CATALOG OF STREAM CROSSINGS WITH CULVERTS AND OTHER MANMADE IMPEDIMENTS TO FISH PASSAGE LOCATED ON ANADROMOUS STREAM REACHES WITHIN SLEEPY HOLLOW CREEK, CORTE MADERA CREEK WATERSHED, MARIN COUNTY, CA.

Prepared for Friends of the Corte Madera Creek Watershed

By
Ross Taylor and Associates

NOTE: This catalog contains three pages for each stream crossing inventoried. The first page consists of location information, site-specific data, passage assessment, habitat notes, and treatment recommendations. The second page is a copy of the USGS map with the crossing of interest marked in "red" with adjacent sites marked in "blue". The third page has inlet and outlet photographs, with the inlet photo on the top and the outlet photo on the bottom. The inventoried sites are ordered in an upstream direction, and from lowermost to uppermost road/stream intersection within a watershed. Finally, distances between crossings were measured from digitized USGS maps (Terrain Navigator by MapTech®) to the nearest 50-foot interval along the path of the stream channel.

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Site ID# SH-01: Sleepy Hollow Creek #1/Taylor Street; Corte Madera Creek

Road Ownership: Town of San Anselmo **Ranking Matrix Score =** 22.5 points **Ranking: #4 = High-Priority**

Location: USGS Quad: San Rafael. T2N, R6W. Lat/Long: 37° 58' 54.9" 122° 34' 10.2" Milepost: approximately 75' to Saunders Avenue.

Crossing Type: Concrete arch culvert with flat floor. **Corrugations:** None. **Dimensions:** 10.4' Rise x 12.2' Span **Length:** 30.7' **Slope:** 4.36% **Modifications:** None. **Rustline Height:** N/A **Ave. Active Channel Width:** 18.6' **Fill Estimate:** 743 Cubic Yards. **Overall Condition:** Fair– floor worn to exposed rebar in several places, several cracks in walls, outlet is undercut. **Sizing:** Adequately-sized; HW/D = 1 on a flow between a 50 and 100-year recurrence interval.

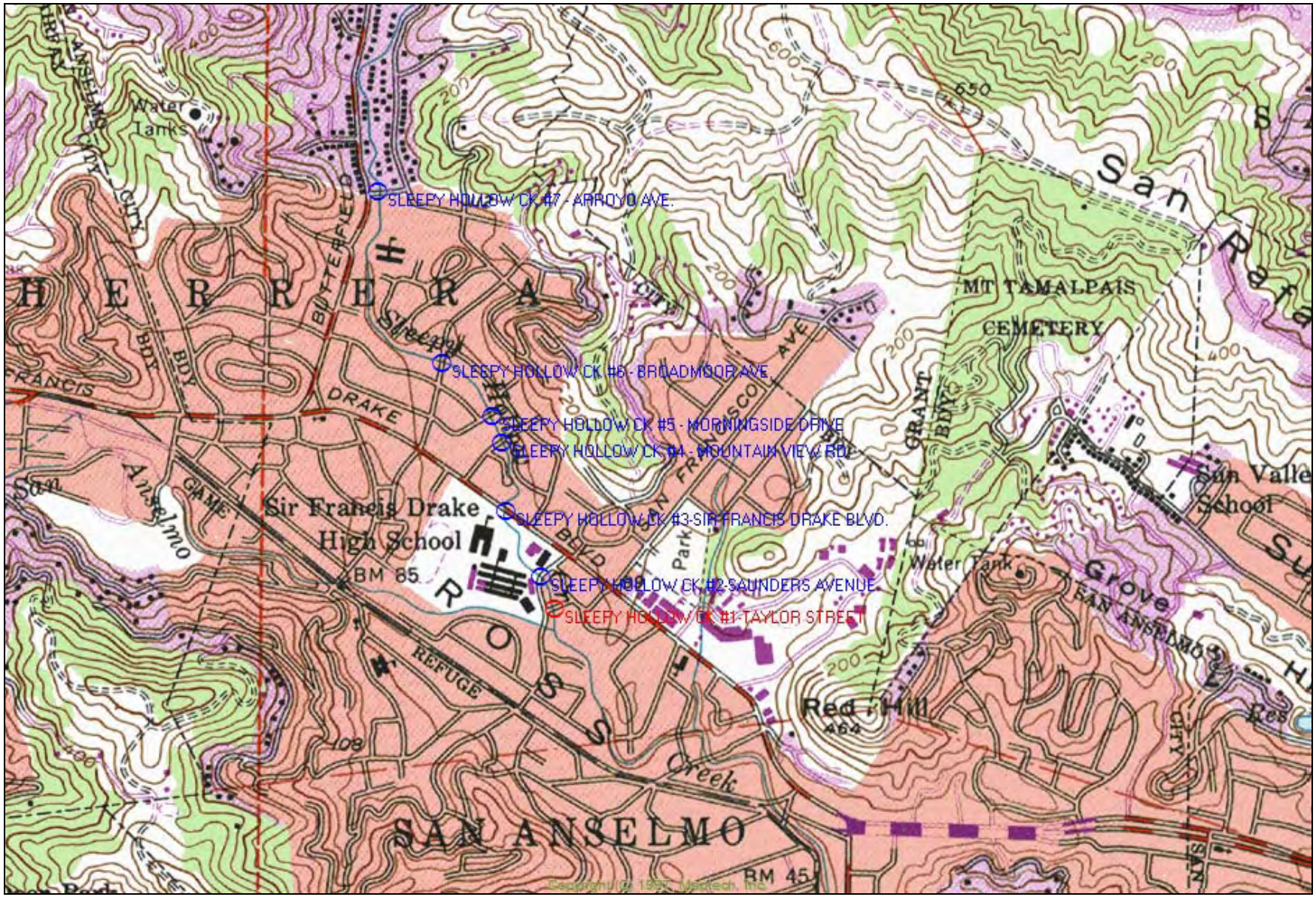
Drainage Area Upstream of Crossing: 3.60 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–100.3 c.f.s; resident/2+ = 2.0-26.0 c.f.s.; 1+/y-o-y = 1.0-11.3 c.f.s. **Passage Evaluation: RED:** as determined by the first-phase filter due to slope >3%; however FishXing was run for adult anadromous salmonids and the model suggested the crossing met the 8-16-16 ft/sec and 0.5ft minimum depth criteria for 37% of the range of estimated migration flow (64.0 – 100.0 c.f.s.). Main violation was lack-of-depth; however the three-tiered drop at the outlet was not modeled in FishXing and probably creates unfavorable hydraulic conditions during migration-level flows.

Additional Stream Crossings: Downstream – (≈200') to San Anselmo Ck. confluence, (≈2,300') to bridge at Nokomis Ave., (≈2,750') to bridge at Madrone Ave., (≈3,750') to bridge at Center Blvd., (≈4,050') to bridge at Bridge St., (≈4,850') to Site ID# SA-01, (≈5,300') to bridge at SFD Blvd., (≈6,000') to bridge at Barber Ave., (≈7,300') to bridge at Winship Ave., (≈7,800') to bridge at SFD Blvd., (≈8,450') to confluence with Ross Creek, (≈10,050') to bridge at Laguanitas Road, and (≈11,100') to upper end of USACE flood control channel. Upstream – (≈400') to Site ID# SH-02, (≈1,200') to Site ID# SH-03, (≈2,000') to Site ID# SH-04, (≈2,300') to Site ID# SH-05, (≈3,000') to Site ID# SH-06, (≈ 5,000') to Site ID# SH-07, (≈7,600') to bridge at Caletta Ave., (≈9,000') to Site ID# SH-08, (≈9,900') to Site ID# SH-09, (≈11,400') to bridge at Green Valley Rd., (≈13,000') to Site ID# SH-10, and (≈14,000') to SH-11 (Raven Dam = 100% barrier).

Habitat: Quantity = approximately 26,000' of *potential* fish-bearing habitat upstream of Site ID# SH-01. There is approximately 14,000' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "poor" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 6/08/05 and there was continuous surface flow in the channel. At 11:50 AM the air temp = 17°C and the water temp = 16°C. The survey crew noted an aggraded stream channel in a residential area, several pools with minimal cover, and a dense riparian zone of hardwoods. Most of the banks were constrained by vertical concrete and stone walls. The crew observed abundant (50-100 fish) numbers of stickleback and roach throughout the channel and a single (3"-6") steelhead downstream of Site ID# SH-01.

Preferred Treatment: Because the current crossing is adequately sized, a retrofit is recommended to improve conditions for fish passage. A series of boulder or concrete weirs are required to sufficiently raise the tail-water elevation and corner baffles within the culvert will increase depths and decrease velocities. Recommend consulting with CDFG and NOAA hydraulic engineers for design assistance.

Site ID# SH-01: Sleepy Hollow Creek #1/Taylor Street; Corte Madera Creek



Site ID# SH-01: Sleepy Hollow Creek #1/Taylor Street; Corte Madera Creek

Site ID# SH-02: Sleepy Hollow Creek #2/Saunders Avenue; Corte Madera Creek

Road Ownership: Town of San Anselmo **Ranking Matrix Score =** 16.0 points **Ranking: tied for #18 = Low-Priority**

Location: USGS Quad: San Rafael. T2N, R6W. Lat/Long: N37^{o} 58' 57.9" W122^{o} 34' 12.3" Milepost: approximately 100' to Park Drive.

CrossingType: Concrete arch culvert. **Corrugations:** None. **Dimensions:** 12.0' Rise x 10.0' Span. **Length:** 42.7' **Slope:** 1.22% **Modifications:** None. **Rustline Height:** N/A **Ave. Active Channel Width:** 18.6' **Fill Estimate:** 973 Cubic Yards. **Overall Condition:** Good. **Sizing:** Properly-sized; HW/D = 1 on a storm flow with more than a 100-year recurrence interval.

