vertical banks. The wetted width of the small flow was approximately 10 to 15 cm and was only a few centimeters deep. Flow continued for about 100 m before going dry approximately 50 m from the canyon mouth. Water temperature in the seep, at the base of the head cut, was 17 C at 17:01. At the mouth, the channel ends at the river floodplain and no channel was evident connecting to the active river channel approximately 20 m away. No aquatic habitat was present upstream of the oak grove. Suitable habitat could be present downstream of the head cut barrier if more water was present. The low flow section encountered during the survey is probably intermittent and goes dry later in the year.

Unnamed Canyon B

This canyon is located approximately one half mile west of Humble Canyon and was surveyed on May 8, 2007. The canyon is a very small, dry and ephemeral with a steep gradient channel measuring approximately 30 cm in width. The canyon was surveyed from the mouth, upstream several hundred meters until the entire headwaters of the drainage were completely visible. The canyon had dense upland brush throughout, with very little riparian vegetation present near the channel. Large portions of the channel were incised with vertical cut dirt banks. The mouth of the canyon opened on to a small plateau elevated 1 to 1.5 m above the Santa Clara River floodplain. Upon reaching this plateau, the channel began to braid and fan out, eventually becoming indiscernible among the grasses and oaks covering the plateau area. The cut bank around the plateau area would be a barrier to upstream fish passage if water ever made it beyond the dissipated channel. No water was observed anywhere in this canyon.

Unnamed Canyon C

This canyon was surveyed on May 8, 2007 and is located approximately one-half mile west of Unnamed Canyon B and about a mile east of Long Canyon. The canyon was surveyed from the mouth to approximately 200 m upstream, and the majority of the headwater area of the canyon was visible. The canyon had a very step gradient channel that was deeply incised with vertical cut dirt banks ranging from1 to 2 m in height. Channel substrate was a mixture of cobbles and boulders, and no riparian vegetation was present in the canyon. The channel terminates at 75 cm drop at the river floodplain which was a barrier to upstream fish movement. No water was seen in the canyon, and the drainage appeared to be an ephemeral stream that likely only transports flash flows during storm events. This drainage's ephemeral nature in conjunction with the steep gradient provided no aquatic habitat anywhere in the canyon.

Lion Canyon

Lion Canyon was surveyed on May 8, 2007 and has two main branches splitting approximately one-quarter mile upstream of the canyon mouth. The entirety of the western arm could be observed from the dirt road rimming the agricultural plateau above and west of the arm. The channel was primarily a broad, sand and gravel wash up to the uppermost reaches where it split into several steep ravines choked with upland brush. The entire arm was very dry, and no riparian vegetation or potential aquatic habitat was present. Cattle were present in the area, and some channel banks appeared degraded from grazing activity. At the mouth of the west arm, the channel was completely dammed by a dirt road berm across the channel. Any flow in the arm would be gathered at this dam, perhaps for cattle use.

The east arm of Lion Canyon was also mainly a broad, sand and gravel wash with dirt roads present along much of the banks. The arm was very dry with no riparian vegetation and no aquatic habitat. Downstream of the junction of the two main arms, the channel continued as a broad, dry wash ranging from 3 to 5 m wide. At the mouth of the canyon, the channel runs along the vertical, east canyon wall before ending at a large 2 m drop into the main river floodplain. Below this fish passage barrier, the channel fanned out and became undefined towards the active river channel. No aquatic habitat or potential aquatic habitat was observed anywhere in the canyon.

Exxon Canyon

Exxon Canyon was surveyed on May 8, 2007. This ephemeral drainage was very dry with no riparian vegetation seen anywhere in the drainage. At the canyon mouth, the channel was 1 to 2 m wide and was a deeply cut, moderately steep gradient ravine which opened abruptly to the main river floodplain where it became undefined. The channel's scoured dirt banks were 1 to 3 m high in this lower section and the substrate was mostly sand and cobbles. The steep gradient is likely a barrier to upstream movement of small fish like UTS. About 40 m upstream of the mouth, the channel splits into two arms. Just upstream of this split, the channels in each arm were completely dammed by filled earth road crossings, indicating this canyon rarely has water present. Upstream, each arm continued as a dry, sandy wash inundated with upland brush. No aquatic habitat or potential aquatic habitat was observed anywhere in this canyon.

Dead End Canyon

Surveyed on May 8, 2007, this drainage was observed to be heavily impacted and degraded by extensive dirt road and graded bare areas throughout this small, dry canyon. The drainage appeared ephemeral, with the channel mainly being a small dry wash alongside a dirt road. Channel width was 1 to 2 m with sandy silt substrate and heavy upland brush throughout. No riparian vegetation was present in the drainage. At the mouth of the canyon, the channel opens onto a broad flat area (San Jose Flats) and disappears completely. These flats were covered with bare soil, grasses, and forbs. The

flats were raised above the river floodplain by a few meters, which would present a barrier to fish movement if flow were to make it across the flats and empty into the river. It appears that this canyon mouth may have historically been artificially dammed with a berm. No aquatic habitat or potential aquatic habitat was seen anywhere in this drainage.

Middle Canyon

Middle Canyon was surveyed on May 8, 2007 from the headwater area down to the mouth. The majority of this canyon, upstream of the final road crossing before the mouth, is a wide, sandy wash. No water and very little riparian vegetation were present. Inundation by upland brush increased moving upstream. The channel was 1 to 3 m wide and large portions of both banks had dirt road or graded bare areas present. No aquatic habitat was observed above the most downstream road crossing. Just downstream of this road crossing, on the east bank, a large water pump was actively pumping water to two large agricultural irrigation systems which were irrigating large flat areas of grasses and forbs. The channel below the road crossing had increasing amounts of riparian growth such as willows and large cottonwood trees. About 40 m downstream of the crossing and pump, water began intermittently flowing. Flowing sections ranged from about 20 to 100 cm wide and just a few centimeters deep, except for a few deeper pools that were 8 to 10 cm deep. One such pool had a water temperature of 16 C at 12:15. The flow became more consistent moving down stream, and riparian vegetation along the banks increased towards the canyon mouth. Approximately 20 m from the mouth of the channel, a 1 m high drop formed a barrier to upstream fish passage. The channel then fans out into the river floodplain amongst thick willow, mulefat, and cottonwood growth. The flowing water went dry in this area and the channel became undefined. No fish were observed in the wetted areas of Middle Canyon, and the low flow that was present may have been a result of the irrigation that was occurring just upstream. This lower wet stretch is likely intermittent in its natural state and would probably have little to no flow for most of the year without irrigation influence.

Unnamed Canyon D

This canyon is located approximately one mile east of Middle Canyon and was surveyed on May 8, 2007. This drainage was a steep, dry ravine with a deep cut channel about a meter wide, and with 1 to 1.5 m vertical, scoured banks. The channel substrate was mostly very fine silt, with occasional cobbles. No water was seen in the drainage, but the channel substrate was moist and a moist alluvial silt deposit was present at the channel opening onto the river floodplain. The entire drainage was only about 150 m long before reaching the top of an agricultural plateau. The evidence of recent flow and the high amount of silt suggests periodic runoff from the agricultural fields upstream had been occurring. Ten meters upstream of the canyon mouth a 1 m head cut created a barrier to upstream fish movement. Upstream of the barrier, the ravine had primarily upland brush growth. Downstream of the barrier drop, dense willow, Arundo and oak choked the channel mouth. Directly adjacent to the channel mouth, the remnants of an old road were observed. The road as obviously abandoned and overgrown, but its path could still be

seen ascending the hillside to the east. A 24 inch corrugated metal pipe culvert was emerging from und the old roadbed with its outlet just a few meters east of the canyon channel mouth. The inlet to the pipe was not found, and may have directed the canyon channel under the road previously, or is perhaps an agricultural drainage pipe draining from the top of the plateau area. No aquatic habitat or potential suitable aquatic habitat was observed in this drainage.

Castaic Creek

Castaic Creek has been extensively examined in previous surveys, and, therefore, was not surveyed in depth during these tributary surveys. Castaic Creek is known to be dry during most of the year. When flow is released from Castaic Lake upstream or when rain events maintain surface flow for an extended period of time, adequate aquatic habitat exists to support various fish species found in the Santa Clara River watershed. Surface flow is intermittent and the creek eventually goes dry either stranding fish or receding at a slow rate where fish can migrate downstream to the Santa Clara River. Previous surveys found exotic non-native fishes to be more common in the main river downstream of the mouth of Castaic Creek, suggesting it may be the source of some of these exotics.

Hasley Canyon

Hasley Canyon was surveyed on June 13, 2007. This canyon is a tributary to Castaic Creek. Its confluence with Castaic Creek was just upstream of the Commerce Center Drive Bridge over Castaic Creek. From the confluence, upstream approximately 900 m the channel was a very wide, sandy wash with cut dirt banks, and small amounts of scattered riparian growth. At 900 m upstream of the confluence, a very large boulder rip-rap structure was present at the base of the large concrete channel that Hasley Creek was confined to upstream. This rip-rap structure was a barrier to upstream fish movement. Flowing water, estimated at 2 cfs, was present in the concrete channel, spilled over the riprap structure, and continued down the wash for approximately 100 m before going intermittent and then disappearing subsurface. The flowing water in the concrete channel was observed to be very turbid, with high amounts of suspended sediment. Riparian growth of willows and mulefat was very thick, with excellent canopy cover within the concrete channel. The concrete channel bottom was inaccessible and so was surveyed from the channel's edge upstream to the Commerce Center Drive Bridge crossing. If any aquatic organisms were present, they were not able to be detected from along the high channel banks and due to the low water visibility.

Unnamed Canyon E

This small canyon was surveyed on June 13, 2007 starting at the end of Magic Mountain Parkway, the canyon's terminus. No obvious channel was evident at the bottom of the canyon, near the road's end, though a drainage inlet structure was present at the fence line of Magic Mountain. Approximately 40 m upstream, a small channel emerged. The channel increased in size heading upstream from 1 to 2 m in width and was a very dry,

shallow wash with sand and cobble substrate. No riparian vegetation was present, and no water was observed in any portion of the canyon or its small headwater ravines. No aquatic habitat was present anywhere in the canyon.

