Appendix N
Archaeological Survey and Evaluation Report - Redacted Version

Part 1

ARCHAEOLOGICAL SURVEY AND EVALUATION REPORT FOR THE DELTA-MENDOTA CANAL SUBSIDENCE CORRECTION PROJECT, CALIFORNIA (REDACTED VERSION)

Signage for the Delta-Mendota Canal

Prepared for

US Bureau of Reclamation
Region 10
2800 Cottage Way
Sacramento, CA 95825

and

San Luis & Delta Mendota Water Authority
15990 Kelso Road
Byron, CA 94514

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With assistance from
JRP Historical Consulting LLC

February 2023

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February 2023

Confidential Information

Archaeological and other heritage resources can be damaged or destroyed through uncontrolled public disclosure of information regarding their location. This document contains sensitive information regarding the nature and location of archaeological sites that should not be disclosed to unauthorized persons.

Information regarding the location, character or ownership of a historic resource is exempt from the Freedom of Information Act pursuant to 54 USC Section 307103 (National Historic Preservation Act) and 16 USC Section 470hh (Archaeological Resources Protection Act) and California State Government Code, Section 6254.10.

If any information in this document is to be released for public review, all locational information associated with archaeological resources must be redacted before distribution.

Summary Of Findings

The U.S. Bureau of Reclamation and San Luis & Delta-Mendota Water Authority are proposing to correct issues associated with subsidence on the Delta-Mendota Canal (DMC) in order to restore the canal to its original design capacity. Two alternatives are under consideration. Alternative 1 is the No Project (under the California Environmental Quality Act)/No Action (under the National Historic Preservation Act) Alternative that describes the future without the project. Alternative 2 proposes to raise deficient concrete lining and embankment (berm) segments of the canal and to raise impacted structures.

The Area of Potential Effects (APE) is approximately 114 miles long and is located on multiple U.S. Geological Survey topographic quadrangle maps and within various Townships, Ranges, and Sections. It is located within Alameda, Contra Costa, Fresno, Merced, San Joaquin, and Stanislaus counties. Due to the need for operational flexibility for field staff, Reclamation's entire DMC ROW and some areas adjacent to the ROW are included in the APE. All access and staging will occur via existing operations and maintenance access roads along the DMC and would be contained within the ROW. The maximum vertical disturbance for the project will extend 100 feet for cone penetration tests and soil borings. The APE for the proposed activities amounts to 5,899 acres in total.

This Archaeological Survey Report documents the results of the Class III inventory and National Register of Historic Places (NRHP)/California Register of Historical Resources (CRHR) eligibility evaluations for archaeological resources. Built environment resources are briefly discussed within this report. The Historic Resources Inventory and Effects Analysis Report prepared by JRP Historical Resources LLC (JRP) addresses the built environment resources in full and is presented in Appendix F. Pacific Legacy, Inc. was subcontracted by CDM Smith to conduct the inventory of the Project area of potential effect (APE) to assist the Authority and Reclamation in complying with their obligations under Section 106 of the National Historic Preservation Act (NHPA) and the California Environmental Quality Act (CEQA). Prior to fieldwork, Pacific Legacy requested an archival and records search of the APE from the California Historic Resources Information System (CHRIS) information centers to identify previous cultural studies and resources. Pacific Legacy also requested that the Native American Heritage Commission conduct a Sacred Lands File search of the APE and was responsible for consultation with Native American Tribes as detailed in Assembly Bill 52. Section 106 consultation was conducted directly between the Bureau of Reclamation and Tribes.

Pacific Legacy completed an intensive pedestrian survey of 5,735 acres of the APE in May and June, 2022. Two newly identified archaeological sites and two archaeological isolates were located during the survey. The two newly identified archaeological sites, DMC-CRP-001 and DMC-CRP-002, were evaluated for eligibility for the NRHP and the CRHR and were recommended ineligible for inclusion in either list. Five built environment resources were recorded within the APE that are considered eligible for the NRHP and CRHR. The JRP report identified three linear historic properties that cross over or under Delta-Mendota Canal and have been previously determined eligible for listing in the National Register of Historic Places: San Joaquin Pipelines/Hetch Hetchy Aqueduct, Santa Fe Grade, and Outside Canal. This report and concludes that two additional properties – Delta-Mendota Canal and San Luis Drain – meet the significance criteria for listing.

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1.0 INTRODUCTION

This Archaeological Survey Report (ASR) documents the results of an archaeological inventory study conducted by Pacific Legacy, Inc. on behalf of the U.S. Bureau of Reclamation (Reclamation) and San Luis & Delta-Mendota Water Authority (Authority) for the proposed Delta-Mendota Canal Subsidence Correction Project (Project) in Alameda, Contra Costa, Fresno, Merced, San Joaquin, and Stanislaus Counties, California (see Appendix A, Figure 1). Pacific Legacy, Inc. was subcontracted by CDM Smith to conduct a Class III intensive survey of the Project area of potential effect (APE) to assist the Authority and Reclamation in complying with their obligations under Section 106 of the National Historic Preservation Act (NHPA) and the California Environmental Quality Act (CEQA).

Background research conducted for the Project included archival and record searches (Appendix B) as well as consultation with the Native American Heritage Commission (NAHC), Native American tribal representatives, and members of the public (Appendix C). The pedestrian field inventory of the survey area was conducted in May and June, 2022. Pacific Legacy conducted archaeological site recording during the field inventory.

1.1 DESCRIPTION OF THE UNDERTAKING

The purpose of the Project is correct issues associated with subsidence on the Delta-Mendota Canal (DMC) in order to restore the canal to its original design capacity and to protect the canal from stormwater that could either enter the canal or flow across the canal. Two alternatives are under consideration. Alternative 1 is the No Project (under the California Environmental Quality Act)/No Action (under the National Historic Preservation Act) Alternative that describes the future without the project. Alternative 2 proposes to raise deficient concrete lining and embankment (berm) segments of the canal and to raise impacted structures.

1.1.1 Alternative 1 – No Project/No Action

The No Project Alternative (under CEQA) describes the future without the project and may include some reasonably foreseeable changes in existing conditions and changes that would reasonably be expected to occur in the foreseeable future if the project were not approved. The No Action Alternative (under NEPA) also describes future circumstances without the Proposed Action and includes predictable actions by persons or entities, other than the federal agency involved in a project action, acting in accordance with current management direction or level of management intensity.

Under the No Project/No Action Alternative, the existing conditions of the DMC would remain unchanged, and the flow rates would be reduced from design capacity during operation to meet Reclamation Design Standards No. 3 (Reclamation 2014). Currently, 30 out of the existing 115 bridges along the DMC are considered deficient because they do not have 1 foot of clearance above the Maximum Water Surface Elevation when the canal is operated at design flow (MWSEL). However, the number of deficient bridges is expected to reach 45 when taking into consideration future subsidence conditions. Deficient bridges would be partially submerged when the canal is operated at the design flow, resulting in safety risks. To operate the canal safely and in accordance with Reclamation safety standards under the No Project/No Action, the maximum flow reduction in the DMC is estimated to be 1,457 cfs (44 percent reduction) from design capacity (Reclamation 2021a).

The No Project/ No Action Alternative includes current conditions in the project area and will be analyzed consistently with the Reinitiation of Consultation on the Coordinated Long-term Operations of CVP and SWP (ROC on LTO) and the 2018 Addendum to the Coordinated Operation Agreement Central Valley Project/State Water Project ROD that are assumed to also reasonably portray future anticipated operational conditions.

Design flows, reduction in flow, and actual flow capacities in the DMC for current and future (with future subsidence) conditions.

1.1.2 Alternative 2

Under Alternative 2, Raise Deficient Structures, the deficient lining, embankment, and impacted structures of the canal would be raised to restore the canal capacity to its original design flow capacity. Specific actions would include raising deficient concrete lining segments and bank segments to meet the minimum freeboard requirements, installing riprap for erosion protection to stabilize the banks along the earthen segment, replacing bridges and pipeline crossings that do not have enough clearance above water surface elevation to meet minimum required clearings, raising the gates of check structures and wasteways to design level and modify impacted structures, and evaluating existing drainage structures to modify them for safe passage of stormwater.

The proposed modifications of the canal and related structures would be in accordance with current federal, state, and local design guidelines and standards. Under this alternative, the canal would be modified to satisfy current Reclamation safety standards including freeboard requirements for the canal lining and embankment. Construction requirements for this alternative include:

- **Raising deficient canal concrete lining**. To achieve this, new concrete lining would be placed above the existing concrete lining, with seals installed between the old and new concrete linings to eliminate seepage. At locations with ladders installed in the concrete lining (every 750 feet), additional risers would be added in the new lining.
- **Raising the earth embankment at deficient bank segments of the canal**. This would be achieved by adding fill material from an existing borrow sites along the canal right-of-way (ROW). The added fill material would be rolled and smooth to match adjacent road elevations, and an asphalt chip seal will be installed on the left service road along the length of the canal.
- **Stabilizing the canal banks along the earthen-lined segment of the canal.** This would require lowering the water depth in the canal by up to six feet during construction, which would allow construction to extend about 6 feet below the Maximum Water Surface Elevation when the canal is operated at design flow (MWSEL). Two-foot-deep sections of earthen materials would be excavated from the sides of the canal, and a one-foot-thick strip of filter material would be installed above the excavated surface followed by a one-foot riprap that would be placed above the filter material.
- **Repairing distressed concrete lining above and below the water's surface.** Lining distresses were found to be either in the upper parts of the canal prism or more extensive, extending to the bottom of the canal prism. Distressed lining at locations above MP 50 (between station 1890+25 and 1905+00.00) include MPs 8.2 (between station 422+01 and 433+00), 17.8 (between stations 982+00 and 996+51), 18.1 (between stations 997+50 and 1019+48), 23.2 (between stations 1260+50 and 1268+37.31), 30 (between stations 841+88 and 862+00), 34 (between stations 1054+75 and 1060+00), 42.3 (between stations 1483+20 and 1505+00), and 42.6 (between stations 1506+19.5 and 1514+00). The

distresses at these locations are local and do not extend to the bottom of the canal, so to fix these the water depth would be lowered about 6 feet below the design level during construction. Damaged lining would be removed, and the embankment would be excavated for at least 2 feet below the lining where all materials would be removed and replaced with selected and acceptable earth fill material. At locations downstream of MP 50 (between station 1890+25 and 1905+00.00), the lining distresses extend under the water surface, and sections are distorted at these locations. Damaged concrete lining and material distorting the canal would be removed with underwater operations, and grouted mattress would be installed and grouted with cement underwater at applicable locations.

- **Replacing impacted vehicle bridges**. Forty-five bridges have been identified as impacted under Alternative 2. Identified bridges would be replaced by single span bridges with deep foundations at two abutments of the bridges in the concrete-lined segment. Along the earthen segment, intermediate piers would be constructed to support the replaced bridges within the canal prism. The low chord elevation of replaced bridges would be at least 3 feet above the MWSEL, including predicted subsidence. Asphalt pavement would be installed for the modified road segments. All affected utilities would be replaced and attached to newly constructed bridges. Earthwork would extend on both sides of the bridge to smoothly merge the profile of the bridge deck with the approach roads. Pipes carrying natural gas would be relocated under the canal utilizing horizontal directional drilling, whereas pipes carrying any other liquids would be replaced by pipes of equal diameter. New pipes would be epoxy coated and attached to bridges with hangers.
- **Replacing impacted pipeline crossings.** Thirty-six pipeline crossings have been identified as impacted under Alternative 2. The new pipelines would be carried by truss bridges, and pipes adjacent to each other would be carried by single bridges.
- **Modifying check structures and wasteways.** Although gates on check structures and wasteways were designed to have heights that exceeded the MWSEL at their locations, subsidence has caused an increase in water surface elevations which has resulted in some of these gates having heights lower than the MWSEL. To avoid overtopping, seventeen gates would require raising. Raising the heights of the gates could require changes to the drums, hoists, and cables to confirm that the gates will open to levels above the new MWSEL. The smaller (20 x 17 foot) gates are not likely to require hoist system replacements while the larger (18 x 15 foot) gates, located at check structures 14, 15, 16, 17, 19, and 20, are likely to require hoist system replacements.
- **Modifying turnouts.** Eighty-two turnouts on the left side of the canal would require raising. The walls requiring raise would be raised with concrete, the existing galvanized steel would be removed, and metal guards would be installed around each stilling pit for all gravitational turnouts.
- **Modifying drainage structures**. Work on drainage structures would include installing trash racks for drain inlets; installing flared inlets for pipe culverts without inlets; replacing drain inlets that require relocation during replacement of deficient bridges; installing additional drain inlets at MP 18.06 (station 997+25), 20.71 (station 1133+75), 41.08 (between stations 1427+00 and 1433+50), 49.83 (between stations 1889+00 and 1890+25)and 60.44 (station 2497+50); replacing existing headwalls and wing walls with new ones that are higher at MP 5.77 (station 303+15), 21.91 (station 1197+00), 25.62 (station 613+36), 30.63 (station 877+92), 41.93 (station 1474+40), 45.75 (station

1673+80), and 64.28 (station 2709+35); replacing the clogged side culvert at MP 5.77 (station 303+15) with a new box culvert, raising the headwalls for drain inlets, culverts, and overchutes at some locations; and installing or replacing riprap at inlets, outlets, culverts, and overchutes to protect embankment from erosion.

1.2 Project Area of Potential Effect

The APE is approximately 114 miles long and is located on multiple U.S. Geological Survey topographic quadrangle maps and within various Townships, Ranges, and Sections. The APE is depicted on these maps in Appendix A, Figure 1. The APE is located within Alameda, Contra Costa, Fresno, Merced, San Joaquin, and Stanislaus counties. Due to the need for operational flexibility for field staff, Reclamation's entire DMC ROW and some areas adjacent to the ROW are included in the APE. All access and staging will occur via existing operations and maintenance access roads along the DMC and would be contained within the ROW. The maximum vertical disturbance for the project will extend 100 feet for cone penetration tests and soil borings. The APE for the proposed activities amounts to 5,899 acres in total. Appendix A contains project location, vicinity, and APE maps.

1.3 Regulatory Context

Reclamation is the lead Federal Agency for the Project under NEPA, and the Authority is the lead State Agency under CEQA. As a federal undertaking, the Project is subject to Section 106 of the NHPA[1] (54 USC 300108), which states:

> The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking in any State and the head of any Federal department or independent agency having authority to license any undertaking, prior to the approval of the expenditure of any Federal funds on the undertaking or prior to the issuance of any license, shall take into account the effect of the undertaking on any historic property. The head of the Federal agency shall afford the [Advisory] Council [on Historic Preservation] a reasonable opportunity to comment with regard to the undertaking.

The implementing regulations of Section 106 of the NHPA are found in 36 CFR Part 800, which identifies the steps and consultation requirements that must be taken to comply with Section 106 of the NHPA. Pursuant to 36 CFR 800.16(l)(1), a historic property is defined as:

> any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria.

The criteria for determining NRHP eligibility are found in 36 CFR Part 60.

[1] Following ACHP guidelines, "Section 106" is referred to as that section of the original public law that enacted the NHPA as opposed to its current legal citation (54 USC 306108). It is a reference that has been in constant use for almost 50 years. The provisions of the newly codified NHPA may be found under 54 USC 300101 et seq.

In the event that historic properties within the APE for an undertaking will be subject to adverse effects, the lead federal agency is required to consider ways to avoid, minimize, or mitigate ("resolve") such effects, in consultation with the Advisory Council on Historic Preservation (ACHP), the State Historic Preservation Officer (SHPO), and other Section 106 consulting parties. This often requires the development and execution of a Memorandum of Agreement or Programmatic Agreement among the consulting parties (36 CFR 800.6).

Section 106 regulations allow federal agencies to conduct "nondestructive project planning activities before completing compliance with Section 106" (36 CFR 800.1[c]), provided any subsequent consideration of alternatives to avoid, minimize, or mitigate adverse effects is not restricted during the planning process. At this time, Reclamation does not have an undertaking with the potential to affect historic properties as the feasibility and environmental studies are planning activities. Should Congress authorize an identified Project alternative or other Project that addresses the stated aims of the Project, and the lead Federal Agency has an undertaking as defined in 36 CFR 800.14(y) and 800.3(a)(1), that federal action will then be subject to NHPA Section 106 compliance and other federal cultural resources laws as applicable.

Because the Project construction alternative includes lands owned and administered by Reclamation, additional cultural resource policies and procedures also are relevant. Among these is the Native American Graves Protection and Repatriation Act (NAGPRA) (Public Law 101-601; 25 USC 3001-3013), which describes the rights of Native American lineal descendants, Indian tribes, and Native Hawaiian organizations with respect to the treatment, repatriation, and disposition of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony, referred to collectively in the statute as "cultural items," with which they can show a relationship of lineal descent or cultural affiliation. NAGPRA also establishes procedures for the inadvertent discovery or planned excavation of Native American cultural items on federal or tribal lands.

Additional mandates applicable to Reclamation administered lands are outlined in the manuals "Policy for Cultural Resources Management" (LND P01; Reclamation 2012a), "Directives and Standards for Cultural Resource Management" (LND 02-01; Reclamation 2012b), and "Administration of the Archaeological Resources Protection Act (ARPA) on Bureau of Reclamation Land" (LND 02-04; Reclamation 2014). Reclamation is also guided by the "Policy for Museum Property Management" (LND P05; Reclamation 2012c) and "Directives and Standards for Museum Property Management" (LND 02-02; Reclamation 2012d).

1.3.1 National Register of Historic Places

The NRHP is "an authoritative guide to be used by federal, state, and local governments, private groups, and citizens to identify the Nation's cultural resources and to indicate what properties should be considered for protection from destruction or impairment" (36 CFR 60.2). Eligibility for inclusion in the NRHP is determined by applying the following criteria, which were developed by the National Park Service in accordance with the NHPA and outlined in 36 CFR 60.4:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and
>
> A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> B. That are associated with the lives of persons significant in our past; or

C. That embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. That have yielded, or may be likely to yield, information important in prehistory or history.

Any prehistoric or historic period district, site, building, structure, or object that meets one or more of the criteria above and possesses sufficient integrity may be eligible for inclusion in the NRHP as a historic property.

Typically, cemeteries, birthplaces, or graves of historic period figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, commemorative properties, and properties that have achieved significance within the past 50 years are not considered eligible for listing in the NRHP. Such properties may qualify, however, if they are integral parts of districts that do meet the criteria or if they fall within the following categories:

- A religious property deriving primary significance from architectural or artistic distinction or historical importance; or
- A building or structure removed from its original location, but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or
- A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life.
- A cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or
- A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or
- A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or
- A property achieving significance within the past 50 years if it is of exceptional importance (36 CFR 60.4).

1.3.2 California Environmental Quality Act

State historic preservation regulations affecting the Project include the statutes and guidelines contained in CEQA. CEQA requires the lead State Agency to consider carefully the potential impacts of a project on historical resources. A “historical resource” includes, but is not limited to, any object, building, structure, site, area, place, record, or manuscript that is considered historically or archaeologically significant (PRC 5020.1). Section 15064.5 of state CEQA *Guidelines* specifies criteria for evaluating the significance or importance of cultural resources as follows:

- The resource is associated with events that have made a contribution to the broad patterns of California history;
- The resource is associated with the lives of persons important in our past;
- The resource embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important individual or possesses high artistic values; or
- The resource has yielded, or may be likely to yield, important information in prehistory or history.

The technical advice series produced by the California Governor's Office of Planning and Research offers guidance on procedures to identify historical resources, evaluate their importance and potential for listing in the CRHR, and estimate potential impacts on historical resources. The advice series strongly recommends that Native American concerns and the concerns of other interested persons and corporate entities including, but not limited to, museums, historical commissions, associates, and societies be solicited as part of the process of cultural resources inventory. In addition, California law protects Native American burials, skeletal remains, and associated grave goods regardless of their antiquity and provides for the sensitive treatment and disposition of those remains.

1.3.3 California Register of Historical Resources

The CRHR, which is similar to the NRHP, is an authoritative guide that was created to identify the state's historical resources and to indicate what properties are subject to protection, to the extent prudent and feasible, from substantial adverse change. The criteria for CRHR eligibility are based upon NRHP criteria. Certain resources are determined by the statute to be automatically included in the CRHR, including California properties formally determined eligible for or listed in the NRHP, California Historical Landmarks (CHL) numbers 770 and above, and California Points of Historical Interest.

Per the CRHR, historical resources may consist of buildings, structures, objects, or archaeological sites. Each of these entities is assessed for its historical, architectural, archaeological, cultural, or scientific importance. Per CEQA *Guidelines*, (Section 15064.5[b]), project activities may have a significant impact on the environment if they would cause a substantial adverse change in the significance of a historical resource. Activities that could result in a substantial adverse change include demolition, replacement, substantial alteration, and/or relocation of the resource. Steps that must be implemented in order to comply with state CEQA *Guidelines* include the following:

- Identify cultural resources;
- Evaluate the significance of the cultural resources based on established thresholds of historical, architectural, archaeological, cultural, or scientific importance;
- Evaluate the effects of a project on all cultural resources; and

- Develop and implement measures to mitigate the effects of the project on significant cultural resources.

