A Reference Manual for Caltrans Staff on Regional Advance Mitigation Impact Assessment Methods

Prepared for California Department of Transportation

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INTRODUCTION

What is Regional Advance Mitigation Planning?

This manual reviews the motivations and methods for transportation project impact assessment under the Regional Advance Mitigation Planning (RAMP) framework. RAMP is a process that creates an inventory of expected environmental impacts from multiple transportation (or other development) projects within a region (Thorne et al. 2009; Thorne et al. 2014). When conducted early in the lifecycle of the projects, such as after projects are identified on long-range transportation plans but prior to being programmed, proposed mitigation can be developed earlier, resulting in efficiencies for both project delivery and budget, and effectiveness of the mitigation developed. The RAMP approach can help avoid the cost of delays and over-runs due to late and fragmented project-by-project environmental planning and mitigation, which in California has been estimated by Caltrans internal reports at $59 million per year (Byrne 2005).

Benefits for project delivery can be achieved through this process, in terms of the speed of environmental review, the potential for proposed mitigation to be accepted more quickly, the potential lower cost of compensatory mitigation, and because the mitigation can be more ecologically effective, both by bundling mitigation to then purchase larger parcels, and through avoidance of temporal loss, which is the continued impacts that occur as a project is going through construction if mitigation is not in place prior to construction starting. The potential for these benefits has been recognized at all levels of transportation agencies including FHWA, who are co-sponsors of a similar approach called ‘Eco-Logical’ (Brown 2006). Further, mitigation performed in advance of development projects can more easily follow systematic conservation planning practices (Margules and Pressey 2000).

The RAMP approach requires early engagement by Caltrans to develop projections of the environmental impacts associated with the planned transportation projects. This includes providing staff time to conduct the impact scoping, and develop an inventory of expected impacts from the projects included. Staff time is also needed to engage the regulatory agencies that will be involved for particular projects on an earlier timeframe than is typical under business as usual. The savings that can accrue from this approach are tied to reducing the delays for environmental review of Caltrans construction projects and potentially speeding the acceptance by regulatory agencies of the proposed mitigation for project environmental permits, because the regulatory agencies are provided with a greater extent of contextual information than might be provided through the business-as-usual format. In addition, it may be possible to save on costs for acquisition of compensatory mitigation lands sooner, and to reduce the chance of lawsuits from regulatory agencies.

The early engagement of staff to this new, and potentially beneficial approach requires having a management structure recognizes the potential benefits and supports the staff to develop a

RAMP. Engineers, planners, biologists, and Geographic Information Systems (GIS) staff are needed to assemble a Caltrans RAMP. This process can start when management shows support for a collaboration of biologists with planners, as they are able to identify a suite of Caltrans projects that can be included in an assessment. Once the collected projects are identified, the engineers responsible for the projects need to be briefed, to permit a small percentage of the relevant budgets to be billed against. At this point Caltrans biologists and GIS staff need to be engaged. They can follow the steps outlined in this document to develop a list of the projected impacts for each project, and from that compile an inventory of the types and extents of impacts expected from all the included projects. The overall goal is to develop and present the list of possible impacts to the relevant regulatory agencies with enough detail that these will be accepted, and that Caltrans can develop the associated proposed mitigation scaled to impacts, which will allow for faster issuing of permits from the US Army Corps of Engineers, Water Boards, US Fish and Wildlife Service, the California Department of Fish and Wildlife, and other regulatory agencies as needed. This early engagement, made possible by management support of a closer coordination between Caltrans planners and biologists, has the potential to provide significant overall savings for project delivery.

Caltrans has invested in the development of systematic GIS-based decision-support methods to identify important species and habitats. This includes participating in the drafting of a statewide framework as well as a pilot project investigating the methods for implementation of a RAMP.

This document outlines the major steps needed to engage in this process.

ENVIRONMENTAL MITIGATION TIMELINE

Environmental law defines mitigation as, and following the sequence of, first avoiding environmental impacts, then taking measures to minimize the impacts that cannot be avoided, and finally compensating for those unavoidable impacts. Currently, the compensatory mitigation is assessed during development of individual transportation projects, and is contingent upon the selection of the preferred alternative. The project-based system requires that a project be programmed and associated with specific funds prior to intensive environmental studies. The compensatory mitigation only addresses the needs of the individual project, and often does not contribute to regional environmental priorities.

The RAMP approach is meant to streamline the environmental aspects of transportation projects through the use of well-understood inventory techniques. It is based on the use of GIS analysis of several data layers. This approach can be used to identify where listed species, habitats, and waters may be impacted directly by Caltrans activities. The approach recognizes that each future project may have impacts, provides a method to estimate those impacts, and then provides a way to summarize the impacts for a suit of projects, which can be done well before the projects are programmed. This manual focuses on the impact assessment side of RAMP. However, the full scope of the RAMP process can also include a method to scope for potentially suitable compensatory mitigation in the implementation phase of the RAMP process. It can also be used to avoid later costly amendments to project budgets, such as by screening for wildlife crossing/motorist safety needs and various types of fish passage issues. The identification of a needed under- or over-pass, or fish passage structures, early in project planning can allow for inclusion of such expenses once the project is programmed.

This is fundamentally a practice that can occur in the planning phase of projects, and can be incorporated into the long range transportation planning process. It is meant to consolidate the processing of multiple projects in terms of assessing and addressing their environmental impacts. Early scoping in some cases may even help inform the selection of the least environmentally damaging preferred alternative of project design that would maximize avoidance of sensitive resources.

Caveats

The methods presented below have been developed with input from the resource agencies, but have not been formally endorsed by them. These methods have not been formally tested for accuracy, and resource agency approval is contingent upon such testing occurring. As such, these methods are subject to revision.

Additionally, these tools are meant strictly to produce an estimate of potential compensatory mitigation need based on anticipated projects presented in long-range transportation plans. The methods are not a substitute for, nor do they pre-empt the requirement for conducting detailed project-level environmental scoping to inform the programming of individual projects, nor do they preclude the requirements under CEQA and NEPA to conduct environmental review of the

project to select the least environmentally damaging project alternative. No endorsement of a project alternative is implied by the use of RAMP methods.

METHODS

Impact Assessment Overview

The early acquisition of compensatory mitigation for projects on long range transportation plans prior to their programming requires the estimation of their unavoidable impacts before these projects have been formally scoped for environmental impacts. This requires the development of two major sets of data: a spatial inventory of the future transportation projects to be included in the analysis, and a compilation of spatial data representing the biological and other resources that require mitigation. These two sets of data are then intersected in a third part of the work to produce the estimates of impacts from each project.

To do this, biologists and planners need to obtain or develop geospatial datasets representing the resources likely to be impacted. While many of these (e.g. land cover datasets) are likely to exist for the RAMP planning region, some, such as species-specific habitat, will need to be modeled using straightforward techniques. Other important models that will need to be created are estimated footprints of future transportation projects that can be overlaid on the resource datasets in order to allow the calculation of likely impacts.