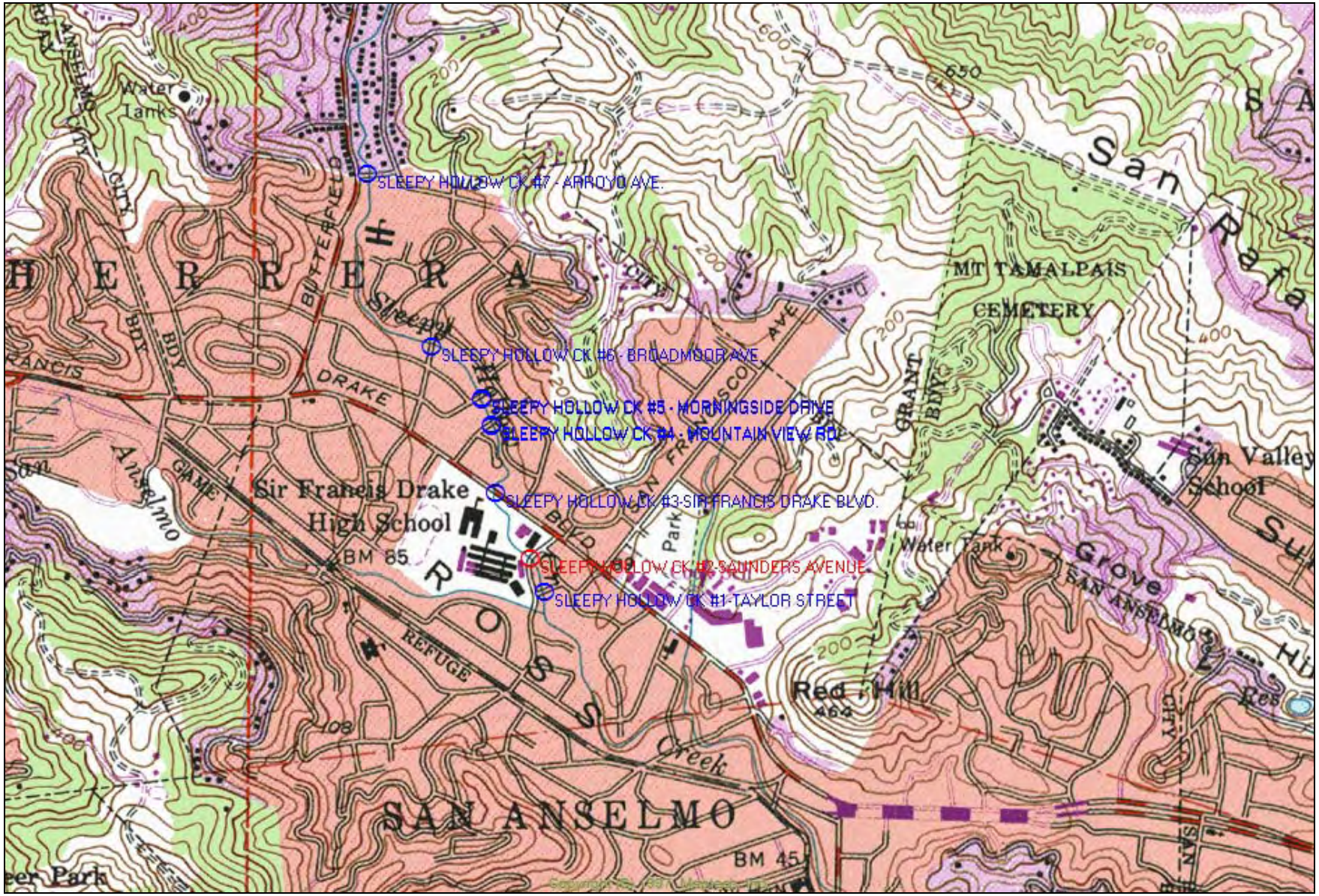
Drainage Area Upstream of Crossing: 3.57 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–99.4 c.f.s; resident/2+ = 2.0-25.7 c.f.s.; 1+/y-o-y = 1.0-11.2 c.f.s. **Passage Evaluation: GRAY:** as determined by the first-phase evaluation filter due to the constriction of the channel width through the crossing and insufficient residual depths at culvert inlet and outlet. FishXing estimated that the crossing met the 8-8-16ft/sec and 0.5 minimum depth passage criteria for adult anadromous salmonids for 66% of the range of migration flows (passable between 35.8-99.4 c.f.s.). FishXing estimated that the crossing failed to meet passage criteria for resident/2+ and 1+/y-o-y age classes. Actual passage of adults and older juveniles is probably higher due to "lack-of-depth" flagged as the primary criteria violation. Crossing was also assessed as having a flat/even invert when in actuality the invert was partially embedded and stream flow was concentrated to the right-bank side.

Additional Stream Crossings: Downstream – (≈400') to Site ID# SH-01, (≈600') to San Anselmo Ck. confluence, (≈2,700') to bridge at Nokomis Ave., (≈3,150') to bridge at Madrone Ave., (≈4,150') to bridge at Center Blvd., (≈4,450') to bridge at Bridge St., (≈5,250') to Site ID# SA-01, (≈5,700') to bridge at SFD Blvd., (≈6,400') to bridge at Barber Ave., (≈7,700') to bridge at Winship Ave., (≈8,200') to bridge at SFD Blvd., (≈8,850') to confluence with Ross Creek, (≈10,450') to bridge at Laguanitas Road, and (≈11,500') to upper end of USACE flood control channel. Upstream – (≈800') to Site ID# SH-03, (≈1,600') to Site ID# SH-04, (≈1,900') to Site ID# SH-05, (≈2,600') to Site ID# SH-06, (≈4,600') to Site ID# SH-07, (≈7,200') to bridge at Caletta Ave., (≈8,600') to Site ID# SH-08, (≈9,500') to Site ID# SH-09, (≈11,000') to bridge at Green Valley Rd., (≈12,600') to Site ID# SH-10, and (≈13,600') to SH-11.

Habitat: Quantity = approximately 25,600' of *potential* fish-bearing habitat upstream of Site ID# SH-02. There is approximately 13,600' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "poor" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 6/08/05 and there was continuous surface flow in the channel. At 12:00 PM the air temp = 17^{o}C and the water temp = 15^{o}C. The survey crew noted an aggraded stream channel in a residential area, several pools with minimal cover, and a dense riparian zone of hardwoods. Most of the banks were constrained by vertical concrete and stone walls. The crew observed abundant (50-100 fish) numbers of stickleback and roach upstream and downstream of Site ID# SH-02.

Preferred Treatment: Because the current crossing is properly sized and is fairly passable, no treatment is recommended at this point. Recommend periodic inspection to ensure that back-watering effect by tail-water control remains effective.

Site ID# SH-02: Sleepy Hollow Creek #2/Saunders Avenue; Corte Madera Creek



Site ID# SH-02: Sleepy Hollow Creek #2/Saunders Avenue; Corte Madera Creek

Site ID# SH-03: Sleepy Hollow Creek #3/ Sir Francis Drake Blvd.; Corte Madera Creek
Road Ownership: Town of San Anselmo **Ranking Matrix Score =** 6.0 points **Ranking: tied for #22 = Low-Priority**

Location: USGS Quad: San Rafael. T2N, R6W. Lat/Long: N37^{o} 59' 04.0" W122^{o} 34' 17.0" Milepost: approximately 100' to Aspen Drive.

Crossing Type: Concrete arch culvert with U-shaped invert. **Corrugations:** None.
Dimensions: 9.9' Rise x 9.5'Span **Length:** 60.3' **Slope:** 1.91% **Modifications:** None.
Rustline Height: N/A **Ave. Active Channel Width:** 18.6' **Fill Estimate:** 1,543 Cubic Yards.
Overall Condition: Good. **Sizing:** Properly-sized; HW/D = 1 on a storm flow with more than a 100-year recurrence interval.

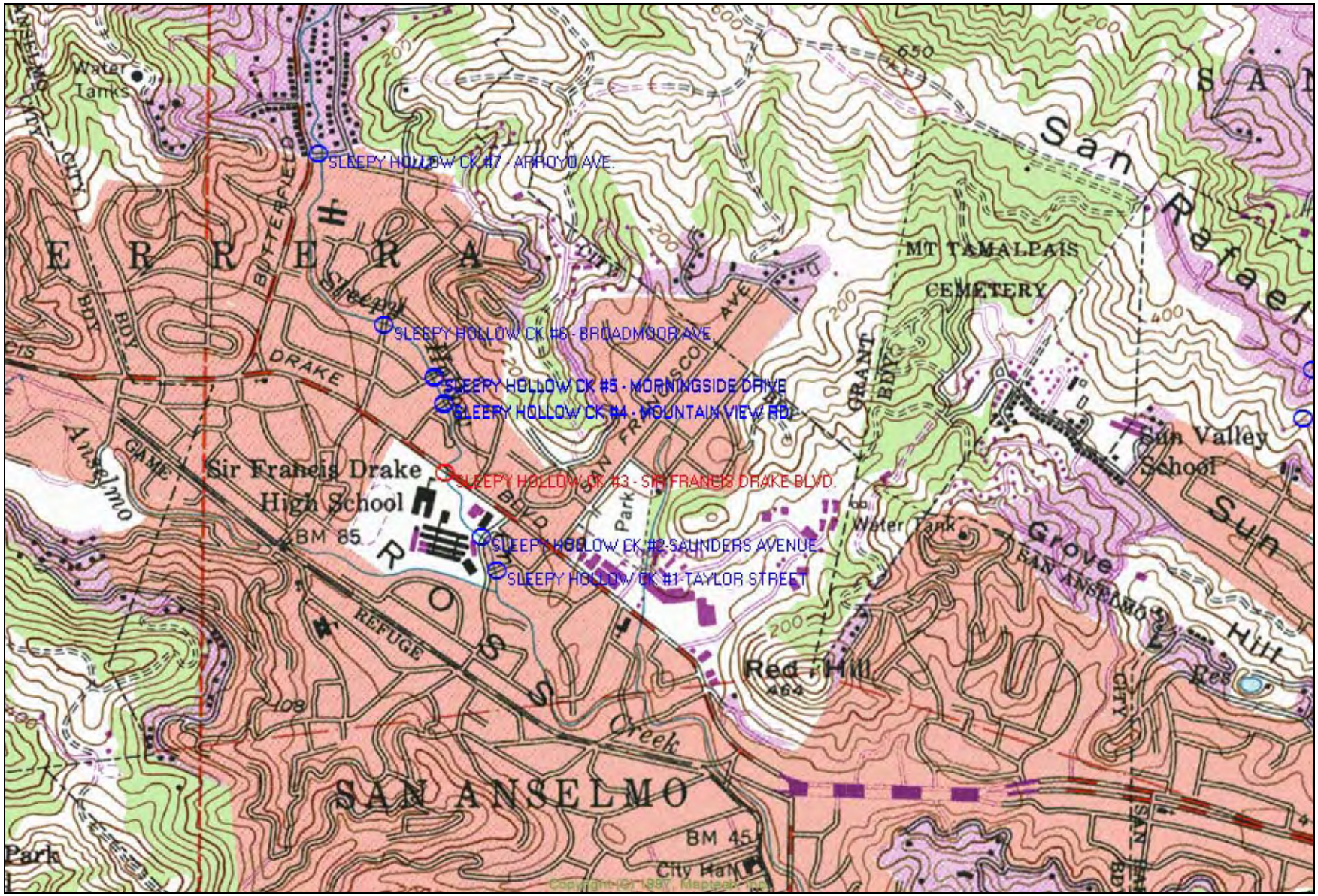
Drainage Area Upstream of Crossing: 3.47 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–96.6 c.f.s; resident/2+ = 2.0-25.0c.f.s.; 1+/y-o-y = 1.0-10.9 c.f.s. **Passage Evaluation: GRAY:** as determined by the first-phase evaluation filter due to the constriction of the channel width through the crossing and insufficient residual depths at culvert inlet and outlet. FishXing estimated that the crossing met the 8-8-16ft/sec and 0.5 minimum depth passage criteria for adult anadromous salmonids for 86% of the range of migration flows (9.7-94.3 c.f.s.). Passage criteria for resident/2+ fish was met for 82% of the range of migration flows (3.1-22.1 c.f.s.) and criteria for 1+/y-o-y fish was met for 67% of the range of migration flows (3.1-9.8 c.f.s.). Actual passage of adults and older juveniles is probably higher because the crossing was assessed as having a flat/even invert when in actuality the invert was U-shaped that created an additional 1.8' of depth through much of the culvert.