The state Office of Historic Preservation has broad authority under federal and state law for the implementation of historic preservation programs in California. The SHPO comments on effect determinations and the eligibility of cultural resources for listing in the NRHP and the CRHR.

1.4 Personnel

John Holson, MA, RPA, and Anmarie Medin, MA, RPA, served as co-principal investigators for this Project. Christopher Peske, BA, served as field director with Ashley Schmutzler, MA, serving as assistant field director. Archaeologists who participated in fieldwork included Griffen Bragagnolo, BA, Gloria Brown, MA, Jack Flynn, BA, Myra Jamison, Bridget Parry, BA, and Walter Tovar Saldana, MA. Graham Dalldorf, MA, served as the geoarchaeologist for the Project. Mr. Peske was the lead author of this report under the supervision of Mr. Holson. Ms. Medin, Ms. Holm, Elena Reese, MA, Mr. Dalldorf, and Ms. Jamison provided contributions to the report. All key personnel involved in the Project meet the professional qualification standards described in *Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines*.

2.0 Setting Summary

2.1 Physical Context and Setting

The DMC runs through several physiographic provinces and biotic communities which are briefly described here because they have bearing on human occupation of the landscape and thus cultural resources that might be affected by the project. The locations and characteristics of California Native American temporary and permanent habitations, procurement areas, and travel routes were influenced by local physiography, flora, and fauna, as were later historic period settlements, infrastructural developments, and commercial enterprises.

The DMC APE lies along the western side of the San Joaquin Valley at the ecological interface with the eastern Diablo Range foothills, where the peaks and mountains to the west give way to the low-lying Central Valley alluvial plain to the east. Excellent treatments of Central Valley physiography, flora, and fauna may be found in Schoenherr (1992), Lightfoot and Parrish (2009), Munz (1963), Bartow (1991), and Rosenthal and Meyer (2004a). The following discussion draws heavily on these sources.

The Diablo Range is marked by a number of seismic faults that have helped to contribute to its varied topography of variable peaks, valleys, and plateaus. Jurassic to Cretaceous metamorphic rock (Franciscan Complex) underly the Range. Soils within the eastern Diablo Range foothills include Carbona-Calla and Wisflat-Badland Arburua series soils in the north and O'Neil-Apollo and Wisflat-Badland Arburua series soils to the south (USDA-NRCS 2007). The A-horizon (surface or near surface) texture of most of these soils may be characterized as loam or clay-loam with 0-30% gravel inclusions. Colors range from brown or dark brown to grayish brown or dark gray. Today, many of these soils support annual forbs and grasses as well as livestock grazing.

The eastern margins of the Diablo Range are characterized by Valley Grassland, which once dominated all well-drained areas within the Central Valley and the larger valleys of the Coast Ranges (Schoenherr 1992). This grassland was largely characterized by perennial bunchgrasses such as needle-grass (*Stipa* spp.), triple-awned grass (*Aristida* spp.), bluegrass (*Poa* spp.), and rye grass (*Elymus* spp.), though annual grasses and herbs also were prevalent along the western edges of the San Joaquin Valley (Schoenherr 1992). Shrubs such as saltbush (*Atriplex polycarpa*) dotted the alluvial fans of the eastern Diablo Range, providing forage for herds of pronghorn. With the arrival of Europeans and the spread of agriculture, many cultivated species were introduced in addition to many Old World weed species such as wild oats (*Avena fatua*), brome grass (*Bromus* spp.), filaree (*Erodium cicutarium*), and star-thistle (*Centaurea melitensis)*, among others.

Until the late 1800s when Euro-American settlement increased dramatically, tule elk (*Cervus canadensis nannodes*), pronghorn (*Antilocapra americana*), and black-tailed deer (*Odocoileus hemionus*) were widespread within the Diablo Range foothills and the San Joaquin Valley. Herds of these animals would have been found throughout Valley Grassland habitats and would have ranged in response to seasonal conditions between the riparian forests and marshes of the lowlands to the lower limits of the foothill woodlands. Pronghorn and tule elk were thought to have been extirpated from the Central Valley by 1870, though a single pair of tule elk was discovered near Buena Vista Lake in 1874, and conservation measures were ultimately undertaken to protect the species in the 1970s (Linse 1998). Pronghorn, once found throughout California, were reintroduced in certain parts of the state, though their numbers remain vastly reduced (Schoenherr 1992:550).

Other mammals once common within the foothills included the grizzly bear (*Ursus arctos* ssp.), black bear (*Ursus americana*), gray wolf (*Canis lupus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus)*, mountain lion (*Puma concolor),* spotted skunk (*Spilogale putorius*), stripped skunk (*Mephitis mephitis*), badger (*Taxidea taxus*), and raccoon (*Procyon lotor*). Smaller mammals such as the cottontail (*Sylvilagus audoboni*), brush rabbit (*Sylvilagus bachmani*), gray squirrel (*Sciurus griseus*), ground squirrel (*Spermophilus beecheyi*), and gopher (*Thomomys bottae)* were also prevalent.

Bird species including the California quail (*Callipepla californica*), dusky grouse (*Dendragapus obscures),* Stellar's jay (*Cyanocitta stelleri),* red-tailed hawk (*Buteo jamaicensis*), black-shouldered kite (*Elanus leucurus*), American kestrel (*Falco sparverius*), California condor (*Gymnogyps californianus*), and raven (*Corvus corax*) were common. Although some of these species such as the kite and kestrel have benefitted from human activities, others such as the condor have suffered from habitat destruction, poaching, and lead poisoning (Schoenherr 1992). Within the shallow streams of the foothills, steelhead trout (*Oncorhynchus mykiss*), Chinook salmon (*Oncorhynchus tshawytscha)*, Sacramento sucker (*Catostomus occidentali*), and Sacramento pike-minnow (*Ptychocheilus grandis*) may have been encountered.

Historic period settlement of the eastern Diablo Range foothills resulted in dramatic changes to the biotic communities that once characterized the region. As Schoenherr (1992:520) has pointed out, "only about 1% of the grassland today could be considered pristine." Many animal species that were once widespread and integral to California Native American lifeways were extirpated within the DMC vicinity or, as in the case of the California grizzly, driven to extinction. Other species, such as rodents, skunks, and certain birds of prey, have thrived and remained abundant.

2.2 ARCHAEOLOGICAL CONTEXT

2.2.1 Central California Archaeology and the Development of Cultural Sequences

The archaeological record within the Central Valley encompasses the full range of prehistoric hunter-gatherer adaptations. Native Californians within the Central Valley developed a sophisticated material culture, became central figures within an extensive trade system incorporating distant and neighboring regions, and achieved population densities equaled only by agricultural societies in the American Southwest and Southeast (Rosenthal et al. 2007). Despite its centrality to California prehistory, however, archaeological research within the Central Valley has progressed relatively little within the three decades since Moratto's (1984) synthesis of California archaeology.

The eastern Diablo Range foothills and the lower Delta and San Joaquin Valley areas that make up the Study Area are characterized by quaternary landscapes with low-elevation alluvial fans, stream channels, sloughs, marshes, and hilly grasslands. Dramatic environmental changes occurred during prehistory within the San Joaquin Valley, including faunal extinctions, the emergence of wetlands, flooding and siltation of bottom lands, the cyclical advent and disappearance of shallow lakes, and numerous climatic fluctuations (Moratto 1984). No single cultural historical framework has been established that accommodates the entire prehistoric record of the Central Valley, though detailed cultural chronologies have been derived for certain sub-regions such as the lower Delta. In discussing the cultural history of the Study Area, it is therefore appropriate to use the broad period and stage classification system developed by Fredrickson (1974) and refined by Rosenthal et al. (2007:150) while referencing more localized cultural historical sequences put forth by Olsen and Payen (1969) and Groza (2002). Broad cultural periods identified for the Central Valley include the Paleo-Indian (13,500-10,500 BP), Lower Archaic (8,500-7,500 BP), Middle Archaic (7,500-2,500 BP), Upper Archaic (2,500-850 BP), and Emergent (850-150 BP) periods. More localized sequences relevant to the Study Area, which were defined largely through distinctive artifact types and mortuary practices, include the Positas (ca. 5,250-4,550 BP), Pacheco (4,550-1,650 BP), Gonzaga (1,650-950 BP), and Panoche (450-100 BP) complexes.

Key temporal phases are outlined in Table 2-1. Organized by geologic time sequence, a chronological synthesis for the Central Valley by Rosenthal et al. (2007) is presented in addition Olsen and Payen's (1969) Diablo Range Foothills sequence and Groza's (2002) San Francisco Bay-Delta Region Scheme D1. All three temporal schemes may be useful in examining the prehistory of the Delta Mendota general area, though the synthetic sequence offered by Rosenthal et al. (2007) and the more localized sequence offered by Olsen and Payen (1969) will be most relevant to the eastern foothills of the Diablo Range and the western margins of the San Joaquin Valley.

The chronological sequence developed by Rosenthal et al. (2007) is based on the Central California Taxonomic System (CCTS), the first cultural chronological scheme developed to describe the prehistory of Central California. The tripartite CCTS sequence was consistent with other archaeological frameworks developed contemporaneously throughout much of North America. The archaeological sites used to develop the framework were centered on the rivers and tributaries that flowed into the Sacramento-San Joaquin Delta area as reported in various publications (Lillard et al. 1939). Key among them was CA-SAC- scheme was 107 (the Windmiller Site), located on the Cosumnes River. CA-SAC-107, unlike other sites on which the scheme was based, appeared to contain three distinct and stratified prehistoric components (i.e., Early, Middle, and Late) as well as a later post-contact period component. Subsequent revisions to the CCTS included those by Beardsley (1948), Fredrickson (1974), and Milliken et al. (2007), though most archaeologists now recognize three basic time periods with two transitional periods (Rosenthal et al. 2007). According to Groza's (2002) San Francisco Bay-Delta Region sequence, these are referred to as the Early Period, Early-Middle Period Transition, Middle Period, Middle-Late Period Transition, and Late Period (see Table 2-1).

Unlike Groza's scheme, the chronological sequence developed by Olsen and Payen (1969) is more specific to the eastern Diablo Range. During the 1960s, in anticipation of the construction of the nearby San Luis, Los Banos, and Little Panoche reservoirs, numerous early Native Californian sites were investigated. The more substantial sites found in these areas were the focus of intensive subsurface investigations (Nissley 1975; Olsen and Payen 1968, 1969, 1983; Pritchard 1970, 1983; Romoli and Ruby 1963). Based on the findings from some of these investigations, Olsen and Payen (1969) and Moratto (1984) proposed estimated dates for the prehistoric cultural sequence of the area that included the Positas, Pacheco, Gonzaga, and Panoche complexes. An older, ephemeral Paleo-Indian period dating to the Terminal Pleistocene has also been recognized in the San Joaquin Valley (Rondeau et al. 2007). Varying occurrences of typologically and technologically distinct artifacts have provided archaeologists with a general sequence of cultural change over time. The causes of these changes tend to be varied, complex, and intricately interrelated, and include factors such as climatic changes and shifts in cultural contact and movement.

Table 2-1 Concordance of Pertinent Chronological Sequences.

Years BP	Geologic Time Sequence	Central Valley Sequence (Rosenthal et al. 2007)	Diablo Range Foothills (Olsen and Payen 1969)	San Francisco-Bay Delta Sequence (Groza 2002)
Present		Emergent Period (850-150 BP)	Panoche Complex (450-100 BP)	Late Period (675-250 BP)
1,000	Late Holocene	Upper Archaic Period (2,500-850 BP)	Gonzaga Complex (1,650-950 BP)	Middle-Late Period Transition (950-675 BP); Middle Period (2,150-950 BP)
2,000				Early Middle Period Transition (2,450-2,150 BP)
3,000			Pacheco Complex (4,550-1,650 BP)	Early Period (3,800-2,450 BP)
4,000		Middle Archaic Period (7,500-2,500 BP)		
5,000	Middle Holocene			
6,000			Positas Complex (5,250-4,550 BP)	
7,000				
8,000				
9,000	Early Holocene	Lower Archaic Period (10,500-7,500 BP)		
10,000		Paleo-Indian Period (13,500-10,500 BP)		
11,000				

2.2.2 The Paleo-Indian Period (13,500-10,500 BP)

Although humans may have been present in North America well before the Paleo-Indian Period, the best available archaeological evidence indicates that the earliest inhabitants of North America arrived sometime around 13,500 years ago (Rosenthal et al. 2007:151). Evidence for Paleo-Indian occupation of the San Joaquin Valley comes primarily from isolated finds of fluted projectile points recovered from remnant Pleistocene landforms (Rondeau et al. 2007), including one point collected from CA-MER-215 (the Wolfsen Mound) near Newman, California (Peak and Weber 1978 in Dillon 2002) and from two sites located near Tracy Lake and the Tulare Lake Basin (Rosenthal et al. 2007:151). These points have often been compared to Clovis Series projectile points, which have been securely dated elsewhere in North American to the period between 13,500-11,500 BP. To date, the most extensive evidence for the Paleo-Indian Period occupation of the San Joaquin Valley comes from CA-KIN-32 (the Witt site), which is located in Kings County along the ancient shoreline of Tulare Lake (Moratto 1984:81-82). CA-KIN-32 revealed hundreds of early concave base points, and the uranium series dating of human bone from the site produced uncalibrated dates of 11,379, 11,380, and 15,802 BP. Although they could not be clearly linked either to the human bone or projectile points, bones from extinct fauna recovered from CA-KIN-32 also produced dates of 10,788, 15,696, and 17,745 BP (Rosenthal et al. 2007: 151). Evidence for early human occupation within the San Joaquin Valley remains sparse, though recent geoarchaeological studies (Rosenthal and Meyer 2004a; White 2003) have highlighted the potential to encounter Paleo-Indian sites in buried Late Pleistocene deposits that have been subject to repeated episodes of deposition and erosion.

2.2.3 Lower Archaic (10,500-7,500 BP)

Climatic changes at the end of the Pleistocene brought about a significant period of deposition along the alluvial fans and floodplains of the Central Valley beginning around 11,000 BP. Many Late Pleistocene landforms were subsumed, resulting in the formation of a geologic boundary between Late Pleistocene and Early Holocene sediments (Rosenthal and Meyer 2004b). Further climatic changes around 7,500 BP during the Middle Holocene resulted in an additional cycle of deposition, which likely buried or obscured many Lower Archaic Period archaeological deposits within the Central Valley (Meyer and Rosenthal 1997). Due in part to these factors, evidence for the Lower Archaic Period occupation of the Central Valley is relatively sparse and is mostly represented by isolated finds such as the stemmed projectile points, flaked stone crescents, and steep-edged, flaked stone tools that have been noted along the shores of Tulare Lake (Wallace and Riddell 1991). To date, only one significant Lower Archaic Period archaeological deposit has been reported within the San Joaquin Valley basin. CA-KER-116, situated along the ancient Buena Vista Lake shoreline, was found to contain a subsurface component comprised of flaked stone crescents, a carved stone atlatl spur, a few flaked stone tools, human remains, and a small but varied faunal assemblage made up of fish, shell, bird, and artiodactyl remains. Researchers did not report on the presence of milling implements or plant remains at CA-KER-116, though radiocarbon dates associated with the site ranged from 9,125-8,400 BP (Fredrickson and Grossman 1977; Hartzell 1992). No large mammal remains were noted at CA-KER-116, but the occurrence of large, heavily worked projectile points led some to argue that deer, pronghorn, and elk must have been an important part of the Lower Archaic Period diet (Rosenthal et al. 2007:152).

Although little evidence for milling implements or plant processing has been recovered from Lower Archaic Period valley basin assemblages, investigations in the eastern Diablo Range foothills have revealed extensive signs of early plant processing. Lower Archaic Period sites that appear to have been seasonally occupied have been recorded containing abundant groundstone implements such as handstones and milling slabs (Meyer and Rosenthal 1997). Based on the presence of these implements and the predominance of acorn and pine nutshell at sites such as CA-CAL-629/630 (the Skyrocket Site) and at CA-COL-696 (the Los Vaqueros Site), some researchers have argued that nut crops associated with the foothill woodlands were a main dietary focus (Moratto 2002; Rosenthal et al. 2007), rather than small seeds as others have argued (Basgall 1987; McGuire and Hildebrandt 1994). Rosenthal et al. (2007:152) posited that the distinct foothill and valley basin cultural traditions and adaptations that became apparent in Middle Archaic Period sites emerged during the Lower Archaic Period, though the relative scarcity of Lower Archaic Period sites along the valley floor renders that difficult to confirm.

2.2.4 Middle Archaic (7,500-2,500 BP)

The Middle Holocene was characterized by warmer, dryer climatic conditions, and many of the pluvial lakes that hunter-gatherers relied on gradually receded or disappeared. At the same time, alluvial fans and floodplains stabilized, and the extensive wetland habitat of the Sacramento-San Joaquin River Delta formed as rising sea levels pushed inland. Many of the most extensive archaeological deposits in the Central Valley have been found in association with deeply buried, stabilized Middle Holocene alluvial landforms (Rosenthal et al. 2007:152). Excavations at CA-COL-247 for instance revealed Middle Archaic Period cultural materials dating to 5,970 BP associated with Middle Holocene soils buried at a depth of 3-3.5 meters below the ground surface (Rosenthal et al. 2007:153).

Evidence from a number of sites has indicated that distinctions between foothill and valley floor settlement and subsistence practices became pronounced within the Middle Archaic Period (Fredrickson 1994; Rosenthal and Meyer 2004b). Deposits within the eastern Diablo Range foothills dating to between 6,000-4,000 BP have been recorded, many in buried contexts (Rosenthal et al. 2007; Rosenthal and Meyer 2004a). Assemblages from these deposits have typically included abundant groundstone tools for chopping, scraping, and pounding along with macrofloral remains dominated by acorns and pine nuts (McGuire 1995; Rosenthal and McGuire 2004; Wohlgemuth 2004). Similar assemblages dating to the Middle Archaic Period have been noted as far north as Sacramento and as far south as Kings River in the southern San Joaquin Valley. Within the eastern Diablo Range foothills, sites such as CA-SOL-315 and CA-GLE-217 have been associated with the Mendocino Pattern, a more localized adaptive expression characterized by high residential mobility (Fredrickson 1974). In general, foothill assemblages were dominated by flaked and groundstone tools used for food procurement and processing with few bone or shell artifacts, beads, or ornaments, though tabular pendants have been broadly if infrequently noted (Basgall and Hildebrandt 1989; Rosenthal and McGuire 2004). Projectile points included notched, stemmed, thick-leaf, and narrow concave base darts with a high degree of local and regional variability. Raw material for flaked stone tools varied widely among eastern Diablo Range foothill sites, due largely to a reliance on local raw materials, though imported obsidian from quarries in the North Coast Ranges, Cascade Mountains, and eastern Sierra Nevada Mountains has been reported (White and Weigel 2006).

In contrast to the eastern foothills of the Diablo Range, comparatively few Middle Archaic Period sites within the San Joaquin Valley basin have been discovered. This is largely attributable to the geomorphic processes noted above and to the urban and agricultural development that has altered so much of the valley floor. Some stratigraphically intact deposits have been recovered, however, notably CA-SJO-68 in San Joaquin County, which was dated to at least 5,000 BP. Sites associated with the later Middle Archaic Period (ca. 4,500 BP) are better represented, particularly in the lower Delta and northern San Joaquin Valley region. Sites such as CA-CCO-637, CA-SJO-068, CA-SJO-112, CA-SJO-142, and CA-SJO-145 have yielded elaborate and diverse assemblages that reflect complex socio-political strategies focused on riverine and marsh resources (Heizer 1949; Moratto 1984; Ragir 1972; Wohlgemuth 2004). Those assemblages included dart points (large, square-stemmed, and contracting-stemmed forms); mortars and pestles indicating a continued reliance on acorns and pine nuts; elaborate fishing technologies (e.g., gorges, composite bone hooks, and spears); basketry and cordage; ceramic items; stone, bone, and shell objects (*Olivella* beads and *Haliotis* ornaments); large burial areas; and non-local materials such as obsidian from the North Coast Ranges (e.g., Napa Valley and Borax Lake sources) and eastern Sierra Nevada Mountains (e.g., Bodie Hills, Casa Diablo, and Coso). These assemblages have been interpreted as a reflection of increasing residential stability and more intensive and logistically organized subsistence practices (Rosenthal et al. 2007: 153-155).

The archetypal expression of the Middle Archaic Period was identified as the Windmiller Pattern by Fredrickson (1973) and Moratto (1984) and was recognized at several sites along freshwater marshes and riparian corridors. Those sites were marked by western-oriented ventrally and dorsally extended burials with extensive grave offerings. Recent investigations have suggested that Windmiller sites were widespread throughout the San Joaquin Valley during the Middle Archaic Period and did not necessarily spread from the Delta region as previously supposed (Heizer 1958; Beardsley 1954). In fact, this tradition of extended burials has been recognized throughout the San Joaquin Valley from Buena Vista Lake northward, persisting into the Upper Archaic Period.