The following steps are typically used to estimate the impacts from a future project where habitat models need to be created. We list them out, and then provide annotation as to what steps are needed to develop each one:

1. Inventory of Infrastructure and Development of Project Footprints

1. Identify an area or region that will be used for the assessment. This could be at the district, county or watershed level, or some combination thereof. The region selected should include a spatial grouping of transportation projects that will collectively require enough compensatory mitigation to justify selecting a RAMP approach.
2. Identify the set of transportation projects that are to be considered within this region.
3. Review the set of transportation projects using a GIS, and develop a set of "footprints" which are the area that will potentially be impacted as each project is developed (See following section Project Footprint for detailed steps).

2. Inventory of Biological and other Natural Resources for Impact Assessment at Regional Scales

1. The biological and natural resource data needed are somewhat dependent on location and scale. However, an effort should be made to compile all the available data, in order to make the subsequent impact assessment as robust and comprehensive as possible.
2. Check for the most recently updated spatial data for waters including wetlands, listed species and their habitats, and land cover.
3. If listed species are in the planning region, acquire or develop habitat-based models to portray their areas of likely presence.
4. If waterways, vernal pools, and/or wetlands are present, acquire or develop projections of their spatial extents.

3. Conduct Impact Assessment

1. Overlay the lines representing transportation projects on lines representing streams and other wetland features, to identify the number of crossings.
2. Assess the area-based impacts to streams and other wetlands through a second spatial analysis that overlays the modeled project footprint and polygons depicting resource features.
3. Assess the area-based impacts to habitats of special concern.
4. Assess the area-based impacts to habitats for listed species.
5. Assess general impacts to landcover.

Impact Assessment Details

1. Inventory of Infrastructure and Development of Project Footprints

To assess the potential impacts from transportation projects, it is necessary first and foremost to develop a model of the likely spatial footprint of a given project. GIS shapefiles of the potential projects will need to be created. Centerline datasets can sometimes be obtained; otherwise this will need to be created using mile markers used to describe the project. These points can be used in a GIS to create a road centerline file.

The following steps describe a process for selecting a study region and creating a polygon shapefile depicting the road project footprint for all the projects included in the exercise:

1. Identify the set of transportation projects that are to be considered within this region. Transportation projects should be drawn from long range transportation plans (10-Year SHOPP, 20-Year RTP).
2. Identify the area or region that will be used. This could be at the city, county or watershed level, or some combination thereof. It could also be done for a Caltrans District, or for larger extents. This step is often done in conjunction with the next step, as sometimes there are not enough projects within a selected area, or the projects that you want to include can help define the area.
3. Next, a polygon shapefile representing the extant roadway prism will be created by generating a buffer around roadway centerline polyline shapefile. Obtain a centerline GIS file or create one using county-route-postmile data. These are generally available as Caltrans GIS data provided in the transportation plans.
4. Use aerial or satellite imagery (such as NAIP or ArcGIS World Imagery) to measure the typical distance from the centerline to the edge of the paved road area in a GIS.
5. Buffer the centerline by this distance to create a polygon shapefile that portrays the current spatial extent of the existing road area. When created the polygon should cover the image of the road. Do this for each transportation project in the analysis.
6. The potential impact area of the project can be created by generating a second buffer around the roadway buffer created using the methods above. Use a second buffer distance

(such as depicted in Table 1) to represent the likely extent of new disturbance associated with the road project, here called the 'project footprint'. The estimated project footprint for each project may be modified from the general foot-values in Table 1, if additional factors related to the project or location are known. For example, Caltrans' Highway Design Manual may prove useful in providing measures for the width of new lanes, how wide shoulders should be and other measurements. Different types of projects have different zones of impact.

Note that for some projects, new work is only being done on one side of a road, and so the second round of buffers, when applied in GIS, should reflect if both sides, or only one side of a road are being worked on.

7. Buffer the existing project polygon created in step 5 by the new distance. The area between these two extents will represent the total area of new disturbance.
8. Extract the first buffered area that approximates the footprint of the existing road only, so that only the additional buffered area outside of the road is remaining. This ensures that biological impacts are not overestimated by calculating overlapping areas where there is already existing road.

Figure 1. Buffer example. The black dotted lines represent the road centerlines, the blue lines represent the edges of existing roads and the red lines are the estimated buffered impacts.

Table 1. Estimated footprints for transportation project types, from California Transportation Investment Systems (CTIS) and input from Caltrans. Additional information may be available in the Caltrans Highway Design Manual (http://www.dot.ca.gov/hq/oppd/hdm/hdmtoc.htm).

Project Type	Estimated footprint width on each side of existing or proposed roadway (feet)
Construct New Interchange	220
Interchange Improvement/Reconstruction	220
New Bridge	100
Seismic Retrofit	100
Realignment	40
Widen Road (per Lane)	20
Bridge Rail Replacement/Upgrade	20
Drainage System Restoration (culverts)	20
Construct left/right turn lane	15
Widen Shoulder	15
Pedestrian Facilities	10
Roadside rest areas	10
Install new signs/traffic operation systems	5
Install ramp metering	5
Roadway Rehabilitation	0
Install median barrier	0

2. Inventory of Biological and other Natural Resources for Impact Assessment

There are several types of biological and ecological data which need to be assembled for screening of potential impacts through the RAMP process. These include legal obligations (see Appendix A for list of laws, relevant regulatory agencies, and the resources they are responsible to protect) to compensate for potential unavoidable impacts to species; sensitive habitats, waterways and wetlands per the applicable state and federal laws. In addition, the regional fragmentation of habitat by multiple transportation projects can be addressed through the RAMP process through concepts such as landscape connectivity, which permits the passage of animals from one location to another, although they are not always associated with listed species. The following steps describe how to compile the information needed to complete the transportation impact assessment, through the assembly of the biological and other natural resource data.

