

Appendix L. Description of Spatial Analysis and Maps Showing the Overlap of the Initial Area of Concern and the Species Habitat Areas

I. Labeled Uses and Associated Land Cover Types for Bensulide

The following use list is derived from label use information. It is used as a basis for the spatial mapping of bensulide. Table 1 shows which land cover types are used to represent the spatial area of the use (*e.g.*, the use footprint). The land cover classes were not designed to represent each use specifically, but were chosen as the best spatial representation of a use area available. For example, dumpster use sites are associated with all developed landcover classes, including developed open space, since there is a possibility dumpsters can be found there.

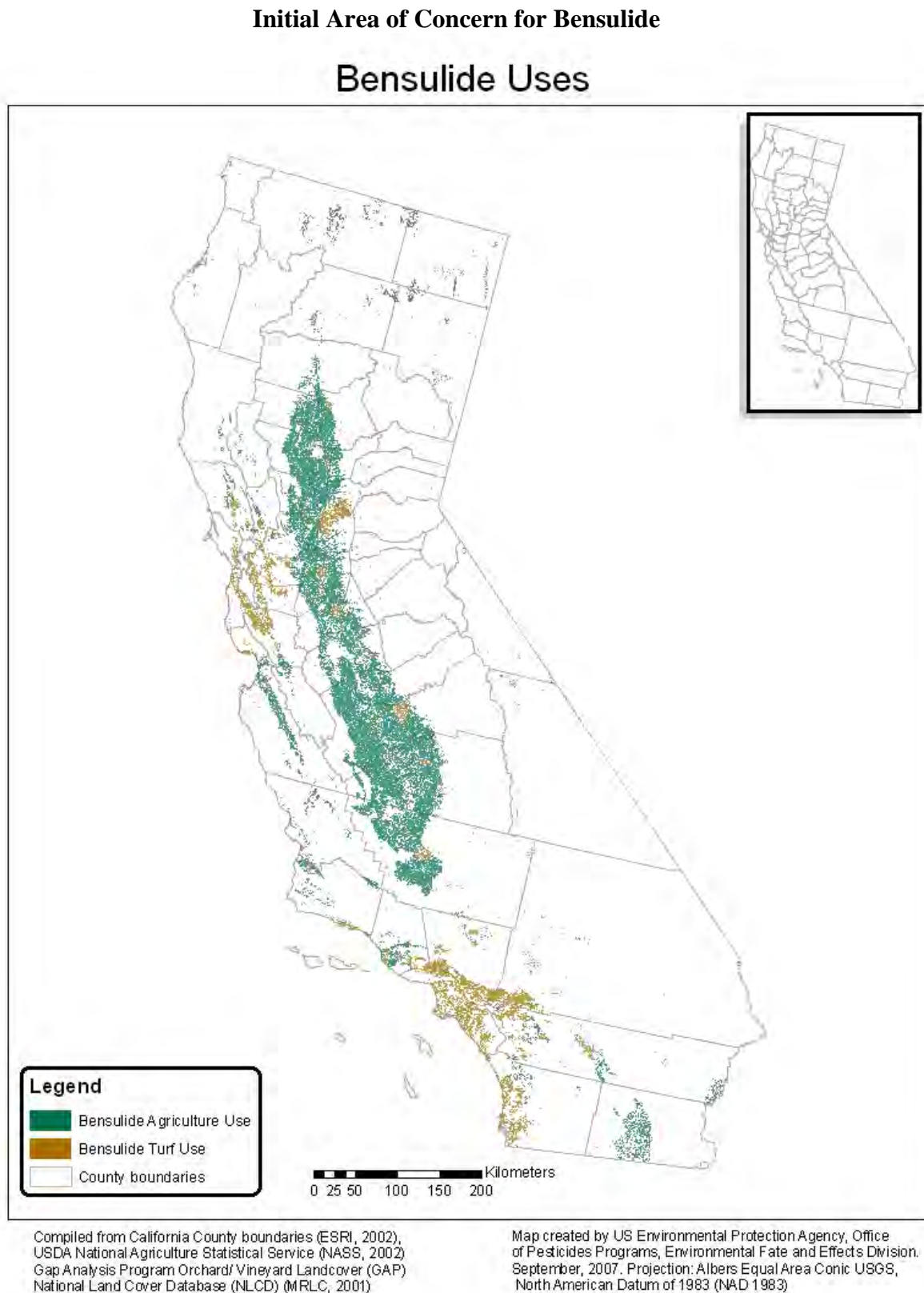
Table 1. Mapping layers and associated use sites.

| Land Cover Mapping Layer | Use list |
|--------------------------|--|
| Cultivated crops | Artichokes, beans, beet, bell pepper, <i>Brassica</i> (head and stem) vegetables, broccoli, broccoli raab, Brussels sprouts, cabbage, cardoon, cauliflower, celery, celtuce, chervil, chicory/radicchio, chrysanthemum (garland), cole crops, collards, corn salad, cress (garden, upland), dandelion, dock (sorrel), eggplant, endive, fennel, garlic, greens, groundcherry (strawberry tomato/tomatillo), kale, kohlrabi, leafy vegetables, lettuce (head, leaf), mustard, mustard cabbage, okra, onion (dry bulb and green), orach (mountain spinach), parsley, peas, pepper, pepper (chili), pimento, radish, roquette (arugula), shallot, spinach, Swiss chard, cantaloupe, chayote, cucumber, cucurbit vegetables, cucuzzi, gherkin, gourds, gourd (wax), melons (bitter, honeydew, citron, mango, musk, water, winter melons), pepino, pumpkin, squash (butternut, summer, zucchini squash) |
| Turf | Golf course turf, ornamental lawns and turf, residential lawns |

II. Initial Area of Concern

After determining uses from label information and obtaining the representative NLCD landcover classes, a potential use ‘footprint’ map is made. This includes all areas within the state of California where the pesticide could be applied, and is shown in Figure 1 for bensulide. The footprint of potential use represents the chemical’s initial area of concern and is based on available NLCD land cover data and derived map layers.

Figure 1. Potential use areas for Bensulide.



A. Land Cover

Land cover layers for the initial area of concern analysis were obtained from the National Land Cover Dataset (NLCD 2001) for the majority of land use types. The NLCD data was released as a nationally consistent, regionally indexed dataset in January 2007. California Gap Analysis Project (GAP) data from the Biogeography Lab from UCLA-Santa Barbara (1998) were obtained for the orchard and vineyard uses. These raster files were converted to vectors using simplification and majority filter routines and merged into NLCD. The turf layer was derived from 2001 NLCD developed areas with the impervious surface layer removed. The rights-of-way land cover layer was derived by combining road and rail information from TeleAtlas (2007) using the U.S. Department of Transportation's National Pipeline Mapping System (1999). Table 2 lists the NLCD 2001 as a surrogate for actual land use practices from which pesticide use is inferred and derived layers used for initial area of concern representation.

Table 2. Layer names and descriptions for 2001 NLCD and derived layers.

| Layer name | Base source | Description |
|---------------------------------------|-------------|---|
| Cultivated Crops (includes sod farms) | NLCD | Grid code 82: Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and orchards/vineyards, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled. |
| Developed, High Intensity | NLCD | Grid code 24: Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover. |
| Developed, Low Intensity | NLCD | Grid code 22: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units. |
| Developed, Medium Intensity | NLCD | Grid code 23: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units. |
| Developed, Open Space | NLCD | Grid code 21: Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes. |
| Forest | NLCD | Grid codes 41, 42, 43: Deciduous, evergreen and mixed. Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. |
| Open Water | NLCD | Grid code 11: All areas of open water, generally with less than 25% cover of vegetation or soil. |
| Orchards and vineyards | CA GAP | Grid codes 11210, 11211 and 11212. This is the only CA GAP reference. |
| Pasture/Hay | NLCD | Grid code 81: Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation. |
| Wetlands | NLCD | Grid codes 90, 95: Woody wetlands and emergent herbaceous. |
| Turf | NLCD | A derived NLCD class based on developed classes and the impervious surface layer with corrections applied. |
| Rights-of-way | US DOT; | A derived class using road, rail, and pipeline coverages. |

| Layer name | Base source | Description |
|------------|-------------|-------------|
| | TeleAtlas | |

Non-agricultural turf and rights-of-way uses are depicted by the combination of all four developed classes, 21 – 24. All the map layers depicted in Table 2 are used to create the footprint maps. Actual analysis for the downstream dilution (discussed below) uses a subset of these layers.