Additional Stream Crossings: Downstream – (≈800') to Site ID# SH-02, (≈1,200') to Site ID# SH-01, (≈1,400') to San Anselmo Ck. confluence, (≈3,500') to bridge at Nokomis Ave., (≈3,950') to bridge at Madrone Ave., (≈4,950') to bridge at Center Blvd., (≈5,250') to bridge at Bridge St., (≈6,050') to Site ID# SA-01, (≈6,500') to bridge at SFD Blvd., (≈7,200') to bridge at Barber Ave., (≈8,500') to bridge at Winship Ave., (≈9,000') to bridge at SFD Blvd., (≈9,650') to confluence with Ross Creek, (≈11,250') to bridge at Laguanitas Road, and (≈12,300') to upper end of USACE flood control channel. Upstream – (≈800') to Site ID# SH-04, (≈1,100') to Site ID# SH-05, (≈1,800') to Site ID# SH-06, (≈3,800') to Site ID# SH-07, (≈6,400') to bridge at Caletta Ave., (≈7,800') to Site ID# SH-08, (≈8,700') to Site ID# SH-09, (≈10,200') to bridge at Green Valley Rd., (≈11,800') to Site ID# SH-10, and (≈12,800') to SH-11.

Habitat: Quantity = approximately 24,800' of *potential* fish-bearing habitat upstream of Site ID# SH-03. There is approximately 12,800' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "poor" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 6/08/05 and there was continuous surface flow in the channel. At 2:30 PM the air temp = 16^{o}C and the water temp = 15^{o}C. The survey crew noted an aggraded stream channel in a residential area, several pools with minimal cover, and a moderately dense riparian zone of hardwoods. Most banks were constrained by vertical concrete and stone walls. The crew observed a moderate abundance (10-50 fish) of stickleback and roach upstream and downstream of Site ID# SH-03 and a single y-o-y salmonid.

Preferred Treatment: Because the current crossing is properly sized and fairly passable, no treatment is recommended at this point. Recommend periodic inspection to ensure that back-watering effect by tail-water control remains effective.

Site ID# SH-03: Sleepy Hollow Creek #3/ Sir Francis Drake Blvd.; Corte Madera Creek



Site ID# SH-03: Sleepy Hollow Creek #3/ Sir Francis Drake Blvd.; Corte Madera Creek

Site ID# SH-04: Sleepy Hollow Creek #4/Mountain View Avenue; Corte Madera Creek

Road Ownership: Town of San Anselmo **Ranking Matrix Score =** 20.0 points **Ranking: #13= dropped to Low-Priority**

Location: USGS Quad: San Rafael. T2N, R6W. Lat/Long: N37^{o} 59' 09.8" W122^{o} 34' 16.6" Milepost: approximately 25' to Rivera Street.

Crossing Type: Concrete arch culvert with slight U-shaped invert. **Corrugations:** None. **Dimensions:** 7.0'Rise x 15.2'Span **Length:** 32.3' **Slope:** 1.27% **Modifications:** None. **Ave. Active Channel Width:** 18.6' **Fill Estimate:** 349 Cubic Yards. **Overall Condition:** Good. **Sizing:** Properly-sized; HW/D = 1 on a storm flow with more than a 100-year recurrence interval.

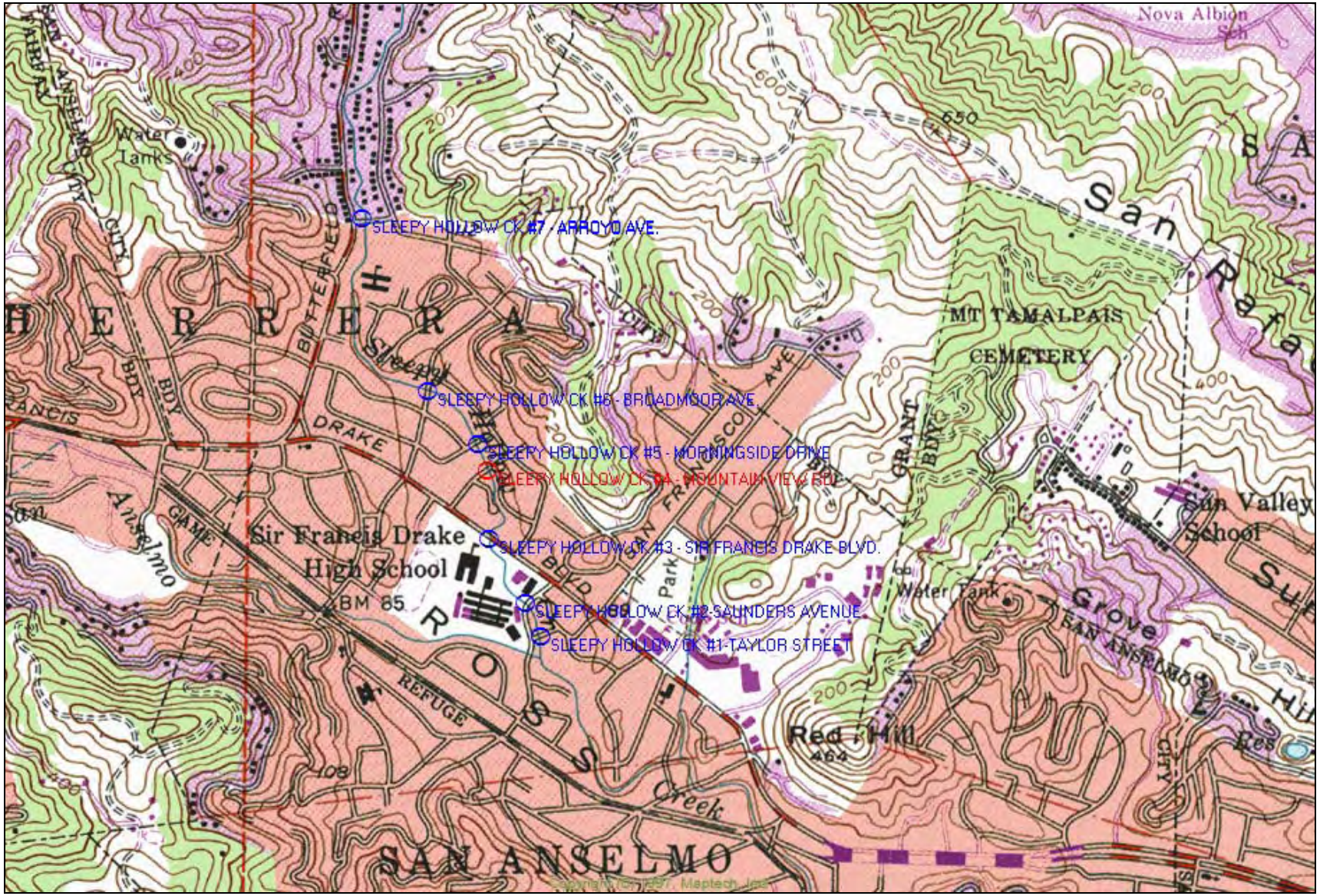
Drainage Area Upstream of Crossing: 3.44 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–95.8 c.f.s; resident/2+ = 2.0-24.8 c.f.s.; 1+/y-o-y = 1.0-10.8 c.f.s. **Passage Evaluation: GRAY:** as determined by the first-phase evaluation filter due to the constriction of the channel width through the crossing and insufficient residual depths at culvert inlet and outlet. FishXing estimated that the crossing met the 8-8-16ft/sec and 0.5 minimum depth passage criteria for adult anadromous salmonids for 47% of the range of migration flows (52.3-95.8 c.f.s.). FishXing estimated that the crossing failed to meet passage criteria for all juvenile age classes. Actual passage of adults and older juveniles is probably higher because the crossing was assessed as having a flat/even invert when in actuality the invert was slightly U-shaped which created additional depth through the culvert.

Additional Stream Crossings: Downstream – (≈800') to Site ID# SH-03, (≈1,600') to Site ID# SH-02, (≈2,000') to Site ID# SH-01, (≈2,200') to San Anselmo Ck. confluence, (≈4,300') to bridge at Nokomis Ave., (≈4,750') to bridge at Madrone Ave., (≈5,750') to bridge at Center Blvd., (≈6,050') to bridge at Bridge St., (≈6,850') to Site ID# SA-01, (≈7,300') to bridge at SFD Blvd., (≈8,000') to bridge at Barber Ave., (≈9,300') to bridge at Winship Ave., (≈9,800') to bridge at SFD Blvd., (≈10,450') to confluence with Ross Creek, (≈12,050') to bridge at Laguanitas Road, and (≈13,100') to upper end of USACE flood control channel. Upstream – (≈300') to Site ID# SH-05, (≈1,000') to Site ID# SH-06, (≈3,000') to Site ID# SH-07, (≈5,600') to bridge at Caletta Ave., (≈7,000') to Site ID# SH-08, (≈7,900') to Site ID# SH-09, (≈9,400') to bridge at Green Valley Rd., (≈11,000') to Site ID# SH-10, and (≈12,000') to SH-11.

Habitat: Quantity = approximately 24,000' of *potential* fish-bearing habitat upstream of Site ID# SH-04. There is approximately 12,000' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "poor" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 6/07/05 and there was continuous surface flow in the channel. At 4:45 PM the air temp = 17^{o}C and the water temp = 15^{o}C. The survey crew noted an aggraded shallow nearly featureless channel, several silted-in pools with minimal cover, and a moderately dense riparian zone of hardwoods. Most banks were constrained by vertical concrete and stone walls. The crew observed extremely abundant (>100 fish) numbers of stickleback and roach upstream and downstream of Site ID# SH-04.

Preferred Treatment: Because the current crossing is properly sized and fairly passable, no treatment is recommended at this point. Recommend periodic inspection to monitor potential changes in elevation of the downstream channel bed.

Site ID# SH-04: Sleepy Hollow Creek #4/Mountain View Avenue; Corte Madera Creek



Site ID# SH-04: Sleepy Hollow Creek #4/Mountain View Avenue; Corte Madera Creek

Site ID# SH-05: Sleepy Hollow Creek #5/Morningside Drive; Corte Madera Creek

Road Ownership: Town of San Anselmo **Ranking Matrix Score =** 12.5 points **Ranking: #19 = Low-Priority**

Location: USGS Quad: San Rafael. T2N, R6W. Lat/Long: N 37° 59' 12.0" W 122° 34' 18.0" Milepost: approximately 100' to Meadowcroft Drive.