1. Land cover. The best available land cover datasets at the appropriate scale should be assembled for the effort. These vary between regions of the state. The California Department of Fish and Wildlife (CDFW) should be consulted to determine the highest quality land cover data available in the planning region. Caltrans planners should either use land cover datasets that have been adopted previously for use in the region by the regulatory agencies, or use aerial imagery to compare multiple datasets in a GIS to determine which is the most accurate. Some land cover datasets to consider are:

    i. VegCAMP. These spatially and taxonomically fine scale datasets have been developed by CDFW for multiple regions across California. However, they have not been developed for large portions of the state. They are available for download at the CDFW website. ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/
    ii. HCP/NCCP. Habitat conservation plans generally require the development of high quality land cover datasets. If such a plan has been developed or the planning is underway within the region, these datasets could serve as adequate land cover data. The data may be available online or may require a direct request to the HCP/NCCP developers. Often times county planners will know the status of these efforts.
    iii. CALVEG. These datasets generally have a coarser taxonomic classification, than the previously mentioned datasets. They are primarily available for areas where the U.S. Forest Service manages land, so they are not fully available across California. They are available for download at the U.S. Forest Service Region 5 website and selecting from the EVEG Map Tile Units, Ecological Subregions and CALVEG Zones Index. http://www.fs.usda.gov/detail/r5/landmanagement/gis/?cid=STELPRDB5327836
    iv. FRAP. The FVEG dataset developed for the Cal Fire Fire and Resource Assessment program (FRAP) is a statewide grid dataset. While it is somewhat coarser than the others listed here, it does have the advantage of being seamless and available in every region in California. Note that an updated version of the FRAP map will be available in 2015. It is available for download at the FRAP website. http://frap.cdf.ca.gov/data/frapgisdata-sw-fveg_download.php
    v. Others. There are numerous land cover mapping efforts being undertaken around California at any given time. Inquiries with resource agencies or other organizations involved with land use planning in the planning region could lead to the best available land cover data in the planning region. Some examples are:

a) the Conservation Lands Network (CLN) (cln_veg; http://www.bayarealands.org/),
b) National Wetlands Inventory (NWI) (http://www.fws.gov/wetlands/),
c) San Francisco Estuary Institute's Bay Area Aquatic Resources Inventory (BAARI_wetlands_01; http://www.sfei.org/ecoatlas/gis),
d) Great Valley Vernal Pool Distribution (Holland 2005), (http://www.dfg.ca.gov/biogeodata/wetlands/)
e) National Hydrography Dataset (NHD) (http://nhd.usgs.gov/),
f) Important farmland as identified from the Greenbelt Alliance (ImportantSoil_2010; http://www.greenbelt.org/).
g) The Sonoma County Vegetation Mapping Program (http://sonomavegmap.org/).

2. Listed species and their associated habitats. Potential impacts to species requiring mitigation can be assessed by overlaying project footprint polygons and species-specific habitat models. Existing habitat models for some species will likely be available in some planning regions. The CDFW, USFWS, and NOAA-Fisheries should be consulted in regards to these existing models and their acquisition. For species without existing models, which will be more typical, new models will need to be generated. If there is time and funding available, sophisticated models could be generated. In the absence of these, however, simple models can be generated by combining species occurrence data with land cover. The amount of habitat likely to require compensatory mitigation from road impacts can then be calculated using the following methodology, assuming that no local, more accurate data are available:

    i. Select California Natural Diversity Data Base species occurrence points that occur within and up to five miles beyond the study region (CNDDB; available from CDFW https://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp). These data represent the known and available inventory of threatened and endangered species and also specifies some habitats. These data are updated on a regular basis. It is important to use the most recent version available for each assessment. A CNDDB subscription is available on the CDFW website, and subscribers are sent an email each month with a link and password to the newest CNDDB version.
    ii. From the CNDDB points, select those that are listed as "Presumed Extant" and from 1980-present, unless there is reason to believe that earlier records contain important and relevant species locality data.

iii. Select federal and/or state-listed species and other species requiring mitigation from this dataset.
iv. Buffer each point in the subset of CNDDB points by two and four miles. These buffer distances, while relatively arbitrary, will provide for a range of potential habitat use by species.
v. Overlay these CNDDB buffers on the land cover dataset selected for use in the planning region and extract the land cover data that fall within these buffered distances.
vi. Identify the appropriate habitat types for each mitigation species using the California Wildlife Habitat Relationships (CWHR; http://www.dfg.ca.gov/biogeodata/cwhr/) database for terrestrial, vertebrate species (for other species, appropriate habitat associations may be found in sources such as Calflora). Habitat identification should ideally be completed in consultation with CDFW. It should also include identifying designated Critical Habitat within the planning area (if any) and consulting species recovery plans (if available).
    a) Select vegetation types with a "High" suitability rating for any size and stage class in the California Wildlife Habitat Relationships model (CWHR) (California Department of Fish and Wildlife; http://www.dfg.ca.gov/biogeodata/cwhr/wildlife_habitats.asp) for terrestrial vertebrate species.
    b) Calflora lists land cover types suitable as habitat for plant species (http://www.calflora.org/).
    c) Various online sources for invertebrate species can be used to define appropriate habitat types for these species.
    d) For plants, invertebrates, and unique types identified from the literature, the habitat requirements are cross-walked to CWHR types, so that their potential locations on the landscape can be identified using the reference maps.
    e) Species-specific habitat types are then selected from the buffer/land cover overlay for each species.
    f) Distribution data from the National Marine Fisheries Service (NMFS) should be used for salmonids. Overlaying these datasets with the road project footprints will provide a list of locations where impacts may occur (http://www.nmfs.noaa.gov/gis/data/critical.htm#west).

3. Wetlands impacts can be estimated by overlaying the road project footprints with land cover datasets. A typical dataset to use is NWI ((http://www.fws.gov/wetlands/); however other fine-scale land cover data may be used as well and are potentially more accurate.

Comparisons should be made using aerial imagery to determine the best fit within a given planning area. Note that wetlands require mitigation themselves, and also may serve as habitat for listed species.

4. Surface waters in and of themselves require mitigation, therefore the area of impact is necessary, in addition to knowing if a stream has anadromous fish or other listed species in it. The area of surface waters can be estimated by buffering stream centerlines. The NHD (http://nhd.usgs.gov/) or other datasets depicting waterways can be used. Waterway width can be estimated by buffering stream centerlines based on stream order (i.e. the higher the stream order, generally the wider the waterway). NHD datasets generally do not contain stream order information; however tables, such as those found in NHDPlus datasets (available for download online), can be joined to the NHD spatial data to derive this information. Once stream orders have been identified, aerial imagery can be used to estimate the typical width of waterways at each stream order. These widths can be used as buffers to the stream centerlines to estimate the surface area of waterways. An example of derived stream widths from a pilot project in the Sacramento Valley is found in Table 2. These buffers should be determined by planners in a given planning region.

Table 2. Example of estimated waterway widths based on stream order. This table was developed for a planning region in the Sacramento Valley; new RAMP efforts in other regions should review these numbers to better estimate widths based on local waterway characteristics. Note these numbers are in meters, with feet in parentheses.

Stream Order	Typical Width m (feet)	Buffer m (feet)
1	32.8	16.4
2	65.6	32.8
3	98.4	49.2
4	131.2	65.6
5	328	164
6	492.1	246
7	656.1	328

The use of 2- and 4-mile buffers around each species location (identified from a CNDDB point), and intersected with buffered transportation project extents permits identification of a certain extent of each transportation project's footprint as possible impacted area habitats. When the length of a transportation project extends beyond the area identified by the species buffer, there could be additional suitable habitat inside the transportation footprint, but beyond the species location buffer. However since at this stage there is no actual evidence that habitat is occupied,

limit the extent of suitable habitat selected to inside the 2- and 4- mile species location buffers (the circles in **Error! Reference source not found.**). This has the effect of making the projections of impacts more conservative than by merely selecting all suitable habitat regardless of its distance from a known point of occurrence. The limits that are imposed are in recognition that not all suitable habitat is usually occupied. The use of two buffer distances also attempts to capture some of the uncertainty inherent in conducting an impact assessment using remote sensing-based vegetation maps as opposed to field surveys or other more direct sampling methods.