B. Initial Stream Reaches

In addition to the land cover classes described above, the initial area of concern includes stream segments found within those land cover areas. The stream segments are obtained from the NHDPlus dataset (2005) (<http://www.horizon-systems.com/NHDPlus/documentation.php>), which includes land cover information summarized by stream segment catchment based on the 1992 NLCD data set. As one moves downstream within a stream network, the size of the contributing landscape drainage area (watershed) increases. The contributing area of each NLCD land cover class (1992) is provided for each reach's catchment in the NHDPlus dataset. Using these data, a cumulative percent cropped area (PCA) is calculated for each stream reach, based on the area of all land cover types to which bensulide might be applied, divided by the total upstream contributing drainage area. The PCA is used along with RQs and LOCs to arrive at a downstream dilution distance as described in Section III B. Because of increasing spatial land cover averaging over larger areas, PCAs tend to decrease with increasing travel distance downstream resulting in an effect that may be considered as “dilution”. Pesticide exposures in streams within the initial area of concern are conservatively assumed to be represented by the estimated environmental concentrations used in RQ calculation.

III. Spatial Extent of the Effects Determination

Based on the results of the risk quotient calculations for bensulide, which is independent of spatial analysis, a Likely to Adversely Affect (LAA) determination was concluded for BCB, CCR, CFWS, CTS (all DPS), DS, SFGS, TG, and VELB, and modification to critical habitat determination was concluded for the BCB, CTS-CC, CTS-SB, DS, TG, and VELB. The spatial extent of the LAA effects determination is the area where there is overlap between the area of potential LAA effects with critical habitat, habitat, or occurrence sections (see Figure 2). This area of potential LAA effects includes the initial area of concern for application of bensulide on cultivated crops and turf (see Table 1) and the total area where there is potential for direct and/or indirect effects to occur using EFED standard assessment procedures via off-site transport mechanisms. The extent of potential off-site transport is determined by deriving an aquatic and terrestrial spray drift distance using AgDRIFT and an estimate of the downstream distance where LOCs are exceeded using the downstream dilution model. Figure 2 is a diagram depicting overlap of a potential area of LAA effects and species habitat, critical habitat, or occurrence sections which would result in an LAA effects determination or Habitat Modification Determination for critical habitat. Figure 3 is a diagram depicting lack of overlap of a potential area of LAA effects and species habitat, critical habitat, or occurrence sections

which would result in a No Effect determination or No Habitat Modification Determination for critical habitat.

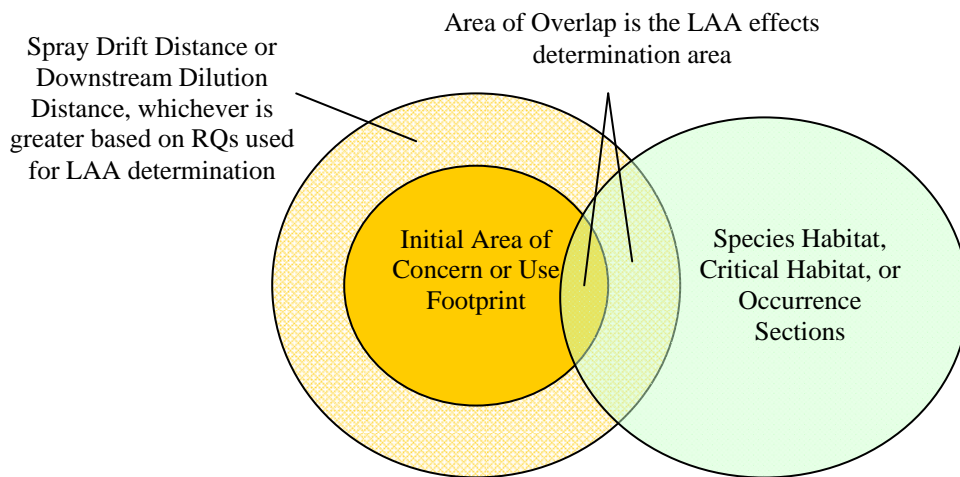


Figure 2. Conceptual diagram depicting an overlap of the area of potential LAA effect and the habitat, occurrence sections, or critical habitat of a species. If there is overlap, a LAA effects determination or habitat modification determination is made for the species.

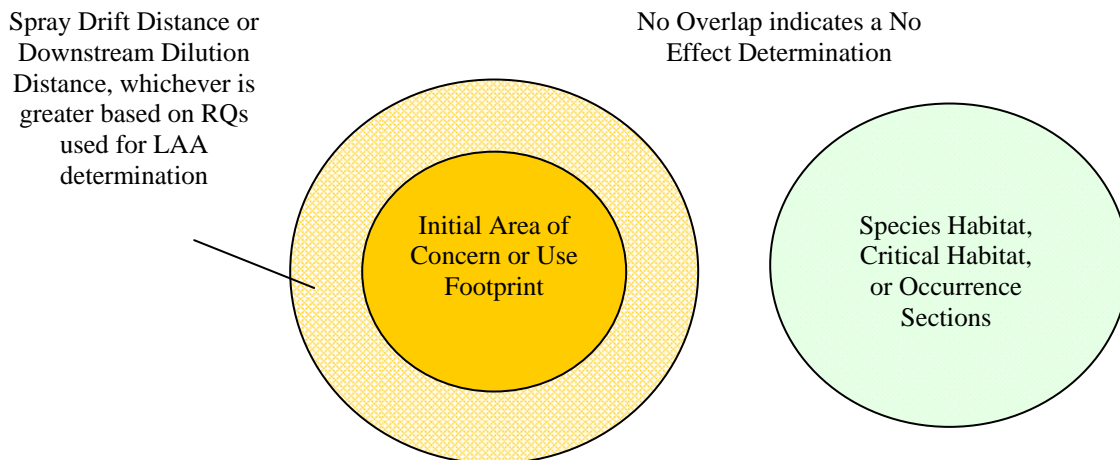


Figure 3. Conceptual diagram depicting no overlap of the area of potential LAA effect and the habitat, occurrence sections, or critical habitat of a species. If there is no overlap, a No Effect determination is made for the species.

The identified direct and indirect effects are anticipated to occur only for those currently occupied core areas, occurrence sections, and areas of designated critical habitat for the San Francisco Bay Species (SFB) that are located up to **440 feet** for ground spray applications from legal use sites where bensulide is applied to cultivated crops and turf. Downstream extent analysis shows that **379.8 km** is the furthest distance downstream from the initial area of

concern, or largest area of potential LAA effects, that could have LOC exceedances. The downstream dilution distance is representative of the maximum continuous downstream dilution from the edge of the initial area of concern where direct/indirect effects and/or critical habitat modification may occur. This distance reflects the largest distance whether from potential for direct or indirect effects. It is possible that areas of potential indirect effects could have a larger area than areas of direct effects. Lotic (*i.e.*, flowing) water bodies within the downstream extent distance that overlap with the SFB habitat potentially contain concentrations of bensulide sufficient to result in LAA determination and/or modification of critical habitat. Results of cumulative downstream dilution analysis are presented in Table 3, below.

Table 3. Summary of inputs and resulting downstream extent estimated based on the RQ:LOC for a specific taxon. These distances reflect the distance from the use area where there is potential for direct effects to the identified taxon.¹

| Taxon | RQ:LOC | Downstream extent (km) |
|--------------------------------|-----------|------------------------|
| Estuarine/marine invertebrates | 7.43:0.05 | 379.8 |

¹ The land cover types run with the downstream dilution model include: cultivated crops and turf.