Positas Complex and Pacheco Complex

Localized expressions of the Middle Archaic Period within the Delta Mendota Study Area included the Positas Complex (5,250-4,550 BP) and the Pacheco Complex (4,550-1,650 BP), both of which were represented at CA-MER-094. The Positas Complex, closely associated with the Early Period of Groza's (2002) San Francisco Bay-Delta Region scheme, was distinguished by small, shaped mortars; short, cylindrical pestles; millngstones; perforated flat cobbles; and spire-lopped Olivella beads (Moratto 1984:191; Olsen & Payen 1969:41). The Pacheco Complex was marked by two distinctive phases that were associated with the late Early Period and Upper Middle Period of the San Francisco Bay-Delta Region scheme (Groza 2002). These phases included Pacheco B, which pre-dated 3,550 BP, and Pacheco A, which post-dated 3,550 BP. Pacheco B was marked by foliate bifaces, rectangular *Haliotis* ornaments, and thick Olivella beads; Pacheco A was distinguished by a proliferation of Olivella bead types; perforated canine teeth; bone awls, whistles, and saws; stemmed and side-notched projectile points; and abundant millingstones, mortars, and pestles (Moratto 1984:192; Olsen and Payen 1969).

2.2.5 Upper Archaic (2,500-850 BP)

The early Upper Archaic Period roughly coincided with the onset of cooler, wetter, and more stable Late Holocene climatic conditions (Rosenthal et al. 2007:155). The lakes that had receded during the Middle Archaic Period returned to their former levels during the Upper Archaic Period, which was also marked by increased freshwater flows into the Sacramento-San Joaquin Delta. Increased soil deposition and formation also occurred during the Late Holocene, capping many earlier Middle Holocene soils and land surfaces (Rosenthal and Meyer 2004a).

Rosenthal et al. (2007:156) noted that "a geographically complex mosaic of distinct sociopolitical entities marked by contrasting burial positions, artifact styles, and other elements of material culture" proliferated during the Upper Archaic Period. These elements of material culture included bone tool types (e.g., tubes, ornaments, and wands), the widespread manufacture and distribution of *Olivella* beads and *Haliotis* ornaments, obsidian biface blanks produced from eastern Sierra Nevada Mountain obsidian sources, ceremonial blades, and charmstones (Rosenthal et al. 2007). In the Delta and portions of the Sacramento and San Joaquin valleys, mortars and pestles became increasingly prevalent in the archaeological record, indicating a heavier reliance on acorns (Moratto 1984, Wohlgemuth 2004), while along the valley margins handstones and milling slabs dominated Upper Archaic Period assemblages along with macrofloral evidence of acorns and pine nuts (Jackson and Ballard 1999). Faunal assemblages reflected regional subsistence strategies that focused on bulk processing of salmon, shellfish, rabbits, and deer or elk.

In the eastern Delta, the Windmiller tradition was replaced by the Berkeley Pattern (Fredrickson 1973), signaled by extensive habitation features and debris reflecting long-term residence, though the Windmiller tradition persisted within the San Joaquin Valley along the western and southern edges of the Delta and along the streams and marshes of Merced County at CA-MER-3, CA-MER-215, and CA-MER-323, (Dougherty and Werner 1993; Peak and Weber 1978; Pritchard 1970). The western margins of the San Joaquin Valley appear to have marked a transitional area, featuring discrete cemeteries with flexed (e.g., CA-MER-94 and CA-CCO-696) or extended burials (e.g., CA-MER-3 and CA-CCO-696), and it has been suggested that the area was alternatively occupied by groups originating in the valley and from the adjacent eastern Diablo Range (Rosenthal et al. 2007:156). Upper Archaic Period acquisition of obsidian in the San Joaquin Valley from sources in the eastern Sierra Nevada Mountains persisted, and in the lower Delta area obsidian from western sources in Napa Valley and the North Coast Ranges also continued to be significant.

Gonzaga Complex

The localized Upper Archaic Period sequence documented within the Delta Mendota Study Area vicinity was termed the Gonzaga Complex (1,650-950 BP), which straddled the Upper Middle Period and initial Late Period according to the San Francisco Bay-Delta Region scheme (Groza 2002). It has been noted in deposits throughout the western side of the San Joaquin Valley (Moratto 1984:192), specifically at sites such as CA-MER-3, CA-MER-14, and CA-MER-94. The Gonzaga Complex was marked by a mix of extended and flexed human burials; bowl mortars; squared and tapered-stem projectile points; grass saws; characteristic Haliotis ornaments; and thin rectangular, split-punched, and oval Olivella beads (Moratto 1984:192; Olsen and Payen 1969). Much remains unknown about the Gonzaga Complex, as excavated occurrences have consisted almost exclusively of funerary sites, and the majority of the artifacts have been comprised of grave goods (Breschini et al. 1983:79).

2.2.6 The Emergent Period (850-150 BP)

Late Holocene climatic conditions continued into the Emergent Period, but episodes of flooding, deposition, and drought have also been documented (Rosenthal and Meyer 2004a). By the Emergent Period, Native Californians living within the San Joaquin Valley had developed the cultural traditions that would be noted at the time of European contact. These traditions included technological adaptations such as the bow and arrow and the fish weir. Native trade networks also appear to have changed during the Emergent Period, as shell beads assumed the role of currency throughout much of the region. Population densities, which had been growing steadily in the Central Valley since the Middle Archaic period, continued to increase during the Emergent Period; this growth correlated with an intensification of hunting, gathering, and fishing as well as increased socio-political complexity (Rosenthal et al. 2007:159). Large, populous villages developed at strategic locations along river courses for accessing seasonally abundant salmon runs (White 2003), and villages and smaller residential communities continued to grow along the many side streams of the foothills and along the river channels and sloughs of the San Joaquin Valley floor (Olsen and Payen 1968; Pritchard 1970).

Panoche Complex

Within the Central Valley, the Emergent Period is most often associated with the Panoche Complex (450-100 BP) (Olsen and Payen 1968, 1969, 1983; Pritchard 1970), which was associated with the terminal Late Period of the San Francisco Bay-Delta scheme (Groza 2002). It has been distinguished at many western San Joaquin Valley sites by the remains of large, circular structures; flexed burials as well as primary and secondary cremations; millingstones; varied mortar and pestle types; bone awls, saws, whistles, and tubes; side-notched projectile points; clamshell disk beads; Haliotis disk beads; and Olivella lipped, side-ground, and rough disk beads (Moratto 1984:193). Although the Panoche and Gonzaga complexes have been documented through a number of sites, there appears to have been a hiatus of approximately 500 years between them both. That lapse may be due to a period of unfavorable climatic conditions—conditions that could not support oaks and a subsistence system focused on the gathering and processing of acorns. Direct archaeological evidence for a dramatic decrease in acorn-bearing oaks during this period has yet to be documented, though additional research may shed some light on the apparent abandonment of the region between approximately 950 and 450 BP (Olsen and Payen 1969; Moratto 1984:191-193).

While a 500-year occupation hiatus between the Gonzaga and Panoche complexes may be apparent based on the excavations of sites in the Pacheco Pass area, according to Breschini and Haversat (1987), this apparent abandonment may have been somewhat limited and fairly localized in nature. Based in part on excavations conducted at CA-FRE-1333, Breschini and Haversat have suggested that the Gonzaga complex dates should probably be extended several hundred years, considerably narrowing the gap between the Gonzaga and Panoche complexes. Evidence for a period of abandonment in the late Panoche to early Gonzaga complexes could still be discerned at CA-FRE-1333, however, as could a dramatic change in site function from a small village to a sporadically utilized camp or shelter (Breschini and Haversat 1987:39).

Although Pritchard (1970) noted some Emergent Period and early historic period materials at CA-MER-3, early accounts suggest that Pacheco Pass and the area around San Luis Reservoir had been largely abandoned by local Native Californians by the early 19th century (Latta 1949; Olsen and Payen 1968). Much of this was likely due to the increased Spanish, Mexican, and American use of the pass as an important transportation route. Bands of cattle and horse thieves reportedly made frequent use of Pacheco Pass, and military expeditions also made incursions into the area in search of runaway coastal mission neophytes or in search of new workers. Collectively, these pressures proved too much for the local Native inhabitants who had largely fled the vicinity by the 1840s and early 1850s (Shumate 1977:22).

2.3 Ethnographic Context

The DMC APE falls within the traditional territory of the Northern Valley Yokuts (Kroeber 1925; Latta 1949, 1977; Olsen and Payen 1968; Wallace 1978), one of three ethnographically and linguistically defined groups that occupied the San Joaquin Valley at the time of European contact. Generally speaking, the Northern Valley Yokuts inhabited the territory extending from the crest of the Diablo Range in the west to the foothills of the Sierra Nevada Mountains in the east and from where the San Joaquin River makes its turn northward in the south to the area midway between the Calaveras and Mokelumne rivers in the north (Wallace 1978:462). The other two groups that occupied the San Joaquin Valley included the Southern Valley Yokuts, who inhabited the region around Tulare Lake, and the Foothill Yokuts, who inhabited the lower reaches of the Sierra Nevada Mountains (Kroeber 1925, Wallace 1978). Collectively, these three Yokuts groups comprised a population of roughly 41,000 individuals at the time of European contact.

The Yokuts were hunter-gatherers who divided themselves into kin and language-based tribelets, resulting in a mosaic of smaller territories and discrete settlements (Kroeber 1925:474). The Yokuts' Penutian language was spoken by some 40 groups using distinctive but closely related dialects. Those groups clustered primarily along narrow strips of land bordering the San Joaquin River and its tributaries, as well as lands east of the river along the Sierra Nevada foothills. Fewer Yokuts are believed to have inhabited the western margins of the San Joaquin Valley, where villages were typically located along watercourses such as Los Banos and Panoche creeks (Wallace 1978:463). Mission birth, baptismal, and death records have been used to reconstruct information on many Native Californian tribelets, and several have been identified within Northern Valley Yokuts territory (Milliken 1995, 2008: Figure 2). These tribelets included *Jalalon*, *Tauquimne*, and *Tamcan* groups in the delta region; *Laquisemne* (*Tonul*) on the Stanislaus River between the San Joaquin River and Sierra Nevada Mountain foothills; *Apelamam* (*Huocon*) on the Merced River between the San Joaquin River and Sierra Nevada Mountain foothills; *Mayem* (*Tejey*) from roughly opposite the mouth of the Merced River south to Mendota; and other tribelets inhabiting the banks of the Chowchilla, Fresno, and San Joaquin rivers within the Sierra Nevada Mountain foothills (Wallace 1978:466).

Tribelet territories were generally defined by physiographic features such as sloughs and rivers. Lightfoot and Parrish (2009:80) have posited that these territories would have been sufficiently large and diverse so as to provide a range of biotic and environmental resources, but sufficiently manageable so as to remain accessible from just a few settlement locations. While tribelets comprised geographic or physiographic units, they functioned foremost as sociopolitical units. Within the tribelet, there would have been a central village or principal settlement that was occupied by a headman or chief along with most members of the tribe (Wallace 1978:466). This central village would have been surrounded by smaller satellite settlements, perhaps comprising as few as two or three households (Kroeber 1962).

Settlements consisted of large, semi-subterranean round or oval dwellings with hard-packed floors (Olsen and Payen 1968:38; Wallace 1978:464-465). Within the San Joaquin Valley basin, tule stalks were readily available and could be woven into mats and stretched over frames of light poles to form dwelling walls. Because of seasonal flooding and the wetland conditions that prevailed within the tule marshes on the valley floor, settlements were typically established on high ground or on piled earthen mounds constructed along water courses. Ceremonial sweat houses and assembly chambers also were frequently constructed within larger, more substantial settlements. A large central village might include as many as 200 inhabitants who lived a primarily sedentary existence, with collecting trips taking place during particular times of the year for the acquisition of seasonally available resources (Wallace 1978).

Accounts of Northern Valley Yokuts subsistence practices suggest that they relied on local plant and animal communities typically found along watercourses (Cook 1955, 1960; Gayton 1936; Wallace 1978). Owing to the many rivers, creeks, sloughs, tule marshes, and ponds within Yokuts territory, several important fish species were taken, including seasonal runs of anadromous fishes (e.g., salmon, sturgeon, and lamprey) and other freshwater fishes (e.g., Sacramento Sucker, Sacramento perch, and Thicktail Chub) (Lightfoot et al. 2009:325-329). Turtles and reptiles were also hunted. Nets with sinkers, baskets, bone- and antler-tipped harpoons, and tule watercraft were all employed (Cook 1960; Wallace 1978). Located on the Pacific Flyway, migratory waterfowl such as geese and ducks were taken for food, bone (for tools), and feathers. Terrestrial mammals (e.g., elk, deer, rabbits, and ground squirrels) were also likely hunted, though the brevity of hunting accounts that appeared in historic period documents led Wallace (1978:464) to conclude that big-game hunting probably represented a marginal activity. In addition to acorns, which could be collected from oak stands on both sides of the San Joaquin Valley, an array of seeds, roots, and corms were collected, processed, and consumed or stored (Lightfoot et al. 2009:307-323). Yokuts landscapes were systematically tended through routine pruning, brush clearance, and prescribed burns that improved the quality and quantity of plant yields (Cook 1960:260).

Riparian habitat along the San Joaquin Valley floor supported numerous fish species and reptiles and, in turn, the birds and carnivorous mammals that preyed on them. Herds of pronghorn, deer, and tule elk passed through the valley, and the seasonal wetlands attracted masses of migratory birds. Once-extensive grasslands bordering the sloughs and marshes supplied nutritious seeds, while the foothills were home to acorn-laden oaks. The Diablo Range foothills and Sierra Nevada Mountain foothills—transitional zones between oak savanna and grassland environments—offered a diverse range of natural resources. These varied ecosystems provided a wide array of floral species, such as acorns, oats, and other seeds that served as staple foods, as well as various grasses used for basketry. Faunal resources found in the area included numerous fish species, shellfish, turtles, waterfowl, deer, tule elk, pronghorn antelopes, lagomorphs, rodents, reptiles, birds, and insect species that would have provided sustenance and sources of various materials such as hide, bone, feathers, and ligaments.

Yokuts material culture and technological systems were as varied as the environments in which they resided, and those systems tended to reflect the availability of environmental resources. Mortars and pestles, handstones and milling slabs, and bedrock mortar outcrops were used for processing acorn nuts, seeds, berries, and other small game for consumption or storage. Flaked stone arrow points, knives, and scraping implements made from imported obsidian and locally available chert, jasper, and chalcedony were used to hunt or process game animals (Wallace 1978:465). Bone tools, particularly awls, were prevalent and were widely used in basketry production. Baskets were produced from grasses such as sedge into a wide variety of sizes and shapes, each suited to a particular task (e.g., cooking containers, winnowing trays, water bottles, seed beaters, etc.) and adorned with patterns characteristic of Yokut artistic expression.

Although the Northern Valley Yokuts were the predominant group in the region, evidence also suggests that there was interaction with neighboring hunter-gatherer groups. Northern Valley Yokuts living along Los Banos Creek probably interacted with Mutsun Ohlone speakers whose territory stretched from the Monterey Bay east to the Diablo Range and to the west end of Pacheco Pass (Golla 2007; Levy 1978; Milliken 1995:257; Milliken 2007). Contact between coastal and interior tribal groups would have been facilitated by the pass, a natural thoroughfare that encouraged the exchange of goods and traditions during the prehistoric and early historic periods (Piling 1950). The influence of Ohlone and Ohlone-descendent groups could be seen in the San Luis area and throughout the Central Valley in the form of exotic materials not found in the region. Archaeological materials uncovered by Treganza (1960), Riddell and Olsen (1964), Olsen and Payen (1969), Pritchard (1966, 1970, 1983), and Riddell (1970), though analyzed and interpreted according to Central Valley cultural and temporal schemes, may have had much in common with manifestations from the western side of the Diablo Range. Abalone shell has been recovered at many archaeological sites, and historic period accounts have indicated that salt, mussels, and dried abalone were frequently traded between the Ohlone and interior groups (Davis 1961:23). Linguistic evidence of extensive contact between the coastal Ohlone and San Joaquin Valley tribelets has been noted as well. For example, some Miwok terms are the same as those among Ohlone groups, which suggests that exchange networks involved not only material goods but other cultural traits as well (Whistler and Golla 1986).

Within the Sacramento-San Joaquin River Delta region, Northern Valley Yokuts would have interacted with Miwok speakers. The San Joaquin River corridor offered an exchange route for rafts laden with food and raw materials, and the Yokuts reportedly traded dogs to their northern Miwok neighbors in exchange for baskets and blankets (Barrett and Gifford 1933:270). Obsidian from Napa Glass Mountain, located in present day Napa County, has been recovered archaeologically from sites in the San Joaquin Valley, and likely reflected trade partnerships with Miwok and Ohlone speakers occupying Suisun Bay (Sutton and Des Lauriers 2002). Obsidian from sources within the Sierra Nevada Mountains (e.g., Bodie Hills and Casa Diablo) has also been recovered, and would have entered the San Joaquin Valley via trans-Sierran networks (Hughes and Milliken 2007). Marine shell, ocean fish, and shellfish from the Pacific Coast were also traded. Piñon nuts found their way to coastal tribes from inland sources (Davis 1961:23), and clam shell beads were traded from coastal areas to regions far inland. Yokuts traders were not only active in pre-contact times but also played an important role in the introduction of European trade goods (e.g., glass beads, metal items, etc.) among other groups inhabiting the Central California interior and Sierra Nevada region (Arkush 1993).

During the Mission Period (ca. 1776-1830s), large numbers of Northern Valley Yokuts were removed from their homes to Spanish missions in the San Francisco Bay Area. Mission San José received many members of Northern Valley Yokuts tribes between 1806 and the late 1820s (Milliken 2008:9), and their language was among the most widely spoken at Mission San José, Mission Santa Clara, and Mission San Juan Bautista (Milliken 2008:9). Most frequently represented during that time period were the *Jalalons* and *Nototomnes* from the Delta, *Yatchicumnes* and *Passasimis* from the main channel of the San Joaquin River, and *Lacquisemnes* from the lower Stanislaus River (Milliken 2008:61). Large numbers of clamshell disk beads likely associated with Yokuts groups from the Central Valley have been found in later Mission Period deposits at Mission Santa Clara, mirroring shifting recruitment practices by missionaries proselytizing further east (Allen et al. 2010:171), as well as enduring exchange practices. In addition to participating in missions, Northern Valley Yokuts also actively resisted them, at times fleeing to the impenetrable tule marshes and at other times participating in raids that resulted in the theft or destruction of mission property (Cook 1960, Milliken 1995, 2008; Phillips 1993). In that sense, Pacheco Pass and other canyon passes would have doubled as routes of exchange and as avenues of cultural escape or survival for Yokuts speakers and other groups entangled with the missions.

Introduced diseases, irreparable damage to Native Californian ecosystems, and the displacement of indigenous communities from missionization was compounded in subsequent years by Mexican and American settlement. Like most Native Californian communities, Northern Valley Yokuts populations declined dramatically as Native people were decimated by epidemic diseases in the early-19th century and then by the tremendous influx of American settlers participating in mining, timbering, farming, and ranching from the mid-19th to 20th centuries (Wallace 1978). Today, however, several Yokuts communities persist, and several have been federally recognized as extant, sovereign tribes.

2.4 Historic Period Context

Spain's missionization and colonization of California was focused on the coastal areas and is discussed abundantly in the historical literature and need not be repeated here. The western edge of the San Joaquin Valley, including those lands encompassed by the DMC APE, would have been used mainly as grazing land during the Spanish Period. Spaniards explored interior regions of California from the 1800s, however permanent settlement by non-native people did not occur until the 1830s and 1840s during the Mexican era. Mission lands were secularized in 1834, and large tracts of land were granted to citizens of Alta California as a reward for loyal service and to increase the Mexican population against American forays and territorial unrest. In San Joaquin, Stanislaus, and Merced counties, there were fourteen ranchos granted by Mexican governors to prominent families and individuals (Beck and Haase 1974: Maps 28 and 32). Table 2-2 provides basic information about the Mexican Period ranchos that intersected or were situated near the DMC APE.

Table 2-2 Mexican Land Grants near the Class I and Class III Inventory Study Areas.

Rancho Name and Number	Date Granted/ Land Patent Date	Grantee(s)/Patentee(s)	County
105: Orestimba Rancho	1844/1863	Sebastián Nuñez	Stanislaus/ Merced
*106: Rancho del Puerto	1844/1864	Mariano and Pedro Hernandez /Samuel Reed and Rubin Wade	Stanislaus
*107: El Pescador	1843/1858	Valentin Higuera and Rafael Felix /Henry Grimes	San Joaquin/ Stanislaus
*108: El Pescador	1843/1865	Pio and Naglee	Alameda/ San Joaquin
*198 Sanjon de Santa Rita	1841/1862	Francisco Soberanes	Merced/ Fresno

*Grant numbers provided by Beck and Haase (1974).

