STATEWIDE ADVANCE MITIGATION NEEDS ASSESSMENT REPORT

State Highway Operation and Protection Program

Ten-Year Project Book

Second Quarter 2017/2018 Fiscal Year

May 2019

Page Intentionally Left Blank

Statewide Advance Mitigation Needs Assessment Report

Prepared For:
Caltrans Headquarters
Office of Strategic Biological Planning, Advance Mitigation and Innovation
Division of Environmental Analysis
1120 N Street
Sacramento, California 95814

Prepared By:

HDR, Inc.
2379 Gateway Oaks Drive, Suite 200
Sacramento, California 95833

May 2019

Page Intentionally Left Blank

TABLE OF CONTENTS

Tables

Figures

Appendices

ACRONYMS

AMP	Advance Mitigation Program
Caltrans	California Department of Transportation
CALVEG	Classification and Assessment with LandSat of Visible Ecological Groupings
CARI	California Aquatic Resource Inventory
CDFW	California Department of Fish and Wildlife
CNDDB	California Natural Diversity Database
CWHR	California Wildlife Habitat Relationship program
CSV	Common separate values
CY	Cubic Yards
EA	Estimated Area
EFIS	Enterprise Resource Planning Financial Enterprise
FGC	Fish and Game Code
FT	Feet
FVEG	CalFire vegetation layer
GAI	Geographic Area of Interest
HUC	Hydrologic Unit Code
NHD	National Hydrography Dataset
LF	Linear Feet
NWI	National Wetland Inventory
PM	Post Mile
RAMNA	Regional Advance Mitigation Needs Assessment
SAMNA	Statewide Advance Mitigation Needs Assessment
SHC	State and Highways Code
SHOPP	State Highway Operations and Protection Program
SF	Square Feet
USFS	United States Forest Services
USFWS	United States Fish and Wildlife Service
Vegcamp	Vegetation Classification and Mapping Program

1.0 INTRODUCTION

California Department of Transportation' (Caltrans') Advance Mitigation Program (AMP) was created through the Road Repair and Accountability Act of 2017 (Stats. 2017, Ch.5, Sec.35) and amended by Senate Bill 103, Committee on Budget and Fiscal Review Transportation, (Stats. 2017, Ch. 95, Sec. 10 – 15), both of which established the AMP under Streets and Highways Code (SHC) §800 et seq. The purpose of the legislation (SHC §800 (a)) is to:

- Accelerate transportation project delivery
- Enhance communications between Caltrans and stakeholders to protect natural resources through project mitigation, to meet or exceed applicable environmental requirements, and to mitigate, to the maximum extent required by law, environmental impacts from transportation infrastructure projects
- Consult with the California Department of Fish and Wildlife (CDFW) on all activities pursuant to SHC §800 et seq., including activities pursuant to Chapter 9 of Division 2 of the Fish and Game Code (FGC §1850 et seq.).

Prior to expending any program funds, Caltrans' Director must make a determination and justification that the expenditure will likely accelerate the delivery of specific transportation projects (SHC §800.6(i)). In support of that determination and justification, the AMP implements a multi-step advance mitigation planning process, which starts with an assessment of needs, identifies appropriate regions, advances advance mitigation concepts, scopes projects and receives approval for funding allocation. The steps are:

1. Statewide Advance Mitigation Needs Assessment (SAMNA): the SAMNA is a Geographic Information System (GIS)-based assessment that is performed on future planned state transportation projects that are identified on current long-range transportation plans. Assumptions are made on the general types of transportation project activities as to what extent, if any, they may potentially incur an off- pavement footprint. These potential footprints are overlaid with natural resource data layers that model species habitat and aquatic resources. Analyses are run on a District-wide basis and impacts to specific resources within specific ecoregions or watersheds are estimated. The SAMNA will be performed, at a minimum, on a biennial basis. The SAMNA is the subject of this report.
2. Geographic Area of Interest (GAI) Selection: following completion of the SAMNA, the AMP coordinates with the Districts to identify which specific natural resources would be of the greatest benefit to implement through an advance mitigation approach, and to identify an ecoregion or watershed-based region within which to develop an advance mitigation project. This region is referred to as the GAI.
3. Regional Advance Mitigation Needs Assessment (RAMNA): the RAMNA is a document that builds on the needs identified in the SAMNA for a given GAI and seeks to maximize the environmental and conservation benefits from potential mitigation actions and provides the Districts with sufficient information to

conceptualize advance mitigation projects that can be scoped and submitted for the Director's Approval.