The overlap of land cover corresponding to bensulide use patterns that result in an LAA determination and BCB, CCR, CFWS, CTS (all DPS), DS, SFGS, TG, and VELB distribution and/or designated critical habitat for is shown in Figures 4-15. The overlap map(s) provide/s a depiction of land cover that corresponds to bensulide use patterns, overlapped with the species' range and/or critical habitat. It does not show the spray drift distance or the downstream dilution distance *e.g.*, areas in addition to the initial area of concern where LAA direct or indirect effects may occur. Because some habitat delineations do not segregate the terrain from surface water, areas showing overlap may not be representative of actual overlap, but rather depict areas where spray drift may occur into aquatic areas. The actual area of overlap is greater when off-site transport via spray drift is included for each land cover type. The buffers may be different for each land cover type due to varying application rates and/or methods for different use patterns. The actual area of overlap would also be greater if the downstream dilution distance were shown on the map. Further analysis of the extent of drift and downstream dilution for each land cover type and the overlap with habitat can be included as part of the consultation process, if needed.

Figure 4. Bensulide Potential Area of Likely to Adversely Affect for BCB.

Bay Checkerspot Butterfly Overlap Areas to Likely Adversely Affect

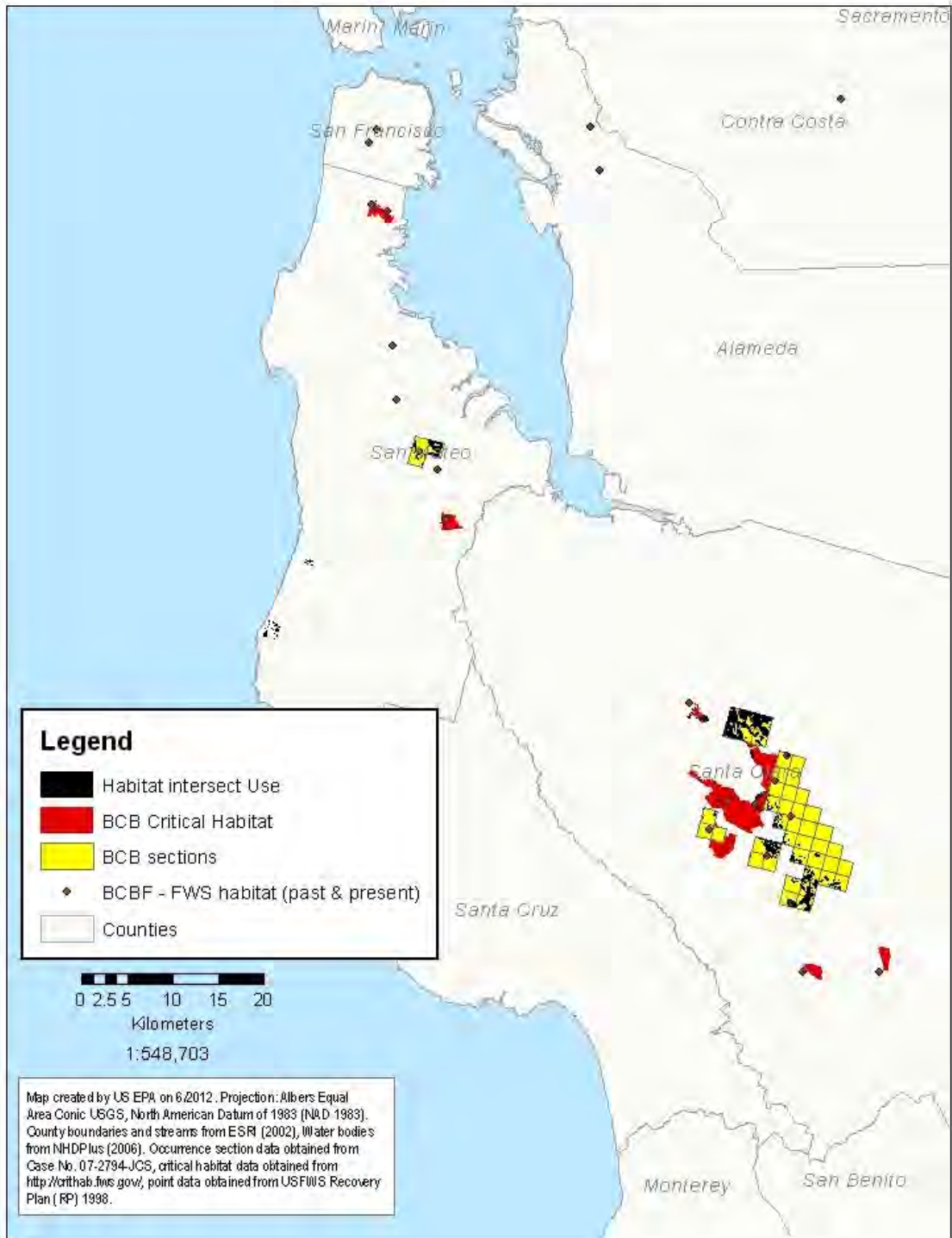


Figure 5. Bensulide Potential Area of Likely to Adversely Affect for CCR.

California Clapper Rail Area to Likely Adversely Affect

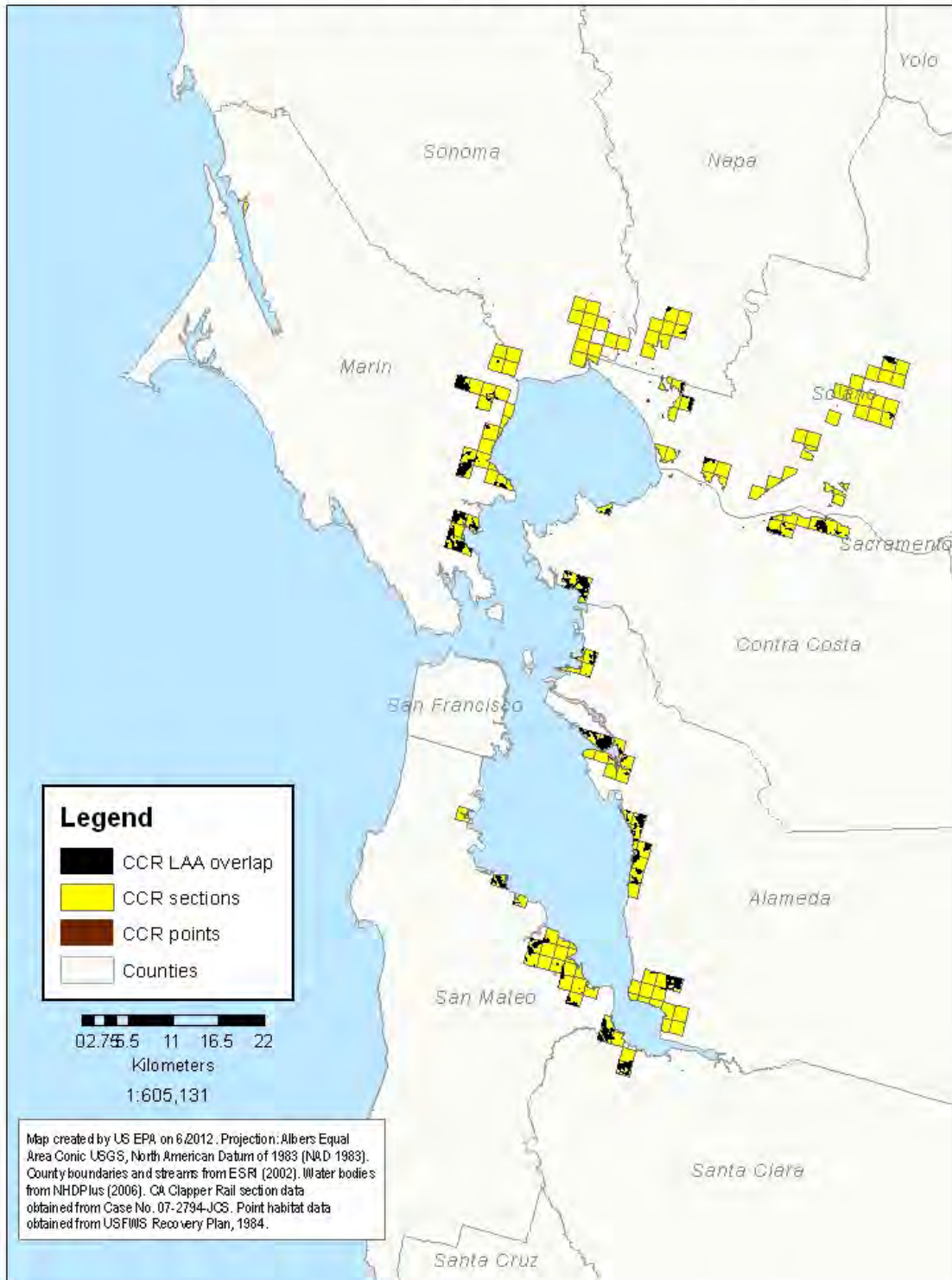


Figure 6. Bensulide Potential Area of Likely to Adversely Affect for CFWS.