Secularization brought an influx of Mexican settlers to California and allowed for the emergence of a new class of wealthy landowners known as "*los rancheros*." The new economy focused on livestock ranching rather than irrigated farming. The Mexican settlers received large land grants and appropriated existing mission irrigated fields, livestock, fences, corrals, irrigation ditches, outbuildings, and other improvements (Bocek and Reese 1992:49). Large-scale water system features were neglected, which resulted in the decline of irrigated farming after the missions were secularized (Caltrans and JRP 2000:11). Agricultural methods continued to rely on California Native American labor for shallow plowing, sowing, and harvesting of crops (Bocek and Reese 1992:49).

During the 1840s, relations between the Mexican and U.S. governments became increasingly strained as the U.S. Government continued to expand its territory westward. These political stresses erupted in the Mexican-American War, which lasted from 1846-1848. The war ended with the 1848 signing of the Treaty of Guadalupe Hidalgo, which called for the U.S. Government to pay $15 million to the Mexican Government. In exchange, lands that would eventually encompass part or all of ten states, including California, were made a part of U.S. territory. Mexican citizens within annexed areas were given the choice between relocating to Mexico and receiving American citizenship with full civil rights. Over 90% chose to remain.

At the close of the Mexican-American War in 1848, James Marshall discovered gold on the American River. Marshall's discovery ushered in the California Gold Rush and shaped American Period settlement and agricultural development in California. Not only did the Gold Rush create a demand for a wide variety of agricultural foodstuffs, but it also set in motion a wave of homesteading and settlement aimed at producing food commercially. Intensive settlement occurred first in San Francisco and Sacramento and then extended into the hinterlands as miners explored the gold fields. Many of these early '49ers turned to agriculture, not simply as a way to subsist, but as a way to profit due to the high demand for fresh foods. Beyond the production of goods, land ownership itself often led to the creation of wealth, self-sufficiency, political power, and independence.

Agricultural activity during the American Period within the San Joaquin Valley was characterized by three types of pursuits: cattle and sheep ranching; grain farming; and irrigated agriculture. Cattle and sheep ranching remained dominant following the Spanish and Mexican periods until the 1880s.

During the 1850s-1870s, free-ranging Spanish cattle were replaced by American breeds of livestock and dairy cows; sheep breeds were also improved during the same period (Burcham 1982). The Homestead Act of 1862 had a profound impact on the expansion of settlement within the western U.S. and played a key role in the development of California's agricultural economy. Although initially focused on agriculture, homesteading eventually shifted to include ranching. The Homestead Act and its amendments had such a huge impact on settlement within the western U.S. that by 1958 some 38,784,000 acres of federal land had been granted in California alone (Caltrans 2007:42).

In addition to the Homestead Act, other key developments spurred the growth of agriculture within the San Joaquin Valley during the late 19th century. These developments included improved transportation, the increased use of irrigation, the greater availability of agricultural labor, and increased mechanization. With the completion of the Transcontinental Railroad in 1869, farmers were able to ship fresh produce to markets in the East, which encouraged a shift in the 1870s towards irrigated crops such as fruits, nuts, and vegetables. The transformation in the late 19th century from expansive grain fields and grazing lands to irrigated crops occurred relatively quickly. The drive to irrigate much of California, and in particular the San Joaquin Valley, played an important role in the expansion of mechanized farming and the establishment of small farming communities. The influx of settlers into the state during and after the California Gold Rush also meant that there was a ready supply of agricultural laborers available as well as an increased demand for agricultural products.

Stock raising or ranching in the San Joaquin Valley also was essential to the regional economy. Hogs, sheep, and cattle, which were raised for meat, wool, and other products, made up the bulk of the stock that roamed across the region (Caltrans 2007:82). Cattle and sheep ranching predominated, while hog production was generally less important (Caltrans 2007:85-86). Throughout the 19th century, ranches of all sizes proliferated. The need for grazing land necessitated larger landholdings than for farmsteads. These needs varied by the type of stock, with sheep requiring wider ranges for herding. Homestead laws were further amended to accommodate these needs, and larger acreage claims were granted that allowed ranching to further expand.

Late 19th century range wars between sheep and cattle ranchers resulted in the dominance of cattle in the California ranching industry. Ultimately, three levels of cattle ranching evolved. These included large corporate or company ranches of more than 160 acres, mid-sized ranches of 40 to 160 acres, and small ranches of 40 acres or less. The overgrazing of natural fodder, combined with late 19th century droughts, led to the ascent of many smaller ranching operations that also grew hay in irrigated fields). Corporate operations with access to water, however, also fared well. Miller and Lux for instance controlled large tracts of land, were well capitalized, and monopolized the market. Unlike farmers who concentrated their land development, cattle and sheep ranchers spread their improvements over large areas (Caltrans 2007:85). The ranchers would move their operations from location to location, as necessary. For larger ranches, this type of land use required a substantial and knowledgeable labor force.

Corporate ranches typically featured multiple barns, feed lots, elaborate water systems, loading chutes, slaughterhouses, and bunkhouses for workers (Caltrans 2007:84). Mid-sized ranches often comprised multiple contiguous or discontinuous homesteads that provided a larger area for grazing (Caltrans 2007:84). Small ranches were generally established by individual homesteaders and would include a main ranch house, a barn, windmills, a slaughterhouse, corrals, and pastures (Caltrans 2007:84). These small ranches, also called ranchettes, became popular after the turn of the century (Caltrans 2007:84).

During the 20th century, livestock production in California and the San Joaquin Valley declined while irrigated crop farming intensified. The exception to this was dairy farming and poultry production, which began to thrive. During 1950s and 1960s, cattle ranching revived somewhat with the innovation of large-scale commercial feedlots (Olmstead and Rhode 2011). With the dominance of irrigated crops in the 20th century, cattle ranching was relegated to the margins of the San Joaquin Valley in the un-irrigated foothills and in high-density feed lots (Parsons 1987). The confinement of ranches to these un-irrigated areas required the use of livestock watering locales that drew water from wells using a windmill and pump, stored the water in tanks or cisterns, and made water available to livestock in troughs. These livestock watering locales were ubiquitous features within the ranching landscape and essential to the success of ranching operations.

2.4.1 The Development of Water Conveyance Systems

The aridity of the western San Joaquin Valley began to pose problems for American Period agriculture during the late 19th century as land was developed further away from water sources. Canal projects were undertaken to move water from the rivers flowing into the San Joaquin Valley from the Sierra Nevada. The Merced Irrigation District was established during the 1870s and 1880s for the eastern side of Merced County and developed many miles of canals (Merced Irrigation District 2014). Henry Miller also was involved in early attempts to develop irrigation within the western Central Valley. He organized the San Joaquin & Kings River Canal and Irrigation Company and built a canal in 1871 from the San Joaquin River to the town of Los Banos (Outcalt 1925:221). In 1870s, Miller extended the canal to Los Banos Creek and Newman, and began developing the Buena Vista Slough area at the downstream end of the Kern River (Outcalt 1925:222). The canals provided much of the irrigation for Miller's properties in the San Joaquin River watershed and for local agriculture. Upon Miller's death in 1916, his daughter and son-in-law inherited the bulk of his vast landholdings along with his water rights (Outcalt 1925:402).

In 1887, the state legislature passed the Wright Act, which permitted the formation of irrigation districts across California (Stene 2011:3). The Wright Act was amended in 1897 to ensure sufficient bond funding for irrigation projects (Stene 2011:4). A report on the "Sacramento Project" produced in 1904 was the first to link the U.S. Reclamation Service to water issues in the Central Valley. It was not until 1911, however, that the state legislature created the State Reclamation Board, which was authorized to spend up to $33 million on Central Valley flood control projects. Both the U.S. Reclamation Service and the California State Engineer reported on the possibility of storing Sacramento River water at Iron Canyon in Tehama County. In 1919, Colonel Robert Marshall, Chief Geographer for the U.S. Geological Survey, further proposed the construction of several storage reservoirs along the Sacramento River system and the transfer of water between the Sacramento Valley and the San Joaquin Valley via two large canals positioned to either side of the Sacramento River; these canals were meant to convey water over the Tehachapi Mountains to Southern California (Stene 2011:2).

In 1921, the state legislature directed the State Engineer to formulate a comprehensive water plan for California to accomplish conservation, flood control, storage, distribution, and water use and appropriated $200,000 to investigate and develop the plan. Over the course of the next decade, fourteen reports were produced detailing water flow, drought conditions, flood control, and irrigation issues in California. State Engineer Edward Hyatt used those reports to draft the California State Water Plan. Salinity control within the Sacramento-San Joaquin Delta was of particular concern to northern California water users. Unless a minimum of 3,300 second-feet of water flowed past Antioch, salt water from the San Francisco Bay would move into Suisun Bay and the Delta during high tide, making the water unusable for crops and industry (Stene 2011:2). The State Water

Plan, among other measures, called for the construction of a 420-foot dam at Kennett to maintain regular water flow to Antioch.

In 1933, the state legislature authorized the Central Valley Project (CVP) as a state project and approved the sale of revenue bonds to fund it. Despite the authorization of revenue bonds, however, the state of California was unable to finance the project. President Franklin D. Roosevelt issued an executive allocation of $20 million under the Emergency Relief Appropriation Act for construction of the CVP in 1935, which was later reduced to $4.2 million. Roosevelt approved the CVP, including the Kennett, Friant, and Contra Costa divisions, on December 2, 1935, and the Rivers and Harbors Act of 1937 re-authorized $12 million for the project. Navigational improvements, regulation, and flood control of the Sacramento and San Joaquin rivers were listed as priorities of the CVP under the Rivers and Harbors Act, with power generation cited as the lowest priority.

Construction of the CVP began in the late 1930s. In 1939, Henry Miller's heirs agreed to exchange riparian rights on their landholdings for substitute water. They did not abandon their riparian water rights but agreed not to exercise them as long as the government could provide substitute water. These contracts are still in effect, and some of Miller and Lux's original canals continue to convey irrigation water today (San Joaquin River Exchange Contractors 2014). During the early 1940s, America's entry into World War II increased demand for agricultural products and further depleted groundwater in the western Central Valley (U.S. Bureau of Reclamation 2011). Controversy surrounding the CVP increased and, following World War II, advocates of small farmers formed the Central Valley Project Conference (CVPC) to contest state versus federal operation and control, public versus private distribution of power, U.S. Army Corps of Engineers versus Reclamation construction of multi-use projects, and acreage limitations outlined in the Reclamation Act of 1902. Despite contention over these issues, construction of the CVP continued through the late 1940s and 1950s.

By the 1950s, the western side of the Central Valley had become the focus of both the CVP and the newly formed State Water Project (SWP) (Stene 2011:10). A 1954 federal investigation identified the area along Pacheco Pass in the Diablo Mountains as the ideal site for the San Luis Reservoir (U.S. Bureau of Reclamation 2011). Despite opposition from a variety of regional factions, a state bond measure to fund irrigation in the western Central Valley was narrowly passed in 1960. To avoid the unnecessary expense of parallel aqueducts, the State of California agreed to partner with the federal government in the creation of the San Luis Unit in 1961 (Stene 2011:13-14). The San Luis Reservoir in the Diablo Mountains west of Los Banos would be filled with water supplied by the federal Delta-Mendota Canal and the state's California Aqueduct (Stene 2011:14). A ground-breaking ceremony officiated by President John F. Kennedy marked the start of construction in 1962, and all construction was completed for the project by 1967. Typically, water from the Delta is pumped into the reservoir in winter and early spring and released in summer when water supplies are low (DWR 1974:276).

The Delta-Mendota Canal, a key feature of the CVP, was completed in 1952. Friant Dam stored San Joaquin River flow and diverted it into the Madera and Friant-Kern canal systems. Reclamation built Delta-Mendota Canal to provide Sacramento River water to irrigators and other water users who lost San Joaquin River water downstream of Friant Dam. The canal transports water from the C.W. Bill Jones Pumping Station (formerly Tracy Pumping Station) along the western side of the San Joaquin Valley for irrigation, for use at the San Luis Reservoir, and for recharging the San Joaquin River where water has been diverted at Friant Dam for the Friant-Kern system. The canal spans roughly 113 miles in length and ends at the Mendota Pool (Stene 1994:13-14).

The California SWP was first envisioned in 1919 by Colonel Robert Marshall who proposed conveying water from the Sacramento River watershed to the San Joaquin Valley and then over the Tehachapi Mountains to Southern California. A State Water Plan was introduced in 1931, however funding remained unavailable during the Great Depression. After World War II, the California Water Plan was reintroduced and finally passed in 1960. In 1963, construction was begun on the California Aqueduct, a series of canals, tunnels, and pipelines that implemented Marshall's early 20th century vision. The main line of the canal was completed in 1971, with subsequent branches or extensions completed as late as 1997 (DWR 2014). The aqueduct begins at the San Joaquin-Sacramento River Delta at the Banks Pumping Plant, which pumps from the Clifton Court Forebay. Water is pumped by the Banks Pumping Plant to the Bethany Reservoir, which serves as a forebay for the South Bay Aqueduct via the South Bay Pumping Plant. From the Bethany Reservoir, the aqueduct flows by gravity to the O'Neill Forebay at San Luis Reservoir. From the O'Neill Forebay, it flows to the Dos Amigos Pumping Plant and then on for roughly 95 miles before it diverges in Kings County into a main line and a Coastal Branch. In southern Kern County, the main line splits into a West Branch and an East Branch, which together serve Los Angeles, San Bernardino, and Riverside counties. The California Aqueduct weaves in and out of the DMC APE in San Joaquin, Stanislaus, and Merced counties.

2.4.2 Transportation Development

While the development of water conveyance systems was critical to settlement and agricultural expansion within the San Joaquin Valley, so too was the development of transportation. Several transportation corridors formed within the DMC vicinity over time, driven largely by local topography. The earliest was the Spanish Period El Camino Viejo that was later paralleled in the 19th century by the Southern Pacific Railroad and in the 20th century by the American Period Interstate-5 corridor. Two east-west trending transportation corridors also cross the DMC vicinity and pass through the Diablo Range, which separates the San Joaquin Valley from the coast. These include Livermore Pass (now Altamont Pass) as well as Pacheco Pass. These transportation corridors were used prehistorically by California Native Americans travelling between the coast and the Central Valley interior, and later used during the Spanish, Mexican, and American periods.

In Alameda and San Joaquin counties, several attempts were made to establish a stage line bridging Stockton and Oakland by way of Livermore Pass to compete with the steamships that crossed San Francisco Bay and navigated up the San Joaquin River to Stockton. The steamers, specifically those controlled by the California Navigation Company, reduced their fees to undercut stage fares and the stage routes were short-lived (Tinkham 1923:103-104).

Pacheco Pass, which intersects the DMC vicinity near the San Luis Reservoir in Merced County, also served as a main transportation corridor connecting the southern San Francisco Bay Area with the San Joaquin Valley. Although the trail was used prehistorically long before the Mexican Period, it eventually took its name from Juan Pérez Pacheco in the 1840s when he and José María Mejía received a land grant that included the Pacheco Pass area. In 1857, Andrew Firebaugh built a toll road across the pass from San José. By 1858, the San Luis Ranch house was acting as a stage station along Firebaugh's toll road (Outcalt 1925:217-218). Pacheco Pass also served as a part of the route used by the Butterfield Overland Mail Company, which ran stage lines from San Francisco to St. Louis beginning in 1858 (Hoover et al. 1990). Stage stations in Merced County included the San Luis Ranch and Lone Willow Stage Station near Los Banos (Hoover et al. 1990:200-201).

Although early pedestrian, stock, and stage routes were critical to the settlement of the DMC vicinity during the Spanish, Mexican, and early American periods, it was the development of railroads that transformed transportation in the San Joaquin Valley. Railroad routes in the San Joaquin Valley followed roughly the same transportation corridors that were established during the Spanish and Mexican periods. The two main railroads that competed within the region were the Southern Pacific Company and the Western Pacific Railroad. By 1884, Southern Pacific emerged as the name of all the main railroads in California, including the Central Pacific and the Western Pacific railroads (Rawls and Bean 1997:175-176). By 1900, the Southern Pacific Company had become a major railroad with a system that spanned the western US from Los Angeles to Portland and east into Arizona, Utah, and Texas. It was ultimately absorbed in the late 1980s by Rio Grande Industries and again in the late 1990s by the Union Pacific Railroad (Sullivan 2010).

The original Western Pacific Railroad was established in 1862 to construct the westernmost portion of the Transcontinental Railroad between the present-day cities of Oakland and Sacramento. Construction was begun in 1865, and the route crossed Niles Canyon to Livermore Pass before proceeding on to the state capital. In 1869, the Western Pacific Railroad was absorbed by the Central Pacific Railroad, which purchased the bankrupt company and completed the rail line that year (Fickewirth 1992:164; Luna 2005:7). In 1903, a second company was founded under the name Western Pacific Railroad. It was established by the Denver and Rio Grande Western Railroad, a competitor of Southern Pacific Railroad. The Western Pacific Railroad acquired the Alameda and San Joaquin Railroad and constructed a route from present day Oakland through the Feather River Canyon. By 1930, this route spanned Oakland to Niles Canyon and then turned north via Carbona, Stockton, Sacramento, and Marysville where it turned east through the Feather River region. A 1930 Denver and Rio Grande Western route map also depicted a Tesla branch line extending south from Carbona (Denver & Rio Grande Western Railroad 1930). In 1982, the Western Pacific Railroad was acquired by the Union Pacific Railroad (Brehm 2014).

Twentieth century road and highway improvements during the 1910s and 1920s turned wagon roads into higher speed auto roads. Prior to that time, the interstate and transcontinental transportation of people and goods relied on railroads, with roads used mainly for local travel (Weingroff 2011). The development of improved roads in the region was part of a national "Good Roads Movement" that arose in the 1880s as a response to the increasing popularity of bicycles and then automobiles in the early 1900s (Roland et al. 2011:E4). A number of interest groups began pressuring the federal and state governments to take control of road building and maintenance (Hugill 1992). Among the goals of these movements was the construction of improved or hard-surface roads of macadam, bituminous macadam, or concrete (Roland et al. 2011:E5). Despite these efforts, in the early 20th century only a small percentage of the roads in California and nationwide were improved (Roland et al. 2011:E5).

The Lincoln Highway Association (LHA) was established in 1913 by automobile enthusiasts and industry officials with the goal of creating a continuous, improved road between New York to San Francisco by the shortest route possible (LHA 2014). The Lincoln Highway was the first transcontinental highway and played a significant role in the development of highways and the founding of Eisenhower's System of Interstate and Defense Highways (Weingroff 2011). The original Lincoln Highway route was identified in 1913 and used existing improved and unimproved roads. It crossed the Sierra Nevada via two routes that are today known as Interstate-80 and US-50. It followed what is now Highway 99 south to Stockton. Interstate-205 and Interstate-580 now parallel much the same route the Lincoln Highway took into Oakland. Through the DMC vicinity, the route followed Old Grant Line Road, north of what has become Interstate-205. In 1927, the Lincoln Highway was realigned to a route that parallels present-day Interstate-80 between Davis and Berkeley (LHA 2014). The portion of the highway that crossed the DMC vicinity has thus reverted to local roads.

3.0 SOURCES CONSULTED

3.1 ARCHIVAL AND RECORDS SEARCH

An archival and records search of the APE and a surrounding 0.25-mile radius was requested by Pacific Legacy on behalf of Reclamation and the Authority on March 10, 2022. Requests were submitted to the Northwest Information Center (NWIC), the Southern San Joaquin Valley Information Center (SSJVIC), and the Central California Information Center (CCIC) of the California Historical Resources Information System (CHRIS). The NWIC, which holds historical resource and study information for Alameda and Contra Costa counties, conducted a records search under file number 21-1476 on April 11, 2022. The SSJVIC conducted a records search of the search area within Fresno and Madera counties on March 21, 2022, under file number 22-107. The CCIC, which covers Merced, San Joaquin, and Stanislaus counties, conducted a search on March 14, 2022, under file number 12106ILN. All searches included a review of the following:

- *Built Environment Resources Directory,* Sonoma County (California Office of Historic Preservation 2022);
- NRHP Directory of Determinations of Eligibility, California Office of Historic Preservation, Volumes I and II, 1990 and updates (California Office of Historic Preservation 1990 and updates);
- *California Inventory of Historic Resources* (State of California 1976);
- *California Historical Landmarks (*State of California 1990); and,
- Historical maps, ethnographic information, historical literature, local inventories, and documents concerning the general area.

The archival and records search was conducted to determine whether cultural resources and built environment resources have been previously discovered within and adjacent to the APE and a 0.25-mile buffer area around the APE. A detailed list of previous cultural resource studies was obtained within the records search area. Full copies of previous cultural resource studies were obtained for those conduced within the APE. Cultural resource records for archaeological sites, isolated finds, and historic period built-environment resources were collected in full. This document details previous archaeological studies and resources within the search area. Documentation pertaining to exclusively historic period built-environment studies and resources is discussed in Appendix F. The results of the archival and records search are depicted on United States Geological Survey (USGS) 7.5-minute series topographic quadrangles in Appendix A, Figure 2.