Unnamed Canyon F

This canyon was surveyed on June 13, 2007 and is located south-east of the main entrance to Magic Mountain, with its headwaters at the Tournament PlAyres Club golf community in the City if Santa Clarita. Downstream the culvert crossing under Magic Mountain Parkway, the drainage was channelized into a concrete lined channel running along the edge of Magic Mountain to the river floodplain. Upstream of the Magic Mountain Parkway crossing, the drainage was a broad canyon, with a large dry wash running down the middle. The channel had primarily sand and cobble substrate, with incised, cut dirt banks approximately 1 m high. The channel width ranged from 10 to 15m wide between these cut banks. Moving upstream, the next 600 m continued as a dry, sinuous wash. Approximately 600 to 650 m upstream of Magic Mountain Parkway, the channel narrowed considerably and was confined between deeply incised banks 2 to 3 m high. Approximately 20 m upstream of this area, the channel widened and returned to a broad wash, with 1 to 2 m banks. About 80 to 100 m upstream of the constricted area, the sandy channel substrate began having intermittent patches of moisture, until surface flow was seen just beyond a large natural gas pipeline that crosses the channel.

This flow was coming out of a large concrete outlet structure another 60 m upstream. Flow was estimated to be less than 1 cfs. Throughout the surface flow below the outlet, 30 or 40 juvenile, recently morphed, western toads were observed. The outlet structure had rock rip-rap imbedded in a concrete apron, with concrete wing walls. A 1 m drop was present at the end of the apron. Pooled water up to 20 cm deep was present in the apron, and approximately 10 western toad larvae were observed in the pool. The outlet structure appeared to drain from the Tournament PlAyres Club golf course and residential community along the ridgeline, immediately south and upstream of the outlet. No channel or surface water was observed upstream of the culvert however, and the water may come from a storm drainage system in this community, or be the result of golf course runoff.

Magic Mountain Canyon

Magic Mountain Canyon was surveyed on June 22, 2007. The survey began at the Magic Mountain property boundary, where the channel is directed under the property fence and into a concrete lined, trapezoidal channel. Upstream of Magic Mountain, the channel was a dry wash with scoured banks up to one meter high, and with sand, gravel and cobble substrate. Channel width ranged from 3 to 6 m. A few isolated stands of mulefat were present just above the concrete channel, but no riparian vegetation was seen throughout the rest of the canyon. Approximately 800 m upstream of Magic Mountain, the canyon splits. Both branches had very dry, ephemeral, channels. No aquatic habitat was observed anywhere in Magic Mountain Canyon.

Discussion of Results

The survey results indicate that limited amounts of aquatic habitat are present in 10 of the 23 tributaries within the RMDP area. The tributaries with some amount of aquatic habitat include:

- Potrero Canyon;
- Salt Canyon;
- Chiquito Canyon;
- San Martinez Canyon;
- Ayres Canyon;
- Humble Canyon;
- Middle Canyon;
- Castaic Creek;
- Hasley Canyon; and,
- Unnamed Canyon F.

The remaining tributaries consist of dry, ephemeral drainages with no observable aquatic habitat or potential aquatic habitat. These tributaries include Homestead Canyon, Off-Haul Canyon, Chiquita Canyon, Mid Martinez Canyon, Long Canyon, Lion Canyon, Dead End Canyon, Magic Mountain Canyon and Unnamed Canyons A, B, C, D and E.

Potrero Canyon

Potrero Canyon had some of the best aquatic habitat of any tributary surveyed. The lower section of the stream, where it is within the river floodplain, had very little water in the upper section and no water was present in the lower section. However, if water levels were higher or if the river level was raised enough to flood this channel, the thick canopy cover along this reach would provide good protection for fish. Farther upstream, out of the flood plain, several deeper pools were observed to have arroyo chubs, clawed frogs, and a southwestern pond turtle. This stretch was only about 40 m long, but was the best habitat in Potrero Canyon. The pools ands flow in this area appeared perennial so this habitat would be present for aquatic organism use year round. Upstream of the culvert crossing there remained ample flow to support aquatic organisms, but shoreline habitat quickly became degraded moving upstream as a result of grazing pressure. Furthermore, the culvert crossing under the dirt road is a barrier to fish movement and therefore the portion of stream upstream of the culvert is inaccessible for fish utilization.

Salt Canyon

Salt Canyon had very limited amounts of aquatic habitat present in its lower section. Although some tree frog larvae were seen in some areas, lack of pools and deep water suggests that the few intermittent areas that were identified in the survey provide very marginal habitat that is probably insufficient to support fish during the majority of the year. Two marshy areas existed just above and below the head cut that was the first

barrier to upstream movement, at the first major canyon branch. While enough water is present to support tree frogs and perhaps other amphibians, there appeared to be insufficient habitat to support fish.

Chiquito Canyon

Chiquito Canyon contained a very small amount of aquatic habitat below the small, perennial spring near the NRMP project boundary. The pool at the base of the spring had adequate depth and size to provide limited fish and amphibian habitat, and a few tree frog larvae were seen utilizing the pool. However, because the pool is so far upstream and because there exists a barrier to upstream movement under a bridge downstream, it is unlikely this area is accessible for use by fish. Downstream of the spring area a small amount of flow was present with good riparian canopy cover, but an insufficient amount of water is likely present for the majority of the year to provide appropriate habitat for fish or amphibians.

San Martinez Grande Canyon

A small amount of habitat was present in the upper portion of San Martinez Grande Canyon. One very small pool had one tree frog tadpole in it. The small amount of flow observed existed for only a short distance before disappearing. The reach appeared intermittent and so does not have water year round and would therefore not support a permanent fish population. Additionally, a barrier downstream of this area, beyond the highway 126 bridge, would prevent access to the area by fish moving upstream from the river.

Ayres Canyon

Ayres Canyon was one of the few drainages that appeared to have perennial flow through most of it. However, a large barrier right at the river floodplain, a steep gradient, and low flows make the majority of this canyon unusable by fish. Just downstream of the barrier, along the edge of the river floodplain, a series of deep, cool pools could provide fish and amphibian habitat. While not normally connected to the river, during high water events when connection is established, this area could potentially be used as a backwater refugia area for fish.

Humble Canyon

Humble Canyon had a very small amount of intermittent flow present in the lower reach. Flows here would generally be insufficient and seasonal, and would therefore not provide good fish habitat. A large barrier just upstream of this intermittent area prevents fish access to any upstream portion of the canyon, none of which had any aquatic potential. During periods of high flows, fish could potentially move up the into Humble canyon as far as the barrier, but unstable banks, lack of spawning areas, and the intermittent nature of this reach would only support fish for a limited time.

Middle Canyon

Middle Canyon had a very small amount of intermittent flow at its lower end. Water in the lower part of Middle Canyon appeared to be generally insufficient and seasonal, and therefore does not provide good fish habitat. A barrier very near the canyon mouth precludes fish movement upstream to the intermittent area, and even during high river flows, only a very short section of the stream at the canyon mouth would be usable by fish as a refugia area.

Castaic Creek

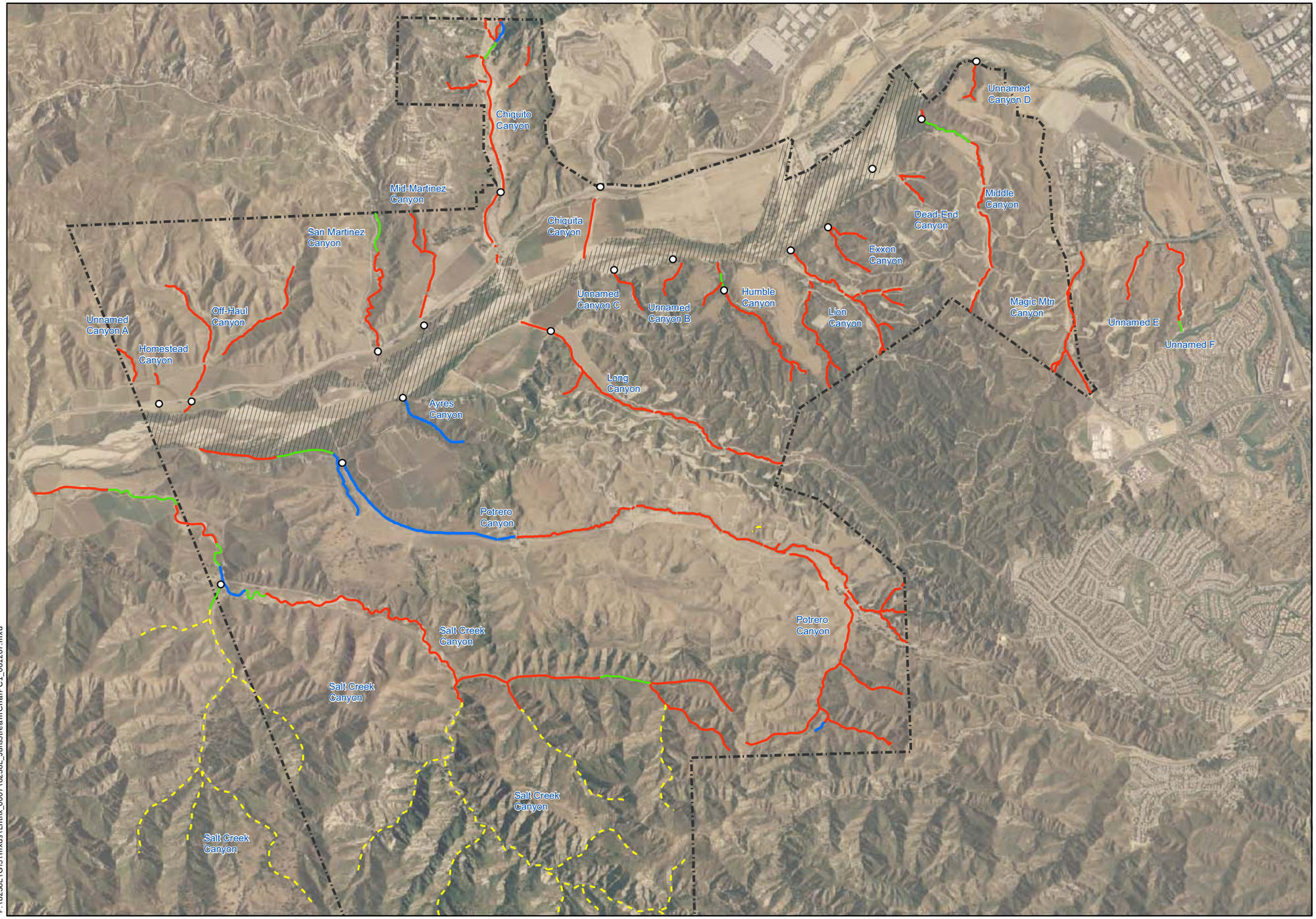
Castaic Creek is known to occasionally contain aquatic habitat for fish. When flow is released from Castaic Lake upstream or when rain events maintain surface flow for an extended period of time, adequate aquatic habitat exists to support various fish species found in the Santa Clara River watershed. Surface flow is intermittent and the creek eventually goes dry either stranding fish or receding at a slow rate where fish can migrate downstream to the Santa Clara River.