California Freshwater Shrimp Area to Likely Adversely Affect

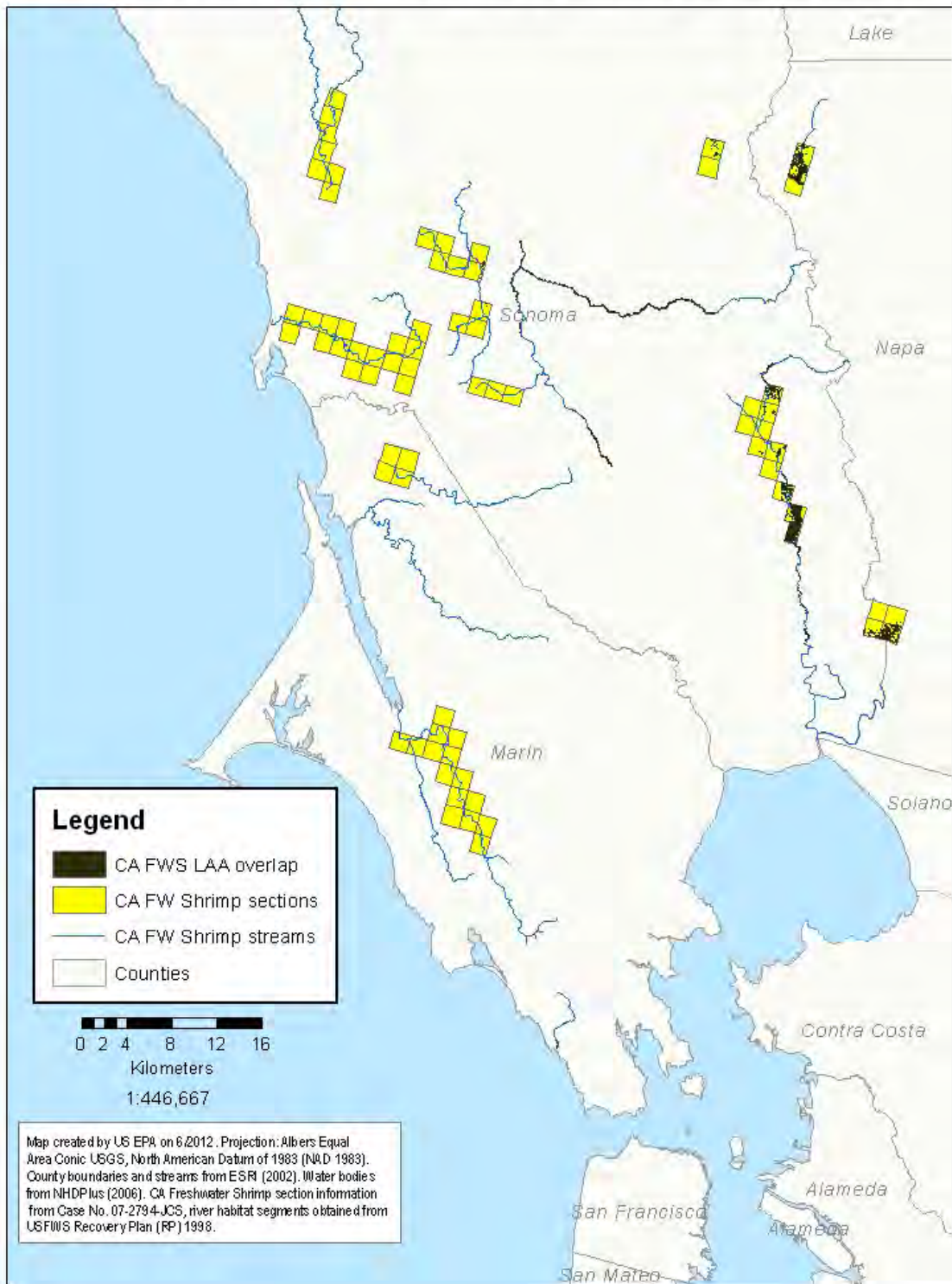


Figure 7. Bensulide Potential Area of Likely to Adversely Affect for CTS.

California Tiger Salamander Areas of Likely to Adversely Affect

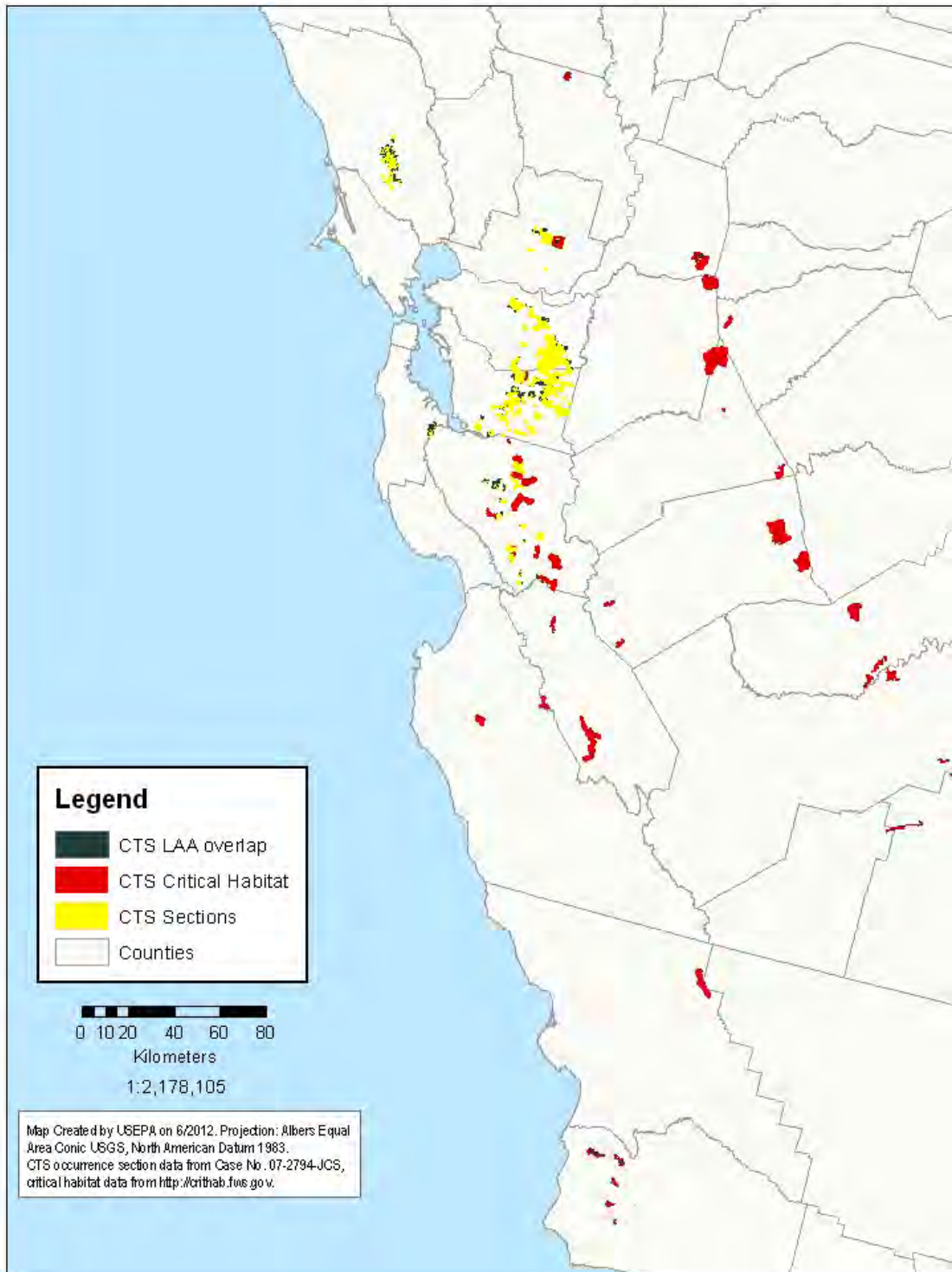


Figure 8. Bensulide Potential Area of Likely to Adversely Affect for DS.