3.2 PREVIOUS CULTURAL RESOURCE STUDIES

A total of 200 cultural resource studies that deal with archaeological resources have been conducted within 0.25-miles of the APE. These studies were reviewed to determine if they documented adequate survey coverage. For the purposes of this report, adequate survey coverage is defined as a survey that has been conducted within the past ten years (2012 or later) and was conducted using a minimum of 15-meter spaced pedestrian transects. A total of 24 studies met these qualifications or included archaeological excavation and are documented in Table 3-1 and discussed below. Approximately 0.9% of the APE has been subject to adequate archaeological study. A complete list of previous cultural studies is presented in Appendix B.

Table 3-1 Previous Archaeological Studies with Adequate Survey Coverage or Excavation.

Study Number	Title	Author	Year	Type
ME-07812	MP-153 Cultural Resources Post Field Sumary Record, 13-SCAO-083; PG&E Newman Canal Gas Line License	Way, M.	2013	Archaeological, Field study
ME-07979	Cultural Resources Inventory Report, Line 331B MP 0.79-1.31 and Valve Lot Extension Reinforcement Project, Santa Nella, Merced County, California.	Ludwig, Brian	2013	Archaeological, Architectural/Historical, Field study
ME-08202	Los Banos Creek Diversion Project, Mreced County, California; Bureau of Reclamation 14-SCAO-241	Carper, M.	2014	Archaeological, Architectural/Historical, Field study
ME-08264	Cultural Resources Post Field Report for the San Luis Water Distrcit New Pump Station on the Delta Mendota Canal	Barnes, A.J.	2015	Archaeological, Field study
ME-08746	Historic Property Survey Report for the Proposed State Route 140 Merced Guardrail Upgrade Project, Merced County, California [plus one western extension in to Stanislaus County]; 10-MER-140 P.M. 0.0/42.1 EA 10-0Y110; EFIS: 1013000108	Delsescaux, J.	2016	Archaeological, Architectural/Historical, Evaluation, Field study
ME-08959	Historic Property Survey Report and Archaeological Survey Report for the Proposed D10 Bridge Substructure Repair Project, Merced, Mariposa, San Joaquin and Stanislaus Counties, California; 10-VAR-VAR P.M. Various E.A. 10-1C810; EFIS: 1015000038	Delsescaux, J.	2018	Archaeological, Architectural/Historical, Field study
ME-09169	Cultural Resources Survey Report and Evaluation for the Installation of a Water Meter via Pipeline from the Delta-Mendota Canal at Turn Out 84.38L, Merced County, California	Kile, M. C.	2020	Archaeological, Architectural/Historical, Field study
ME-09301	Historic Property Survey Report/Finding of Effect, Newman Community Conservation Area, 78 and 24-acre Parcels, Merced County, California	Basin Research Associates	2021	Archaeological, Architectural/Historical, Field study

Study Number	Title	Author	Year	Type
SJ-07782	Cultural Resources Survey of the Fabian Tract Spoils Reuse Project, San Joaquin County, CA	Soule, W.	2012	Archaeological, Field study, Other research
SJ-08299	Cultural Resources Assessment of the City of Tracy Public Utility Corral Hollow Road Utility Improvements Project, San Joaquin County, California	Fergusson, A. and A. Farber	2014	Archaeological, Architectural/Historical, Field study
SJ-09239	Cultural Resources Inventory and Evaluation Report, International Park of Commerce Arroyo Project, San Joaquin County, California	Ludwig, B. and J. A. Coleman	2020	Archaeological, Architectural/Historical, Evaluation, Field study
ST-07826	Cultural Resources Inventory for License to Del Puerto Water District for New Discharge Point near Milepost 52.40L on the Delta-Mendota Canal, Stanislaus County, California; 13-SCA)-030	Carper, M.	2013	Archaeological, Field study
ST-07968	MP-153 Cultural Resources Post Field Summary Record, Tracking Number: 14-SCAO-076, Project: Cultural Resources Post Field Report for the Del Puerto Water District New Well Discharge System on the Delta-Mendota Canal.	Barnes, Amy J.	2014	Archaeological, Field study
ST-08341	Historic Property Survey Report North Valley Regional Recycled Water Program (NVRRWP) Vicinity of Patterson, Stanislaus County	Basin Research Associates	2014	Archaeological, Architectural/Historical, Field study
ST-09248	Archaeological Survey Report, Sperry Avenue at Interstate 5 Interchange Project, Stanislaus County, California; 10-STA-005, PM 15.8/15/9, Caltrans District 10, EA 10-0G420/E-FIS 1014000038	Falke, M. and K. Vallaire	2018	Archaeological, Field study
FR-02536	Archaeological Survey Report Seismic Retrofit of the Sierra Avenue Bridge Over the Delta-Mendota Canal (42C0281), Fresno County, California	Armstrong, Matthew D.	2012	Archaeological, Field study
FR-02591	Cultural Resources Inventory and Evaluation for the First Lift Canal Project, Fresno County, California	Baloian, Randy and Jay B. Lloyd	2013	Archaeological, Evaluation, Field study

Study Number	Title	Author	Year	Type
FR-02646	Cultural Resources Post Field Summary Record for the San Luis Pipe at DMC Milepost 98.60	Carper, Mark A.	2013	Archaeological, Field study
FR-02706	Post Field Summary Report for the Delta-Mendota Canal Interceptor Sumps Re-plumb Project, Fresno County, California	Carper, Mark A.	2014	Archaeological, Field study
FR-02710	Cultural Resources Inventory and Evaluation for the Second Lift Canal Project, Fresno County, California	Baloian, Randy, Matthew Armstrong, and Jay B. Lloyd	2014	Archaeological, Evaluation, Field study
FR-02729	Historic Property Survey Report for the Replacement of Bridge 42C0074 over the Delta-Mendota Canal on West Nees Avenue, Fresno County, California	Morlet, Aubrie and Randy Baloian	2015	Archaeological, Architectural/Historical, Evaluation, Field study
FR-02970	Cultural Resources Investigation for the Widren Water District Water Quality, Supply, and Drainage Enhancement Project.	Barns, Amy J.	2017	Archaeological, Evaluation, Field study
FR-03031	Cultural Resource Inventory and Evaluation Report for the Mowry Bridge Replacement Project, City of Mendota, Fresno County, California	Dyste, Diana T., M. Colleen Hamilton, Amber Long, Annie McCausland, Randy Ottenhoff, and Carlos van Onna	2020	Archaeological, Architectural/historical, Evaluation, Field study
S-46401	PG&E Tracy District Electrolysis Test Station Program (letter report)	Patrick, Melinda P.	2012	Archaeological, Field study

3.3 Previously Documented Archaeological Sites

No previously recorded archaeological sites were documented within the APE. Two archaeological sites and a single isolate were identified within the 0.25-mile records search area around the APE. The two archaeological sites within the records search area are associated with Native American habitation or activities. The isolate is associated with the historic period. Table 3-2 provides a list of archaeological sites found during the archival and records searches.

Table 3-2 Previous Archaeological Sites within the Records Search Area.

Resource Designation(s)	Type	Author	Date Recorded	Description	NRHP/ CRHR Status*
P-24-000172 CA-MER-72	Site	F. F. Latta	1950	Native American occupation site that was not relocated in 1993.	Not Evaluated
		Albert Knight and Leonard Manuel, Jr.	1993		
P-39-000066 CA-SJO-262	Site	John W. Foster	1995	Cache of milling equipment	Not Evaluated
PEP 12-ISO-7	Isolate	D. Anderson, J. Panichelle, and T. Langheim	1992	Three fragments of sun-colored amethyst glass	Not Evaluated

3.4 Native American Consultation

Pacific Legacy submitted a Sacred Lands File search request for the APE to the Native American Heritage Commission (NAHC) on April 5, 2022. A response was received on April 20, 2022, from Pricilla Torres-Fuentes, Cultural Resources Analyst with the NAHC, indicating that the Sacred Lands File search was positive within the APE. Ms. Torres-Fuentes provided a list of Native American tribal representatives who may have knowledge of or interest in cultural resources in the Project vicinity. These individuals and a record of correspondences are listed in Appendix C. As a part of the environmental review process, Reclamation is consulting with Native American tribal representatives and other potential stakeholders regarding the Project consistent with Section 106 of the NHPA.

Pacific Legacy is responsible for consulting with Native American tribal representatives regarding the Project in accordance with CEQA and Assembly Bill 52. On June 14, 2020, the Authority sent certified letters to Native American tribal representatives identified by the NAHC to inform them about the Project and request consultation. Five responses were received. Corrina Gould of the Confederated Villages of Lisjan Nation requested to be updated on the results of the Sacred Lands File Search in Alameda, Contra Costa, and San Joaquin counties. Paige Berggren of the Santa Rosa Rancheria Tachi-Yokut Tribe stated that the tribe has serious concerns regarding the Project and requested Native American monitoring during any ground disturbing activity. Anna Cheng of the United Auburn Indian Community indicated that the Project was outside of their geographic area of traditional and cultural affiliations. Katherine Perez of the Northern Valley Yokuts Tribe and the Nototome Cultural Preservation requested Native American monitoring of all cultural resource surveys and ground disturbing activities in tribal cultural resource areas. Venesa Kremer of the Wilton Rancheria requested copies of any cultural resource studies conducted within the APE. Follow letters updating the progress of cultural resource studies were sent out by the Authority on August 18, 2022. The complete responses as well as sample letters and the Native American contact log are presented in Appendix C.

4.0 SURVEY AND RECORDING METHODOLOGY

Inventory methods to identify cultural resources in the Project APE involved documentary research, archival and record searches, and a pedestrian field inventory of the Project survey area. The results of the record searches, as described in Section 2.0, were used during the field inventory to assist in relocating previously recorded archaeological resources. The methods used to document built environment resources are briefly discussed here and are developed more fully in in Appendix F.

4.1 ARCHAEOLOGICAL SURVEY AND RECORDING METHODS

4.1.1 Field Survey Methods

Fieldwork was conducted over the course of three rotations between May 17th and 26th, June 6th and 10th, and June 13th through the 17th, 2022, by Pacific Legacy archaeologists. Christopher Peske, BA, served as field director with Ashley Schmutzler, MA, serving as assistant field director. Archaeologists who participated in fieldwork included Griffen Bragagnolo, BA, Gloria Brown, MA, Jack Flynn, BA, Myra Jamison, Bridget Parry, BA, and Walter Tovar Saldana, MA. The intensive pedestrian field inventory of the survey area involved the use of 15-meter transects, which were narrowed to 1-meter transects when potential archaeological resources were identified. Areas within the APE that appeared to be private property were not surveyed. These locations and the surveyed areas are depicted in Appendix A, Figure 3. Site Records are included in Appendix D. Photographs were taken of the survey area and all cultural resources encountered and documented in a photographic log. Photographs from the field inventory are provided in Appendix E.

4.1.2 Site Recording

All cultural resources encountered during the inventory surveys were documented on DPR Forms 523 and on supplemental records in keeping with procedures identified in the *Instructions for Recording Historical Resources* (California Office of Historic Preservation 1995). At a minimum, resource documentation was completed on DPR Form 523(a) (a Primary form) and DPR Form 523(j) (a 1:24,000-scale map depicting the cultural resource location). Archaeological sites were defined as three or more artifacts discovered within 30 meters of each other. Isolated finds were defined as a single artifact, two artifacts located less than 30 meters apart, or as isolated, discrete features within the landscape (e.g., a historic period well head or trough, two prehistoric lithic flakes, etc.).

Isolated finds were recorded positionally recorded with a GNSS receiver, photographed, and briefly described. Prehistoric sites and historic period resources were recorded with a GNSS receiver, photographed, described, documented on a sketch map at an appropriate scale, and supplemented with additional forms, as necessary. Sketch maps were prepared that depicted the resource boundary, its major elements, and its relationship to other resources or natural features in the vicinity. No cultural materials were collected during the field inventory. Site mapping was conducted using ESRI Field Maps software paired with a Trimble R1 GNSS receiver in conjunction with hand-drawn maps prepared using a tape and compass. GNSS points were taken in the UTM Zone 10N projection, NAD 83 datum. Site maps were generated using ArcGIS Pro software and were plotted onto aerial photographs and topographic maps. Resource and isolate locations are depicted in Appendix A, Figure 3. Archaeological site and isolate records are presented in Appendix D.

In addition to the standard DPR Forms 523, additional data sheets were included as necessary to document each cultural resource. Diagnostic and unusual, rare, or unique artifacts were assigned artifact numbers and recorded with a GNSS receiver and on-site sketch maps. The potential for buried cultural deposits was noted through the inspection of natural or artificial exposures of soil stratigraphy (e.g., vertical soil exposures, areas of bioturbation, etc.). Daily field notes documenting inventory survey efforts were kept on standardized forms and archived at the Berkeley office of Pacific Legacy.

4.2 Geoarchaeological Testing Methods

[Placeholder for Geoarchaeological Testing Write-up]

4.3 Built Environment Survey and Recording Methods

JRP staff recorded and evaluated five built environment resources in the APE: Delta-Mendota Canal, two rural residential properties, and two drainage canals. JRP staff recorded Delta-Mendota Canal by visually observing the entire 116-mile canal from its headworks at the inlet canal upstream from C.W. Bill Jones Pumping Station to its outlet at Mendota Pool. JRP recorded the canal with digital photography and field notes. In order to photographically capture the characteristics of the canal, JRP took photographs of all major structures – check structures, siphon inlets and outlets, overchutes, turnouts, and bridges – and photographed representative examples of common and ubiquitous minor structures like inlet drains, culverts, road drains, and ladders. JRP photographed representative examples of the canal prism at regular intervals no greater than one-half mile for the entire length of the canal. JRP recorded Delta-Mendota Canal on a set of DPR 523 forms that consists of a Primary Record, a Building, Structures and Object Record, 22 DPR 523 Linear Feature Records, and a Site Map (Appendix F). The DPR 523 Forms for the canal do not include photographs of each of the approximately 750 appurtenant structures on the canal but do include photographs of representative examples. JRP recorded two rural residential properties and two drainage ditches on DPR 523 forms sets that provide descriptions of the resources and NRHP and CRHR evaluations.

5.0 INVENTORY RESULTS

5.1 ARCHAEOLOGICAL SURVEY AND INVENTORY RESULTS

Pacific Legacy completed an intensive pedestrian survey of 5,736 acres of the APE. The remaining portions of the APE were not surveyed due to total development with no ground visibility (2.0 acres), or a lack of access permission to private lands (161 acres). Ground surface visibility was generally excellent throughout the APE. Limits to surface visibility included vegetation outside of the canal access roads and sections of pavement on the access roads. When surface visibility was limited, survey transect spacing was reduced to ensure adequate survey coverage. Two newly identified archaeological sites and two archaeological isolates were located during the survey. Appendix D contains the site and isolate records for all cultural resources encountered in the survey area.

The two newly identified archaeological sites, temporarily designated as DMC-CRP-001 and DMC-CRP-002, both date to the historic period. DMC-CRP-001 is a ditch complex that was partially obliterated by the construction of the Delta-Mendota Canal and Interstate 5. It comprises an earthen ditch that has portions carved into rock, an earthen linear berm, the ruins of a flood gate, and a patch of green grass that was anomalous to the surrounding survey corridor that may suggest a buried feature. Ground surface visibility at the site was low due to dense brush and grasses. DMC-CRP-002 is a trash scatter comprising 15 glass bottle fragments, some of which feature maker's marks and finishes that date to the 1950s. Ground surface visibility at the site was 100% as the grasses had been mowed recently.

Two new archaeological isolates were identified within the APE. DMC-CRP-ISO-001 comprised two crypto-crystalline silicate (CCS) flakes located near the old San Luis Creek bank. Ground surface visibility at the isolate was 100%. DMC-AAS-ISO-001 is the remains of a historic period plow located in a field along the Delta-Mendota Canal. The surface visibility around this isolate was extremely low due to tall grasses.

5.2 BUILT ENVIRONMENT INVENTORY RESULTS

Information Center search results identified three linear historic properties that cross under or over Delta-Mendota Canal and have been previously determined eligible for listing in the NRHP, as well as nine additional linear built environment resources that cross under or over the DMC and have been previously determined not eligible for listing in the NRHP. See Table 2 in Appendix F and APE maps for these previously evaluated historic linear resources. These resources were not rerecorded during this inventory. Newly recorded resources include the Delta-Mendota Canal, San Luis Drain, two rural residential properties on Lammers Road (APN 251-050-120 and 240-140-260) in San Joaquin County and a drainage canal that is part of Firebaugh Canal Water District in Fresno County.

6.0 Site Evaluations

Criteria for formally evaluating cultural resources under the NRHP and the CRHR were introduced in Sections 1.3.1 and 1.3.3. In addition, the JRP document in Appendix F addresses the historic context and results of the built environment survey. Using those criteria, evaluations are based on an approach that assesses the integrity or condition of cultural resources and their significance in relation to the four criteria outlined under 36 CFR Part 60.4 and under Section 15064.5 of state CEQA *Guidelines*.

Assessments of integrity are based upon the integrity of location, design, setting, materials, workmanship, feeling, and association for each resource examined. Integrity of location refers to whether a resource has been displaced from its original position. It may apply to standing structures or infrastructural elements, or it may apply to archaeological sites or cultural resource deposits that have been moved or displaced from where they originated. Cultural resources that lack integrity of location will generally have lost their depositional or historic context and would be expected to provide little significant information important to the study of prehistory or history. Integrity of setting, feeling, and association are particularly relevant when assessing historic period buildings, structures, objects, and sites for which the physical setting and its degree of preservation are important (e.g., a historic period irrigation ditch that is part of a larger intact site or district, a canal or aqueduct that remains in use and has not been substantially altered, or a historic period farmstead that retains its rural agricultural setting). In contrast, archaeological sites, particularly cultural deposits associated with Native American activities, can be significant if undisturbed even if they are encountered in a developed setting incongruent with the context of their original deposition. Integrity of design, materials, and workmanship may be pertinent to archaeological resources, though integrity of design and workmanship are most often examined with reference to built environment resources.

In order to evaluate cultural resources for their potential eligibility for listing in the NRHP and CRHR, it is necessary examine them with reference to a historic context. Information regarding the natural environment and cultural history of the Project APE was included in Section 2.0. Research themes and questions relevant to the specific resource types that are known to occur in the Project Area are offered below in Sections 5.1 and 5.2. Contextual information specific to individual cultural resources is presented in Section 5.3. A variety of sources, many available online, were consulted. These included previous site records; historic period topographic maps; federal land patents; GLO survey plats and mineral survey plats; federal manuscript and agricultural census records; mining bulletins and journals; historical newspapers and photographs; and local county histories, tax documents, and voter registers.

The aim in constructing resource-specific contexts was to identify potential associations with events that made a significant contribution to the broad patterns of our history (NRHP Criterion A/CRHR Criterion 1) and to identify potential associations with one or more individuals who were significant to our past (NRHP Criterion B/CRHR Criterion 2). The distinctive physical characteristics—the construction, style, or artistic values (NRHP Criterion C/CRHR Criterion 3) of cultural resources—were most evident through their material aspects but were also considered in light of their historic context. Finally, resource-specific contexts were used to evaluate the potential of sites or structures to yield information important to the study of prehistory or history (NRHP Criterion D/CRHR Criterion 4).

6.1 Potential Archaeological Research Themes and Questions for Evaluating Cultural Resources

A series of research themes and questions that might be addressed during the evaluation of cultural resources within the APE are presented below. Most of these themes and questions are relevant to both Native American associated resources and historic period resources, though the manner in which they are addressed will vary greatly based on the type of resource under assessment.

- *Chronology* is a fundamental research theme central to the study of cultural resources. A focus on chronology allows researchers to examine sites and/or structures as representative of (or anomalous within) a particular time and place, relate sites and/or structures to one another and to broader regional landscapes or patterns in prehistory or history, and better understand change through time as expressed through a given resource. Questions relating to chronology might include the following:
    - Does the resource contain dateable or temporally sensitive materials such as charcoal, other organic remains, obsidian, diagnostic projectile point types, or dateable historic period glass, metal, or ceramic artifacts?
    - Does the historic period structure exhibit details in its fabrication or construction that would render it dateable?
    - What do dateable materials or structures reveal about when the site was used, how it was related to other sites in the vicinity, and how use or occupation of the resource may have changed through time?
- *Economy* comprises another key research theme that is relevant to the study of cultural resources. For historic period resources, the theme of economy has much to do with how products or materials were produced, sold, purchased, and consumed. For prehistoric sites, the theme of economy is closely related to subsistence, though it also may relate to how raw materials or finished goods were obtained or traded. The theme of economy is closely aligned to other research themes such as settlement or community organization, technology, trade and exchange, and cultural identity. Questions relating to economy or economic subsistence might include the following:
    - Does the resource contain evidence of the subsistence economy such as macrofloral or faunal remains? Do those materials represent seasonally or more permanently available foods? If seasonal materials are represented, what might they reveal about when or how a given site was used (e.g., temporary versus long-term habitation)? Is there evidence of food storage present?
    - Are non-local resources represented, perhaps indicating trade or exchange?
    - What do the floral or faunal remains reveal about the use of technology at the site?