4. Advance Mitigation Project Scoping and Initiation: based on the RAMNA, Districts will identify and scope advance mitigation project alternatives and document how these alternatives will likely accelerate the delivery of transportation projects documented in the SAMNA and RAMNA. The AMP will screen the proposals and make recommendations to the Director.
5. Director's Approval: the Director will review the advance mitigation projects scoping and nomination documents and the AMP's recommendations and make a determination and justification that funding the advance mitigation project is likely to accelerate transportation project delivery, per SHC §800.6 (i). Once the determination and justification have been made, the Districts can request a fund allocation from the AMA for the advance mitigation project, and delivery of that advance mitigation project can commence.

Advance mitigation planning is conducted early in transportation planning and is a proactive approach to mitigation, with the goal of meeting both conservation goals and objectives as well as accelerate delivery of transportation projects by strategically scoping, siting and implementing mitigation projects so that they provide the correct type and amount of compensatory mitigation and contribute materially to environmental recovery efforts. Advance mitigation project delivery timelines therefore are decoupled from, and in advance of, transportation project delivery timelines and strive to maximize the environmental benefit by aggregating the estimated impacts of multiple future transportation projects. Advance mitigation planning thus is fundamentally geospatial in its scope, and conducive to GIS based solutions.

This report presents the methods and results of the SAMNA performed on the list of projects in the State Highway Operations and Protection Program (SHOPP) Ten Year Project Book for the Second Quarter of the 2017/2018 Fiscal Year. In order to develop meaningful and appropriate advance mitigation projects, an understanding of the potential impact to resources in the geographic area must be developed. For this reason, GIS is utilized as a decision-making tool for developing advance mitigation projects. Core GIS processes employed in this assessment are informed by a methodology published by UC Davis[1]. The workflow involves the consolidation, processing, and analysis of a variety of GIS data layers from authoritative State and Federal agencies. GIS layers considered fall into resource categories that correspond to Project mitigation needs. Those categories are terrestrial and aquatic special-status species (and sub-species), special-status fish, wetlands, and water.

Planned projects were identified in the Caltrans SHOPP Tool database. Potential Project impact footprints were developed using a combination of manual and automated

[1] Thorne, James H; Bjorkman, Jacquelyn; & Huber, Patrick R. (2015). A Reference Manual for Caltrans Staff on Regional Advance Mitigation Impact Assessment Methods. UC Davis: Information Center for the Environment. Retrieved from: http://escholarship.org/uc/item/76n8793q

workflows. A custom ArcGIS Desktop Add-In tool (Caltrans Advance Mitigation Needs Assessment Reporting Tool) was developed to generate reports summarizing the potential impacts to these four categories of resources. The tool assists in preparing resource data for the reporting analysis, as well as automating the overlay of thousands of proposed projects with over a thousand resource source data sets and generating a summary report. Each reporting workflow can be completed for a given district.

The Advance Mitigation Needs Assessment Methods are only intended to produce an estimate of potential mitigation need for the purpose of justifying, authorizing, proposing and scoping an advance mitigation project. They are not intended to provide transportation project level assessment for impacts, scoping, providing environmental analysis, or permitting transportation projects. Transportation projects still need to go through environmental and permitting processes and must demonstrate avoidance and minimization prior to compensation. Additionally, use of these methods does not imply an endorsement of a transportation project alternative. Transportation projects must also include mitigation costs in the scoping and programming of their budgets, as they are required under law to reimburse the Program for use of mitigation produced by the Program (SHC §800.6(b)).