Delta Smelt Area of Likely to Adversely Affect

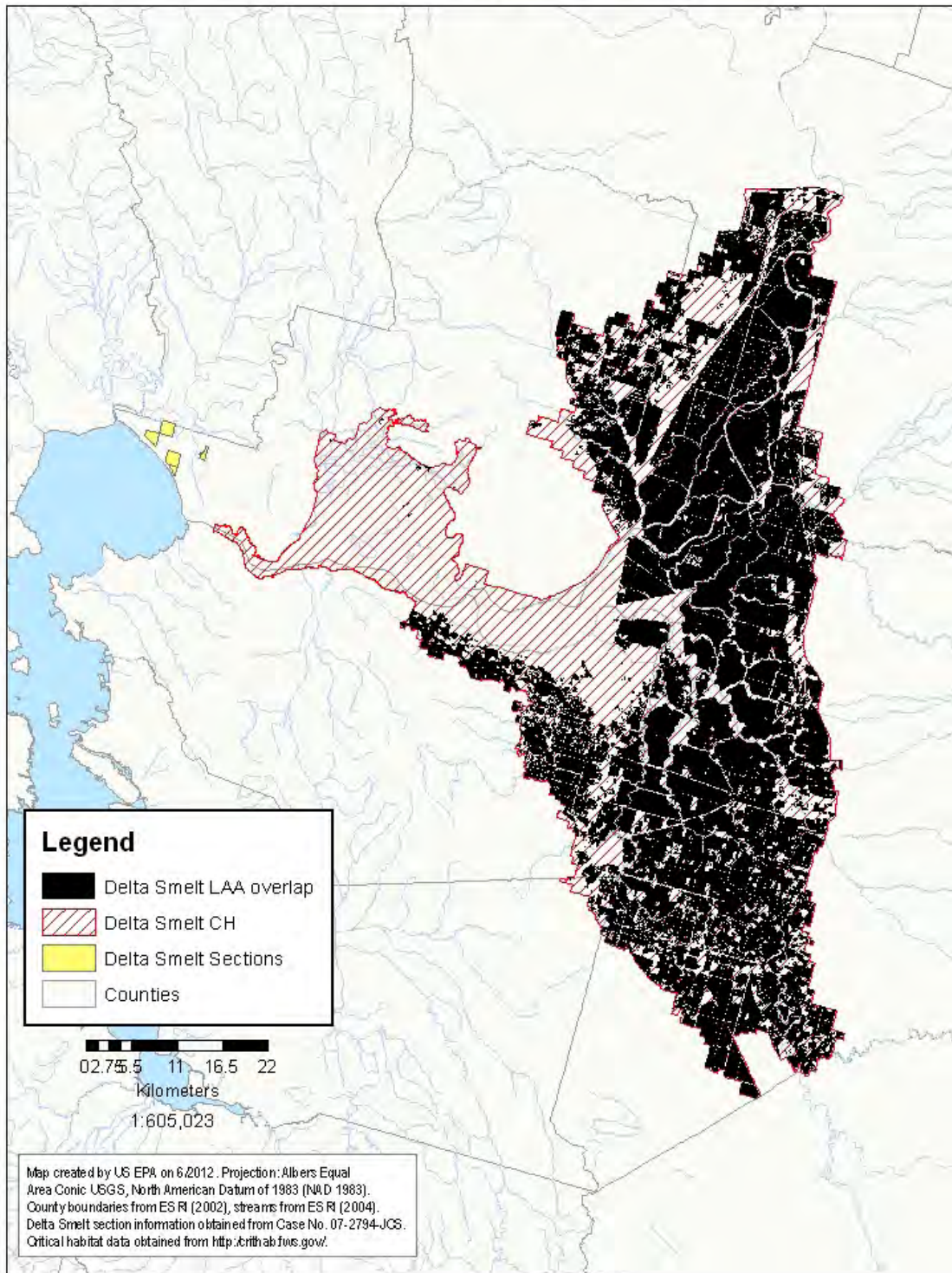


Figure 9. Bensulide Potential Area of Likely to Adversely Affect for SFGS.

San Francisco Garter Snake Area of Likely to Adversely Affect

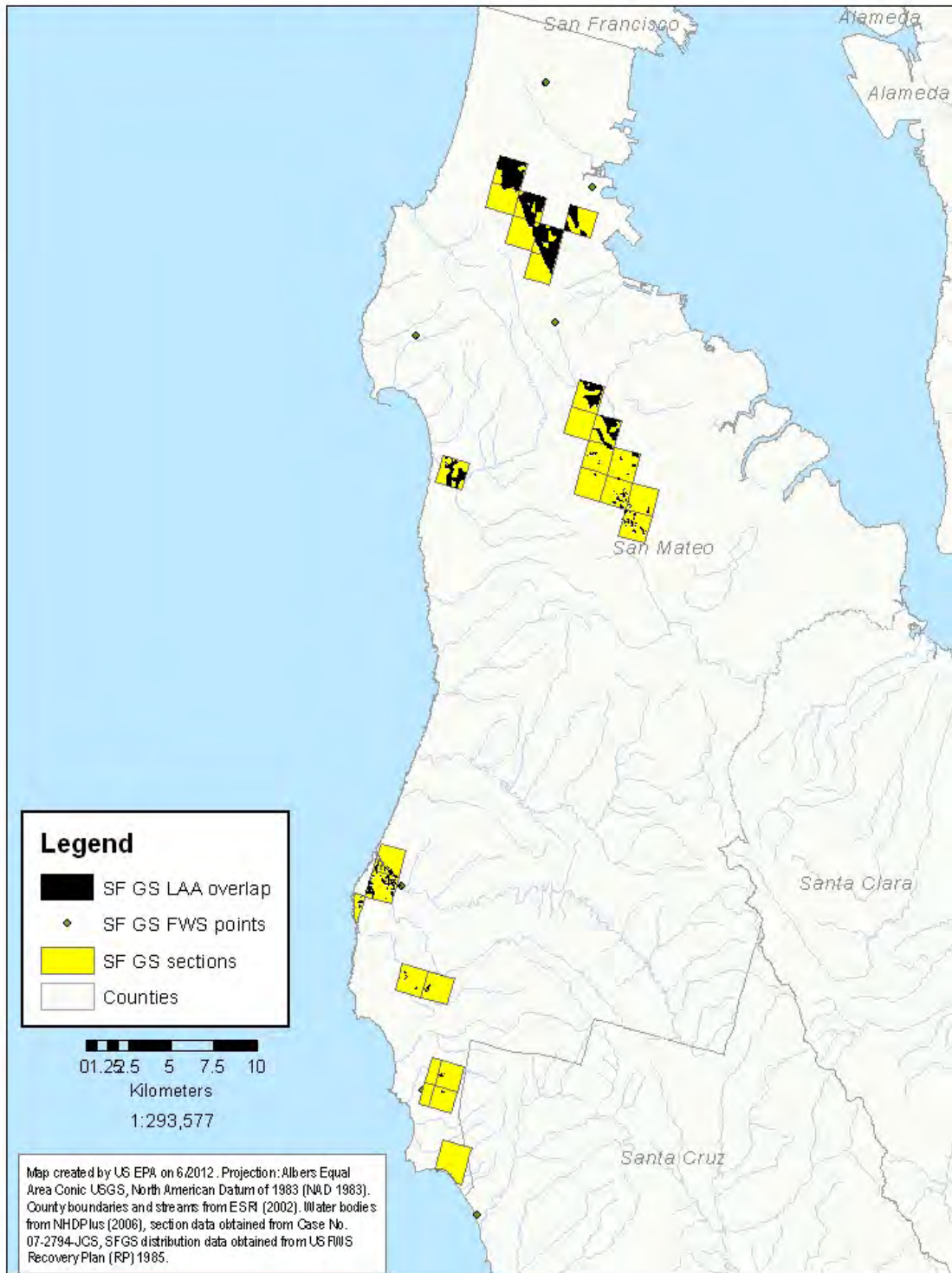


Figure 10. Bensulide Potential Area of Likely to Adversely Affect for TG Central Coast.