    - Within historic period resources, is there evidence that food was grown for household consumption and/or grown as an economic commodity? Is there evidence for the consumption of non-local or mass-produced goods?

- *Settlement or Community Organization* refers to how people occupied the landscape—how they moved through space, where they established their settlements or communities, how those settlements or communities were structured and organized, and how they related to others within the same region or territory. Questions associated with settlement or community organization might include the following:

    - How is space structured within the boundaries of the resource? Is there evidence for different activity areas? What might that reveal about aspects of cultural identity such as gender, race, or ethnicity?

    - How does a particular resource relate to the larger settlement landscape or community? What cultural or environmental factors might have influenced the choice of one locale versus another?

    - Was a given resource area used temporarily or permanently? On a seasonal or year-round basis?

    - What might the resource reveal about social or economic structures at the local or regional level?

- *Technology* refers to the tools or methods that are used during the course of daily activities such as procuring or processing foods, building dwellings or other structures, and manufacturing utilitarian or non-utilitarian items. Questions relating to technology might include the following:

    - What kinds of tools were being used or manufactured by the people accessing or inhabiting the resource area?

    - Do they shed light on how the resource area was used or what activities may have been carried out there?

    - Do the artifacts present represent finished or unfinished items and what might that reveal about trade, exchange, and/or commerce?

    - What does the technology represented at a given resource location reveal about cultural chronology, the economy, and/or trade and exchange?

- *Trade and Economic Exchange* relate to how raw materials and finished goods were obtained through direct or indirect interactions between social groups. At Native American associated sites, it is possible to discover marine shell from the coast at sites within the San Joaquin Valley interior or non-local lithic materials procured from other regions. At historic period sites, it is even more common to find goods or materials of non-local manufacture that were acquired through commercial activity. Questions relating to trade and exchange might include the following:

- Does the site contain non-local materials or goods? How and from whom were those materials obtained?
- What do those items reveal about the spatial extent and stability of trade networks? What might those items reveal about technology, community organization, cultural identity, or the priorities and values of a given site's occupants?
- How do non-local materials at a resource location relate to the broader cultural landscape and environmental region?

- *Cultural History and Identity* pertain to the ways in which groups developed and formed shared identities based on social organization, political affiliation, religious practices, and/or gender, race, and ethnicity. Questions relating to cultural history and identity might include the following:
  - Does the resource area contain materials that can be linked to a particular social group that may shed light on the cultural history or identity of its inhabitants?
  - What do those materials or the ways in which they were structured, used, or organized reveal about gender, race, or ethnic identity?
  - Are particular ethnographic, linguistic, or ethnic groups represented?
  - For late Native American or historic period resources, how do the materials or remains within a given site support or refute other lines of evidence such as oral history or documentary records?

The research themes and questions above are not exhaustive but provide a basic framework for examining cultural resources within the Project APE and for evaluating the potential NRHP and CRHR eligibility of those resources.

6.2 Site Types and Attributes

An integral part of conducting cultural resource evaluations includes defining and documenting the site types represented by a given group of cultural resources. This was noted in Section 6.0 when discussing the types of cultural resources that were encountered during Project inventory surveys. Defining and documenting general site types is useful because it can guide the construction of contexts for historic period sites and structures or suggest fruitful research themes and questions for prehistoric sites. A brief outline of site types and attributes representative of those typically found within the Project vicinity is presented below.

6.2.1 Native American Associated Site Types and Attributes

Typical sites associated with Native American activities might include permanent or temporary habitation sites or activity-specific sites such as lithic scatters or food processing areas.

- *Permanent habitation sites* comprise residential sites that were occupied on a permanent or nearly permanent basis. Such sites are often distinguished by their size and by evidence for long-term occupation and material deposition. Permanent habitation sites frequently contain stratified midden deposits or mounds. Midden deposits consist of black or very dark, organic-rich soils that accumulate through intensive or long-term and repeated deposition. Permanent habitation sites might also be expected to feature evidence of house-pit depressions or the remains of other habitation structures. House-pit depressions are typically round, measure between 2-20 meters in diameter, and feature a low berm around their periphery. Given the effects of environmental forces and modern development, house-pit depressions are rarely encountered in the archaeological record but can provide valuable information about daily activities and the use of space in prehistory. The presence of bedrock milling features may also be indicative of long-term habitation. Frequently encountered in the foothills and in areas with bedrock outcrops, bedrock milling features contain mortars or slicks—rounded, cup-like depressions or shallower, elongated depressions that were formed by and used for grinding hard seeds such as acorns and other materials. Although many bedrock milling features have been associated with long-term habitation, they also frequently occur in isolation or independent of other archaeological deposits. The evaluation of a site's physical setting or context is critical in examining such features. In addition to midden soils, house-pit depressions, and bedrock milling features, the archaeological assemblage at permanent habitation sites might be expected to include an array of groundstone and lithic tools as well as floral and faunal remains.

- *Temporary or seasonal habitation sites* include those that were occupied for a short duration or those that were occupied repeatedly, though on a seasonal or short-term basis. Typically smaller than permanent habitation sites, temporary or seasonal habitation sites usually lack accumulated midden deposits or formal house-pit depressions. An array of activities may be evident at temporary or seasonal habitation sites, though materials would be expected to be less diverse than encountered at permanent habitation sites. Bedrock milling features, groundstone, lithic tools, and floral and faunal remains may all be present at temporary or seasonal habitation sites, though the assemblage would likely be less varied, and materials would be expected to be fewer in number when contrasted with permanent habitation sites.

- *Activity-specific sites* include those that were used for one purpose or for a very limited range of purposes. Lithic scatters, lithic quarry areas, or food processing locales are all examples of such sites. Typically used once or for a short duration, these sites are often characterized by limited assemblages that represent the narrow range of activities that would have occurred there.

6.2.2 Historic Period Site Types and Attributes

Historic period site types that have been encountered or might be anticipated within the APE would include intact or remnant farmstead or ranch sites, agricultural sites, transportation infrastructure, water conveyance features, prospect pits or mining sites, foundations or structure pads, and debris scatters or deposits. Historic period site types are usually based on functional categories and are typically easy to distinguish based on their physical attributes. Cultural constituents often encountered at historic period sites include pits, privies, fences, ditches, water retention or conveyance features, other structural elements, and domestic or industrial debris.

- *Farmstead or ranch sites* frequently include a residence and one or more outbuildings or structures clearly associated with ranching or agricultural activity (e.g., barn, corral, livestock watering locale, and/or shed). They may feature associated historic period debris deposits or scatters and may contain pits, privies, fences, ditches, and livestock watering locales marked by troughs, windmills, and/or water pumps.

- *Agricultural sites* typically include features that are functionally related to the cultivation, production, and harvesting of crops. Such sites are often distinguished by irrigation ditches and canals, fence lines, modified or landscaped hedgerows or tree lines, and berms or mounded soil areas meant to aid water retention or abatement.

- *Transportation infrastructure* consists of historic period features such as paved or unpaved roads and railroad lines or grades. Railroad lines or grades generally feature a relatively level grade, typically on a constructed berm that may or may not include rails, ties, or spikes. Former railroad lines are often dismantled and repurposed as roads and can be difficult to distinguish in the form of berms that have been converted into unpaved roads. Roads are usually easier to distinguish and are sometimes associated with bridges, culverts, and/or secondary debris deposits or scatters left casually or deliberately by passing vehicles.

- *Water conveyance features* include infrastructural elements such as canals, ditches, dams, and dikes and are generally easy to distinguish in form and function, though they can be hard to discern or differentiate when encountered as a part of a larger water conveyance system. For instance, an agricultural canal and ditch system may contain hundreds of elements that have been added, removed, or transformed through time, and it can be difficult to distinguish the precise date or period when certain elements were constructed or altered.

- *Foundations or structure pads* include the material remains of a building's base and are generally constructed of stone, concrete, or wood. Structure pads are areas that have been leveled, typically for the placement of small, less permanent structures, and do not contain foundation elements.

- *Prospect pits or mining sites* typically comprise excavated pits or quarry areas made to test for or extract rocks, gravels, minerals, or metals. Spoils piles, or areas of mounded soils or displaced stone, are often found in conjunction with prospect or mining sites.

- *Debris scatters or deposits* are usually composed of domestic and/or industrial materials that have been scattered or deposited in the area in which they were used (i.e., a primary deposit) or in an area unassociated with their use (i.e., a secondary deposit). For instance, a farmstead or ranch site might feature one or more primary debris scatters containing domestic items such as glass, metal, and ceramics and might contain debris associated with ranching or farming activities such as barbed wire, fencepost remnants, and horseshoes. A historic period road might feature a secondary scatter of domestic or industrial items representing one or more roadside discard events.

6.3 Archaeological Resource Evaluations

6.3.1 DMC-CRP-001

DMC-CRP-001 is a historic period ditch segment consisting of four features: a hand-operated flood gate (Feature 1); an earthen ditch (Feature 2), an earthen berm (Feature 3), and a discrete flat area with grasses that differ from the surrounding vegetation (Feature 4). Feature 1 is an iron hand-operated flood gate with wood and concrete elements. It is located on Feature 2, an earthen drainage that has been partially cut through stone. It appears to be a channelized natural drainage. The drainage is depicted on topographic maps as early as 1917. It appears to have been channelized ca. 1953 based upon historic aerial imagery (NETROnline 2022). Feature 3 is a north-south oriented earthen berm approximately 15 ft. long by 2 ft. 4 in. tall. Feature 4 is a distinct area of green, lawn-like vegetation that is approximately 40 ft. (E/W) by 15 ft. (N/S). The resource may be associated with flood control for a channelized drainage that was installed in association with the construction of the Delta-Mendota Canal, or it may be part of an irrigation system. The site is located west of Newman in Township 8 South, Range 8 East, Section 4 in Stanislaus County.

Historic Context

As part of the Central Valley, the Newman area was primarily used for agriculture employing both dry and irrigated farming techniques. In 1871, the Joaquin and Kings River Canal Company formed to build a canal, which Miller and Lux later constructed after they acquired control of the company. This canal ran north-south for 75 mi. from Crows Landing to Firebaugh past Newman and became the first irrigation canal in Stanislaus County. This started irrigated farming on the west side of the San Joaquin River in Stanislaus County (Barnes 1987). Between the 1870s and 1920s, irrigation infrastructure, including the Main Canal and Outside Canal, were constructed. The Sullivan Extension of the Outside Canal was constructed between 1941 and 1949 (Jensen 2017; NETROnline 2022; USGS 1941). In 1951, the Central California Irrigation District (CCID) was organized, which acquired the infrastructure and a large territory along the west side of Stanislaus County between Crows Landing and Mendota (Barnes 1987:Chapter 3; Central CA Irrigation District 2020; Jensen 2017:6). DMC-CRP-001 is located outside of the CCID (2020) boundaries as currently depicted. It is not known if the larger irrigation system that included the site was ever associated with the CCID system.

By 1900, two farming households were situated within a mile of the site location in T8S, R8E, Sections 4 and 5 and might be associated with the site. An unpaved road that ran between the farms and passed the site location is seen depicted on USGS topographic maps (1917, 1919, 1941). A 1906 county map (Carlton 1906) identified these early twentieth century households established by A. L. Yates and W. F. Draper. Yates started farming in Stanislaus County by 1880 and retired to Pacific Grove in Monterey County between 1906 and 1910 (US Census Bureau 1880: 285D, 1900:10; 1910:11A). Draper came to Merced County in 1870 and was farming in Stanislaus County by 1884 (Merced County 1870; Stanislaus County 1884). When he retired by 1910, he remained in Newman Township until his death in 1919 (FindaGrave 2022a; US Census Bureau 1900:7, 1910:13A). Neither of these farmers were considered important enough to be included in a 1921 county history with biographical sketches of prominent residents (Tinkham 1921). Based on the dates, neither of these farmers appears to be associated with the channelizing and expansion of the irrigation system that includes DMC-CRP-001 between 1949 and the early 1950s. The California Water Board was checked for ditch water rights that might identify the owner, however, neither the ditch nor a later owner were identified (California Water Board 2022). The builders have not been identified.

The drainage/ditch appears on historic period maps (USGS 1917, 1919, 1941, 1952) and on a 1949 aerial photograph (Fairchild Aerial Surveys, Inc. 1949) as a natural drainage that extended from the western hills to flow east towards Newman. The drainage was channelized by 1953, based on 1953 and 1957 aerial photographs (NETROnline 2022). During the 1949 to 1953 time period, the north-south oriented Delta Mendota Canal was constructed near the site location and appears to have cut the segment off from the rest of the irrigation system (Reclamation 1959). The 1957, 1958 and 1982 aerial photographs depict the ditch continuing on the east side of the Delta-Mendota Canal. The ditch extends northeast to intersect Flanders Court and then turns east to follow Pete Miller Road toward the Sullivan Extension Canal and/or the Main Canal of the Central California Irrigation District (CCID). The site vicinity is not currently within the CCID boundaries, but it may have been in the past. Currently, the eastern extension of the site segment of the irrigation ditch is obscured by current farming crops and does not appear connected to the site segment. There is a visible ditch segment along the north side of Pete Miller Road to Eastin Road where it disappears.

Evaluation

DMC-CRP-001 is an abandoned remnant irrigation ditch segment with a berm and a former pond that have been cut off from a larger irrigation system by the Delta-Mendota Canal between 1949 and 1952. The ditch segment appears to have been used as a water source in its natural drainage form starting by the early twentieth century but was not channelized until the early 1950s. The irrigation ditch is not part of the first irrigation canal system in the region, nor does it contribute notably to the history of the development of irrigation systems nationally, state-wide or locally. The ditch site is not clearly associated with either the early twentieth century farmers, Draper and Yates, nor is it clearly associated with the CCID and its later irrigation complex. The builder who channelized and expanded the irrigation system in the 1950s has not been identified. As such, DMC-CRP-001 is not recommended eligible for listing on the NRHP or CRHR under Criterion A/1 or under Criterion B/2. DMC-CRP-001 exhibited no unusual or outstanding workmanship or engineering and, therefore, is recommended not eligible for the NRHP or CRHR under Criterion C/3. The ditch complex had no associated artifact deposits or potentially buried features and has been fully recorded. As such, it is unlikely to possess the data potential to contribute significant new information to research related to historical water systems. The site, therefore, is recommended not eligible for the NRHP or CRHR under Criterion D/4.

The site condition is fair. The features are overgrown and in disrepair, but the layout and function of the site segment is still apparent. The construction of Interstate 5 and the Delta-Mendota Canal have isolated this segment of the canal, though a tunnel to allow flow is present where the ditch meets Interstate 5. The connection with irrigation on the east side of the Delta-Mendota Canal is no longer obvious. The ditch segment site retains its integrity aspects of location, materials and workmanship. The association and design aspects are retained with regard to the function of the site and association with irrigation to the west of Interstate 5, however, it is diminished by the loss of clear association with the irrigation system to the east of the Delta-Mendota Canal. The setting and feeling aspects are diminished by the presence of the interstate highway and the canal resulting in a fair integrity of the site. DMC-CRP-001 has fair integrity, however, the site does not meet Criteria A/1, B/2, C/3, or D/4 and is recommended not eligible for listing on the NRHP or CRHR.

6.3.2 DMC-CRP-002

This resource is a historic period refuse scatter. It comprises over 15 glass bottle fragments with a minimum number of individuals (MNI) of 5 bottles. Eight diagnostic glass bottle fragments were identified. The remaining 7 glass fragments were non-diagnostic. Artifact A-01 is a colorless bottle base fragment that measures 1.75 in. (l) x 5 in. (w). It features an Owens Illinois maker's mark, "OI", that dates from 1954 to present (Toulouse 1971:403). A-02, A-06, and A-08 are three colorless bottle finish and neck fragments with threaded metal caps. The caps are marked "Old Sunny Brook/ TURN TO OPEN" printed around the caps. Old Sunny Brook brand was in use from the 1890s to 1975 (Sullivan 2013). A-03 is a stippled bottle base fragment that measures 2.9 in. square. It features a maker's mark from the Obear-Nester Company, "N [in square] 4…", that provides a partial date code for a 1940s date (Whitten 2022). A-04 is a bottle base fragment marked "4/5 quart". A-05 is a bottle base fragment embossed "57". A-07 is a bottle base fragment marked "800…/10 [H on anchor] …/3", an Anchor Hocking mark that dates from 1937 to 1968 (Anchor Hocking Museum 2015). The diagnostic bottle marks suggest the artifact scatter dates between the 1940s and 1968. The site is located on the top of a berm that appears to be the result of grading the access road along the Delta-Mendota Canal. The site is located west of Newman and southeast of the Stimba Pumping Station in Township 6 South, Range 8 East, Section 32 in Stanislaus County.

Historic Context

DMC-CRP-002 is on agricultural lands west of Crows Landing. In the 1870s, Miller and Lux constructed the San Joaquin and Kings River Canal from Crows Landing to Firebaugh, which started irrigated farming on the west side of Stanislaus County (Barnes 1987). Between the 1870s and 1920s, irrigation infrastructure including the Main Canal and Outside Canal were constructed on the west side of the San Joaquin River in association with the San Joaquin and Kings River Canal (Jensen. In Section 32, the Stimba Pumping Station appears on USGS topographic maps starting in 1917 (USGS 1917, 1919, 1941, 1952). It is just northwest of the site location. It appears to be a water pumping station for the channelized Crow Creek (Metsker Map Company 1939; USGS 1917).

Historical map research demonstrates that the area was fully parceled for farming by ca. 1900. A 1906 county map identified the site area belonged to the Yancey family. Although John Yancey managed a local lumber yard, his wife, Merle C. Yancey, owned the parcel and they may have farmed it as a sideline (Carlton 1906; US Census Bureau 1910:3A). The Yanceys remained in the area until at least 1944 (Stanislaus County 1944). Mr. Yancey died the following year (FindaGrave 2022b). The north-south oriented Delta-Mendota Canal was constructed between 1949 and 1953 (Reclamation 1959). DMC-CRP-002 is located along the Delta-Mendota Canal near a canal check station and south of a county highway and bridge depicted on a 1939 road map (Reclamation 1959; Metsker Map Company 1939). The road and berm associated with the site were part of the Delta-Mendota Canal system and not part of an earlier road, based on USGS topographic and other maps (Metsker Map Company 1939; USGS 1917, 1919, 1941 and 1952).

Evaluation

DMC-CRP-002 is a scatter of historic period glass bottle fragments located on the Delta-Mendota Canal access road. The artifact scatter was deposited between the 1940s and 1968, based on the bottle date ranges. The scatter may be associated with the construction, maintenance, or construction personnel associated with the Delta-Mendota Canal; however, it does not appear to directly contribute to any historic significance the canal may possess. The site scatter may be associated with persons or activities associated with the Stimba Pumping Station nearby. Since the road and berm are not fenced off, the scatter may be associated with passersby who used the access road to access the nearby orchards. The site scatter is unlikely to be associated with the Yancey family as the patriarch died in 1945 before the bottles were manufactured. The historical association for DMC-CRP-002 is not clear and no individuals were clearly associated with the scatter deposition. As such, the DMC-CRP-002 site is not recommended eligible for listing on the NRHP or CRHR under Criterion A/1 or under Criterion B/2.

DMC-CRP-002, as an artifact scatter, does not retain any standing structures that might represent an outstanding example of architecture or engineering. As such, the site is recommended not eligible under Criterion C/3.

DMC-CRP-002 consisted of 15 artifact fragments, with an MNI of 5. At least three of the bottles were alcohol bottles of the same brand, "Old Sunny Brook". This assemblage does not possess sufficient quantity and quality of materials to retain data potential sufficient to address historical archaeology research questions. There do not appear to be any signs of intact hollow-fill features or stratigraphic depth present, which might provide intact deposits. Based on this, the site is recommended not eligible for the NRHP or CRHR under Criterion D/4.

The site condition is poor. This site has been heavily impacted by canal maintenance and road grading. All of the soil has been disturbed, and there is nearly no vegetation due to regular mowing. The berm upon which the site lies appears to be an artificial build-up as a result of road grading. The deposit does not appear to be intact. The site scatter retains its integrity aspects of materials and workmanship. It is unknown whether the scatter is primary or secondary deposition, and it has been disturbed by maintenance activities. The site is unlikely to retain its integrity aspects of location and design. The setting, association and feeling aspects are diminished by construction of the nearby freeway, a lack of knowledge as to who might have deposited the scatter or under what circumstances. The site integrity is poor. DMC-CRP-002 has poor integrity and the site does not meet Criteria A/1, B/2, C/3, or D/4 and, as a result, is recommended not eligible for listing on the NRHP or CRHR.

6.4 Built Environment Resource Evaluations

JRP staff recorded and evaluated five built environment resources in the APE: Delta-Mendota Canal, two rural residential properties, and two drainage canals. The JRP report concludes (Appendix F) that the Delta-Mendota Canal and San Luis Drain are considered eligible for the NRHP or CRHR significance criteria. The three other newly discovered resources evaluated, the two rural residential properties on Lammers Road (APN 251-050-120 and 240-140-260) in San Joaquin County and a drainage canal that is part of Firebaugh Canal Water District in Fresno County, were recommended not eligible for the NRHP or CRHR. The Santa Fe Grade, San Joaquin Pipelines – Hetch Hetchy Aqueduct, and the Outside Canal have been previously determined eligible for the NRHP and CRHR.