2.0 METHODS

The basic analysis for assessing the acreage of habitat and waters impacts to specifically defined terrestrial and aquatic resources is an intersection of modeled transportation project footprints and natural resource spatial layers. These two input layers did not exist as geospatial products in forms that were readily utilizable in an overlay analysis and had to be created from existing data products. The creation of these input data layers involved the management of over 600 input data layers, and given the volume of data, the processing capacity required to compile the data layers and run the tools described below was substantial. The methods presented here generally follow the methods presented in Thorne et al., 2015.

Project Footprint Development

Future Project estimated footprints were developed to estimate the impact of a given Project. The first step to building the Project footprints was to gather Project information from the SHOPP tool database. Data from the SHOPP tool was queried to represent data available after September 2018. Data required a degree of conditioning to identify a unique identification number and the county, route, and post-mile for the beginning and end of each Project.

Locations for projects, except for culvert and bridge projects, were generally identified using the Caltrans Post-Mile Validation Tool, which allows a user to input a table with a list of county, route and post-miles and returns line geometry for each row in the table. Many projects were located manually by tracing line geometry over a GIS roads layer as access to the Post-Mile Validation Tool was limited. Bridge and culvert related activities and projects were identified using a bridge report exported from the SHOPP tool database, Highway Maintenance Culvert Inspection Program listing the drainage projects identified as of June 11, 2018, and existing GIS data files that provide locations of bridges and culverts as point and linear geometry features.

Unique identifiers were developed for each Project using existing information where possible. Most projects were provided with an Enterprise Resource Planning Financial Infrastructure (EFIS) number from the SHOPP tool. Projects that did not have an EFIS number assigned were given a unique ID from one of the following sources, in order of priority; EFIS number, Expenditure Authorization number, SHOPP ID, and lastly, a generated ID based on county and route.

Once linear representations of each Project extent were available, edge of pavement was approximated by developing buffers. Caltrans' Highway Design Manual was consulted to obtain standard lane and should widths, whose values were halved so as to be applied as buffer radii. The number of lanes for the State Highway System were obtained from Caltrans' 2017 Transportation System Network geodatabase line feature class. The buffer varied depending on the number of lanes and whether the highway was divided or undivided. On undivided highways the edge of pavement buffer was equal to six times the number of lanes plus five feet. On divided highways, the edge of pavement buffer was equal to three times the number of lanes plus five feet. For example, a two-lane undivided highway would have a buffer applied of six times two plus five feet, or seventeen-foot buffer from the centerline of the road segment and the same sized divided highway would have a buffer of three times two plus five feet, or eleven foot buffer from centerline of the road segment.

With the exception of culvert projects, the Project impact was defined as a buffer from the edge of pavement. Different buffer widths were used depending on the activity identified for the Project. Culvert project impact was defined as a buffer from Project culvert GIS geometry. For SHOPP projects, each Project has an Activity ID field. The buffers applied are presented in **Table 1** below. All activities absent from Table 1 were not given a buffer and are not represented in this analysis.

Table 1. SHOPP Project Activity Code Buffer Widths

Activity ID	Activity Category	Activity Description	Activity Unit**	Buffer Distance (Ft)
A02	Bridge	Bridge Replacement/New Construction	SF	40
A03	Bridge	Bridge Rail	LF	20
A05	Bridge	Bridge Widening	SF	15
C01	Drainage	Replace/Install Culverts	EA	20
C02	Drainage	Replace Install/Culverts	LF	20
C03	Drainage	Slip line Culvert	EA	20
C04	Drainage	Slip line Culvert	LF	20
C05	Drainage	Cure in place line Culvert	EA	20
C06	Drainage	Cure in place line Culvert	LF	20
C07	Drainage	Abandon/remove culvert	EA	20