Hasley Canyon

Hasley Canyon, a tributary to Castaic Creek, had relatively good aquatic habitat in the concrete channel portion. Flows here were high enough to support fish, and excellent riparian canopy cover existed. However, the channel is inaccessible by fish moving upstream due to the large rip-rap barrier at the base of the concrete channel. Downstream of the barrier, flows decrease quickly and vegetation and instream structure is inconsistent. During periods of higher flows and when Castaic Creek is flowing, fish may utilize this lower section temporarily.

Unnamed Canyon F

Unnamed Canyon F had a very small amount of water present at its headwater area. Although we did observe numerous western toad juveniles and larvae in this area, there was little habitat for fish. The pooled water in the outlet structure likely provided the breeding area for the western toads, but the concrete and rock bottom would not provide any breeding area for fish. The flow below the outlet structure was very shallow and slow, and disappeared subsurface after a short distance, offering no suitable fish habitat. Furthermore, flow from the outlet appeared to be dependant on the upstream golf course and residential area runoff, suggesting the flow here is likely intermittent throughout the year. The upper portion of this stream, including the outlet structure, is inaccessible to fish moving upstream from the river due to the channelized barrier along Magic Mountain downstream.



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LEGEND

- Fish Passage Barrier

Stream Characteristics

- Ephemeral
- Intermittent
- Perennial
- Unknown

- Resource Management Development Plan
- Santa Clara River CDFG Jurisdiction

Location	Type	Length by Type (ft)
Ayres Canyon	PER	**2,464.4**
Chiquita Canyon	EPH	**1,849.8**
	EPH	10,959.1
	INT	643.1
	PER	721.4
Chiquito Canyon		**12,323.6**
Dead-End Canyon	EPH	**1,936.4**
Exxon Canyon	EPH	**3,542.7**
Homestead Canyon	EPH	**391.0**
	EPH	5,922.0
	INT	574.6
Humble Canyon		**6,496.5**
Lion Canyon	EPH	**11,952.8**
Long Canyon	EPH	**10,579.8**
Magic Mtn Canyon	EPH	**6,130.1**
	EPH	5,925.2
	INT	1,670.2
Middle Canyon		**7,595.5**
Mid-Martinez Canyon	EPH	**4,350.8**
Off-Haul Canyon	EPH	**8,238.3**
	EPH	32,749.4
	INT	1,751.2
	PER	8,855.3
	UNK	370.7
Potrero Canyon		**43,726.6**
	EPH	25,034.2
	INT	6,788.3
	PER	1,439.7
	UNK	75,918.6
Salt Creek Canyon		**109,180.8**
	EPH	3,910.1
	INT	1,259.8
San Martinez Canyon		**5,170.0**
Unnamed Canyon A	EPH	**1,293.7**
Unnamed Canyon B	EPH	**1,272.5**
Unnamed Canyon C	EPH	**1,574.1**
Unnamed Canyon D	EPH	**1,494.6**
Unnamed E	EPH	**2,020.2**
	EPH	2,782.8
	INT	343.4
Unnamed F		**3,126.2**

NEWHALL LAND
A LENNAR/LNR COMPANY

1 inch equals 3,000 feet
0 1,500 3,000 4,500 Feet

PACE
PACIFIC ADVANCED CIVIL ENGINEERING

FIGURE 1

JURISDICTIONAL STREAM CHARACTERISTICS

SENSITIVE ACQUATIC SPECIES REPORT

APPENDIX F

RESUMES

ENTRIX
ENVIRONMENTAL CONSULTANTS

Steven R. Howard

Project Scientist

Discipline/Specialty

- Aquatic Invertebrate Ecology
- Fisheries Biology
- Habitat Assessments and Mapping
- IFIM/PHABSIM
- Limnology
- Salmonid Biology
- Stream and Estuarine Ecology
- Water Quality Assessment
- Environmental Monitoring

Education

- B.S., Fisheries: Humboldt State University, Arcata, CA, 1999

Training/Certifications

- California Department of Fish and Game. Resident Scientific Collecting Permit No. 801293-01
- USFWS Project Permitted Tidewater Goby Specialist in Ventura and Santa Cruz Counties
- Theory and Application of the Physical Habitat Simulation System, Utah State University, May 2002
- Sampling Theory and Design Workshop, Humboldt State University, March 2002
- Aquatic Ecological Assessment Workshop, CDFG, March 2002
- Electrofishing Workshop, AFS and Smith-Root, March 2006

Affiliations

- American Fisheries Society, Oregon and Cal-Neva Chapters since 1998

Summary of Qualifications

Mr. Howard is an interdisciplinary scientist with an emphasis on aquatic studies including fishery habitat assessment and population surveys, fish species identification, fisheries techniques, fish passage assessment, fish and aquatic invertebrate population analysis, water quality assessment, and wildlife population and escapement surveys. Mr. Howard has preformed numerous projects in aquatic habitats ranging from high elevation lakes and streams to coastal estuaries. Mr. Howard has also conducted projects including subsurface soil and groundwater investigations, environmental impact studies, environmental monitoring, and site closure and remediation. Mr. Howard has been involved in permitting large power projects and smaller instream projects throughout California.

Mr. Howard has conducted numerous fish population studies throughout many of the western states. Representative projects include chinook, steelhead and bull trout studies in northern California and Oregon, steelhead studies in central and southern California, various trout species studies in California, Oregon and Idaho, and native fish studies in Oregon and southern California. Mr. Howard has also conducted fish population surveys in southern and central California estuaries for the endangered tidewater goby.

Mr. Howard manages the majority of the aquatic projects in southern California. Proven management skills along with technical expertise with special status aquatic species, instream flow studies and mitigation compliance has been a key factor in the retention of on-call services contracts with several clients in southern California.

Relevant Experience

Fish and Wildlife Studies

McKenzie River Watershed Spring Chinook Population Study – Lane County, Oregon

Mr. Howard conducted chinook salmon spawning surveys, obtained biological samples from spawned-out salmon, collected downstream migrants, monitored fish passage though leaburg dam, and monitored bull trout migration under the Western Oregon Research and Monitoring Program. Mr. Howard conducted these projects for the Oregon Department of Fish and Wildlife.

Oregon State Elk Population Study – Lane County, Oregon

Mr. Howard managed an initial statewide effort to obtain elk teeth and tissue samples throughout the state of Oregon. This effort was successful and set precedent for future Oregon Department of Fish and Wildlife elk tissue collection efforts.

United Water Conservation District FERC Relicensing Project – Ventura County, California

ENTRIX, Inc. designed multiple studies under agency consultation during the FERC application process. Mr. Howard conducted fish population studies and identified fish species present in Piru Creek below Santa Felecia Dam, within Piru Lake and above the lake in Piru Creek.

United Water Conservation District Steelhead Migration Project – Ventura County, California

ENTRIX, Inc. directed fish passage monitoring and fish rescue consultation involving steelhead on the lower Santa Clara River. Mr. Howard was the lead fisheries biologist for the project. The Vern Freeman Diversion fish passage facility includes a fish ladder, fish screens, and a downstream migrant fish trap. During steelhead migration, facilities at the diversion were inspected for stranded steelhead and resident rainbow trout for relocation to the appropriate habitat. These operations were interim mitigation measures for section 10 incidental steelhead take.

PacifiCorp FERC Relicensing Project – Jackson County, Oregon

ENTRIX, Inc. conducted numerous aquatic studies under agency consultation during the FERC reliscencing application process. Mr. Howard analyzed fish population data in the upper Rogue River watershed to estimate salmonid population densities above and below dams.

Moyie River Fish Population Study – Bonner County, Idaho

ENTRIX, Inc. conducted a salmonid relative abundance survey in the Moyie River in Idaho. The survey was performed utilizing four divers at several gas pipeline river crossings. This was conducted in conjunction with past monitoring and a proposed expansion of the pipeline at the crossings in the Moyie River. Mitigation for each crossing consisted of installing Riprap wings to prevent bank Scour and rock-drop structures to form rearing and holding pools.

Ventura County Flood Control Tidewater Goby Project – Ventura County, California

ENTRIX, Inc. served as fisheries professional to the Ventura County Flood Control District during pipe maintenance in the Hueneme drain. A temporary impoundment was placed around the work area which trapped numerous fish including tidewater gobies. Mr. Howard identified fish species within the impoundment and relocated all fish away from the work area.

Ventura County Flood Control Bank Stabilization Project – Ventura County, California

ENTRIX, Inc. served as fisheries professional for Ventura County Flood Control District during a bank stabilization and habitat restoration project on the Sespe River. Mr. Howard was in charge of identifying fish species for relocation outside of the project boundary.

San Clemente Dam Retrofit Drawdown Project – Monterey County, California

ENTRIX, Inc. is conducting annual fish rescues upstream of San Clemente Dam and fish trapping and relocation activities to appropriate habitats downstream of San Clemente Dam for California-American Water Company. Water quality monitoring was also an important part of this project during the drawdown activities. Dissolved oxygen can drop dramatically during these types of projects. Aerators were installed throughout the reservoir to maintain adequate DO levels during the project. A low percentage of steelhead mortalities occurred during this project. Mr. Howard conducted fish rescues and relocations and water quality monitoring during this project. Mr. Howard was one of a few biologists permitted by NOAA Fisheries to conduct electrofishing and fish relocation activities during this project.