Crossing Type: Concrete box culvert w/inlet apron. **Corrugations:** None. **Dimensions:** 7.7' H x 14.0'W **Length:** culvert = 40.0'; apron = 29.5' **Slope:** 0.78% **Modifications:** None. **Rustline Height:** N/A **Ave. Active Channel Width:** 18.6' **Fill Estimate:** 429 Cubic Yards. **Overall Condition:** Good. **Sizing:** Properly-sized; HW/D = 1 on a storm flow with more than a 100-year recurrence interval.

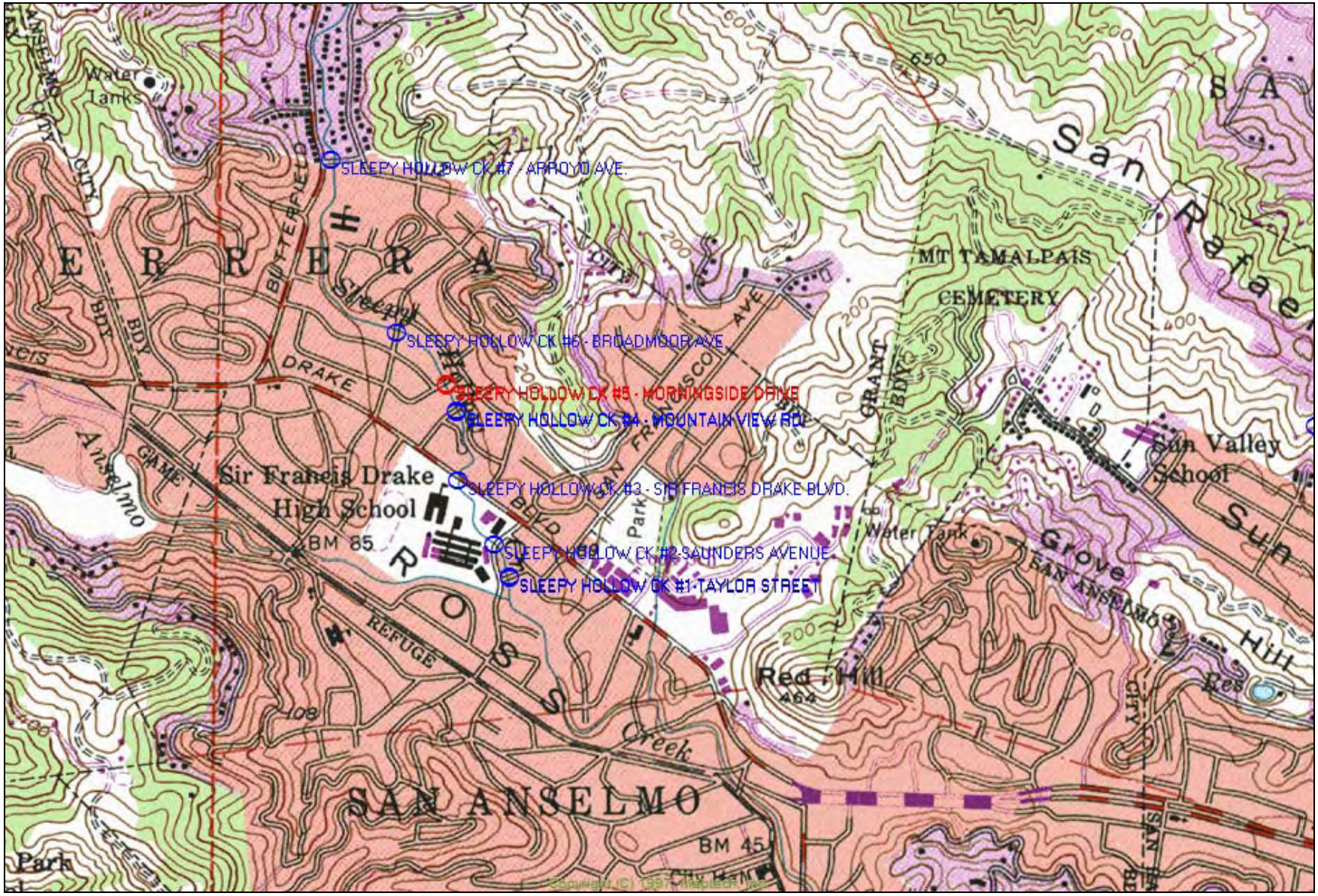
Drainage Area Upstream of Crossing: 3.40 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–94.7 c.f.s; resident/2+ = 2.0-24.5 c.f.s.; 1+/y-o-y = 1.0-10.7 c.f.s. **Passage Evaluation: GRAY:** as determined by the first-phase evaluation filter due to the constriction of the channel width through the crossing and insufficient residual depths at culvert inlet and outlet. FishXing estimated that the crossing met the 8-8-16ft/sec and 0.5 minimum depth passage criteria for adult anadromous salmonids for 75% of the range of migration flows (52.3-95.8 c.f.s.). The crossing met passage criteria of resident/2+ age class salmonids for 55% of the range of migration flows (12.1-24.5 c.f.s.) and failed to meet passage for 1+/y-o-y juveniles. Actual passage of adults and juveniles is probably higher because the crossing was assessed with a flat/even invert when in actuality the invert was slightly U-shaped which created additional depth.

Additional Stream Crossings: Downstream – (≈300') to Site ID# SH-04, (≈1,100') to Site ID# SH-03, (≈1,900') to Site ID# SH-02, (≈2,300') to Site ID# SH-01, (≈2,500') to San Anselmo Ck. confluence, (≈4,600') to bridge at Nokomis Ave., (≈5,050') to bridge at Madrone Ave., (≈6,050') to bridge at Center Blvd., (≈6,350') to bridge at Bridge St., (≈7,150') to Site ID# SA-01, (≈7,600') to bridge at SFD Blvd., (≈8,300') to bridge at Barber Ave., (≈9,600') to bridge at Winship Ave., (≈10,100') to bridge at SFD Blvd., (≈10,750') to confluence with Ross Creek, (≈12,350') to bridge at Laguanitas Road, and (≈13,400') to upper end of USACE flood control channel. Upstream – (≈700') to Site ID# SH-06, (≈2,700') to Site ID# SH-07, (≈5,300') to bridge at Caletta Ave., (≈6,700') to Site ID# SH-08, (≈7,600') to Site ID# SH-09, (≈9,100') to bridge at Green Valley Rd., (≈10,700') to Site ID# SH-10, and (≈11,700') to SH-11.

Habitat: Quantity = approximately 23,700' of *potential* fish-bearing habitat upstream of Site ID# SH-05. There is approximately 11,700' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "poor" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 6/08/05 and there was continuous surface flow in the channel. At 9:30AM the air temp = 16°C and the water temp = 15°C. The survey crew noted an aggraded shallow nearly featureless channel, several silted-in pools with minimal cover, and a moderately dense riparian zone of hardwoods. Most banks were constrained by vertical concrete and stone walls. The crew observed extremely abundant (>100 fish) numbers of stickleback and roach upstream and downstream of Site ID# SH-05.

Preferred Treatment: Because the current crossing is properly sized and fairly passable, no treatment is recommended at this point. Recommend periodic inspection to ensure that back-watering effect by tail-water control remains effective.

Site ID# SH-05: Sleepy Hollow Creek #5/Morningside Drive; Corte Madera Creek



Site ID# SH-05: Sleepy Hollow Creek #5/Morningside Drive; Corte Madera Creek

Site ID# SH-06: Sleepy Hollow Creek #6/Broadmoor Avenue; Corte Madera Creek

Road Ownership: Town of San Anselmo **Ranking Matrix Score =** 16.0 points **Ranking: Tied for #18 = Low-Priority**

Location: USGS Quad: San Rafael. T2N, R6W. Lat/Long: 37° 59' 16.6" 122° 34' 22.9" Milepost: approximately 25' to Brookside Drive.

Crossing Type: Box culvert, concrete. **Corrugations:** None. **Dimensions:** 7.5' H x 14.0'W **Length:** 50.0' **Slope:** 0.58% **Modifications:** None. **Rustline Height:** N/A **Ave. Active Channel Width:** 18.6' **Fill Estimate:** 429 Cubic Yards. **Overall Condition:** Good. **Sizing:** Properly-sized; HW/D = 1 on a storm flow with more than a 100-year recurrence interval.