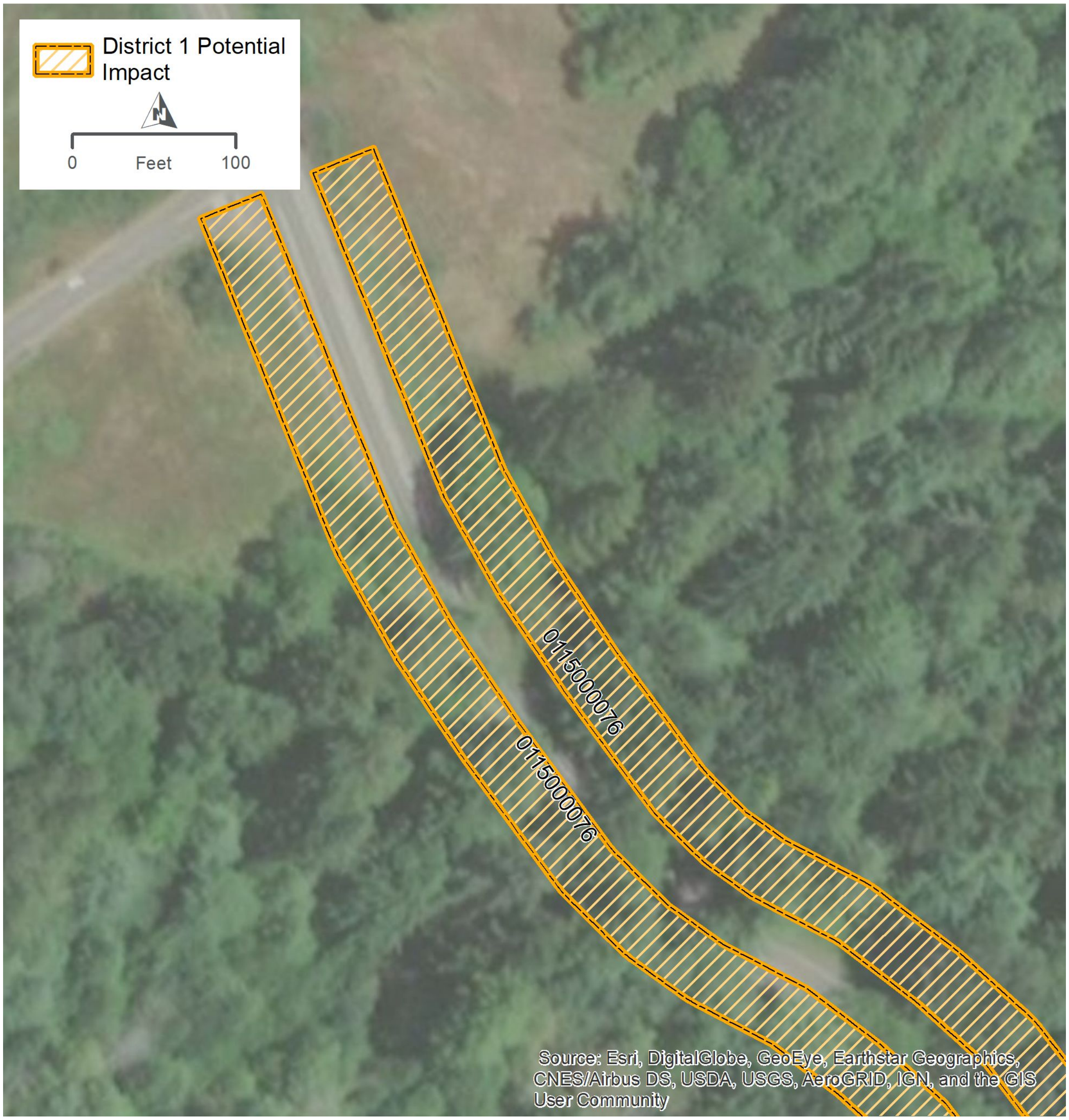
Activity ID	Activity Category	Activity Description	Activity Unit**	Buffer Distance (Ft)
C08	Drainage	Abandon/remove culvert	LF	20
C09	Drainage	Headwall/Endwall	EA	20
C11	Drainage	Energy Dissipation & other Element {RSP, DI, FES etc.}	EA	20
E03*	Safety	Drainage Improvements	EA	20
E08	Safety	Improved Highway Geometry	EA	40
E09	Safety	Lane Widening	LF	15
E10	Safety	Left-turn Channelization	EA	15
E14	Safety	Rockfall Mitigation	EA	30
E15	Safety	Roundabouts	EA	40
E18	Safety	Standard Slopes	EA	30
E20	Safety	Widen Shoulders	LF	15
E21	Safety	Extend Merging/Acceleration Lane	LF	15
F07	Mobility	Turn pockets	EA	15
F08	Mobility	Widen roadway	LF	15
F09	Mobility	Truck climbing lane	LF	20
F10	Mobility	Acceleration/deceleration lane		20
F19	Mobility	Shoulders - New & Widening	Linear Miles	15
F36	Mobility	Auxiliary Lane		20
G13	Roadside	Safety Roadside Rest Area Building	SF	10
G14	Roadside	Safety Roadside Rest Area Utilities	EA	10
G16	Roadside	Safety Roadside Rest Area Parking	SF	10
G17	Roadside	Roadside Stopping Opportunities	Location	10
G18	Roadside	Retaining Wall	SF	15
G19	Roadside	Rock Slope Protection	CY	30
G20	Roadside	Slide Removal (or Slope Excavation)	CY	30