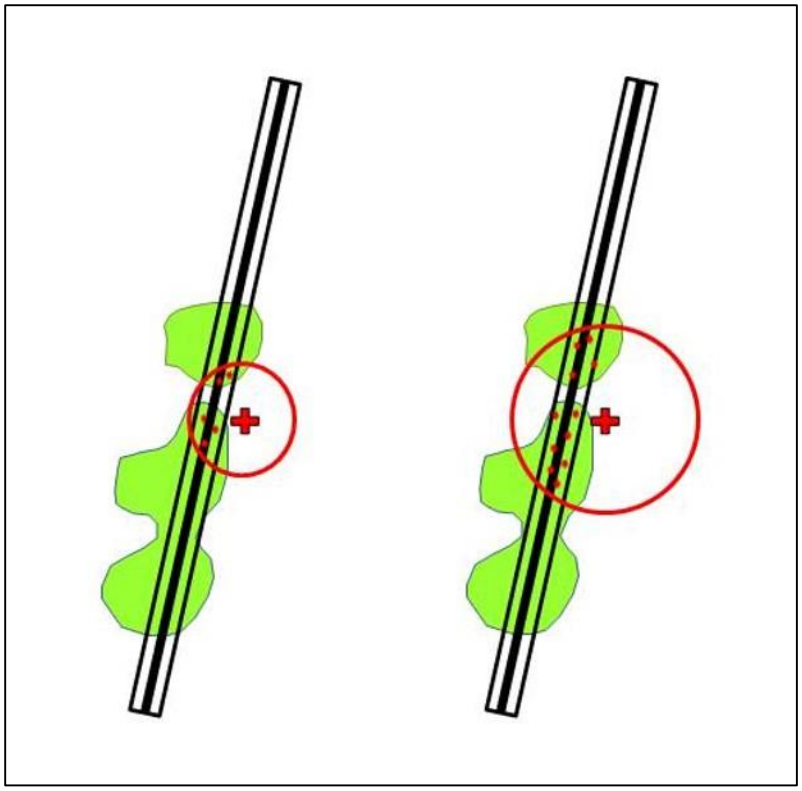


Figure 1. Habitat model example. This image shows the use of CNDDB records with transportation project impacts, to predict the extent of suitable habitat that could be impacted by a project. Green represents suitable habitat for a species, although it is not known if the species is occupying that entire habitat. The red cross represents a known occurrence record for that species. The black outlines depict a transportation corridor, and its estimated impact footprint. The green areas within the red circles of (a) a 2-mile and (b) a 4-mile buffer from the CNDDB point represent the suitable habitat that falls within the project footprint. Any appropriate habitat patches within the circles are then summed to provide the impact estimate for that species on that project.

3. Conduct Impact Assessment

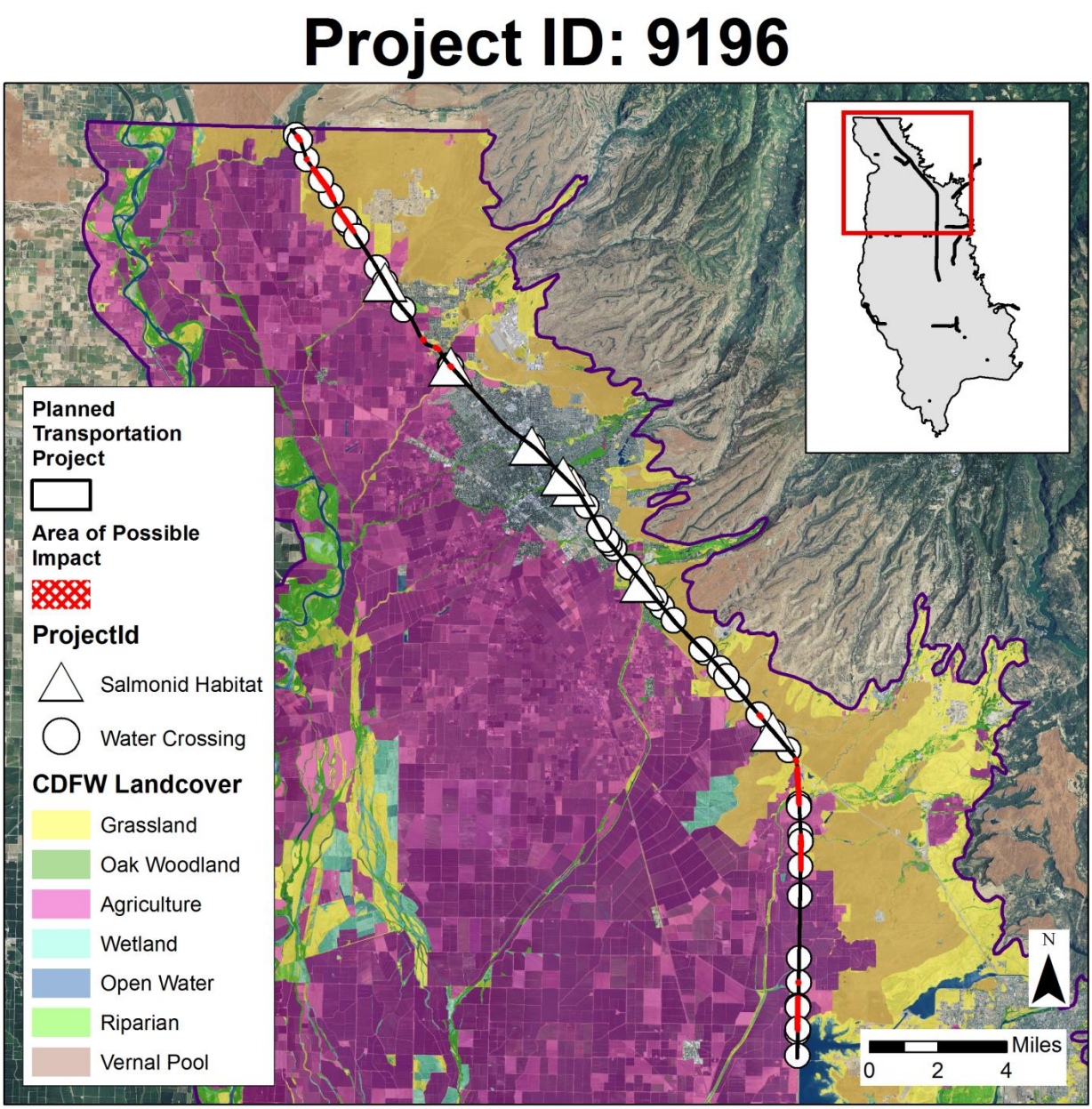
1. Review each project to determine if it potentially has unavoidable impacts under the various laws, regulations and codes. Examples of the laws and resources include the

following, while a full list of laws and relevant agencies is provided as reference in Appendix A:

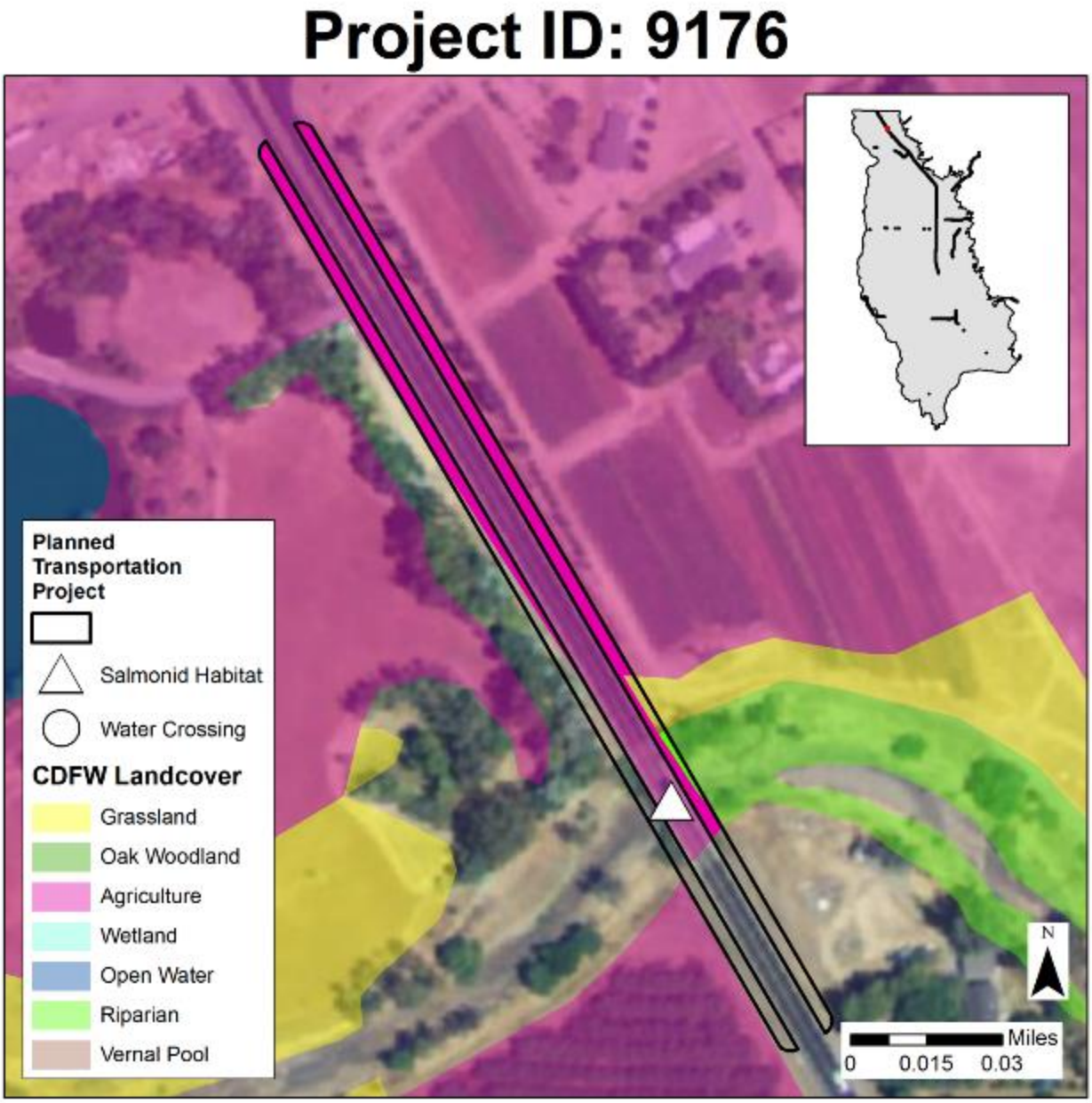
- **Clean Water Act (CWA), Section 401 and 404**: U.S. waters, including wetlands;
- **California Fish and Game (CFG) Code Section 1600**: rivers, streams or lakes (activities that could divert, obstruct or change the natural flow or bed, channel, or bank);
- **Endangered Species Act (ESA)**: endangered and threatened species and designated critical habitat;
- **California Endangered Species Act (CESA) Section 2080.1**: threatened and endangered species that are listed by both the federal Endangered Species Act and the California Endangered Species Act; and
- **California Endangered Species Act (CESA) Section 2081 (b)**: threatened and endangered species that are listed by the California Endangered Species Act only.

2. The number of times that road projects cross waterways (and potentially producing impacts) should be calculated. This can be done by overlaying the centerlines of both the projects and waterways. This will provide a total number of crossings for projects being assessed, but will not provide information on the magnitude of those impacts.
3. Estimated surface water impacts can be calculated by overlaying the surface water areas (see previous section 4) with the project footprints.
4. Impacts to habitat types requiring mitigation actions can be calculated by overlaying project footprints on the appropriate habitat types found in whichever land cover datasets are being used.
5. Road project footprints can be overlaid on both the 2- and 4-mile buffered species-specific habitats to estimate a range of expected impacts to individual species.
6. For all of these impact assessments, impacts can be aggregated in a variety of ways. These can be by: resource impacted; road project; highway; watershed; other service area; etc.