Tidewater Goby Central Coast Habitat Intersection with Cultivated and Turf Potential Use Sites

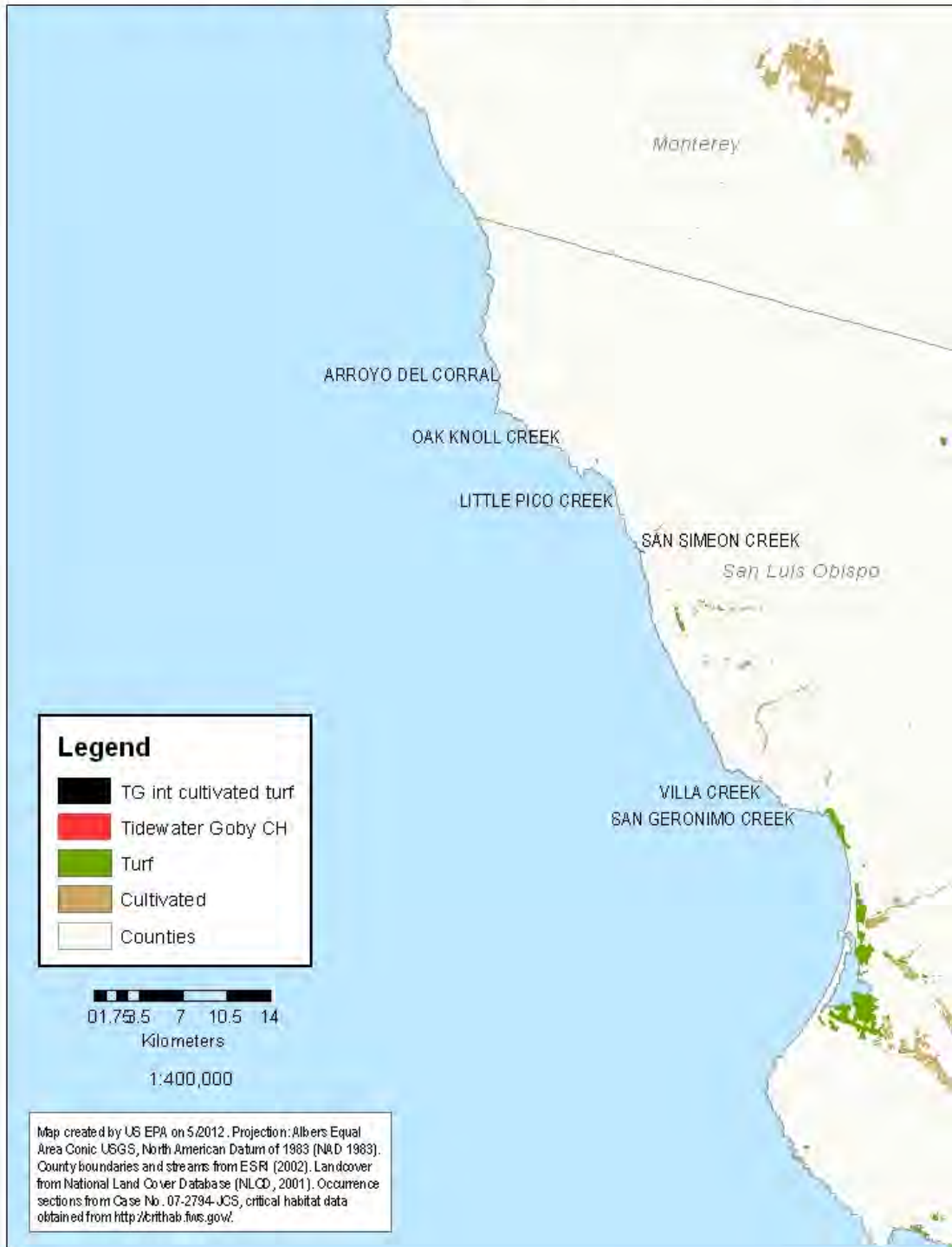


Figure 11. Bensulide Potential Area of Likely to Adversely Affect for TG Conception.

Tidewater Goby Conception Habitat Intersection with Cultivated and Turf Potential Use Sites

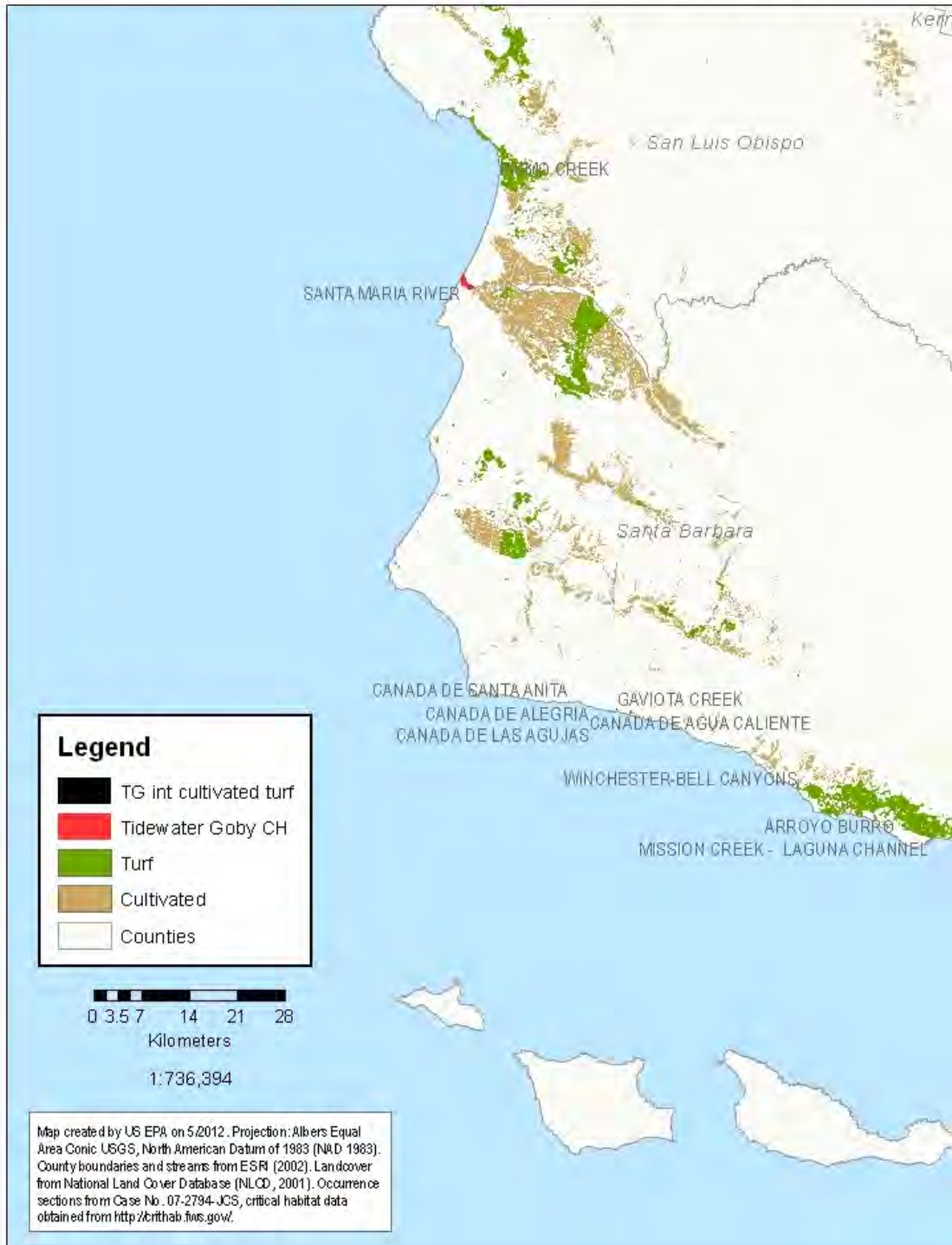


Figure 12. Bensulide Potential Area of Likely to Adversely Affect for TG Greater Bay.