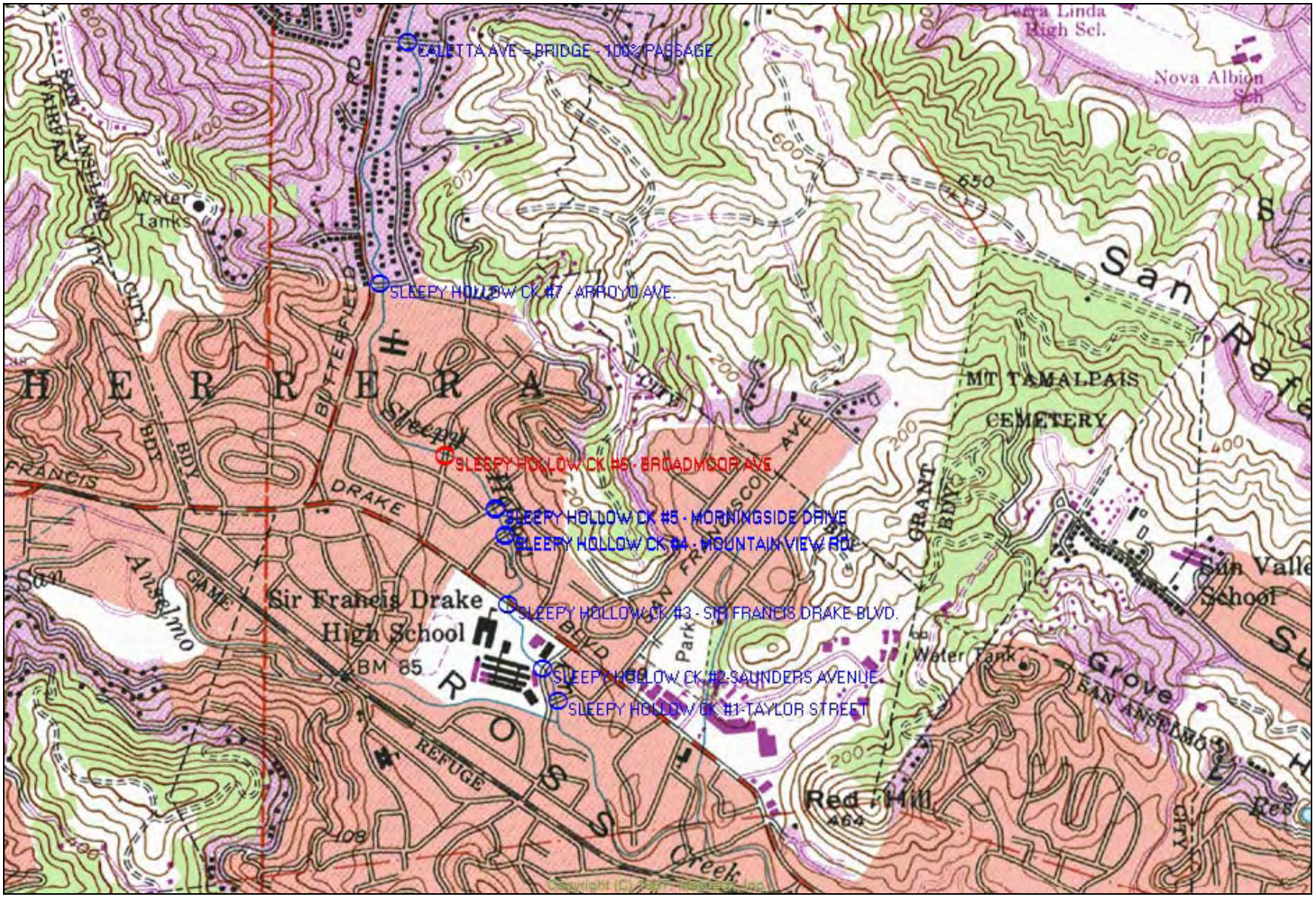
Drainage Area Upstream of Crossing: 3.33 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–92.7 c.f.s; resident/2+ = 2.0-24.0 c.f.s.; 1+/y-o-y = 1.0-10.5 c.f.s. **Passage Evaluation: GRAY:** as determined by the first-phase evaluation filter due to the constriction of the channel width through the crossing and insufficient residual depths at culvert inlet and outlet. FishXing estimated that the crossing met the 8-8-16ft/sec and 0.5 minimum depth passage criteria for adult anadromous salmonids for 68% of the range of migration flows (31.9-92.7 c.f.s.). The crossing failed to meet passage criteria for all juvenile salmonid age classes. Actual passage of adults and possibly resident/2+ juvenile salmonids is probably higher because the only criteria violation was "lack-of-depth".

Additional Stream Crossings: Downstream – (≈700') to Site ID# SH-05, (≈1,000') to Site ID# SH-04, (≈1,800') to Site ID# SH-03, (≈2,600') to Site ID# SH-02, (≈3,000') to Site ID# SH-01, (≈3,200') to San Anselmo Ck. confluence, (≈5,300') to bridge at Nokomis Ave., (≈5,750') to bridge at Madrone Ave., (≈6,750') to bridge at Center Blvd., (≈7,050') to bridge at Bridge St., (≈7,850') to Site ID# SA-01, (≈8,300') to bridge at SFD Blvd., (≈9,000') to bridge at Barber Ave., (≈10,300') to bridge at Winship Ave., (≈10,800') to bridge at SFD Blvd., (≈11,450') to confluence with Ross Creek, (≈13,050') to bridge at Laguanitas Road, and (≈14,100') to upper end of USACE flood control channel. Upstream –(≈2,000') to Site ID# SH-07, (≈4,600') to bridge at Caletta Ave., (≈6,000') to Site ID# SH-08, (≈6,900') to Site ID# SH-09, (≈8,400') to bridge at Green Valley Rd., (≈10,000') to Site ID# SH-10, and (≈11,000') to SH-11.

Habitat: Quantity = approximately 23,000' of *potential* fish-bearing habitat upstream of Site ID# SH-06. There is approximately 11,000' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "poor" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 6/07/05 and there was continuous surface flow in the channel. At 3:15PM the air temp = 16°C and the water temp = 14°C. The survey crew noted an aggraded shallow nearly featureless channel, several silted-in pools with minimal cover, and a moderately dense riparian zone of hardwoods. Most banks were constrained by vertical concrete walls and sloped rip-rap banks. The crew observed extremely abundant (>100 fish) numbers of stickleback and roach upstream and downstream of Site ID# SH-06.

Preferred Treatment: Because the current crossing is properly sized and fairly passable, no treatment is recommended at this point. Recommend periodic inspection to ensure that back-watering effect by tail-water control remains effective.

Site ID# SH-06: Sleepy Hollow Creek #6/Broadmoor Avenue; Corte Madera Creek



Site ID# SH-06: Sleepy Hollow Creek #6/Broadmoor Avenue; Corte Madera Creek

Site ID# SH-07: Sleepy Hollow Creek #7/Arroyo Avenue; Corte Madera Creek

Road Ownership: Town of San Anselmo **Ranking Matrix Score =** 5.0 points **Ranking: #23 = Low-Priority**

Location: USGS Quad: San Rafael. T2N, R6W. Lat/Long: 37° 59' 31.4" 122° 34' 30.2" Milepost: approximately 30' to Butterfield Road.

Crossing Type: Arch culvert with open bottom. **Corrugations:** None. **Dimensions:** 9.35' Rise x 13.8' Span **Length:** 39.8' **Slope:** -0.95% **Modifications:** None. **Rustline Height:** N/A **Ave. Active Channel Width:** 18.4' **Fill Estimate:** 612 Cubic Yards. **Overall Condition:** Good. **Sizing:** Properly-sized; HW/D = 1 on a storm flow with more than a 100-year recurrence interval.

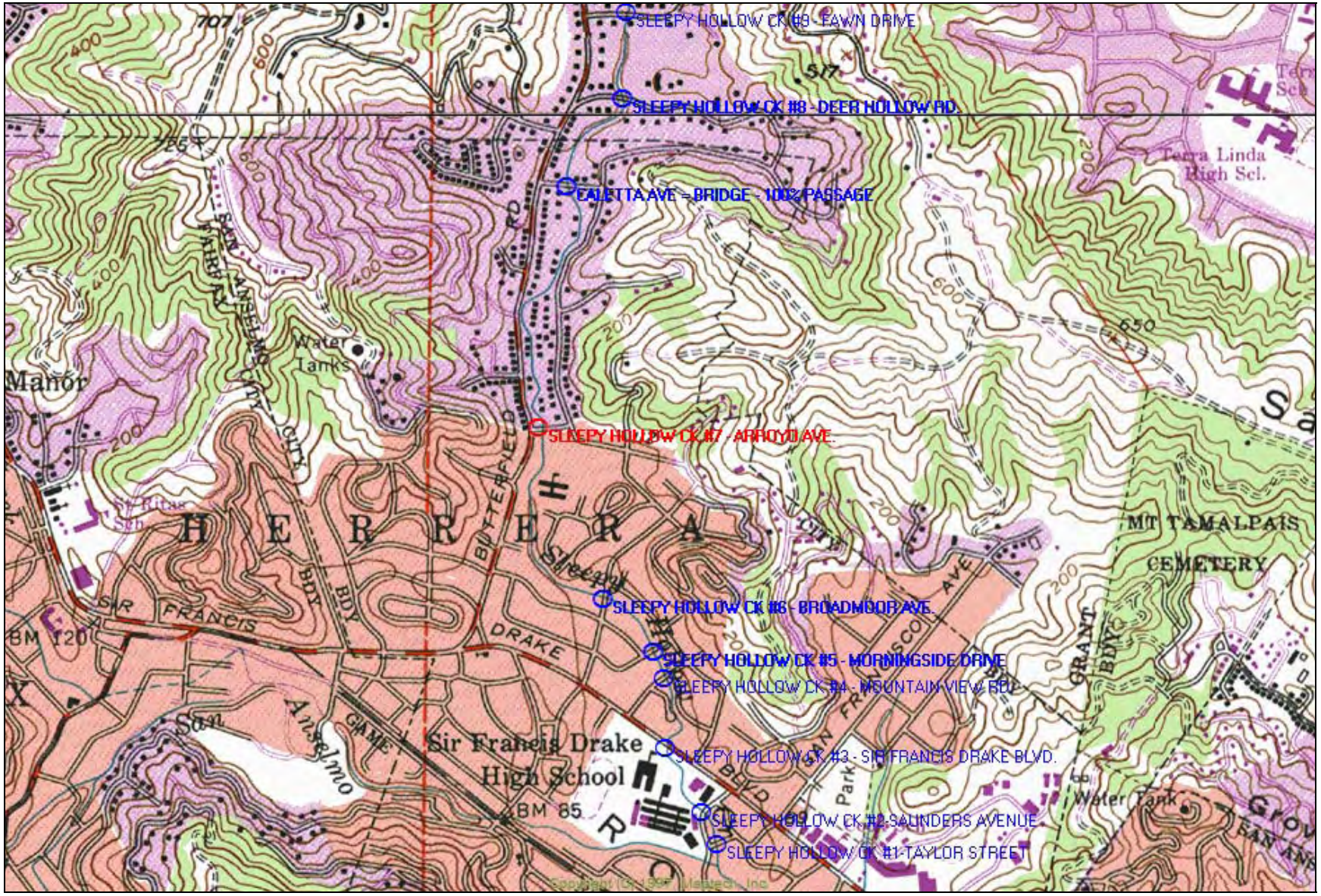
Drainage Area Upstream of Crossing: 3.07 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–85.5 c.f.s; resident/2+ = 2.0-22.1 c.f.s.; 1+/y-o-y = 1.0-9.6 c.f.s. **Passage Evaluation: GRAY:** as determined by the first-phase evaluation filter due to the constriction of the channel width through the crossing. However, FishXing estimated that the crossing met the passage criteria for adult and all juvenile age classes of anadromous salmonids for all migration flows. Although classified as "open-bottom", the crossing does have concrete supports at the inlet and outlet set perpendicular to the stream channel with were 0.8' and 0.4' deep (respectively) at low flow.

Additional Stream Crossings: Downstream – (≈2,000') to Site ID# SH-06, (≈2,700') to Site ID# SH-05, (≈3,000') to Site ID# SH-04, (≈3,800') to Site ID# SH-03, (≈4,600') to Site ID# SH-02, (≈5,000') to Site ID# SH-01, (≈5,200') to San Anselmo Ck. confluence, (≈7,300') to bridge at Nokomis Ave., (≈7,750') to bridge at Madrone Ave., (≈8,750') to bridge at Center Blvd., (≈9,050') to bridge at Bridge St., (≈9,850') to Site ID# SA-01, (≈10,300') to bridge at SFD Blvd., (≈11,000') to bridge at Barber Ave., (≈12,300') to bridge at Winship Ave., (≈12,800') to bridge at SFD Blvd., (≈13,450') to confluence with Ross Creek, (≈15,050') to bridge at Laguanitas Road, and (≈16,100') to upper end of USACE flood control channel. Upstream –(≈2,600') to bridge at Caletta Ave., (≈4,000') to Site ID# SH-08, (≈4,900') to Site ID# SH-09, (≈6,400') to bridge at Green Valley Rd., (≈8,000') to Site ID# SH-10, and (≈9,000') to SH-11.