7.0 STUDY FINDINGS AND CONCLUSIONS

7.1 ARCHAEOLOGICAL RESOURCES

Pacific Legacy completed an intensive pedestrian survey of 5,736 acres of the APE. The remaining portions of the APE were not surveyed due to total development with no ground visibility (2.0 acres), or a lack of access permission to private lands (161 acres). Two newly identified archaeological sites and two archaeological isolates were located during the survey. Appendix D contains the site and isolate records for all cultural resources encountered in the survey area.

The two newly identified archaeological sites, temporarily designated as DMC-CRP-001 and DMC-CRP-002, both date to the historic period. DMC-CRP-001 is a ditch complex that was partially obliterated by the construction of the Delta-Mendota Canal and Interstate 5. It comprises an earthen ditch that has portions carved into rock, an earthen linear berm, the ruins of a flood gate, and a patch of green grass that was anomalous to the surrounding survey corridor that may suggest a buried feature. Ground surface visibility at the site was low due to dense brush and grasses. DMC-CRP-002 is a trash scatter comprising 15 glass bottle fragments, some of which feature maker's marks and finishes that date to the 1950s. Ground surface visibility at the site was 100% as the grasses had been mowed recently. Both DMC-CRP-001 and DMC-CRP-002 are recommended to be ineligible for inclusion in the NRHP and CRHR.

Two new archaeological isolates were identified within the APE. DMC-CRP-ISO-001 comprised two crypto-crystalline silicate (CCS) flakes located near the old San Luis Creek bank. Ground surface visibility at the isolate was 100%. DMC-AAS-ISO-001 is the remains of a historic period plow located in a field along the Delta-Mendota Canal. The surface visibility around this isolate was very low due to tall grasses.

No archaeological resources have been identified within the APE that are considered historic properties. If Reclamation agrees with this determination, then the Delta-Mendota Canal Subsidence Correction Project would not have an adverse effect on archaeological resources.

7.2 BUILT ENVIRONMENT

Five resources have been identified as historic properties. This includes the Delta-Mendota Canal, San Luis Drain, The Santa Fe Grade, San Joaquin Pipelines – Hetch Hetchy Aqueduct, and the Outside Canal. JRP, in their finding of effect analysis (Appendix F), concluded that the Delta-Mendota Canal Subsidence Correction Project would adversely affect Delta-Mendota Canal but would not adversely affect the other historic properties in the APE. This conclusion is the same for both Alternatives 1 and 2.

7.3 CONCLUSIONS

A Draft Initial Study/Environmental Assessment (IS/EA) is being prepared by Reclamation and the Authority that addresses potential impacts of the two Project alternatives to cultural resources under NEPA and CEQA. Given the information available, adverse effects to significant cultural resources (i.e., historic properties) may result from implementation of Alternative 2. Mitigation measures to resolve adverse effects on historic properties, pursuant to Section 106 of the NHPA, cannot be determined until all cultural resources in the APE for the undertaking have been fully evaluated for NRHP eligibility and consultations are conducted under Section 106 of the NHPA. This will not occur until after the submission of the draft IS/EA to Reclamation. Any adverse effects to historic properties would be resolved through completion of the Section 106 process.

The resolution of adverse effects to historic properties occurs through the implementation of measures agreed on through consultation with the SHPO, ACHP, and other Section 106 consulting parties. These measures are discussed in the 2021 Amendment One Programmatic Agreement Between the Bureau of Reclamation, Interior Region 10 California-Great Basin; and the California State Historic Preservation Officer Regarding Compliance with Section 106 of the National Historic Preservation Act Pertaining to the Implementation of the Delta-Mendota Canal Subsidence Correction Project, which remains in review. In general, significant impacts to cultural resources under NEPA would be mitigated through the measures agreed to through the Section 106 process and the preparation of a Historic Properties Treatment Plan. Cultural resources that are formally determined not eligible for inclusion in the NRHP or the CRHR would require no further management prior to Project implementation. If cultural resources determined not eligible for listing in the NRHP but eligible for listing in the CRHR are identified as part of the Project, such resources will be managed per CEQA requirements.

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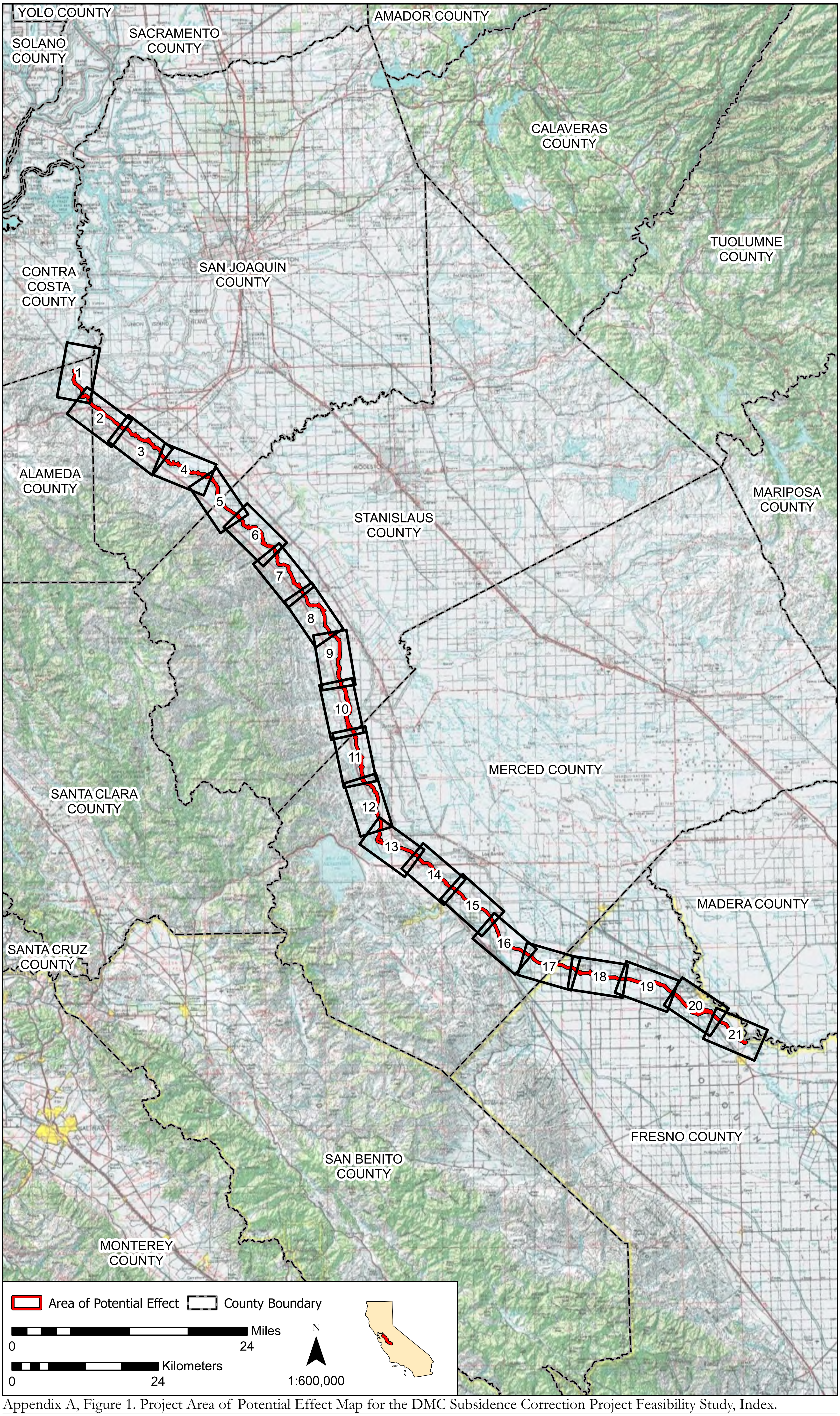
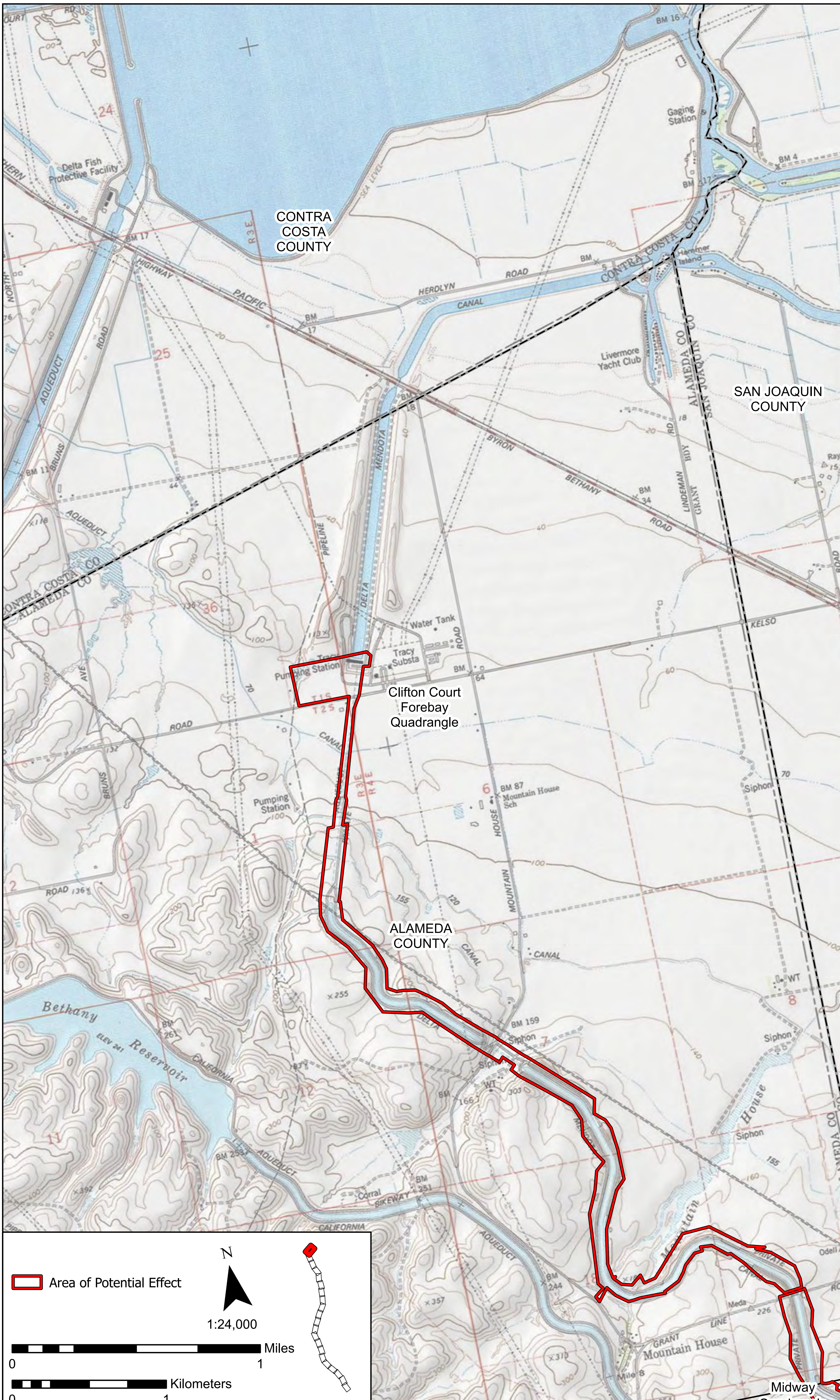
APPENDIX A – PROJECT FIGURES (REDACTED)

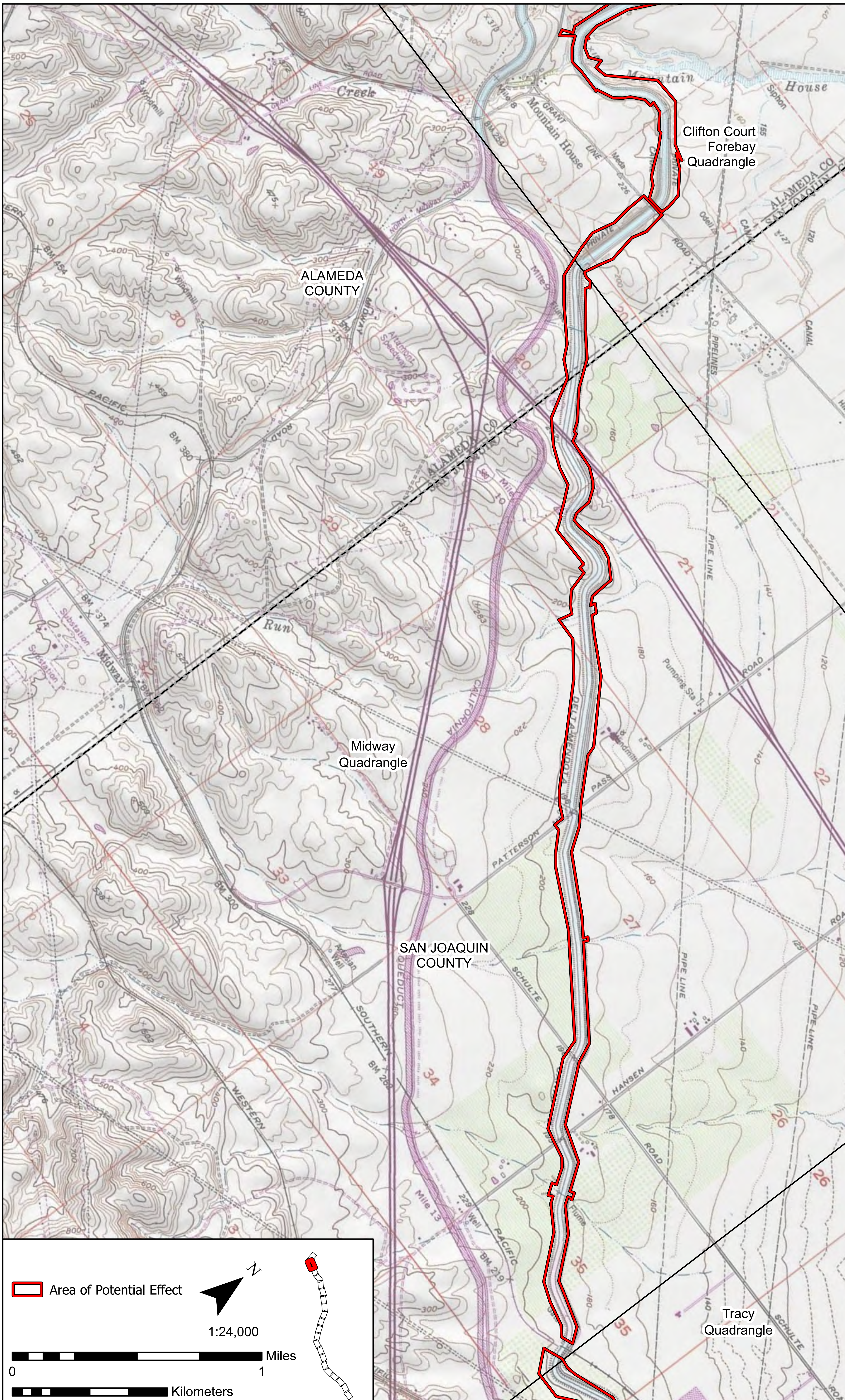
Note: Figures Containing Confidential Information Have Been Removed



Appendix A, Figure 1. Project Area of Potential Effect Map for the DMC Subsidence Correction Project Feasibility Study, Index.



Appendix A, Figure 1. Project Area of Potential Effect Map for the DMC Subsidence Correction Project Feasibility Study, Page 1 of 21.



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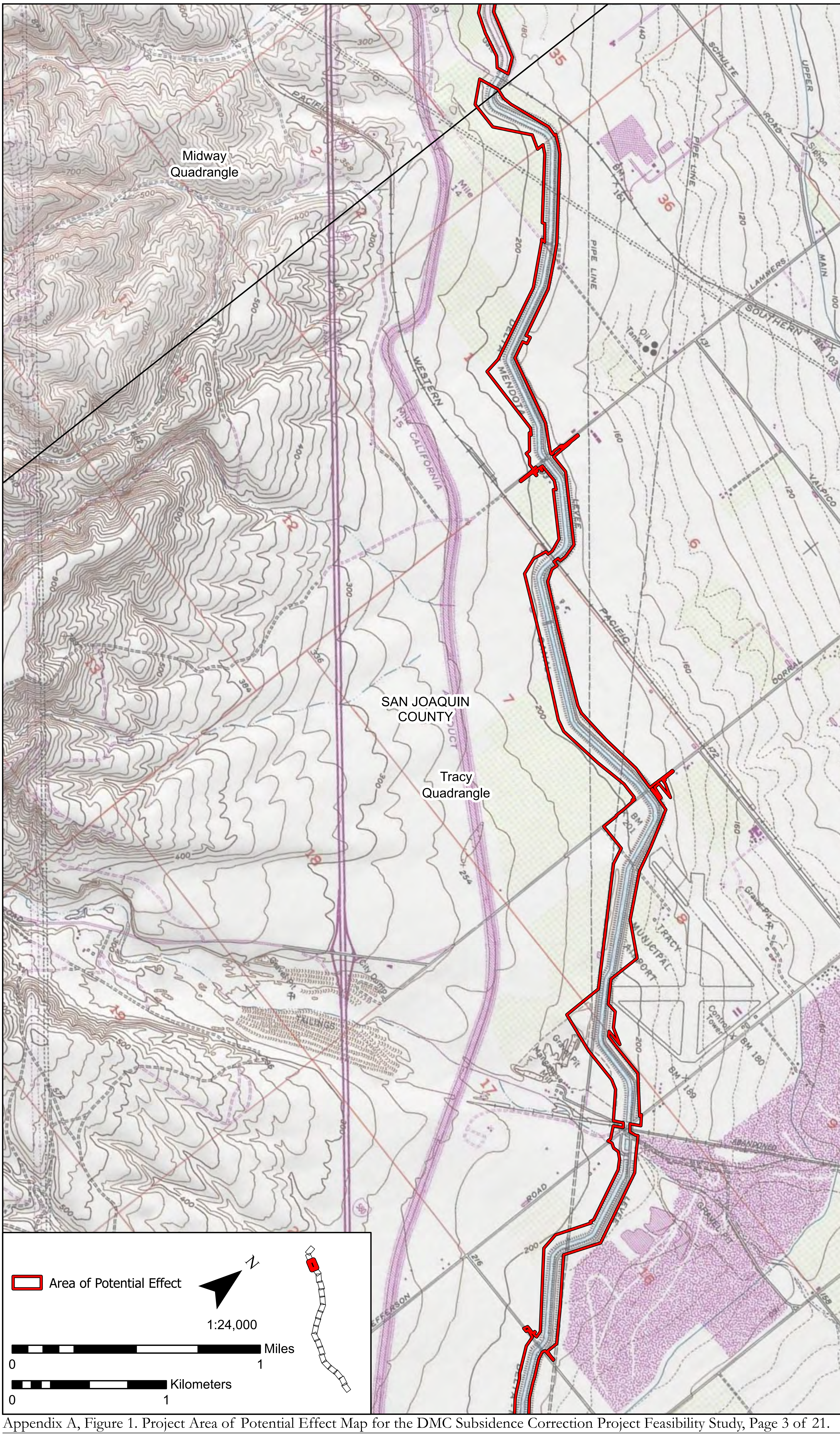