Tidewater Goby Greater Bay Area Habitat Intersection with Cultivated and Turf Potential Use Sites

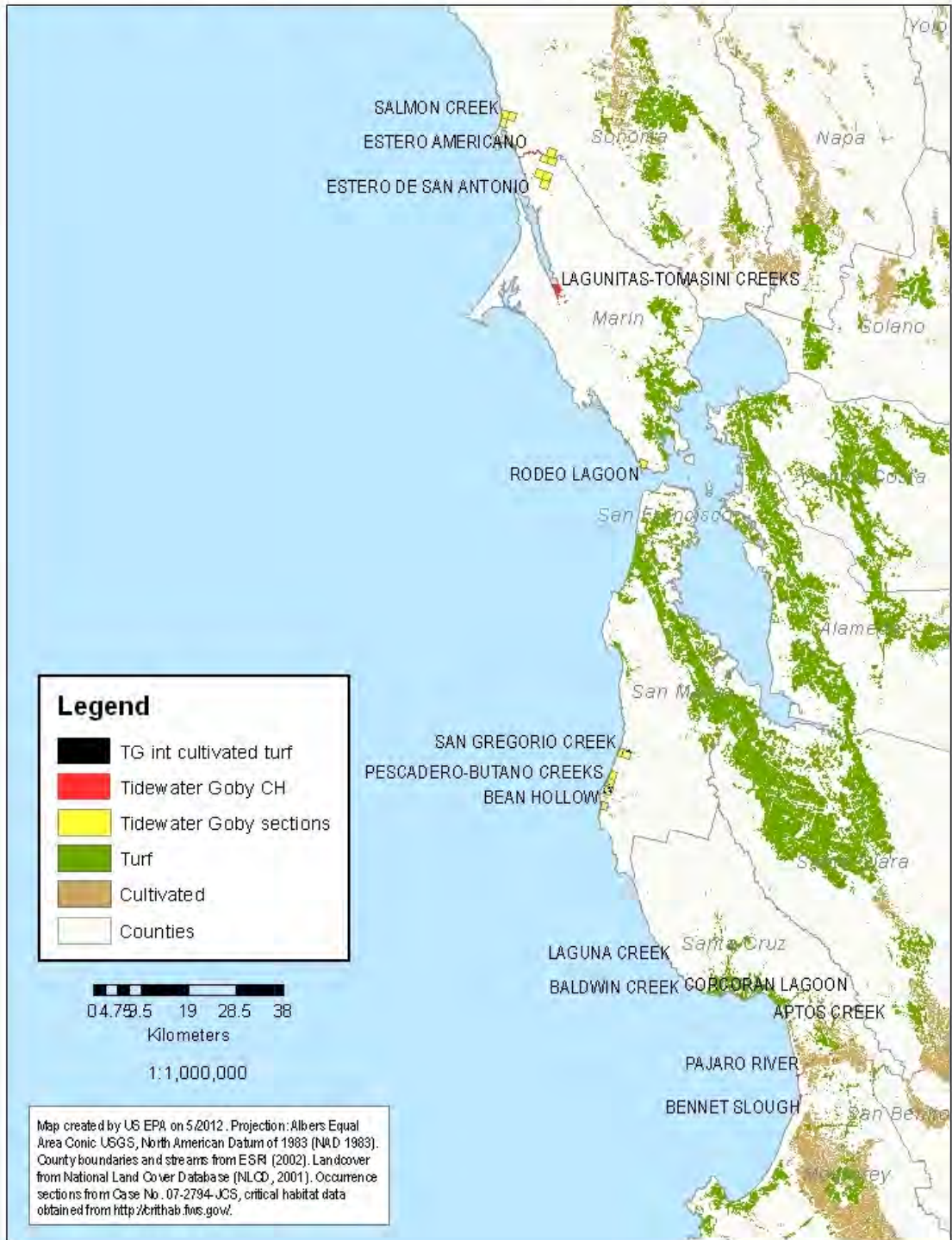


Figure 13. Bensulide Potential Area of Likely to Adversely Affect for TG LA Ventura.

Tidewater Goby LA/Ventura Habitat Intersection with Cultivated and Turf Potential Use Sites



Figure 14. Bensulide Potential Area of Likely to Adversely Affect for TG North Coast.

Tidewater Goby North Coast Habitat Intersection with Cultivated and Turf Potential Use Sites