Habitat: Quantity = approximately 21,000' of *potential* fish-bearing habitat upstream of Site ID# SH-07. There is approximately 9,000' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "poor" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 6/07/05 and there was continuous surface flow in the channel. At 2:15PM the air temp = 15°C and the water temp = 14°C. The survey crew noted an aggraded shallow nearly featureless channel, several silted-in pools with minimal cover, and a moderately dense riparian zone of hardwoods and brush. Most banks were constrained by vertical concrete walls and sloped rip-rap banks. The crew observed extremely abundant (>100 fish) numbers of stickleback and roach upstream and downstream of Site ID# SH-07. A single young-of-year salmonid was observed upstream of Site ID# SH-07.

Preferred Treatment: Because the current crossing is properly sized and 100% passable, no treatment is recommended at this point. Recommend periodic inspection to ensure that back-watering effect by tail-water control remains effective.

Site ID# SH-07: Sleepy Hollow Creek #7/Arroyo Avenue; Corte Madera Creek



Site ID# SH-07: Sleepy Hollow Creek #7/Arroyo Avenue; Corte Madera Creek

Site ID# SH-08 aka MR-081: Sleepy Hollow Creek #8/Deer Hollow Road; Corte Madera Creek

Road Ownership: County of Marin **Ranking Matrix Score** = 21.8 points **Ranking: #5 = High-Priority**

Location: Road ID# SF010; County Map Sheet #9. USGS Quad: Novato. T2N, R6W. Lat/Long: 38° 00' 1.35" 122° 34' 21.19" Milepost: 0.1 miles to Butterfield Road.

Crossing Type: Box culvert, Concrete. **Corrugations:** None. **Dimensions:** 11.8' H x 13.0' W **Length:** 27.3' **Slope:** 0.84% **Modifications:** None. **Rustline Height:** N/A **Average Active Channel Width:** 18.4' **Fill Estimate:** 739 Cubic Yards. **Overall Condition:** Fair– floor is worn. **Sizing:** Properly-sized; HW/D = 1 on a storm flow with more than a 100-year recurrence interval.

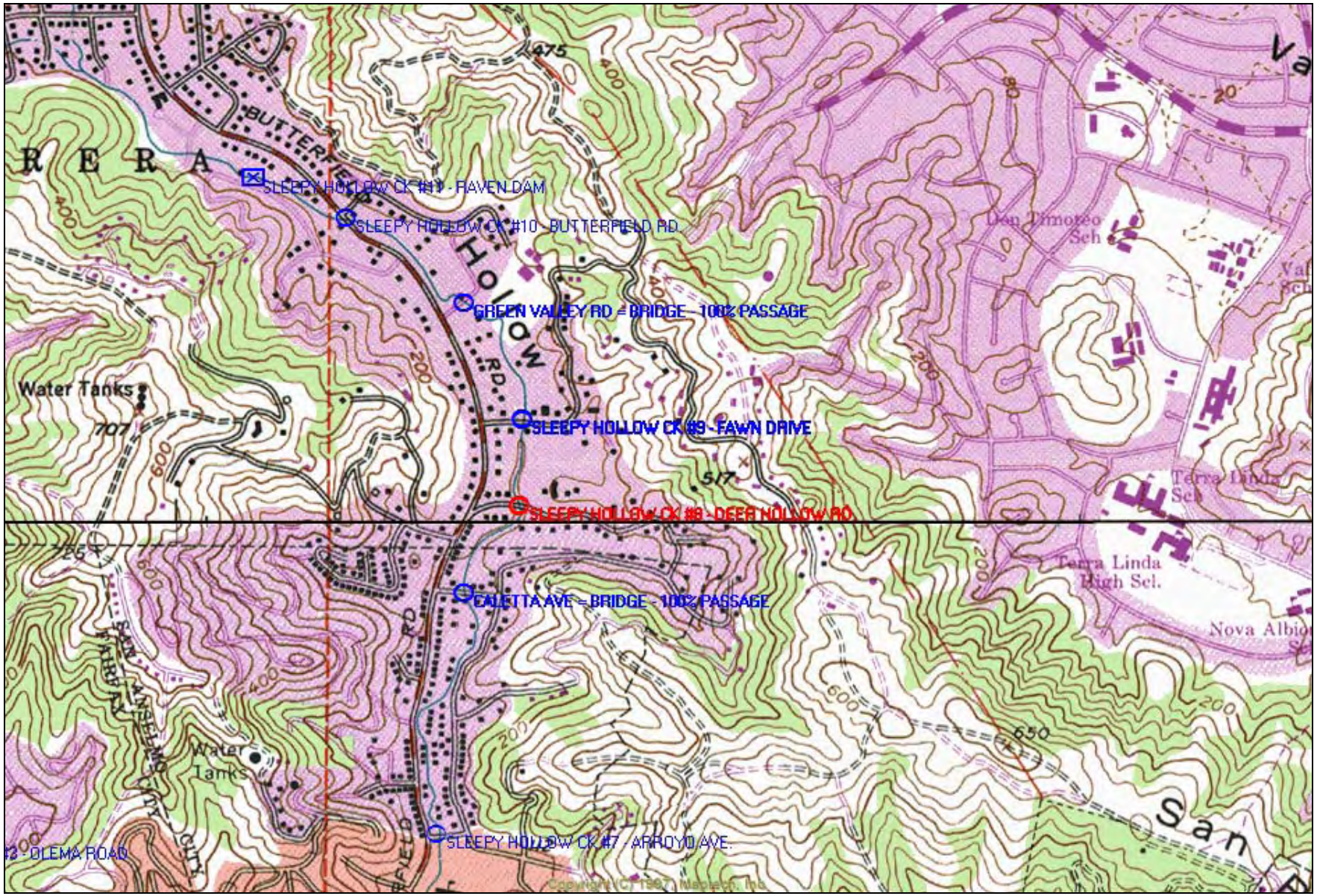
Drainage Area Upstream of Crossing: 2.44 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–68.0 c.f.s; resident/2+ = 2.0-17.6 c.f.s.; 1+/y-o-y = 1.0-7.7 c.f.s. **Passage Evaluation: RED:** the Green-Gray-Red filter determined this crossing fails to meet passage criteria for all species of adult salmonids and all age classes of juveniles. Outlet is perched 5.8 feet (residual height) and spills over a sloped bedrock/concrete drop.

Additional Stream Crossings: Downstream – (≈1,400') to bridge at Caletta Ave., (≈4,000') to Site ID# SH-07, (≈6,000') to Site ID# SH-06, (≈6,700') to Site ID# SH-05, (≈7,000') to Site ID# SH-04, (≈7,800') to Site ID# SH-03, (≈8,600') to Site ID# SH-02, (≈9,000') to Site ID# SH-01, (≈9,200') to San Anselmo Ck. confluence, (≈11,300') to bridge at Nokomis Ave., (≈11,750') to bridge at Madrone Ave., (≈12,750') to bridge at Center Blvd., (≈13,050') to bridge at Bridge St., (≈13,850') to Site ID# SA-01, (≈14,300') to bridge at SFD Blvd., (≈15,000') to bridge at Barber Ave., (≈16,300') to bridge at Winship Ave., (≈16,800') to bridge at SFD Blvd., (≈17,450') to confluence with Ross Creek, (≈19,050') to bridge at Laguanitas Road, and (≈20,100') to upper end of USACE flood control channel. Upstream – (≈900') to Site ID# SH-09, (≈2,400') to bridge at Green Valley Rd., (≈4,000') to Site ID# SH-10, and (≈5,000') to SH-11.

Habitat: Quantity = approximately 17,000' of *potential* fish-bearing habitat upstream of Site ID# SH-08. There is approximately 5,000' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "poor" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 10/14/02 for the County of Marin's passage inventory and there were isolated areas of surface water in the channel. At 3:00PM the air temp = 22°C and the water temp = 12.5°C. The survey crew noted an aggraded stream channel in a residential area, several pools, and a dense riparian zone of hardwoods. The crew observed several (<10) juvenile fish of unknown species downstream of Site ID# SH-08.

Preferred Treatment: Because the current crossing is properly sized, a retrofit is recommended to improve conditions for fish passage. At least five to six boulder weirs are required to sufficiently raise the tail-water elevation and corner baffles within the culvert will increase depths and decrease velocities. Or consider feasibility of constructing a concrete fish ladder onto the bedrock outcrop at the culvert outlet in conjunction with a series of sloped, concrete weirs with low-flows notches through the box culvert to increase depths. Recommend consulting with CDFG and NOAA hydraulic engineers for design assistance.

Site ID# SH-08 aka MR-081: Sleepy Hollow Creek #8/Deer Hollow Road; Corte Madera Creek



Site ID# SH-08: Sleepy Hollow Creek #8/Deer Hollow Road; Corte Madera Creek

Site ID# SH-09 aka MR-082: Sleepy Hollow Creek #9/Fawn Drive; Corte Madera Creek

Road Ownership: County of Marin **Ranking Matrix Score =** 19.5 points **Ranking: #9 = dropped to Medium-Priority**

Location: Road ID# SF012; County Map Sheet #9. USGS Quad: Novato. T2N, R6W. Lat/Long: 38° 00' 8.82" 122° 34' 20.86" Milepost: 0.1 miles to Butterfield Road.

Crossing Type: Box culvert, Concrete. **Corrugations:** None. **Dimensions:** 8.5' height x 13.0' width **Length:** 48.9' **Slope:** 4.21% **Modifications:** None. **Rustline Height:** N/A **Average Active Channel Width:** 18.4' **Fill Estimate:** 767 Cubic Yards. **Overall Condition:** Good. **Sizing:** Properly-sized; HW/D = 1 on a storm flow with more than a 100-year recurrence interval.