Haines Creek Native Fish Population Monitoring and Exotic Species Removal Project – Los Angeles County, California

ENTRIX, Inc. is involved in a multi-year fish population monitoring project on Haines Creek. Haines Creek is one of a few creeks that has sustaining populations of Santa Ana suckers and Santa Ana speckled dace. Numerous exotic species are also found in Haines Creek such as largemouth bass, green sunfish, mosquito fish and crawfish. Sampling is conducted by a 2-pass seining method in 200-meter sample sites.

San Lorenzo River Steelhead and Tidewater Goby Relocation Project – Santa Cruz County, California

ENTRIX, Inc. conducted steelhead and tidewater goby rescue and relocation activities during a bank stabilization project in the tidally influenced reach of the San Lorenzo River. A portadam was constructed around the work area and water was pumped out the impoundment. During fish rescue operations, Mr. Howard discovered the first known tidewater goby in the San Lorernzo River, which prompted further consultation to complete the project. Entrix, Inc. assisted in expediting this consultation process with the USFWS and NOAA Fisheries by monitoring water quality within the impoundment and describing tidewater goby habitat and in the San Lorenzo River.

Habitat Assessment Studies

Habitat Typing Projects – California and Oregon

ENTRIX, Inc. performs numerous habitat typing investigations for multiple clients throughout the United States. Mr. Howard has performed habitat typing field projects in northern California coastal rivers and in mountain streams in southern California and Oregon.

Steelhead Habitat and Passage Assessment – Ventura County, California

ENTRIX, Inc. conducted a steelhead habitat and passage assessment for the City of Ventura to be included in the Ventura River Habitat Conservation Plan. Mr. Howard was the lead fisheries biologist in charge of assessing steelhead habitat on North Fork Matilija Creek. A diversion facility on the Ventura River currently blocks access to headwater steelhead habitat in North Fork Matilija Creek and its tributaries. A fish passage facility is planned for construction in the near future allowing upstream migration to important steelhead habitat in the North Fork Matilija. This habitat assessment quantified spawning and rearing habitat for southern California steelhead trout.

Matilija Creek Steelhead Habitat Evaluation – Ventura County, California

ENTRIX, Inc. conducted a steelhead habitat evaluation for the Matilija Dam Ecosystem Restoration Project. Mr. Howard assisted a project team during this evaluation. The report supplemented the F3 Feasibility Study prepared by the US Army Corps of Engineers and Ventura County Flood Control District. The Matilija Dam project is the largest dam removal and restoration activity ever proposed in California. Restoration will connect endangered southern California ESU steelhead with nearly 50 percent of its historic Ventura River basin spawning and rearing habitat.

Salsipuedes Creek Fish Passage Project – Santa Barbara County, California

ENTRIX, Inc. modified an existing concrete apron to provide for fish passage along Salsipuedes Creek near Lompoc, California. Responsibilities included surveying, conducting site reconnaissance studies, preparing design drawings, permit information, and a grant application, and construction oversight. Mr. Howard assisted the project engineer on anadromous fish passage criteria for the project.

Bioassessment and Invertebrate Studies

Olympic View Sanitary Landfill Wetland Evaluation – Kitsap County,Washington

ENTRIX, Inc. conducted statistical analysis of previously collected data to evaluate relationships between chemical and physical water parameters and the abundance and diversity of macroinvertebrates in a wetland adjacent to the landfill. Stepwise regression analysis attempted to correlate species abundance and richness with water quality and chemistry to assess localized impacts. Mr. Howard conducted this statistical analysis and assisted the project team with the final report.

Santa Clara River Estuary Bioassessment – Ventura County, California

ENTRIX, Inc. designed and conducted this bioassessment study which involved stratified sampling of several estuarine habitats for benthic macroinvertebrates in the Santa Clara River Estuary. Mr. Howard was the lead field biologist on this project. The macroinvertebrate data characterized the assemblage diversity and develops relationships between species abundance, density, richness and microhabitat preferences (grain size, salinity tolerances, etc.). The objective of this study was to support the City and LAWRQCB in the development of defensible site-specific NPDES limits for metals discharged to the estuary.

Big Creek FERC Relicensing Bioassessment Project - Sierra National Forest, California

ENTRIX, Inc. performed this study under agency consultation for the SCE Big Creek FERC relicensing application process. Mr. Howard was a lead biologist on this bioassessment project. The project was conducted in a large portion of the South Fork San Joaquin River watershed. Macroinvertebrate sampling occurred above and below large dams and small diversions to assess Southern California Edison project impacts.

Instream Flow Studies/PHABSIM Modeling

United Water Conservation District FERC Relicensing IFIM Project – Ventura County, California

ENTRIX, Inc. conducted an instream flow study to determine the impacts of Santa Felicia Dam on the steelhead habitat in Piru Creek. Mr. Howard lead a crew comprised of client staff and sub-contractors.

United Water Conservation District FERC Relicensing Steelhead Migration Project– Ventura County, California

ENTRIX, Inc. conducted a migration study on the Santa Clara River downstream of Piru Creek to determine adequate flow releases that would facilitate steelhead upstream migration to Piru Creek.

Ventura River IFIM Project – Ventura County, California

ENTRIX, Inc. conducted this instream flow study to determine the impacts of dams and diversions on the steelhead habitat in the Ventura River. The results of this study will assist in the identification of factors potentially limiting fish populations in the effected reaches of the Ventura River and to determine appropriate minimum instream flows. Mr. Howard conducted the field investigation, PHABSIM Modeling and produced the final report. Instream Flow Incremental Methodology (IFIM) studies in Oregon and California including the Ventura River. These projects use multiple flow regimes in determining fish habitat suitability downstream from dams and diversions.

Matilija Creek IFIM Project – Ventura County, California

ENTRIX, Inc. conducted this instream flow study to determine the impacts of releases from Matilija Dam on Steelhead rearing and spawning habitat from the dam to the Robles Diversion on the Ventura River. The

results of this study will assist in the identification of factors potentially limiting fish populations in the effected reach and to determine appropriate release flows and ramping rates. Mr. Howard conducted the field investigation, data collection, and modeling setup.

PacifiCorp FERC IFIM Project – Jackson County, Oregon

ENTRIX, Inc. conducted this instream flow study to determine the impacts of dams and diversions on fisheries habitat in the upper Rogue River watershed. Mr. Howard assisted in the field investigation and data collection.

Water Quality Studies

Santa Clara River Estuary Metals Translator Study – Ventura County, California

ENTRIX, Inc. conducted a yearlong investigation focused on determining the metals translators for copper, nickel, zinc, and lead in the Santa Clara River Estuary. There are chemical differences between the Ventura Water Reclamation Facilities (VWRF) discharged effluent and the receiving Santa Clara River water. The Metals Translator Study determined what fraction of metals in the VWRF effluent were dissolved in the receiving water, and therefore bioavailable. Mr. Howard was the lead investigator on the Santa Clara River Estuary Metals Translator Study for the City of San Buenaventura.

Big Creek FERC Relicensing Water Quality Project – Sierra national Forest, California

ENTRIX, Inc. conducted a water quality study related to the hydroelectric relicensing of Southern California Edison's Big Creek system in the San Joaquin River watershed. Study sites were selected by ENTRIX and a combined agency working group targeting large reservoirs, small impoundments, and streams below project facilities. Mr. Howard was in charge of multiple sampling teams working throughout the San Joaquin watershed.

Environmental Monitoring

360 Networks Fiber Optics Project – Modoc, Lassen, Tehama, Glenn, Butte, Yuba, and Sutter Counties, California

ENTRIX, Inc. monitored fiber optic installation that occurred within a variety of sensitive habitats including rivers, wetlands, vernal pools, caves, and cultural resource areas. Many species listed under the California and Federal endangered species acts were of special concern on this project. Mr. Howard was the lead environmental monitor on this fiber optics project for the California Public Utilities Commission. No significant environmental impacts, under the adopted environmental mitigation measures, occurred on this project.

Southern Trails Gas Pipeline Project – Riverside County, California

ENTRIX, Inc. monitored fiber optic installation that occurred within a variety of sensitive dessert habitats including rivers, washes, reptile and bird habitats, and cultural resource areas in the Mojave Dessert near Palm Springs, California. Mr. Howard was the Lead Field Coordinator for the California State Lands Commission on this project. The pipeline right-of-way was 8 miles long which crossed numerous washes including the San Gorgonio River. No significant environmental impacts, under the adopted environmental mitigation measures, occurred on this project.

Ventura County Water Protection District Sediment Removal– Ventura County, California

ENTRIX, Inc. monitored a sediment removal and channel maintenance project on Pole Creek in Fillmore, California. Mr. Howard served as fisheries professional and Environmental Monitor to the Ventura County Flood Control District on this project. This creek is a tributary to the Santa Clara River which supports a small population of endangered southern California steelhead trout. Mr. Howard assessed steelhead habitat quality and steelhead migration barriers. Additionally, Mr. Howard monitored construction to eliminate the possibility of project related steelhead impacts.

Ventura County Water Protection District Emergency Instream Restoration Projects– Ventura County, California

ENTRIX, Inc. assisted the County of Ventura during and following the floods events that caused extensive damage to private property, flood control and fish passage facilities, and the agricultural communities throughout Ventura County in 2004 and 2005. Mr. Howard managed 15 projects for the county following the flood events. Mr Howard, along with other ENTRIX biologists permitted to work with local endangered fish species including steelhead and tidewater gobies captured and relocated fish species prior to instream construction activities. Construction monitoring was also conducted to ensure emergency permit compliance and to minimise potential take of endangered species and their habitat.

El Paso Natural Gas Conversion Project– San Berbardino County, California

ENTRIX, Inc. monitored pipeline installation that occurred within a variety of sensitive desert habitats including rivers, washes, reptile and bird habitats, and cultural resource areas near Blythe, California. Mr. Howard was the Lead Field Coordinator for the California State Lands Commission and the BLM on this project. The pipeline right-of-way was 80 miles long. This project had multiple compliance challenges that were identified and managed onsite with oversite by the Lead Field Coordinator and Project Manager. No significant environmental impacts, under the adopted environmental mitigation measures, occurred on this project.