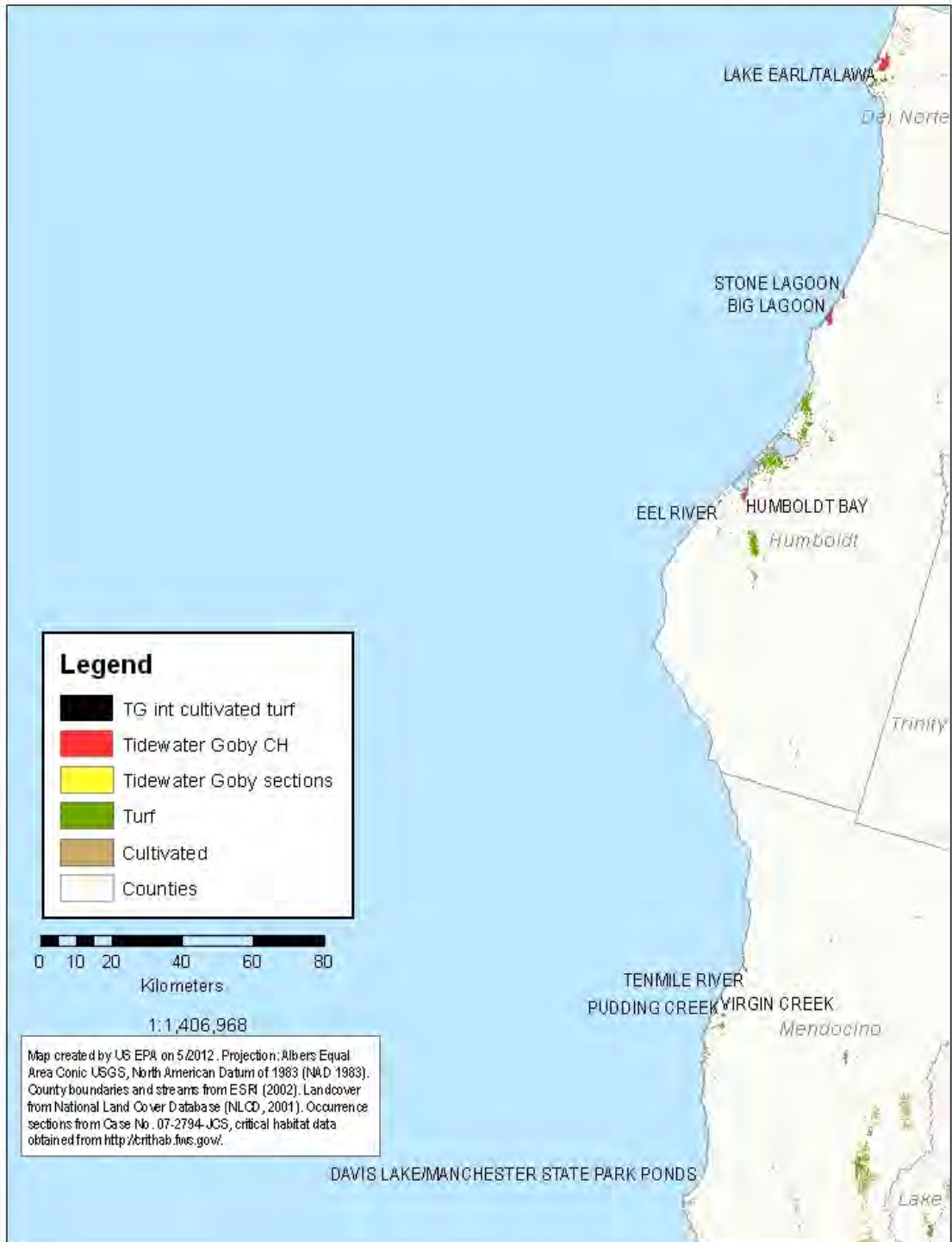
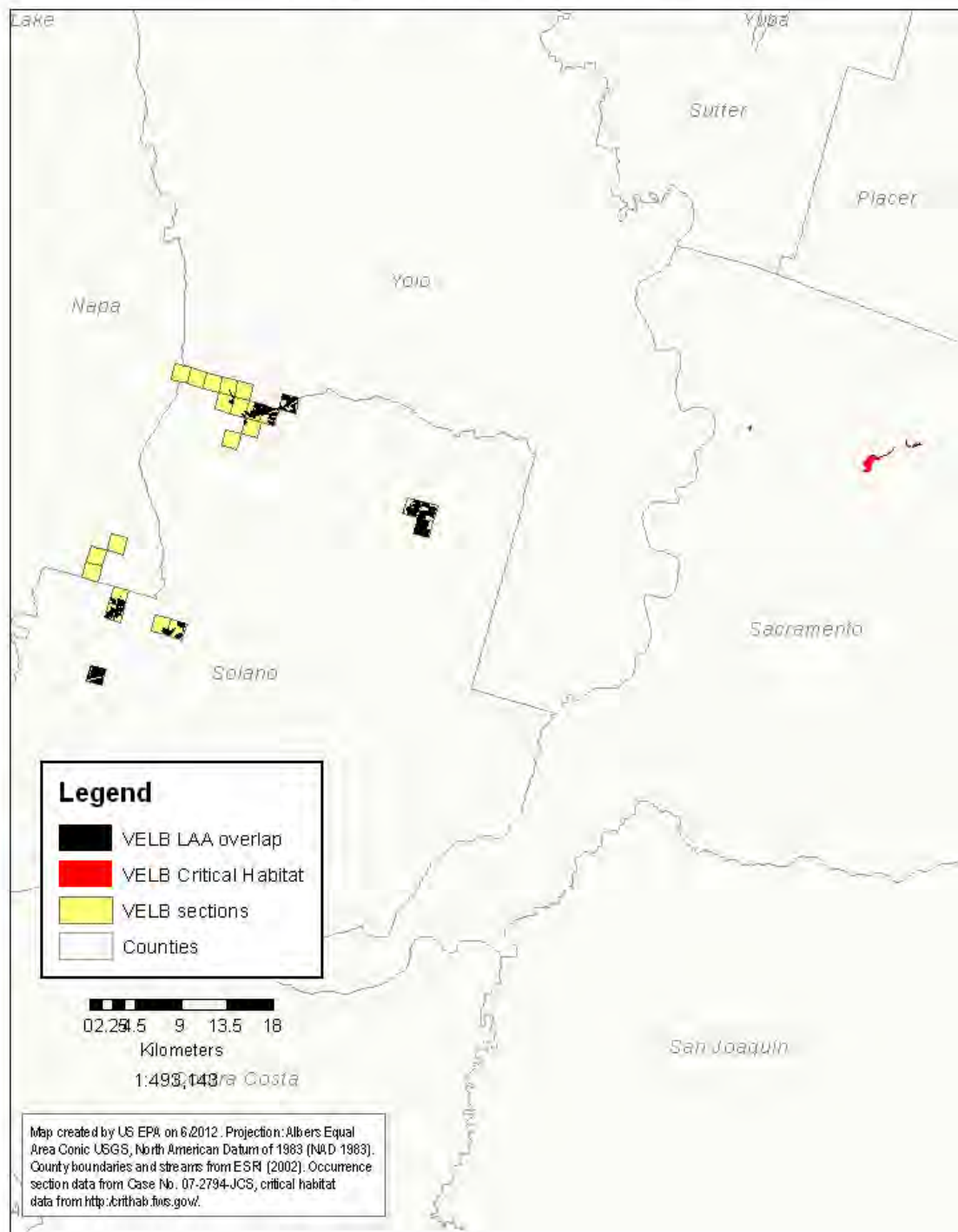


Figure 15. Bensulide Potential Area of Likely to Adversely Affect for VELB.

Valley Elderberry Longhorn Beetle Area of Likely to Adversely Affect



A. Spray Drift Area

AgDRIFT and/or AgDISP spray drift models are used to determine the distance from the initial area of concern where no direct or indirect effects are expected to occur. Water bodies representing potential habitat areas are not excluded from risk to receiving spray drift.

B. Downstream Dilution

The downstream dilution approach is used to determine the downstream extent of exposure in flowing streams and rivers where direct/indirect effects and/or habitat modification may occur. The downstream component, combined with the initial area of concern, define the downstream dilution area. The downstream extent includes the area where predicted levels of exposure could potentially exceed the highest RQ (risk quotient) to LOC ratio. The approach calculates two values, the dilution factor (DF) and the threshold Percent Cropped Area (PCA). The dilution factor (DF) is the maximum RQ/LOC, and the threshold PCA is the inverse value represented as a percent.

As previously noted, the dilution approach uses the NHDPlus dataset for the downstream analysis. After the stream segments in the initial area of concern are identified, the dilution model traverses downstream from each stream segment. At each downstream node, the threshold PCA is compared to the aggregate cumulative PCA. If the cumulative PCA for that segment exceeds the threshold, the stream segment is included in the downstream extent. This continues downstream until the cumulative PCA no longer exceeds the threshold.

The extent of downstream dilution is derived by identifying the stream segment that represents the maximum continuous length of stream miles downstream from the outer boundary of the initial area of concern.

In order to determine the downstream extent of the entire “LAA” area, a conservative assumption is made that all streams exiting the boundary of the initial area of concern are the same length as the identified longest stream reach and extend the maximum distance. For example, if the analysis indicates that 100 streams exiting the initial area of concern have concentrations above the LOC and the average length of these streams is 200 feet but the maximum length for any one stream is 1,000 feet; the analysis will conservatively assume that all streams exiting the initial area of concern have concentrations above the LOC for 1,000 feet downstream. It is likely, however, that this conservative assumption will result in an overestimation of stream reaches that are identified as “LAA”. Although the maximum continuous downstream distance is reported, the overlap of potentially impacted stream reaches with species habitat is not depicted. However, shapefiles of the downstream analysis are available for further consideration as part of the consultation process, if needed.

IV. A Note on Limitations and Constraints of Tabular and Geospatial Sources

The geographic data sets used in this analysis are limited with respect to their accuracy and timeliness. The National Land Cover Data Set (Homer et. al, 2007) represents a comprehensive collection of national land use and land cover information for the United States obtained

between 1994-1998. Three additional data sets were used as land cover types to depict use categories not available in the NLCD dataset. These supplemental data include orchard and vineyard land cover data from the California Gap Analysis Project data (Davis, 1998), rights-of-way data derived from road and pipeline data from Teleatlas (2007), and the turf layer derived from NLCD 2001 developed class with corrections applied.

The hydrographic data are from the NHDPlus data set and the generalized streams and rivers layer is from Environmental Systems Research Institute (ESRI). The NHDPlus data set contains the most current and accurate nationwide representation of hydrologic data also depicted in maps. At a spatial scale of 1:100,000, the NHDPlus data set might omit the smallest streams and water bodies. In addition, in some isolated instances, there are errors in the data including missing or disconnected stream segments and incorrect assignment of flow direction.

OPP will continue to identify and incorporate (as appropriate) additional land cover data sets for other land classes not captured in this assessment. In addition, as new updates to existing data occur, these will be evaluated and incorporated as appropriate.

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