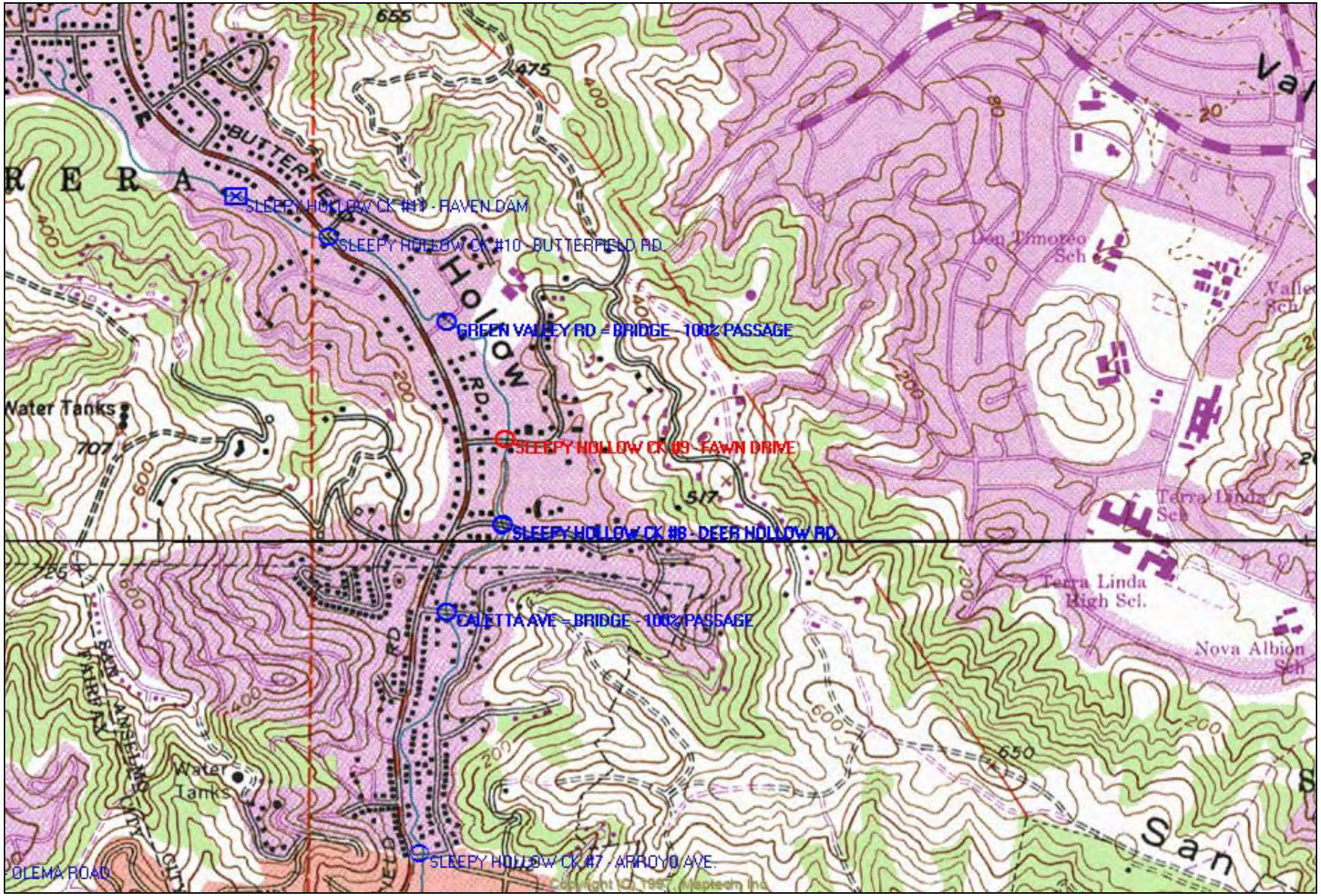
Drainage Area Upstream of Crossing: 2.34 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–65.2 c.f.s; resident/2+ = 2.0-16.9 c.f.s.; 1+/y-o-y = 1.0-7.3 c.f.s. **Passage Evaluation: RED:** FishXing determined this crossing failed to meet the 8-16-16 ft/sec passage criteria for adult steelhead and all age classes of juveniles. For adults, FishXing indicated a lack-of-depth up to 30 c.f.s. (then excessive velocities occur at higher flows), thus some adult steelhead may burst through this moderately steep, yet short box culvert. The concave invert provides additional depth not accounted for by FishXing.

Additional Stream Crossings: Downstream – (≈900') to Site ID# SH-08, (≈2,300') to bridge at Caletta Ave., (≈4,900') to Site ID# SH-07, (≈6,900') to Site ID# SH-06, (≈7,600') to Site ID# SH-05, (≈7,900') to Site ID# SH-04, (≈8,700') to Site ID# SH-03, (≈9,500') to Site ID# SH-02, (≈9,900') to Site ID# SH-01, (≈10,100') to San Anselmo Ck. confluence, (≈12,200') to bridge at Nokomis Ave., (≈12,650') to bridge at Madrone Ave., (≈13,650') to bridge at Center Blvd., (≈13,950') to bridge at Bridge St., (≈14,750') to Site ID# SA-01, (≈15,200') to bridge at SFD Blvd., (≈15,900') to bridge at Barber Ave., (≈17,200') to bridge at Winship Ave., (≈17,700') to bridge at SFD Blvd., (≈18,350') to confluence with Ross Creek, (≈19,950') to bridge at Laguanitas Road, and (≈22,000') to upper end of USACE flood control channel. Upstream – (≈1,500') to bridge at Green Valley Rd., (≈3,100') to Site ID# SH-10, and (≈4,100') to SH-11.

Habitat: Quantity = approximately 16,100' of *potential* fish-bearing habitat upstream of Site ID# SH-09. There is approximately 4,100' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "poor" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 10/14/02 for the County of Marin's passage inventory and there were isolated areas of surface water in the channel. At 4:00PM the air temp = 22°C and the water temp = 15°C. The survey crew noted an aggraded stream channel in a residential area, several pools, and a moderately dense riparian zone of hardwoods and redwoods. The crew observed several (<10) juvenile fish of unknown species downstream of Site ID# SH-09.

Preferred Treatment: Because the current crossing is properly sized, fish passage could be cost-effectively improved by installing fully-spanning, sloped concrete weirs within the box culvert, an outlet beam with a low-flow notch, and possibly one to two downstream boulder weirs to raise tail-water elevation. Recommend consulting with CDFG and NOAA hydraulic engineers for design assistance.

Site ID# SH-09 aka MR-082: Sleepy Hollow Creek #9/Fawn Drive; Corte Madera Creek



Site ID# SH-09 aka MR-082: Sleepy Hollow Creek #9/Fawn Drive; Corte Madera Creek

Site ID# SH-10 aka MR-083: Sleepy Hollow Creek #10/Butterfield Road; Corte Madera Creek

Road Ownership: County of Marin **Ranking Matrix Score =** 18.0 points **Ranking: #15 = Medium-Priority**

Location: Road ID# ASF002; County Map Sheet #8. USGS Quad: Novato. T2N, R6W. Lat/Long: 38° 00' 26.76" 122° 34' 40.72" Milepost: At Sleepy Hollow Road.

Crossing Type: Box culvert, Concrete. **Corrugations:** None. **Dimensions:** 6.15' height x 11.8' width **Length:** 75.3' **Slope:** 0.81% **Modifications:** None. **Rustline Height:** N/A **Average Active Channel Width:** 18.4' **Fill Estimate:** 1,347 Cubic Yards. **Overall Condition:** Fair–floor is worn. **Sizing:** Adequately Undersized; HW/D = 1 on a storm flow with approximately a 96-year recurrence interval.

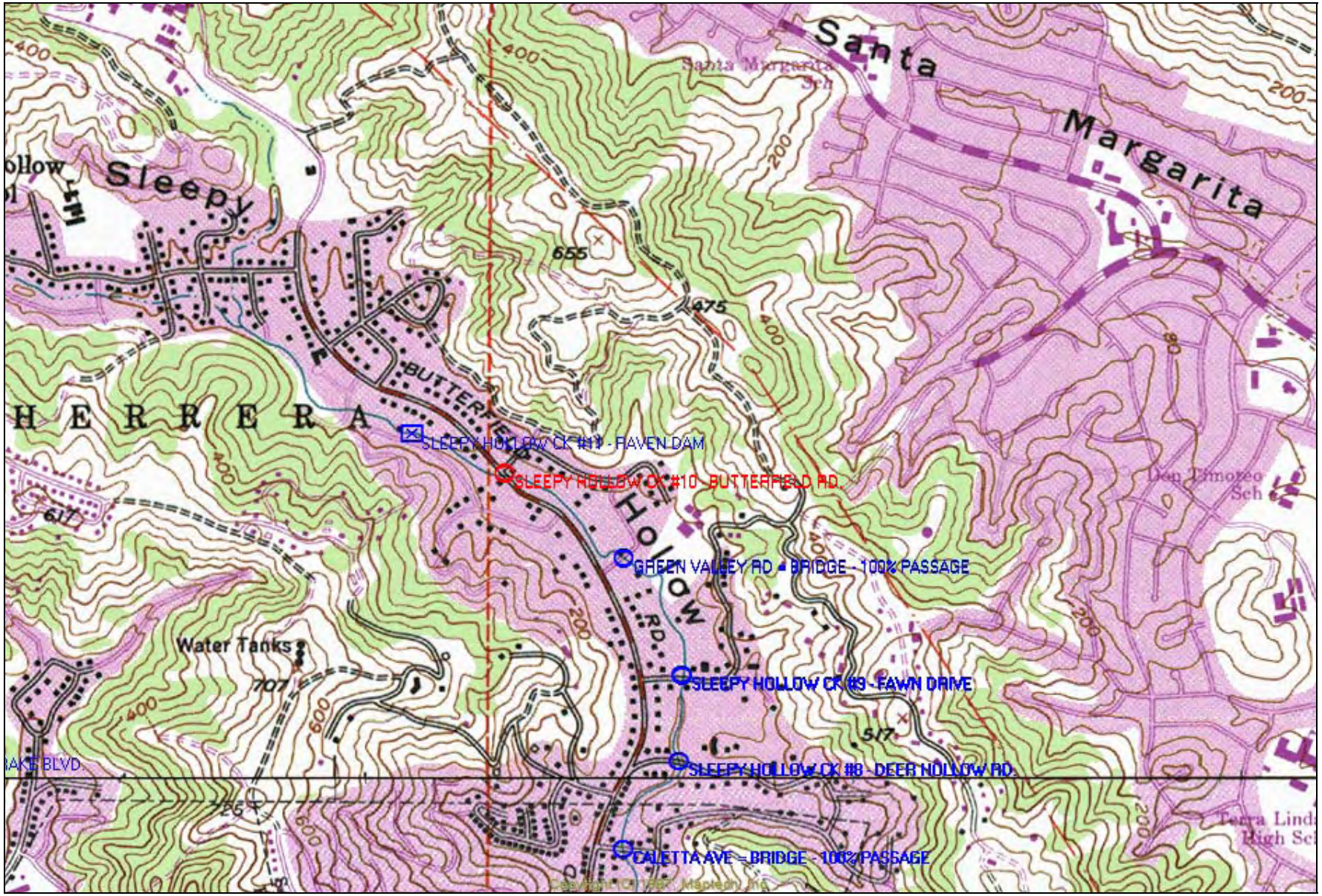
Drainage Area Upstream of Crossing: 1.99 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–55.4 c.f.s; resident/2+ = 2.0-14.3 c.f.s.; 1+/y-o-y = 1.0-6.2 c.f.s. **Passage Evaluation: GRAY:** FishXing estimated this crossing met the 8-16-16 ft/sec passage criteria for adult steelhead on 37% of the range of estimated migration flows and failed to meet the passage criteria for all age classes of juvenile salmonids. For adults and resident trout/2+ juveniles the only criteria violation was lack-of-depth, thus some passage probably occurs regardless of the FishXing output.