ENTRIX

Joel James Mulder

Senior Staff Scientist

Discipline/Specialty

- Aquatic Ecology
- Fisheries Biology
- Amphibian Biology
- Rangeland Ecology

Education

- B.S., Environmental, Population and Organismic Biology, University of Colorado at Boulder, 2001

Certifications

- California Department of Fish and Game. Resident Scientific Collecting Permit No. 801144-01 (Valid through 6/09)
- Swiftwater Rescue Training, 2008
- Emergency Medical Technician, State of California, 2005
- SCUBA Advanced Open Water Diver, 2006

PROFESSIONAL TRAINING

- Mountain Yellow Legged Frog CDFG inter-regional training, 2001, 2002, 2003
- American Canoe Association Coastal Kayak Instructor Workshop and Examination, 2003
- State Water Resources Control Board Surface Water Ambient Monitoring Program(SWAMP) Workshop, 2007

Summary of Qualifications

From his interdisciplinary background in the environmental sciences, Mr. Mulder has a range of experience in ecological studies, including aquatic and terrestrial ecology, fishery habitat assessment and population surveys, amphibian ecology and survey techniques, amphibian habitat restoration, rangeland ecology and monitoring, grazing related erosion and stream bank alteration, high desert and mountain meadow system botany, and invasive plant eradication. Mr. Mulder has led numerous field crews and volunteer groups, and is proficient at planning and executing project design and strategy.

Relevant Experience

Fish and Wildlife

San Gabriel River Fish Toxicology Survey, Los Angeles County, California

Mr. Mulder has conducted fish surveys for the San Gabriel River Regional Monitoring Program, Annual Fish Toxicology Study. The monitoring program is sponsored by the Los Angeles and San Gabriel Rivers Watershed Council. Captured target fish species through a variety of sampling techniques including gill neting, seining, gigging and hook and line. Samples were used to assess fish toxicology associated with human consumption of fish from the San Gabriel River system.

California Wild Trout, North Central Mountain Region, California

As part of the California Department of Fish and Game's ongoing monitoring on sensitive reaches of river and stream containing wild trout, Mr. Mulder participated in backpack electro-shocking surveys to assess trout population numbers and health in sections of the Truckee River, East Walker River, and Upper Carson River. Mr. Mulder also coordinated volunteer groups assisting in the surveys and educated public observers.

Mountain Yellow Legged Frog Survey, North Central Mountain Region, California

Mr. Mulder served as California Department of Fish and Game crew leader for the north central mountain region of a statewide mountain yellow legged frog survey project. Surveys were conducted high mountain lakes of the Sierra Nevada. Mr. Mulder led a series of biological surveys for amphibians and fish which included visual encounter surveys for amphibians, gill net sampling, fish identification, backpack electro-shocking, otolith collection, fish barrier identification, fish spawning area identification, chitrid fungus inspections on mountain yellow legged frogs, fairy shrimp collection, and terrestrial and aquatic habitat surveys. Mr. Mulder was additionally responsible for the project's data management, fish population analysis, GIS mapping, restoration area identification, and co-presentations of project progress and results.

Exotic Species Removal Project, Big Tijunga Mitigation Project, Los Angeles County, California

Performed removal of exotic fishes, invertebrates, and amphibians in the Haines Creek ponds and in Haines Creek. Efforts included trapping, snorkel surveys, bullfrog gigging, spearfishing, and water quality testing.

Exotic Species Removal Project, San Mateo Lagoon Mitigation Project, Orange County, California

Performed removal of exotic fishes, invertebrates, and amphibians in San Mateo Lagoon and lower San Mateo Creek. Efforts included trapping, seining, bullfrog gigging, water quality testing and surveys for tidewater goby presence/absence.

City of Santa Clarita – Special Staus Species Survey and Unarmored Threespine Stickleback Relocation, Los Angeles County, California

Conducted weekley pre-construction surveys for nesting special status and migratory birds. Conducted weekly surveys for sensitive upland reptile and mammal species . Conducted sensitive aquatic species surveys. Performed capture and relocation of federally endangered unarmored threespine stickleback during river diversion activites. Provided consulting for design, construction and implementation of a temporary river diversion channel.

Caltrans Fish Passage Survey, Ventura, Santa Barbara, Los Angeles and San Luis Obispo Counties, California

Conducted habitat and fish passage assessments throughout Ventura, Santa Barbara, Los Angeles and San Luis Obispo County highway systems. Conducted field surveys and analysis of potential fish passage barriers, and inventoried culvert and bridge locations.

Ventura County Watershed Protection District – Lower Santa Paula Creek Biological Assessment, Ventura County, California

Conducted benthic macroinvertebrate sampling in lower Santa Paula Creek using the California stream bioassessment procedure (CSBP) prior to maintenace and sediment removal activities. Sorted and identified all organisms sampled.

Ventura County Watershed Protection District – Doris Drain Repair Fish Rescue and Biological Monitoring, Ventura County, California

Served as fisheries professional to Ventura Watershed Protection District during riprap repair activities at Doris drain. Rescued, identified and relocated fish from construction area. Provided biological monitoring for construction activities and performed water quality sampling.

Ventura County Watershed Protection District - Hueneme Drain Tidewater Goby Project, Ventura County, California

Served as fisheries professional to Ventura Watershed Protection District during pipe maintenance activities in the Hueneme drain. A temporary impoundment was placed around the work area that trapped numerous fish including tidewater gobies. Responsible for identifying fish species within impoundment and relocated all fish away from work area.

City of Santa Barbara - Tidewater Goby Rescue, Laguna Creek Tide Gate Project, Santa Barbara County, California

ENTRIX, Inc. conducted tidewater goby rescue and relocation activities during a tide gate maintenance project in the tidally influenced reach of Laguna Creek. An aqua-dam was constructed around the work area

and water was pumped out of the impoundment. Mr. Mulder, in conjunction with other ENTRIX, Inc. scientists, rescued numerous tidewater gobies. Additionally, Mr. Mulder identified and rescued numerous individuals of nine other fish species.

Tidewater Goby Presence/Absence Survey, Pismo Creek, San Luis Obispo County, California

ENTRIX, Inc. conducted presence/absence surveys, for federally endangered tidewater goby, in Pismo Creek. Surveys were performed for an ananlysis of potential impacts from of installation of a proposed oil field wastewater outfall system. Mr. Mulder assisted in conducting these presence/absence surveys and identifying the fish species present in the creek and the lagoon area.

Tidewater Goby Presence/Absence Survey, Las Flores Canyon, Los Angeles County, California

ENTRIX, Inc. conducted presence/absence surveys, for federally endangered tidewater goby, in the estuary of Las Flores Canyon. Surveys were performed for an upcoming creek and estuary rehabilitation project. Mr. Mulder assisted in conducting these presence/absence surveys and identifying the fish species present.

Tidewater Goby Presence/Absence Survey, Santa Clara River Estuary, Ventura County, California

ENTRIX, Inc. conducted presence/absence surveys, for federally endangered tidewater goby, in the estuary of the Santa Clara River. Surveys were performed for an analysis of potential impact of removing a current wastewater treatment plant outfall. Mr. Mulder assisted in conducting these presence/absence surveys and identifying the fish species present.

Golden Trout Habitat Assessment, Kern County, California

Mr. Mulder conducted stream condition inventory surveys in the Golden Trout Wilderness of California. These surveys were performed as part of an ongoing monitoring effort to assess riparian area grazing impact on golden trout habitat, stream bank stability, riparian vegetation, and stream geomorphology. Mr. Mulder participated in this project for the United States Forest Service.

Permitting

Rangeland Monitoring and Permit Compliance, Inyo County, California

Mr. Mulder performed an array of rangeland monitoring and survey techniques for United States Forest Service grazing permit compliance, and for a NEPA permitting process. As lead field technician, Mr. Mulder conducted toe-point surveys to assess vegetation populations, conducted utilization surveys on riparian and upland vegetation, contributed to inter-disciplinary team assessments of proper functioning conditions for lentic and lotic systems, performed watershed analysis, and assessed aspen stand health and risk.

Invasive Species Management

Caltrans San Mateo Creek and Lagoon, Exotic Removal Project, Orange County, California

Mr. Mulder assisted Entrix, Inc. senior staff in the management of and conduction of an exotic species eradication project. Species targeted included non-native fishes, crustaceans, and bullfrogs. Methods utilized included spearfishing, night gigging, trapping, seining, and snorkel surveys. Additionally, tidewater goby surveys were performed in the creek and lagoon.

Big Tijunga Wash Ponds, Exotic Removal Project, Los Angeles County, California

Mr. Mulder assisted Entrix, Inc. senior staff in the management of and conduction of an exotic species eradication project in the Big Tijunga Wash Ponds for Los Angeles County Parks. Species targeted included

non-native fishes, crustaceans, and bullfrogs. Methods utilized included spearfishing, night gigging, trapping, and snorkel surveys.

Bull Thistle Removal Project, Inyo County, California

In order to treat several infestations of non-native bull thistle on federal land, Mr. Mulder served as Project Leader in directing volunteer and co-worker teams to perform eradication. The teams continued ongoing treatment of several known infestations, and initiated an ongoing treatment plan for a large, previously unknown and untreated infestation. Mr. Mulder organized teams, set field objectives and strategy, supervised removal, and prepared a final report of the bull thistle removal project for submittal to the United States Forest Service.

Employment History

- ENTRIX, Inc., Assistant Staff Scientist, 2006 - present
- United States Department of Agriculture – Forest Service, Inyo National Forest, Biological Science Technician, May 2006 - October 2006
- Paddle Sports of Santa Barbara, Manager/Head Guide/Head Instructor, March 2003 - May 2006
- California Department of Fish and Game, Scientific Aid, May 2001 - August 2003

ENTRIX

Camm Churchill Swift, Ph.D.