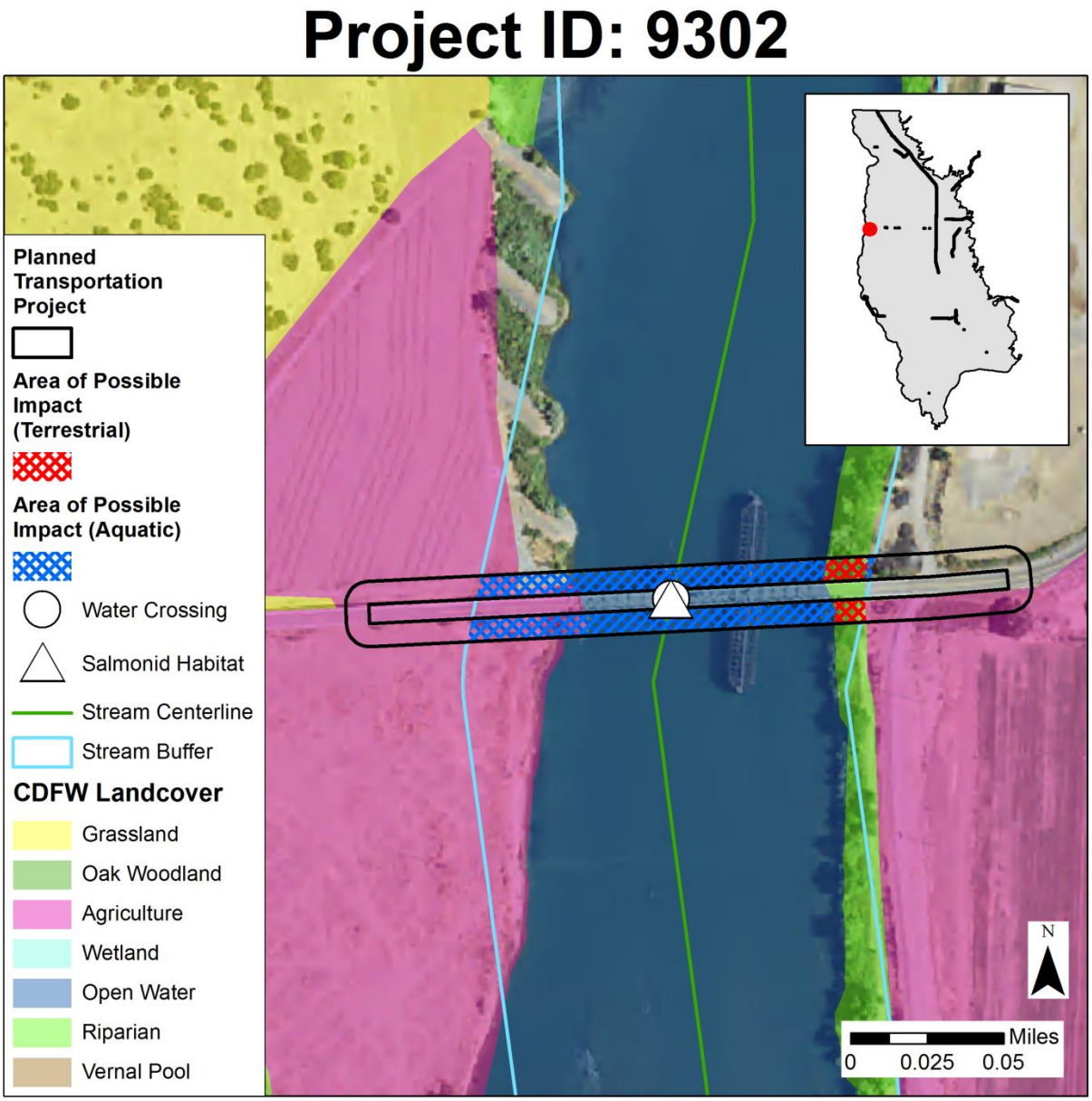
The following are three examples of what an impact assessment for different project types look like. The captions describe the steps used in each case. These two examples are from a pilot RAMP assessment from a region in the Sacramento River Valley.



Transportation Corridor View - Project 9196. This is a rail upgrade project along CA 99. It is 32.5 miles in length with a buffer of 20 feet, for an estimated footprint of 157.4 acres. The footprint overlaps 0.2 acres of riparian forest, <0.1 acres of wetlands, 0.3 acres of open water, 42.1 acres of agriculture, and 2.9 acres of vernal pool complex. Within the estimated footprint, there are 5.9 acres of tricolored blackbird (5.9 of AGS and <0.1 of FEW), 0.4 acres of burrowing owl (AGS), 2.7 acres of Conservancy fairy shrimp, 2.7 acres of vernal pool fairy shrimp, 2.4 acres of Swainson's hawk (2.3 of AGS, 0.1 of VRI, and <0.1 of BAR), 0.2 acres of Hoover's spurge, 0.4 acres of vernal pool tadpole shrimp, <0.1 acres of Butte County meadowfoam, 0.1 acres of giant garter snake (all RIV), and 0.3 acres of Green's tuctoria potential habitat. There are 51 stream crossings. There are also five crossings of Chinook salmon and six crossings of steelhead waterways. Each stream crossing will also have an area of impact, the intersection of the road buffer area with the stream buffer area.



Project 9176 – Widen shoulder on structure. This is a shoulder widening project on CA 99. The current paved surface was buffered by 15 feet (Table 1). This buffer was intersected with land cover types, resulting in estimated impacts of 0.5 acres of agriculture and less than 0.1 acres of riparian forest. Intersection with modeled species habitat results in estimates of 0.1 acres of burrowing owl impacts (i.e. grasslands in proximity to CNDDB records of burrowing owls) and 0.01 acres of Swainson's hawk habitat. There was one stream crossing identified by overlaying the road centerline with NHD waterway centerlines. This unnamed waterbody has a stream order of 4, which has a buffer distance of 20 meters from the centerline. Intersecting the road footprint with the buffered waterway resulted in an estimated 0.09 acres of impacts to surface waters. This stream crossing also is on a salmonid-bearing stream, meaning impacts to salmonids will be a consideration.



Project 9302 – Seismic retrofit. This project is a seismic retrofit of a bridge on CA 162. The current paved surface was buffered by 40 feet (Table 1). This buffer was intersected with land cover types, resulting in estimated impacts of 0.9 acres of agriculture and 0.1 acres of riparian forest. Intersection with modeled species habitat results in estimates of: 0.1 acres of Swainson's hawk habitat (i.e. the riparian forest that is in close proximity to CNDDB records for Swainson's hawk); and 0.1 acres of valley elderberry longhorn beetle habitat (i.e. the riparian forest is in close proximity to CNDDB records for Swainson's hawk). There was one stream crossing identified by overlaying the road centerline with NHD waterway centerlines. This corresponded to potential impacts to both Chinook salmon and steelhead habitat on the same waterway. This waterway has a stream order of 7. It therefore has a buffer distance of 100m (328 feet) (Table 2). Intersecting the road project footprint with the buffered waterway results in an estimated 1.2

acres of impacts to surface waters. Some overlap of the terrestrial extent of vegetation and modeled stream extent based on the NHDPlus data can be seen.

NEXT STEPS: IMPLEMENTING REGIONAL ADVANCE MITIGATION THROUGH GREENPRINTS

Although not the subject of this manual, one of the central concepts behind RAMP is to use the advance nature of this approach to mitigation planning to enable the application of systematic conservation planning principles in the siting of mitigation actions that otherwise would be difficult to incorporate in the current, project-by-project planning process. Ideally, the potential compensatory mitigation needs identified through the RAMP process outlined above will be used to align mitigation actions with regional conservation needs, thereby achieving multiple benefits beyond simply meeting regulatory requirements (e.g. Hoctor et al. 2000; Noss et al. 1999). A set of spatially-explicit and comprehensive regional sustainability needs, or "greenprint", can be used to direct mitigation actions to locations that both meet regulatory requirements and contribute to multiple sustainability needs outside the typical mitigation framework.