Additional Stream Crossings: Downstream – (≈1,600') to bridge at Green Valley Rd., (≈3,100') to Site ID# SH-10, (≈4,000') to Site ID# SH-08, (≈5,400') to bridge at Caletta Ave., (≈8,000') to Site ID# SH-07, (≈10,000') to Site ID# SH-06, (≈10,700') to Site ID# SH-05, (≈11,000') to Site ID# SH-04, (≈11,800') to Site ID# SH-03, (≈12,600') to Site ID# SH-02, (≈13,000') to Site ID# SH-01, (≈13,200') to San Anselmo Ck. confluence, (≈15,300') to bridge at Nokomis Ave., (≈15,750') to bridge at Madrone Ave., (≈16,750') to bridge at Center Blvd., (≈17,050') to bridge at Bridge St., (≈17,850') to Site ID# SA-01, (≈18,300') to bridge at SFD Blvd., (≈19,000') to bridge at Barber Ave., (≈20,300') to bridge at Winship Ave., (≈20,800') to bridge at SFD Blvd., (≈21,450') to confluence with Ross Creek, (≈23,050') to bridge at Laguanitas Road, and (≈25,100') to upper end of USACE flood control channel. Upstream – (≈1,000') to SH-11.

Habitat: Quantity = approximately 13,000' of *potential* fish-bearing habitat upstream of Site ID# SH-10. There is approximately 1,000' of stream channel to current limit of anadromy at Raven Dam. Quality = in the vicinity of the crossing, rated as "fair" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 10/14/02 for the County of Marin's passage inventory and there were isolated areas of surface water in the channel. At 5:00PM the air temp = 21°C and the water temp = 13°C. The survey crew noted an aggraded stream channel in a residential area, several pools, and a moderately dense riparian zone of hardwoods. The crew noted extremely abundant numbers (>100) of fish of unknown species in isolated pools located both upstream and downstream of Site ID# SH-10.

Preferred Treatment: Because the current crossing is properly sized, fish passage could be cost-effectively improved by installing two downstream boulder weirs to raise tail-water elevation and back-water the culvert. However, more serious passage impediments within Sleepy Hollow Creek should be treated prior to this crossing including Raven Dam located 1,000' upstream.

Site ID# SH-10 aka MR-083: Sleepy Hollow Creek #10/Butterfield Road; Corte Madera Creek



Site ID# SH-10 aka MR-083: Sleepy Hollow Creek #10/Butterfield Road; Corte Madera Creek

Site ID# SH-11: Sleepy Hollow Creek #11/Raven Dam; Corte Madera Creek
Crossing Ownership: Private **Ranking Matrix Score** = 20.3 points **Ranking: #11 = High-Priority**

Location: USGS Quad: Novato. T2N, R7W. Lat/Long: 38° 00' 30.2" 122° 34' 49.4" Milepost: 0.1 miles to Legend Road.

Crossing Type: Dam, concrete set on bedrock outcrop. **Corrugations:** N/A. **Dimensions:** dam spans a 20.7' width and is 2.6' thick. **Length:** 14.7' from upstream edge of dam to downstream edge of bedrock outcrop. **Slope:** Not applicable **Modifications:** None. **Rustline Height:** N/A **Average Active Channel Width:** 19.4' **Fill Estimate:** Not applicable. **Overall Condition:** Good. **Sizing:** Not applicable since a dam is an open structure with no top or sides to limit flow.

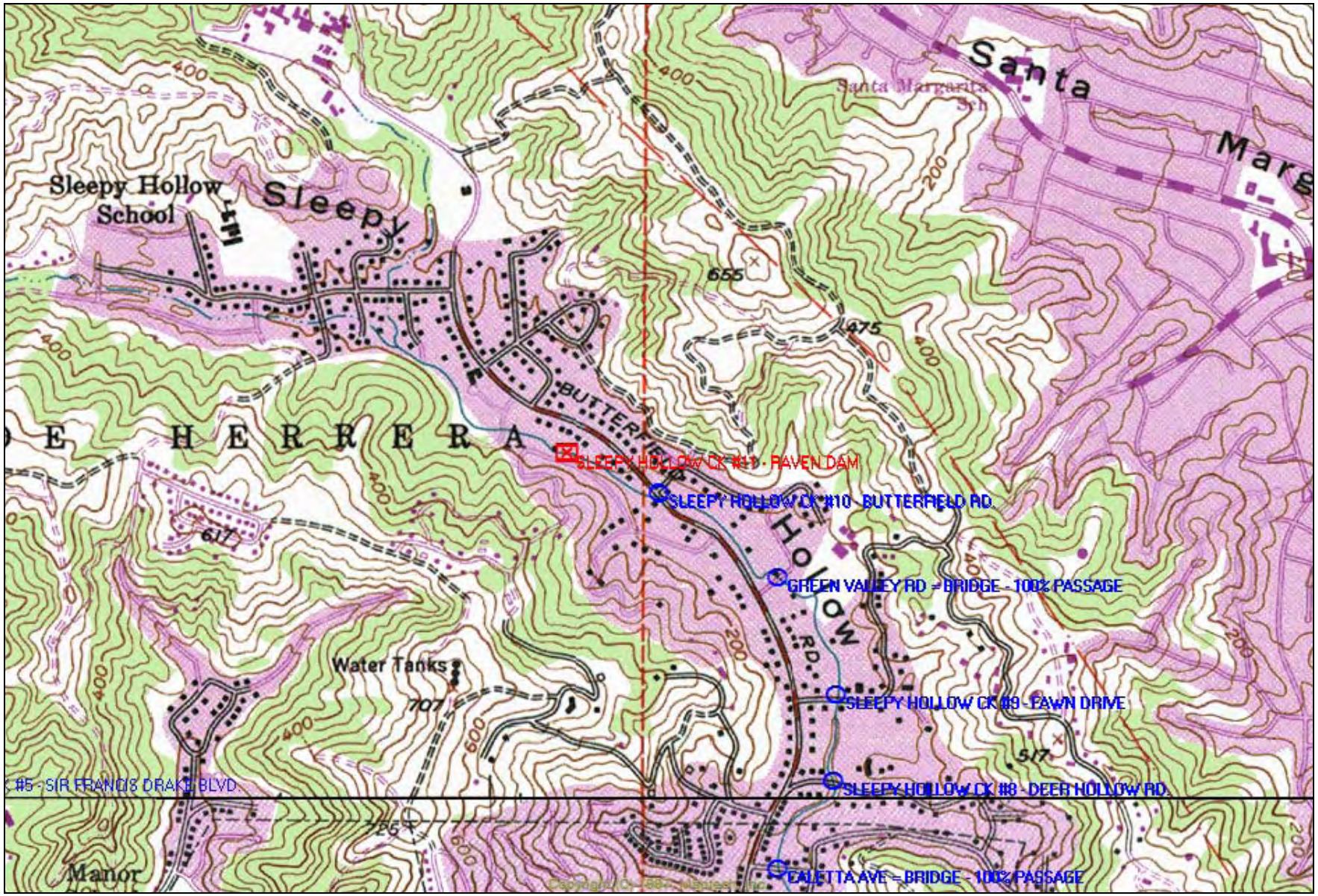
Drainage Area Upstream of Crossing: 1.97 square miles. **Estimated Migration Flows:** anadromous adult salmonids = 3.0–54.9 c.f.s; resident/2+ = 2.0-14.2 c.f.s.; 1+/y-o-y = 1.0-6.2 c.f.s. **Passage Evaluation: RED:** as determined by the first-phase evaluation filter for the excessive drop over the dam. FishXing was utilized to assess changes in drop height at varying discharges. At 20 c.f.s. drop = 8.4'; at 50 c.f.s. drop = 8.2'; at 100 c.f.s. drop = 8.0'; and at 150 c.f.s. drop = 7.9'. Total drop occurs in two stages: flow drops from lip of dam onto bedrock outcrop, length of outcrop is 12 feet, followed by a final drop into a large downstream pool.

Additional Stream Crossings: Downstream – (≈1,000') to SH-10, (≈2,600') to bridge at Green Valley Rd., (≈4,100') to Site ID# SH-10, (≈5,000') to Site ID# SH-08, (≈6,400') to bridge at Caletta Ave., (≈9,000') to Site ID# SH-07, (≈11,000') to Site ID# SH-06, (≈11,700') to Site ID# SH-05, (≈12,000') to Site ID# SH-04, (≈12,800') to Site ID# SH-03, (≈13,600') to Site ID# SH-02, (≈14,000') to Site ID# SH-01, (≈14,200') to San Anselmo Ck. confluence, (≈16,300') to bridge at Nokomis Ave., (≈16,750') to bridge at Madrone Ave., (≈17,750') to bridge at Center Blvd., (≈18,050') to bridge at Bridge St., (≈18,850') to Site ID# SA-01, (≈19,300') to bridge at SFD Blvd., (≈20,000') to bridge at Barber Ave., (≈21,300') to bridge at Winship Ave., (≈21,800') to bridge at SFD Blvd., (≈22,450') to confluence with Ross Creek, (≈24,050') to bridge at Laguanitas Road, and (≈26,100') to upper end of USACE flood control channel. Upstream – USGS map indicates three additional crossings approximately 2,500' to 3,000' upstream – status unknown.

Habitat: Quantity = approximately 12,000' of *potential* fish-bearing habitat upstream of Site ID# SH-11; however it is unlikely that any steelhead are able to pass over Raven Dam. Quality = in the vicinity of the crossing, rated as "fair" for the ranking matrix based on Taylor and Associates survey crew's field notes and interpretation of previous habitat assessment (Rich, 2000). The crossing was surveyed by Taylor and Associates on 6/07/05 and there was continuous surface flow in the channel. At 11:15AM the air temp = 15°C and the water temp = 14°C. The survey crew noted a fairly aggraded stream channel, numerous pools with suitable spawning substrate, and a moderately dense riparian zone of mostly hardwoods. The crew noted abundant numbers (50 – 100 fish) of roach and sticklebacks both upstream and downstream of Site ID# SH-11. Between 10 – 20 young-of-year salmonids were observed in several pools downstream of Raven Dam.

Preferred Treatment: Explore options for dam removal and restoration/re-grade of the stream channel. However, three downstream crossings (SH-01, 08, 09) should first be treated to restore adult steelhead passage up to Raven Dam.

Site ID# SH-11: Sleepy Hollow Creek #11/Raven Dam; Corte Madera Creek



Site ID# SH-11: Sleepy Hollow Creek #11/Raven Dam; Corte Madera Creek