Senior Project Biologist

Discipline/Specialty

- Ichthyology
- Fishery Biology
- Estuarine Biology

Education

- Ph.D., Department of Biology, Florida State University, Tallahassee, 1970
- M.A., Department of Zoology, University of Michigan, Ann Arbor, 1965
- A.B., Department of Zoology, University of California, Berkeley, 1963

Training/Certifications

- California Department of Fish and Game. Resident Scientific Collecting Permit No. 801056-01 with Memoranda of Understanding covering federally listed tidewater goby, Santa ana sucker, unarmored threespine stickleback, southern steelhead & incidental take of redlegged frog and Species of special concern arroyo chub and speckled dace.
- USFWS U. S. Fish and Wildlife Service Scientific Collecting Permit (10A) No. TE793644-5 for tidewater goby, Santa Ana sucker and unarmored three-spined stickleback
- NOAA Fisheries project specific southern steelhead handling permit

Summary of Qualifications

Dr. Swift is one of the leading authorities on the biology, management, and conservation of the fresh and brackish water fishes of coastal southern California. He served on the Recovery Teams for the unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*) and tidewater goby (*Eucyclogobius newberryi*), both feder1ally endangered species, and was an author for the recovery plans for both fish. He currently serves on the Technical Recovery Teams for tidewater goby (U. S. Fish and Wildlife Service) and southern steelhead (National Marine Fisheries Service). Dr. Swift is a member of the Desert Fishes Council.

With over 20 years of experience working in the field, Dr. Swift is one of the most knowledgeable persons in the state on the status and distribution of freshwater fishes of coastal southern California. He has a strong understanding of their biology, requirements for recovery, and habitat restoration needs to improve their conservation status. He has worked with a wide variety of public and private agencies to conserve these species and advise on habitat restoration for their benefit.

Dr. Swift also has major expeditionary experience in the fresh and estuarine waters of the southeastern United States, marine shore fishes of Pacific coastal Mexico and Costa Rica (including Cocos Island), the Indus River Delta, Pakistan, and Amazonian Peru. He has done extensive field work, led field crews, conducted literature searches, and written several comprehensive reports and peer reviewed publications. He serves as an expert witness in fishery conservation issues. He also has considerable experience in identification and analysis of archaeological and fossil fish bones from the southeastern United States, southern California, and coastal Pakistan.

Relevant Experience

Research Expertise

Dr. Swift is a recognized expert in the biology, conservation, and paleontology of freshwater and estuarine fishes in coastal southern California, including the federally endangered brackish water species, the tidewater goby, *Eucyclogobius newberryi*, the migratory (anadromous) and federally listed steelhead (*Oncorhynchus mykiss*), and the federally threatened Santa Ana sucker (*Catostomus santaanae*). Of approximately eight species of freshwater fishes native to the Los Angeles Basin, the Santa Ana sucker, Santa Ana speckled dace (*Rhinichthys csculus ssp*.), and arroyo chub (*Gila orcutti*) are endemic in this region and have been highly impacted by man. The severe alteration of freshwater and estuarine habitat in much of California has led to most of the freshwater and brackish water species having special conservation status.

Newhall Land and Farming – Special Status Aquatic Species EIR Assessment, Los Angeles County, California

Performed habitat surveys in the upper Santa Clara River for sensitve aquatic species with an emphasis on the federally listed endangered unarmoured threespine stickleback. Surveyed tributary habitat potential, mapped refugia areas and analyzed instream flow velocity model alternatives for project impacts on stickleback habitat.

Wastewater Impacts on Native and Sensitive Fish Species

Provide assessment of impacts of changes in water flow from San Bernardino Infiltration and Extraction Wastewater Treatment Facility (RIX) on populations of Santa Ana sucker, City of San Bernardino.

Environmental Compliance and Monitoring/Terrestrial Biology – The Old Road Outlet Project - Valencia, California

ENTRIX continues to provide environmental compliance assistance to Newhall Land and Farming Company and the City of Santa Clarita. ENTRIX provided environmental compliance via a Verification Request Letter submittal to ACOE and CDFG. Other services included a biological assessment of the project area, impact assessment and pre-construction surveys. ENTRIX continues to support The Old Road Outlet Project by providing environmental compliance work (i.e., environmental monitoring) for sensitive species, paticularly the federally listed endangered unarmored threespine stickleback. Monitoring efforts also include weekly nesting bird and preconstruction monitoring.

City of Santa Clarita – Special Staus Species Survey and Unarmored Threespine Stickleback Relocation, City of Santa Clarita, California

Conducted weekley pre-construction surveys for nesting special status and migratory birds for the Old Road Outlet Project. Conducted weekly surveys for sensitive upland reptile and mammal species. Conducted sensitive aquatic species surveys. Performed capture and relocation of federally endangered unarmored threespine stickleback during river diversion activites. Provided consulting for design, construction and implementation of a temporary river diversion channel.

Biological Assessment Santa Paula Creek Maintenance Project - Santa Paula, Ventura County, CA

In winter-spring of 2007, ENTRIX surveyed a 2+ mile reach of lower Santa Paula Creek to assess impacts of instream flood control measures that were placed in lower Santa Paula Creek just above the city of Santa Paula. Field surveys included vegetation mapping, general habitat assessment, wildlife observations, nesting bird surveys and bird monitoring, benthic macro-invertebrate sampling and fish sampling.

Owen's Lake Native Fishes Survey, Lone Pine, California

In late 2002 and early 2003, Dr. Swift directed and carried out surveys for the Owens pupfish and other native and non-native fishes in the lower Owens River and its delta in northern Owens dry lake bed. All of the known springs around the delta and dry lake beds (riverine, marsh, and hot spring environments) were sampled. This work was conducted for the Great Basin Unified Air Pollution Control District as a revision of their Environmental Impact Report.

Estuarine Fishes of Ballona Marsh, Los Angeles County, California

Dr. Swift is coauthor of "Estuarine Fish Communities of Ballona Marsh [Los Angeles County]", In: Ralph Schrieber, Ed., Biota of the Ballona Region, Los Angeles County. Suppl. No. 1, Marina del Rey/Ballona Local

Coastal Plan, Los Angeles Co. Dept. Regional Planning. This one year study sampled fishes monthly at 13 staions in the marsh and provided the most comprehensive study of the fish communities of the marsh to date. It continues to be followed to monitor changes to the fish community. Currently Dr. Swift serves on the Scientific Advisory Committee for the Ballona Marsh Restoration.

Santa Clara River Estuary Tidewater Goby Surveys and Expert Witness Testimony, Ventura, California

For over five years Dr. Swift has been conducting biannual sampling of the tidewater goby population in the Santa Clara River Estuary as an element of the compliance monitoring program for the City of San Buenaventura's National Pollutant Discharge Elimination System (NPDES) Permit. He participated in permit renewal workshops and provided expert witness testimony on the impacts of they City's discharge and estuarine hydrodynamics on tidewater goby and steelhead populations at Regional Water Quality Control Board hearings for the permit renewal.

Study of Santa Ana Sucker Biology on the Middle Santa Ana River, Riverside, California

As part of the Santa Ana Sucker Conservation program on the Santa Ana River, Dr. Swift participated in a long-term study to assess the population size and distribution of Santa Ana Suckers in the Santa Ana River near the city of Riverside, California. The program was administered by the multi agency Santa Ana Water Projects Authority (SAWPA) in Riverside. Survey protocols included annual summer surveys employing electrofishing using three pass depletion transects at locations in the mainstem Santa Ana River near the city of Riverside. Santa Ana suckers were measured, weighed, and tagged with PIT tags if over about 80 mm standard length. Dr. Swift holds federal permits for capture, handling and PIT tagging of the suckers. In addition to the mainstem river sites, electrofishing efforts were conducted at sites in the mainstem and tributaries of the river to detect tagged suckers. Dr. Swift participated in the program from 1999-2003, which formed the beginning of a long term annual survey of population size, movements and distribution of the Santa Ana sucker in the river.

U.S. Geological Survey, National Water-Quality Assessment Program, Santa Ana River, California

Dr. Swift participated in the USGS NAWQA program, a nationwide river monitoring and quality assessment designed to assess the status and trends in the quality of freshwater streams and aquifers, and to provide a sound understanding of the natural and human factors that affect the quality of these resources. The program included a three year survey of Santa Ana suckers on the Santa Ana River. Survey protocols required electrofishing of a total of one kilometer of river in 100 meter increments at two localities on the Santa Ana River. The goal of this assessment was to characterize, in a nationally consistent manner, the broad-scale geographic and seasonal variations of water-quality related to major contaminant sources and background conditions.

California Department of Fish and Game Native Fish Surveys, San Gabriel River, California

The California Department of Fish and Game periodically assesses the status of wild trout, Santa Ana sucker, speckled dace, and arroyo chubs in the San Gabriel River system. Dr. Swift participated in four of these sampling efforts in the early 1990s. Survey protocols included electrofishing with three pass depletion of 100 meter transects in the West Fork of the San Gabriel River and its tributary Bear Creek. Fish were identified, measured and released back to the stream.

Restoration of the Santa Maria River Estuary, Santa Barbara County, California

Dr. Swift prepared a historical analysis of coastal estuaries, habitat change, and restoration options for the estuary at the mouth of the Santa Maria River, Santa Barbara County, CA for California Department of Fish and Game Oil Response Team, for its contribution to the Trustees of Guadalupe Site, through Hagler-Bailly Inc., Boulder, Co. Field work. In addition Swift collaborated with ENTRIX biologists in surveying the estuary for tidewater gobies and preparing a report on their current status at the site.

Big Tujunga Mitigation and Restoration, Sunland, CA

On behalf of the Los Angeles County Department of Public works, Dr. Camm Swift, with Dan Holland, designed and implemented the exotic removal program at Big Tujunga Wash from from 2000 to 2004. Work included extensive trapping for crayfish, gill netting and snorkeling for bass, removal of bullfrog egg masses, and monitoring of the three native fish species in Haines Creek. Dr. Swift was instrumental in making recommendations with respect to the refinement of methods, equipment needs and sampling design and strategy. Effectiveness monitoring of the eradication efforts included periodic surveys of the native fishes in the streams at randomly selected transects along the 1.7 km of stream in the mitigation area.

Expert Witness Testimony Big Tujunga Wash, CA

In support of the California Department of Fish and Game's Community Arbitration with Foothill Golf and Development in California State Superior Court, Los Angeles, Dr. Swift provided extensive and detailed information on the biology of Southern California Coastal Minnow and Santa Ana Sucker to support the Department's position of the extreme importance of the wash habitat for the continued existence of the native fishes and other native species in this surviving remnant fish community consisting of the Santa Ana sucker (federally threatened) and Santa Ana speckled dace and arroyo chub, both California species of special concern.