* E03 Activity Code is treated as a drainage project

** Acronyms – EA (Estimate Area); LF (Linear Feet); SF (Square Feet); CY (Cubic Yards)

Many projects included multiple activities. In those cases, the largest buffer took priority and was assigned to the Project for the potential impact analysis. The resulting geometry estimates the potential impact area for each proposed Project, which can be overlaid with resource data in subsequent steps. An example of a Project image polygon is shown below in **Figure 1**.

Page Intentionally Left Blank



Project EFIS 0113000090 in Humboldt County		
Activity Category: Safety - SI		
Back PM 0.1, Ahead PM 1.6		
Activity Detail	**Activity ID**	**Buffer (ft)**
Improved Highway Geometry (201.010, .015)	E08	15
Widen Shoulders (201.010, .015)	E20	40

Figure 1. Map of Example Project Impact on Hwy 36 in Humboldt County (Impact Buffer = 40ft)

Page Intentionally Left Blank

Terrestrial and Aquatic Special-Status Species Habitat Value Layer Development

In order to characterize habitat across California, a seamless and continuous layer of habitat was developed with habitat values for each of the considered species and sub-species. This layer was limited to the ranges of each species and sub-species. Habitat is represented in California by the CDFW California Wildlife Habitat Relationship (CWHR) program. The CWHR program identifies grouping of vegetation communities and evaluates each community for suitability for special-status amphibians, reptiles, birds, and mammals. In addition to identifying special-status species habitat preferences, the CWHR program provides an average habitat suitability index value from 0 to 1, 0 being no habitat and 1 being most suitable. The CWHR program also provided bounding polygons that represent the limits of where a species or sub-species may be found within California. These polygons are called range polygons. The CWHR program only addresses terrestrial vertebrates, and does not provide habitat suitability or range polygons for special-status plants, invertebrates, or fish. For the species not covered under the CWHR, commensurate methods were developed as described in subsequent sections.

CWHR habitat types are included as attributes in several California wide vegetation layers. Mirroring the UC Davis publication, three vegetation layers were merged in an order of priority using best data available approach. The most recent and accurate data to represent CWHR habitat was determined to be the CDFW's Vegetation Classification and Mapping Program (VegCAMP) GIS layers. These layers map vegetation primarily in private and state owned lands. The next priority was given to the United States Forest Service (USFS) Classification and Assessment with LandSat of Visible Ecological Groupings (CALVEG) program data which maps vegetation for nearly the entire state and provides a CWHR type attribute for each polygon. Any gaps not addressed by VegCAMP and CALVEG data were filled by CalFire's FVEG layer. A summary of the data sources is presented in **Table 2**.

Table 2. CWHR Data Sources

Priority	Layer Name	Source Agency	Data Layer Link
1	VegCAMP	CDFW	https://www.wildlife.ca.gov/Data/VegCAMP
2	CALVEG	USFS Region 5	http://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192
3	FVEG	CalFire	http://frap.fire.ca.gov/data/frapgisdata-subset

Once the CWHR type layer was established, GIS workflows were developed to assign a habitat value for each considered special-status species and sub-species to relevant CHWR habitat types. These habitat values were then assigned to polygons within the range of each species.