Greenprints are not uniform planning products but rather can take multiple forms, depending on the geographic or regulatory contexts. Some examples of greenprints or approaches to designing them for use in RAMP include:

- *Existing HCP/NCCP*. When a RAMP project is undertaken in region with one or more existing Habitat Conservation Plan (HCP)/Natural Community Conservation Plan (NCCP), mitigation actions can be directed within the priority conservation areas delineated in these plans, utilizing the data and analysis as appropriate. An example is the Multiple Species HCP in San Diego, which is being used by SANDAG in their mitigation process, to which Caltrans is a partner. Existing conservation plans can also be used in conjunction with other strategic planning efforts as one input to a comprehensive regional sustainability strategy.
- *Existing conservation plans*. In some regions, government and sometimes stakeholder groups have developed comprehensive, systematic conservation plans. Examples of government plans which should be considered, in addition to HCP/NCCPs, are US Fish and Wildlife Service's species recovery plans and the California Department of Fish and Wildlife Service's State Wildlife Action Plans. Additionally, there is an avian species recovery plan in the California Essential Habitat Connectivity report (Spencer et al. 1210).

  Multi-stakeholder plans that are not explicitly among the previous types of plans also exist. An example is the Conservation Lands Network in the San Francisco Bay area. In this case, numerous stakeholders worked jointly and used conservation planning tools to identify important conservation lands in the region. Where efforts similar to this one have been undertaken, mitigation activities can be directed to the priority areas previously identified, to integrate acquisition of necessary mitigation credits with regional conservation objectives.

- *New greenprints*. Many areas in California have not been the subject of regional conservation planning efforts. When a RAMP is established in one of these regions, it will be necessary to undertake some sort of systematic conservation planning process to identify conservation priority areas within which to conduct mitigation actions. There are several ways to identify a new regional greenprint. One is to assemble spatially-explicit GIS data representing conservation priorities from organizations in the region and overlaying them to identify priority "hotspots". Another is to use software such as Marxan (Ball et al., 2009) to identify a conservation network that meets conservation needs across those priorities. Finally, a full stakeholder process in which both regulatory, nonprofit groups, and the public at large are invited to participate could be conducted to identify a comprehensive regional greenprint. While the latter approach might be the most robust, it is also the most time and resource intensive. Note that a variety of state agencies have compiled statewide data which can be used in this regard, including the California Department of Fish and Wildlife which provides the currently named ACE II, a GIS of hexagons that are weighted according to species richness and/or other measures of biodiversity, and the Cal Fire California Fire Resource and Assessment Program (FRAP) which has produced the most up to date statewide landcover map.

Once a regional greenprint has been identified for use in a RAMP process, mitigation actions should be directed within this network. Methods for determining placement of these actions can range from ad hoc acquisition as properties are available to more systematic approaches, again using Marxan or similar software to identify the locations that best meet mitigation needs while conforming to other, non-regulatory attributes (e.g. adjacency to existing preserves, location within important wildlife corridors, etc.).

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Appendix A. Legal Obligations for Mitigation

Federal

There are a number of federal acts that transportation projects are subject to regarding environmental mitigation when Caltrans or FHWA is the federal lead agency. The Standard Environmental Reference (SER), Volume 1, Chapter 1, "Federal Requirements," provides a listing of laws and regulations including executive orders, policy, guidance, directives and advisories related to the National Environmental Policy Act (NEPA) compliance, which can be found here: http://www.dot.ca.gov/ser/vol1/sec1/ch1fedlaw/chap1.htm. The descriptions below account for the relevant clauses to environmental mitigation for the entire state, including some that may not be pertinent within the pilot area.

- **National Environmental Policy Act (NEPA):** Requires agencies to consider the potential environmental consequences of their proposals, document the analysis, and make the information available to the public for comment prior to implementation of a federal action. "Environment" includes the physical environment (air and water quality), natural environment (what RAMP is concerned with), and community impact (including noise).
- **Rivers and Harbors Appropriations Act, Section 10**: prohibits the building of any wharfs, piers, jetties and other structures affecting navigable waters, and any excavation, or filling within navigable waters without the approval of the Chief of Engineers and Secretary of the Army (USACE). Section 404 of the Clean Water Act jurisdiction encompasses areas regulated by Section 10; the Corps typically combines the permit requirements of Section 10 and Section 404 into one permitting process. U.S. Fish and Wildlife Service concerns include contaminated sediments associated with dredge or fill projects in navigable waters.

- **Clean Water Act (CWA)**: U.S. waters, including wetlands; U.S. EPA has ultimate jurisdiction of this federal law, however Congress delegated day-today administration of Section 404 permitting to the USACE, the Regional Water Quality Control Board (RWQCB) is authorized to issue permits under Section 402, and if no federal permit is required for Section 401 the State Water Regional Control Board (SWRCB) will regulate under Porter-Cologne Authority.
    - **Section 401**: for projects involving dredging, filling or otherwise impacting waters of the US or waters of the State a water quality certification from the SWRCB is required, and applications for water quality certification under CWA Section 401 are typically processed by the Regional Water Quality Control Board (RWQCB) for local jurisdiction.
    - **Section 402**: storm water (National Pollutant Discharge Elimination System (NPDES)) permits from the RWQCB are required for discharges from a municipal separate storm sewer system serving a population of 100,000 or more.

- **Section 404**: permit program for discharge of dredged or fill material into US waters including wetlands, with authorization by USACE. Section 404 of the Clean Water Act jurisdiction encompasses areas regulated by Section 10, so the USACE typically combines the permit requirements of Section 10 and Section 404 into one permitting process.

- **Coastal Zone Management Act (CZMA):** This Act, administered by NOAA, provides for the management of the nation's coastal resources, to preserve, protect, develop and where possible, to restore or enhance the resources of the nation's coastal zone. The CZMA is administered in California through three designated coastal management agencies: The California Coastal Conservancy, the Bay Conservation and Development Commission (BCDC) and the California Coastal Commission.

- **Fish and Wildlife Coordination Act**: any federal project where the waters of any stream or other body of water are modified. Requires consultation with USFWS and appropriate state wildlife agency. Agencies prepare reports and recommendations that document project effects on wildlife (animals and plants) and identify measures that may be adopted to prevent loss or damage. Provisions of the Act are implemented through the NEPA process and Section 404 permit process.

- **Federal Endangered Species Act (ESA) Section 7**: Federal agencies are directed to consult on any activities that may affect endangered and threatened species and designated critical habitat. For terrestrial species and non-anadromous/marine fish, consultation is required with USFWS; for anadromous and marine species, consultation is required with the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA-NMFS). Issuance of an incidental take permit is a Federal action subject to both NEPA compliance and Section 7 of the ESA. A Biological Assessment is required if listed species or critical habitat may be present in the area affected. http://www.fws.gov/endangered/species/us-species.html.