Exotic Predators on Tidewater Gobies on Marine Corps Base Camp Pendleton

Dr. Swift, working with Mr. Holland, used their extensive experience on the Base to prepare a management plan for exotic fishes and other species on Marine Corps Base Camp Pendleton. Many of these prey on tidewater gobies and this plan included methods for removal of exotics and for prevention or minimizing their impact on native aquatic species. Since 1998, Dr. Swift has led teams of biologists to implement the exotic species removal plan at San Mateo Lagoon on the Base.

San Juan Creek Native Fish Survey – La Novia Bridge, San Juan Capistrano, California

Dr. Swift provided biological support and pre-construction monitoring for a project involving widening of the La Novia Street Bridge over San Juan Creek. The project included field surveys and monitoring, developing best management practices for fish avoidance and developing mitigation measures for post-construction planning. Species of concern included migrating southern steelhead, unarmored three-spine stickleback and arroyo chub.

Tidewater Gobies on Vandenberg Air Force Base

Cooperative Agreement between National Biological Service (now part of USGS) and Loyola Marymount University for study of the biology of the federally endangered tidewater goby on Vandenberg Air Force Base, Santa Barbara County. Included three to four paid undergraduate research assistants at Loyola Marymount University. This contract extended for two years and comprehensively studied the biology and distribution of

the tidewater gobies at five sites on Vandenberg Air Force Base. A comprehensive report detailed many aspects of needs for restoration of habitats on the Base.

Bixby Ranch Steelhead, Tidewater Goby and California Red-Legged Frog Baseline Habitat Assessment, Santa Barbara, California

Dr. Swift conducted a baseline biological assessment of the Bixby Ranch in Santa Barbara, California. The focus of this assessment was to assess aquatic habitat conditions as it pertains to steelhead, tidewater goby, California red-legged frog, and southwestern pond turtle. Terrestrail habitat was also assessedbut was limited by access constraints. New poulations of tidewater gobies were discovered during this assessment.

Tidewater Gobies on Marine Corps Base Camp Pendleton

Dr. Swift, working with Mr. Dan Holland, did multiple surveys from 1991 to 2000 for the tidewater gobies and other members of the estuarine fish community at seven estuaries and lagoons on Marine Corps Base Camp Pendleton, coastal southern California. They provided the first descriptions of the estuarine fish communities for several of these sites and provided recommendations for maintenance and improvement of habitat for the species on the Base. With Dan Holland, Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA for Marine Corps Base Camp Pendleton

Surveys of Freshwater Fishes of Southern California

Dr. Swift has extensive experience surveying, researching and studying freshwater species of special concern. A representative sample of these surveys includes:

- Advised a Six Agency committee of southern California water and power purveyors, including Metropolitan Water District of Southern California] on the quality and rationale for U.S. Fish and Wildlife Service Critical Habitat designations for endangered big river fishes of the Colorado River, southwestern United States. Responsibilities included expert testimony, literature research and report writing.

- Supervised crews of three to six graduate students surveying the estuarine and freshwaters of southern California for fishes for four months and prepared report for the California Department of Fish and Game on the status and distribution of these fishes, at Natural History Museum of Los Angeles County.

- Evaluated the status of the native freshwater fishes of southern California, including the status of the estuarine tidewater goby, *Eucyclogobius newberryi*, with recommendations for preserves to maintain their existence. California Department of Fish and Game Contract FG-7455, one year. Compiled data bases on fish records collaborating with Peter Moyle, U. C. Davis, to incorporate data into the California Department of Fish and Game's Natural Heritage Data Base, at Natural History Museum of Los Angeles County.

- Participated in a Cooperative Agreement between National Biological Service (now part of USGS) and Loyola Marymount University for study of the biology of the federally endangered tidewater goby on Vandenberg Air Force Base, Santa Barbara County. Included three to four paid undergraduate research assistants at Loyola Marymount University.

- Analyzed bottom samples from Delta Mendota Canal, central California, for invertebrate densities of the Asiatic clam, *Corbicula fluminea*, as a research assistant Zoology Department, University of California, Berkeley.

- Identified freshwater and coastal fish habitats to determine Significant Ecological Areas for Regional Planning Department, Los Angeles County, via contract to Natural History Museum of Los Angeles County.

- Co-author, U.S. Fish and Wildlife Service Recovery Plan for Endangered Unarmored Threespine Stickleback, as member of Unarmored Threespine Stickleback Endangered Species Recovery Team.
- Author, Estuarine Fish Communities of Ballona Marsh [Los Angeles County], In: Ralph Schrieber, Ed., Biota of the Ballona Region, Los Angeles County. Suppl. No. 1, Marina del Rey/Ballona Local Coastal Plan, Los Angeles Co. Dept. Regional Planning.
- Served on an expert panel, habitat suitability criteria and curves for three native cyprinoid fishes (state species of special concern) of the Santa Ana River, southern Calif., EA Engineering and Technology (Lafayette, CA) for Southern California Edison Company.
- Surveyed for freshwater fishes of the Los Angeles River. Field work and report writing, as part of contract from the California Department of Fish and Game to the Natural History Museum of Los Angeles County, to assess the fauna and flora of the river.
- Monitored populations of native federally endangered fish species during streambed alterations in the Santa Clara River, southern. Performed both field work and report writing.
- Surveyed for the proposed endangered fish, the tidewater goby, in coastal estuaries of Camp Pendleton Marine Base, southern California. Performed both field work and report preparation.
- Surveyed for the federally endangered tidewater goby in the estuarine Shuman Lagoon, Vandenberg Air Force Base, Santa Barbara County, CA for U.S. Fish and Wildlife Service, Ventura Field Office,
- Analyzed diet of the endangered bird, the least tern, with Patricia Baird, Department of Biology, California State University, Long Beach. Under U.S. Navy contract (to P. Baird) at Long Beach, with three undergraduate research participants at Loyola Marymount University.
- Prepared draft recovery plan for tidewater goby as a member of the Tidewater Goby Technical Recovery Team, with U. S. Fish and Wildlife Service, Ecological Services, Ventura California.
- Prepared historical analysis of coastal estuaries, habitat change, and restoration options for the estuary at the mouth of the Santa Maria River, Santa Barbara County, CA for California Department of Fish and Game Oil Response Team, for its contribution to the Trustees of Guadalupe Site. Performed field work, research and report writing in collaboration with Entrix Inc., retained by UNOCAL Corporation.
- Surveyed for the endangered fish species, the tidewater goby on Marine Corps Base Camp Pendleton, coastal southern California, and provide recommendations for maintenance and improvement of habitat for the species on the Base. With Dan Holland, Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA for Marine Corps Base Camp Pendleton.
- Prepared management plan for exotic fishes on Marine Corps Base Camp Pendleton, including methods for removal of exotics and for prevention or minimizing their impact on native aquatic species. With Dan Holland (Principal Investigator), Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA.
- Surveyed for native and introduced freshwater fishes in the middle Santa Ana River in the Prado Dam vicinity with special reference to Santa Ana sucker and arroyo chub. For U. S. Army Corps of Engineers, Los Angeles CA.
- Surveyed, downstream trapping, and analysis of habitat quality for the three endangered fishes (southern steelhead, tidewater goby, and unarmored threespine stickleback) in San Antonio Creek, Santa Barbara County for Vandenberg Air Force Base.

- Surveyed, downstream trapping, and food habit studies of Santa Ana suckers in the Santa Ana River to document movements into diversions and impact of exotic species on suckers. Phase II for Santa Ana Water Project Authority, Riverside, CA.
- Expert witness on Southern California Minnow/sucker community for California Department of Fish and Game in their arbitration with Foothill Golf and Development, State Superior Court, Los Angeles, No. 99-0600-DW (This fish community consists of Santa Ana sucker, Santa Ana speckled dace, and arroyo chub).
- Prepared preliminary assessment of impacts of shore dredging on the fisheries of Big Bear Lake, for Big Bear Municipal Water District.
- Surveyed and estimate population sizes of endangered unarmored threespine stickleback and tidewater goby, and analyze steelhead habitat on several drainages on Vandenberg Air Force.
- Monitored population of tidewater goby in San Luis Obispo Creek Lagoon in relation to Avila Beach clean up site. For Unocal through Essex Environmental, San Luis Obispo.
- Surveyed for tidewater gobies in Santa Clara River Lagoon, Ventura County. For City of Ventura CA.
- Surveyed for populations of sensitive native freshwater fish in the Santa Ana River near Colton and Loma Linda, CA.
- Surveyed for populations of native fishes in the Santa Ana River in the vicinity of the Interstate 210 crossing, for Cal Trans, CA.
- Monitored for Santa Ana suckers and assess effects of bridge maintenance, sand mining, and alternative bridge design on this fish. For Riverside County Transportation Department.
- Surveyed for the federally endangered tidewater goby in lower San Luis Rey River, CA. with Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA.
- Surveyed and monitored for the federally endangered tidewater goby in San Mateo Lagoon, Camp Pendleton Marine Corps Base with recommendations for restoration and recovery.
- Interaction of native and exotic freshwater fishes during El Nino disturbance in the Santa Margarita River, southern California. With USGS Laboratory, San Diego State University with partial support of the Nature Conservancy.
- Determined possible effects on steelhead of UNOCAL remediation of soil contamination in the vicinity of the lower Santa Maria River.
- Reviewed and assessed mitigation features for Seven Oaks Dam on the Santa Ana River in relation to populations of Santa Ana sucker downstream. For the U. S. Army Corps of Engineers.
- Review and assess mitigation plans and Biological Assessments for tidewater goby and steelhead in relation to Lower Mission Flood Control Project of U. S. Army Corps of Engineers. For City of Santa Barbara, CA.
- Survey for fishes and assess possible impacts of the construction of a pipeline crossing over Dominguez Channel in Wilmington.
- Directed surveys for Santa Ana speckled dace in lower Fremont, Blackstar, and Silverado canyons, Orange County.