Polygons of habitat were assigned a species habitat suitability index value if any part intersected that species range polygon. This approach resulted in polygons of habitat that were only partially within a species or sub-species range polygon being attributed with that species or sub-species habitat value. This approach reflects a conservative approach as range polygons are not real physical barriers to a species movement and continuous areas of habitat may be used by a given species or sub-species beyond the range polygon extent.

As habitat suitability and range for special-status amphibians, reptiles, birds, and mammals were available from the CWHR program, that information was gathered and applied to each polygon of habitat within the CWHR type layer. Habitat value and range for special-status plant and invertebrate species were also considered in the CWHR type layer. As habitat suitability values were not available from the CWHR program, each species was assigned 1 for suitable and 0 for not suitable.

Habitat types and Jepson Herbarium[2] codes for listed plants were cross-walked from the California Native Plant Society Rare Plant Inventory plant habitat classifications and the geometry for special-status plant range polygons were sourced from a floristic province GIS layer developed by the Jepson Herbarium. The GIS layer is called "Geographic Subdivisions" which has polygons that represent the California Floristic Provinces as used in the Jepson Manual. Each special-status plant was assigned a CWHR type based on the crosswalk. Each plant was assigned a geographic range limited to the appropriate floristic province by joining the species table and the GIS data layer "Geographic Subdivisions" by Jepson Herbarium code.

For invertebrates, a CDFW-sanctioned GIS layer for the ranges of each listed invertebrate species was not found. For listed invertebrates, the suitable habitat types for each invertebrate species were cross-walked from CDFW's RareFind 5 database to the appropriate CWHR vegetation type. The polygon GIS occurrence layer from the California Natural Diversity Database (CNDDB) for each listed invertebrate species was used to define range. Range polygons were developed by creating a four mile buffered polygon of the centroid of each CNDDB GIS data layer occurrence for each special-status invertebrate species. The centroid was restricted so as to be located within the CNDDB occurrence polygon.

The application of these methods resulted in twelve Caltrans district-wide vegetation layers with a habitat suitability attribute for each special-status species that is limited by the species range, such that these layers provide statewide coverage. It is anticipated that these layers will not need to be updated for one or more years.

[2] Jepson Flora Project (eds.) 2017. Jepson eFlora, http://ucjeps.berkeley.edu/eflora/ [accessed on May 25, 2017]

Special-Status Terrestrial and Aquatic Species and Sub-Species Report

The AMP created reports for each district by overlaying the Project footprint layer with species-attributed vegetation layer, extracting the area of each CWHR type within each Project footprint including habitat value attributes for each species that have a non-zero habitat value. The USFS Ecological Regions are overlaid as well, so that the potential impacts can be summarized by Ecological Region Section and Sub-Section. The report can be exported with acreage summaries by habitat or by species.

Special-Status Fish Report

The process of developing a habitat layer for fish started with identifying water bodies and waterways. Those features are represented in the United States Geological Survey National Hydrography Dataset (NHD). Most waterways are represented by polyline geometry. A buffer of 25 feet was applied to linear features and the buffered features were then merged in with the two other water polygon NHD layers, prioritizing the water polygon features over the buffered features.

Once the potential habitat polygon layer was developed, special-status fish ranges were used to assign species to polygons in a similar fashion to the terrestrial and aquatic species report. Critical Habitat from the National Marine Fisheries Service and United States Fish and Wildlife Service (USFWS) was used for the range boundaries for federally listed species. Other special-status fish range boundaries were developed by identifying CNDDB occurrences and selecting the Hydrologic Unit Code (HUC) 10 basin from NHD that intersects the occurrence and using the basin geometry as the range for that species. Waters polygons that intersected a fish species range polygon were assigned a habitat value of one. All other polygons were attributed with a habitat value of zero. Similar to the special-Status Terrestrial and Aquatic Species Report, the report can be exported with acreage summaries by habitat or by species, and aggregated by HUC 8 or HUC 10 basins.

Waters Report

The waters report is generated by following the same process as the fish report, without applying fish habitat range layers. That is to say, waters geometry are identified using NHD layers with linear features buffered by 25 feet and merged without overlap with the NHD polygon layers, prioritizing the NHD polygon layers over the buffered lines. The Project footprints are overlaid with the modified NHD layer, and potential impacts are totaled by water type as identified in the NHD layer and aggregated by HUC (both HUC 8 and 10).