- **Federal Endangered Species Act (ESA) Section 10:** provides a means whereby a non-federal action with a potential to result in the "take" of a listed species could be allowed under an incidental take permit. Similar to Section 7, the USFWS is the consulting agency for terrestrial and non-anadromous/marine fish and NOAA-NMFS consults on anadromous and marine species.

- **Marine Mammal Protection Act (MMPA):** prohibits the "take" of marine mammals in US waters (NOAA can authorize take for certain activities). http://www.mmc.gov/species/speciesglobal.shtml.

- **Magnuson-Stevens Fishery Conservation and Management Act**: promotes the conservation and management of fishery resources and anadromous fish and requires federal agencies to consult with NOAA Fisheries on activities that may adversely affect Essential Fish Habitat (EFH). Essential Fish Habitat is defined as those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity. The federal agency must provide NOAA Fisheries with an assessment of the proposed action's impacts to EFH, and NOAA Fisheries provides the federal agency with EFH Conservation Recommendations to avoid, minimize, mitigate or otherwise offset those adverse effects. Although a separate consultation than the Endangered Species Act Section 7, the EFH assessment under the Magnusson-Stevenson Act is usually administered simultaneously and issued with the Biological Opinion. An EFH consultation can be combined with other existing environmental review procedures, such as those under the NEPA, the CWA, and the Fish and Wildlife Coordination Act to streamline the requirements and avoid duplication with other environmental reviews. http://www.nmfs.noaa.gov/msa2007/docs/list_of_protected_lmr_act_022610.pdf.

- **Migratory Bird Treaty Act**: The USFWS has statutory authority and responsibility for enforcing the MBTA, which makes it illegal to take, possess, export, transport, sell, purchase, barter (or offer to do those things) any migratory birds, or the parts, nests, or eggs of such a bird except under the terms of a permit. http://www.fws.gov/migratorybirds/regulationspolicies/mbta/MBTANDX.HTML.

- **2008 Final Rule on Compensatory Mitigation for Losses of Aquatic Resources**: The EPA and USACE issued revised regulations to improve the planning, implementation and management of compensatory mitigation by creating higher standards for compensatory mitigation, and requiring that mitigation decisions be made within the context of a watershed approach. There were also regulations designed to expand public participation in compensatory mitigation decision-making and to increase the efficiency and predictability of the mitigation project review process. These regulations follow the recommendations of the National Research Council by establishing equivalent, effective standards for compensatory wetland mitigation under the Clean Water Act. These regulations need to be followed in order to receive permits from USACE under Section 401 and Section 404 of the Clean Water Act. For impacts to wetlands, streams and other aquatic resources authorized by Clean Water Act section 404 permits;

- **Bald and Golden Eagle Protection Act**: Prohibits anyone from "taking" bald or golden eagles, including their parts, nests or eggs without a permit issued by the Secretary of the Interior (USFWS). "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

State

In addition to federal laws, there are a number of California-specific laws and regulations. Because some federal and state regulations have similar goals, there is some flexibility in consolidating and avoiding duplication within the review process, provided that each regulation's requirements are sufficiently met. See the Standard Environmental Reference (SER) Volume 1, Chapter 2 for state requirements for compensatory environmental mitigation http://www.dot.ca.gov/ser/vol1/sec1/ch2statelaw/chap2.htm. The descriptions below account for the relevant clauses to environmental mitigation for the entire state, including some that may not be pertinent within the pilot area.

- **California Environmental Quality Act (CEQA)**: Seeks to protect environmental factors including aesthetics, agricultural resources, air quality, biological resources, cultural resources, geology and soils, greenhouse gases, hazards and hazardous materials, hydrology and water quality, land use and planning, mineral resources, and noise, population and housing, public services, recreation, transportation and traffic, utilities and service systems or a combination of these factors, by regulating activities which may adversely affect the those factors. For projects with potential impacts, agencies must identify mitigation measures and alternatives by preparing an Environmental Impact Report (EIR), which must allow for public review and comment. This is a public disclosure law for state actions to disclose the environmental impact of a state action, and to allow public review and comment on the action and its impacts.

- **Porter-Cologne Water Quality Act:** to protect and oversee water quality on a day-to-day basis at the local and regional level. The Porter-Cologne Act establishes nine Regional Water Quality Control Boards which prepare update Basin Plans for each region, and issue permits to control pollution. Under the auspices of the US EPA, the State Board and nine Regional Boards have the responsibility of granting Clean Water Act Section 402 NPDES permits, for point-source discharges and waste discharge requirements or conditioned water quality certifications.

- **California Native Plant Protection Act (CFG Code Sections 1900-1913)**: protects endangered and rare native plants by allowing the California Department of Fish and Wildlife (CDFW) to designate plants as rare or endangered, prohibit take of endangered or rare native plants, and issue permits for some exceptions; See here for list of species: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEPlants.pdf.

- **California Fish and Game (CFG Code Section 1600) Lake and Streambed Alteration (LSA)**: requires an entity to notify California Department of Fish and Wildlife (CDFW) of any activity that could divert, obstruct or change the natural flow of any river, stream or lake; substantially change or use any material from the bed, channel, or bank of any river, stream, or lake; or deposit debris, waste or other materials that could pass into any river, stream or lake. "any river, stream or lake" includes those that are episodic as well as those that are perennial, including ephemeral streams, desert washes

and watercourses with a subsurface flow, or work undertaken within the flood plain of a body of water. Before issuing an LSA Agreement, CDFW must comply with the California Environmental Quality Act (CEQA).

- **California Endangered Species Act (CESA) Section 2080.1**: Protects threatened and endangered species that are listed by both the federal Endangered Species Act and the California Endangered Species Act, by requiring consultation with the California Department of Fish and Wildlife in the event that an otherwise lawful activity may result in the "take" of any listed species. CDFW is authorized to issue an incidental take through permits or memoranda of understanding. "Take" is defined as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." https://www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEAnimals.pdf.

- **California Endangered Species Act (CESA) Section 2081 (b)**: Protects threatened and endangered species that are listed by the California Endangered Species Act only, by requiring consultation with the California Department of Fish and Wildlife in the event that an otherwise lawful activity may result in the "take" of any listed species. CDFW is authorized to issue an incidental take through permits or memoranda of understanding. "Take" is defined as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."https://www.dfg.ca.gov/biogeodata/cnddb/pdfs/TEAnimals.pdf.

- **California Wild and Scenic Rivers Act:** Preserves certain designated rivers in their free-flowing state. These rivers must possess extraordinary scenic, recreational, fishery or wildlife values.

- **Senate Concurrent Resolution No. 17 Oak Woodlands:** requests State agencies to preserve and protect native oak woodlands and to provide replacement plantings whenever Blue, Engelmann, Valley or **C**oast Live Oak are removed from native woodlands. "Oak Woodlands" are defined as 5-acre circular areas with 5 or more oak trees/acre.