- Survey for native freshwater fishes and advise on mitigation for quarry operations at the mouth of Fish Canyon, near Azusa, CA.
- Implement eradication plan for exotic fishes in Los Angeles County Public Works mitigation area of lower Big Tujunga Canyon-Haines Creek area. With Camp Pendleton Amphibian and Reptile Survey, Fallbrook, CA, for Los Angeles County Department of Public Works.
- Identify freshwater fossil fish remains from a variety of late Pleistocene freshwater sites in Riverside County.
- Monitor, rescue, and transfer federally threatened Santa Ana suckers from diversion of Santa Ana River, Orange County. For U. S. Corps of Engineers
- Provide assessment of impacts of changes in water flow from San Bernardino Infiltration and Extraction Wastewater Treatment Facility (RIX) on populations of Santa Ana sucker. For City of San Bernardino.
- Survey for native fishes in relation to highway crossing of streams at Temecula Creek, San Diego County and Chino Creek, San Bernardino County. For CalTrans.
- Provide assessment of impacts and mitigation possibilities for native sensitive fish species in lower San Juan Capistrano Creek, Orange County and lower San Mateo Creek, northern San Diego County for various alternatives of the proposed new highways. For Foothill/Eastern Transportation Corridor Agency.
- Provide expertise and field work to study steelhead in Topanga Creek including snorkel surveys, habitat assessment, and up and downstream migrant trapping. With Resource Conservation District of the Santa Monica Mountains, Topanga, CA.
- Prepare draft Recovery Plan for combined South Central Coast Steelhead (federally threatened) and South Coast Steelhead (federally endangered) as member of NOAA Technical Recovery Team for Southern Steelhead.

Professional Affiliations and Honors

Dr Swift has held various elected and appointive positions in the California-Nevada Chapter of the American Fisheries Society, Southern California Academy of Sciences, and American Society of Ichthyologists and Herpetologists. Secretary, Vice-president, and President of the Academy; elected President-elect, and proceeded to President, and past President of California Nevada Chapter, 1997-1999. Served on host committees for Los Angeles meetings of the American Society of Ichthyologists and Herpetologists (twice), Society of Vertebrate Paleontology, California-Nevada Chapter of the AFS, and the Southern California Academy of Sciences (three times).

Dr. Swift served as a member of the Unarmored Threespine Stickleback Endangered Species Recovery Team (1972-1995). He currently serves on the Technical Recovery Team for the Tidewater Goby (2003-present), both for U.S. Fish and Wildlife Service, and is a member of the Southern Steelhead Technical Recovery Team (2003-present) for the National Marine Fisheries Service.

Dr. Swift was elected Fellow of the Southern California Academy of Sciences in 1991 and Emeritus Associate Curator of Fishes, Natural History Museum of Los Angeles County in 1993. He received the Award of Excellence from California Nevada Chapter of the American Fisheries Society in 1997.

Dr. Swift is an active member in numerous professional associations including: American Fisheries Society, including California Nevada Chapter, Estuarine Research Foundation, American Society of Ichthyologists and Herpetologists, Desert Fishes Council, Southeastern Fishes Council, Society of Vertebrate Paleontology, Sigma Xi (Loyola Marymount University Chapter), American Association for the Advancement of Science, Southern California Academy of Sciences, Society for Conservation Biology, Society of Systematic Biology, Biological Society of Washington, Japanese Ichthyological Society, Western Field Ornithologists, and California Native Plant Society

Publication, presentation and grant list available

Publications: 1989-present

1993. Swift, T. H. Haglund, M. Ruiz, and R. Fisher. Status and distribution of the freshwater fishes of southern California. Bull. S. Calif. Acad. Sci., 92(3):101-168.

1996. Chapter 30. Distribution and migration. Pp. 595-630. (excluding literature cited in single collection at end of book). In: Carl Bond. Biology of Fishes, (textbook) Second Edition. Harcort, Brace, and Co., Philadelphia.

1996. Lafferty, K., R. Swenson, and C. C. Swift. Tidewater goby; endangered species profile. Environmental Biology of Fishes, 46:254.

1998. The fish fauna of Ballona Marsh, an urban estuary on the western of the Los Angeles Basin. p. 1427 (Abst). In: Orville T. Magoon, et al. Eds, California and the World Ocean '97. 2 vols. American Society Civil Engineers, Reston, VA

1999. K. Lafferty, C. C. Swift and R. Ambrose. Postflood persistence and recolonization of endangered tidewater goby populations. North American Journal of Fisheries Management, 19(2):618-622.

1999. _____. Extirpation and recolonization in a metapopulation of an endangered fish, the tidewater goby. Conservation Biology, 13(6):1447-1453.

2002. Swift, K. Hieb, and R. Swenson. Family Gobiidae. pp. 7-9. IN: William S. Leet, Christopher M. Dewees, Richard Klingbeil, and Eric J. Larson (editors), California's Living Marine Resources: A status report. The Errata. California Department of Fish and Game, Sacramento, CA (December, 2001) (www.dfg.ca.gov/mrd) [The larger work appeared in hard copy in earliest 2002 minus this Gobies article later added to an electronic Errata on the web site for inclusion in the Section on Bay and Estuarine Finfish Resources]

2002. M. N. Dawson, K. D. Louie, M. Barlow, D. K. Jacobs, and C. C. Swift. Comparative phylogeography of sympatric sister species, Clevelandia ios and Eucyclogobius newberryi (Teleostei, Gobiidae), across the California transition zone. Molecular Ecology, 11, 1065-1075.

2002. Swift and D. C. Holland. Exotic Fish species and their impacts on small costal lagoons in southern California. (Abst.) Bull. S. Calif. Acad. Sci., 101(2), Supplement, p. 32

2002. Interaction between native fish, habitat, and exotic fish species in the middle Santa Ana River, southern California. (Abst.) Bull. S. Calif. Acad. Sci., 101(2), Supplement, p. 32.

2006. Chapter 29. Distribution. Pp. 601-638. IN: Michael Barton, Bond's Biology of Fishes, 3rd Edition, Thompson Brooks/Cole, Belmont, CA.

Presentations: (1999 to present)

The disappearing fishes of southern California. In: Swimming Upstream: Restoring California's rivers and streams for salmon, steelhead and other species. Educational Workshop sponsored by the Sierra Club and California Trout, 12 June 1999, Los Angeles Zoo, Los Angeles, CA

Biodiversity and conservation of the freshwater fishes of southern California. (with Jonathan Baskin) In: Planning for Biodiversity: Bringing research and management together. A symposium sponsored by the USDA Forest Service and USGS Western Ecological Research Center. California State Polytechnic University, Pomona, 29 February-2 March 2000.

Dramatic effects of rainfall on species distributions in the Santa Margarita River. (with Manna Warburton [presenter] and Robert N. Fisher), California-Nevada Chapter, American Fisheries Society, 34th Annual Meeting, Ventura, CA 31 March-1 April 2000.

Freshwater fishes of the Los Angeles River, southern California. (with Jeffrey Seigel and Dan Holland), and Fish population fluctuations 1997-2000 in small lagoons on Marine Corps Base Camp Pendleton. (with Dan Holland), Annual Meeting, Southern California Academy of Sciences, University of Southern California, Los Angeles, CA 19-20 May 2000.

El Nino effects on the native and exotic fish populations of the Santa Margarita River southern California. (with Robert N. Fisher [presenter] and Manna Warburton). Society for Conservation Biology Annual Meeting, Hilo Hawaii, 29 July-Aug. 1, 2001.

El Nino effects on estuarine fish populations associated with the southernmost populations of tidewater goby, 1990-2001 (with Dan Holland), and The federally threatened Santa Ana sucker in the Santa Ana River-Distribution, habitat, and exotic predators. Ann. Meeting, California Nevada Chapter American Fisheries Society, Tahoe City, CA April 19-20, 2002

Exotic fish species and their impacts on small coastal lagoons in southern California (with Dan Holland, presenter), and Interaction between native fish, habitat, and exotic fish species in the middle Santa Ana River, southern California. Annual. Meeting, Southern California Academy of Sciences, Claremont, CA June 7-8, 2002.

Fish populations of small coastal lagoons in southern California. California Estuarine Research Society, Inaugural Meeting, Hubbs Sea World Research Institute, San Diego, CA, April 14, 2003

Status of and prognosis for the freshwater fishes of coastal southern California. Swift [presenter], Jonathan N. Baskin, Robert Fisher, and Thomas Haglund; Status, Habitat, and restoration of southern Steelhead in Topanga Creek and State Park, just south of Malibu Creek. Rosi Dagit [presenter] and Swift; Visual Display of stream habitat survey profiles using GIS: An example from Topanga Creek, coastal Southern California. Kevin Reagan [presenter], Rosi Dagit, and Swift; and a Poster: Genetic structure in the staghorn sculpin from Alaska to southern California. Kristina D. Louie [presenter], K. P. Kloepfli, D. K. Jacobs, and Swift. Western Division/Cal-Neva Chapter of American Fisheries Society,

Joint Annual Meeting, San Diego, April 14-17, 2003. In addition Swift organized two days of symposia on the freshwater fish, amphibian, and aquatic reptile fauna of coastal southern California.

Organized one day Symposium for California Nevada Chapter of the American Fisheries Society Meeting, San Luis Obispo, March 30, 2006. Chaired session and presented "Annual and seasonal variations in fish populations of San Mateo Lagoon, San Diego County, CA" with Dan Holland, Melissa Booker, Brian Lohstroh, and Eric Bailey.

Status and distribution of freshwater fishes of coastal southern California. In symposium on Aquatic Vertebrates of Southern California. Southern California Academy of Sciences Meeting, Pepperdine University, Malibu, 13,14 May 2006.

Expanding distributions of invasive fishes in coastal southern California estuaries and freshwaters. Presentation at the California Nevada Chapter of the American Fisheries Society Meeting, Lake Tahoe, Nevada, April 2008.

Employment History

- ENTRIX, Inc., Senior Project Scientist, September, 2003 - present
- Emeritus Associate Curator, Natural History Museum of Los Angeles County, January, 1993 - present
- Part-time instructor, Mount San Antonio College, 1993 - 1994
- Visiting Assistant Professor of Biology, Loyola Marymount University, Los Angeles, 1994 - 1998
- Part-time instructor, East Los Angeles, Rio Hondo, and Valley colleges, 1993-1994, 1998 - 1999
- Associate Curator of Fishes, Natural History Museum of Los Angles County; and Adjunct Assistant Professor of Biology, University of Southern California, 1970 - 1993