Wetlands Report

The wetlands report is generated by simply merging two publicly available wetland layers and completing an overlay summary by wetland type. The two source layers were the USFWS National Wetland Inventory (NWI) layer and the San Francisco Estuary Institute's California Aquatic Resource Inventory (CARI) layer. Both layers were merged together without overlap and the priority for areas of overlap was NWI. Potential impacts are totaled by wetland type as identified in the NWI and CARI layers, respectively, and aggregated by HUC (both HUC 8 and 10).

Report Format

The report is exported as a comma separated values (CSV) file that can be manipulated in Excel to summarize acreage of each kind of CWHR habitat and habitat value for any special-status species that are estimated to utilize that habitat. Reports are created for each district and include all SHOPP projects with footprints that have been coded to that district regardless of where the footprint of each Project falls on the ground. The results section details suggestions for how to interact and use the data in the reports.

Summary Reports

Several summary reports were developed from the CSV reports. These summary reports are provided in table format in the Appendices. One summary report lists the transportation Projects along with the total footprint area within both ecoregion section and by hydrologic unit (HUC 8). The next series of tables depict the impact to species habitat within each ecoregion section. Each ecoregion section has its own table, with the first row of data depicting the total potential impact to each of the CWHR habitat types within that ecoregion section. These habitat totals represent the maximum potential impact within that ecoregion section per habitat type. The subsequent rows in each table detail how those potential habitat impacts could be impacts to the various special status species that the model indicated could use those habitats within their ranges. These tables are preceded by an index map, which shows the ecoregion sections and the transportation projects. The next section is preceded by an index map showing the HUC 8s and transportation projects and are followed by two additional tables depicting impacts to aquatic resources. One table depicts total potential impacts on water types and fish habitat by HUC 8. The third summary report provided impacts to wetlands.

3.0 RESULTS

Potential project impact boundaries were generated for 957 projects. A matrix of the number of proposed projects is provided below in **Table 3**.

Table 3. Potential Project Impact Boundaries by District

District	SHOPP Projects	SHOPP Activities
1	91	354
2	85	267
3	97	398
4	118	322

District	SHOPP Projects	SHOPP Activities
5	117	333
6	145	430
7	92	241
8	54	168
9	34	97
10	59	341
11	32	137
12	33	101
Total	957	3189

This analysis considered over 600 terrestrial and aquatic species and sub-species. It also considered 34 special-status species of fish (18 with designated critical habitat, and 16 without).

All four reports were generated for all districts, except District 6, which did not show any impacts to special-status fish. Each special-status fish and terrestrial and aquatic species report was exported both as a summary by habitat and by species, making a total of six CSV files per district, except in District 6 which had four CSV files.

The final reports are data rich and include attributes that enable district biologists to evaluate potential impacts district-wide and aggregated by ecoregion section and subsection for terrestrial resources and HUC 8 and 10 for aquatic resources. Each report was consolidated into an interactive Microsoft Excel "Pivot Table" format. Acreages of potentially impacted habitat can be easily filtered to Ecological Regions, HUCs, resource types, or even individual projects. These "Pivot Table" format reports are summarized by a project table and set of maps for each district (**Appendices A through L**).

4.0 DISCUSSION

The methods and results discussed in this document were developed working with subject matter experts and peer-reviewed literature, and are subject to the status and condition of the data as of the publication of overlay reports. They are a snapshot in time and current only to the day the data was queried. As the assessment progressed, adjustments were made to the process and requirements were changed. The expectation is for the process to continue to be refined as the districts use the workflows, tools, and reports. This assessment was successful in developing a snapshot of potential impacts to natural resources by over 957 proposed projects within the state of CA with the goal of developing advance mitigation projects that can streamline the mitigation process during project permitting and construction. A number of reports and map figures were developed that summarize the results of the analysis by district and are presented as appendices to this document (one for each district). This Project accomplishes the goal and lays the groundwork for a successful AMP.

Page Intentionally Left Blank