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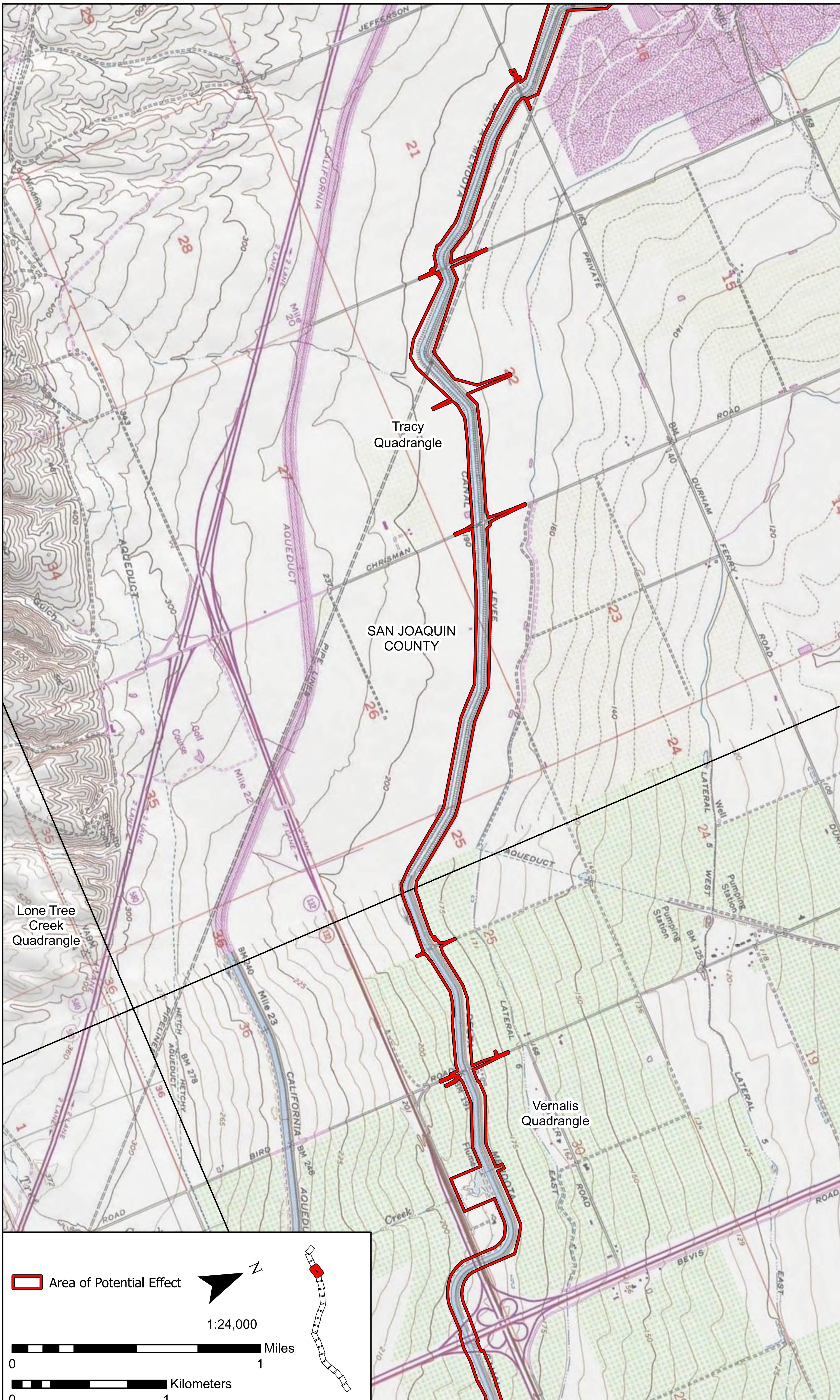

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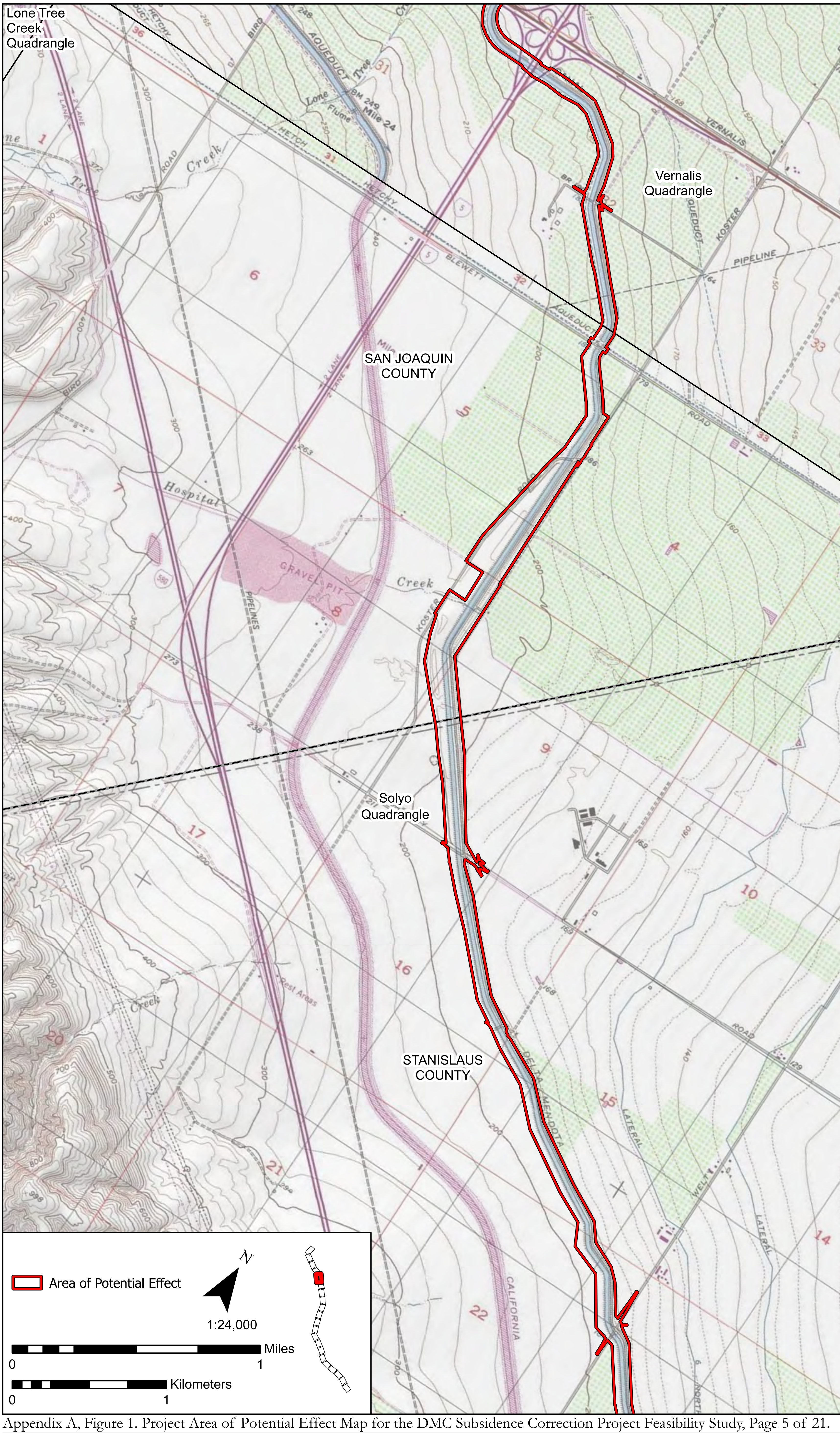

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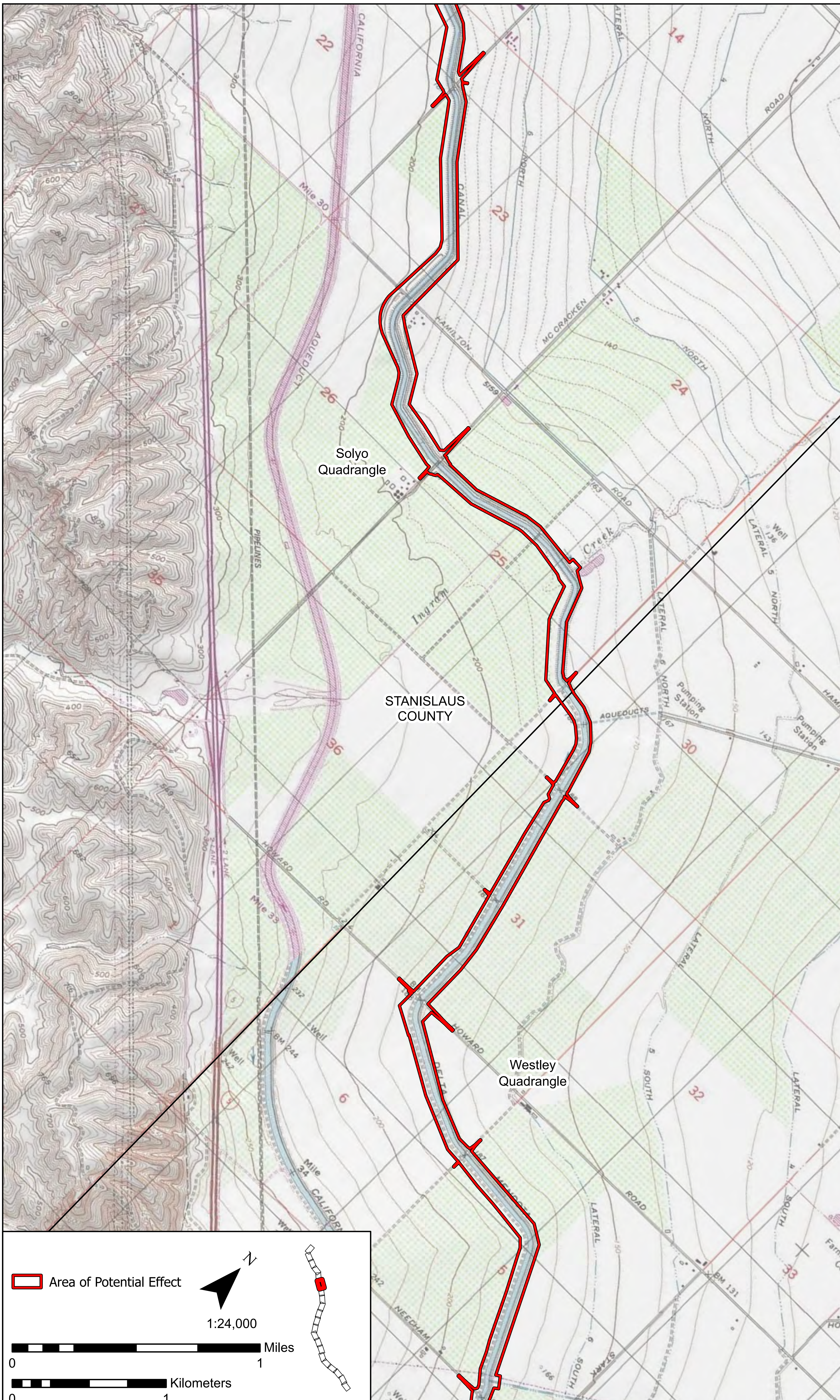

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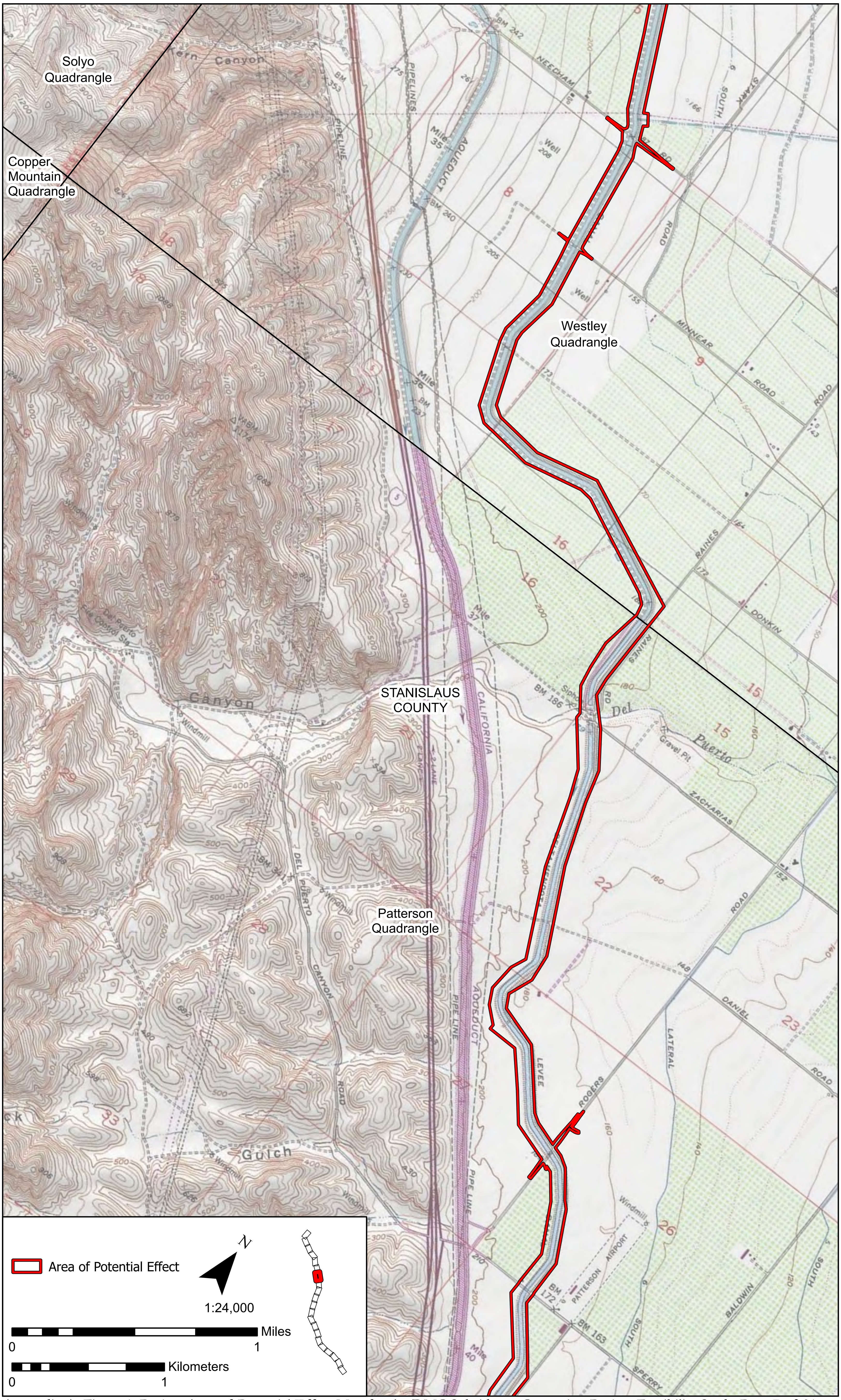

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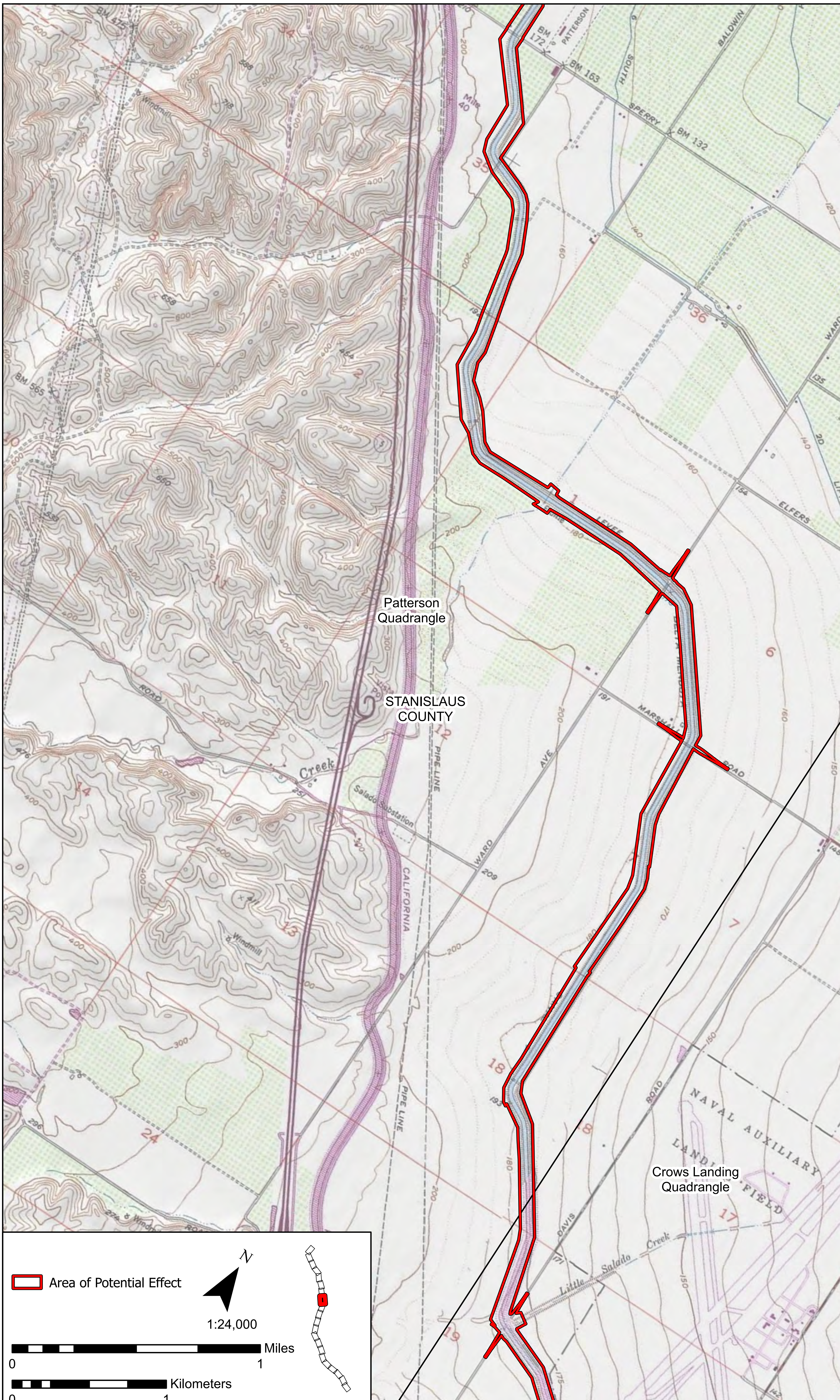
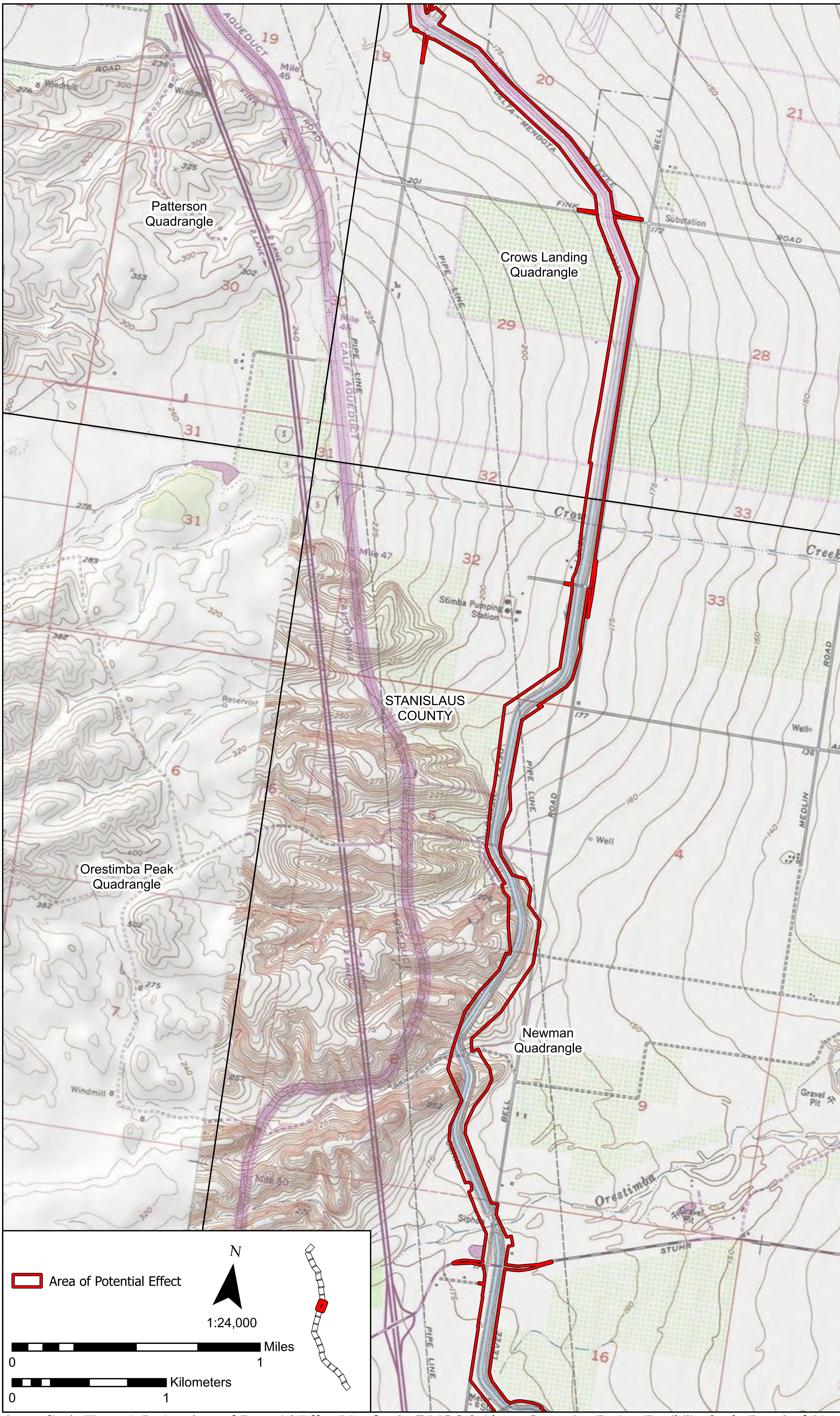


Appendix A, Figure 1. Project Area of Potential Effect Map for the DMC Subsidence Correction Project Feasibility Study, Page 8 of 21.



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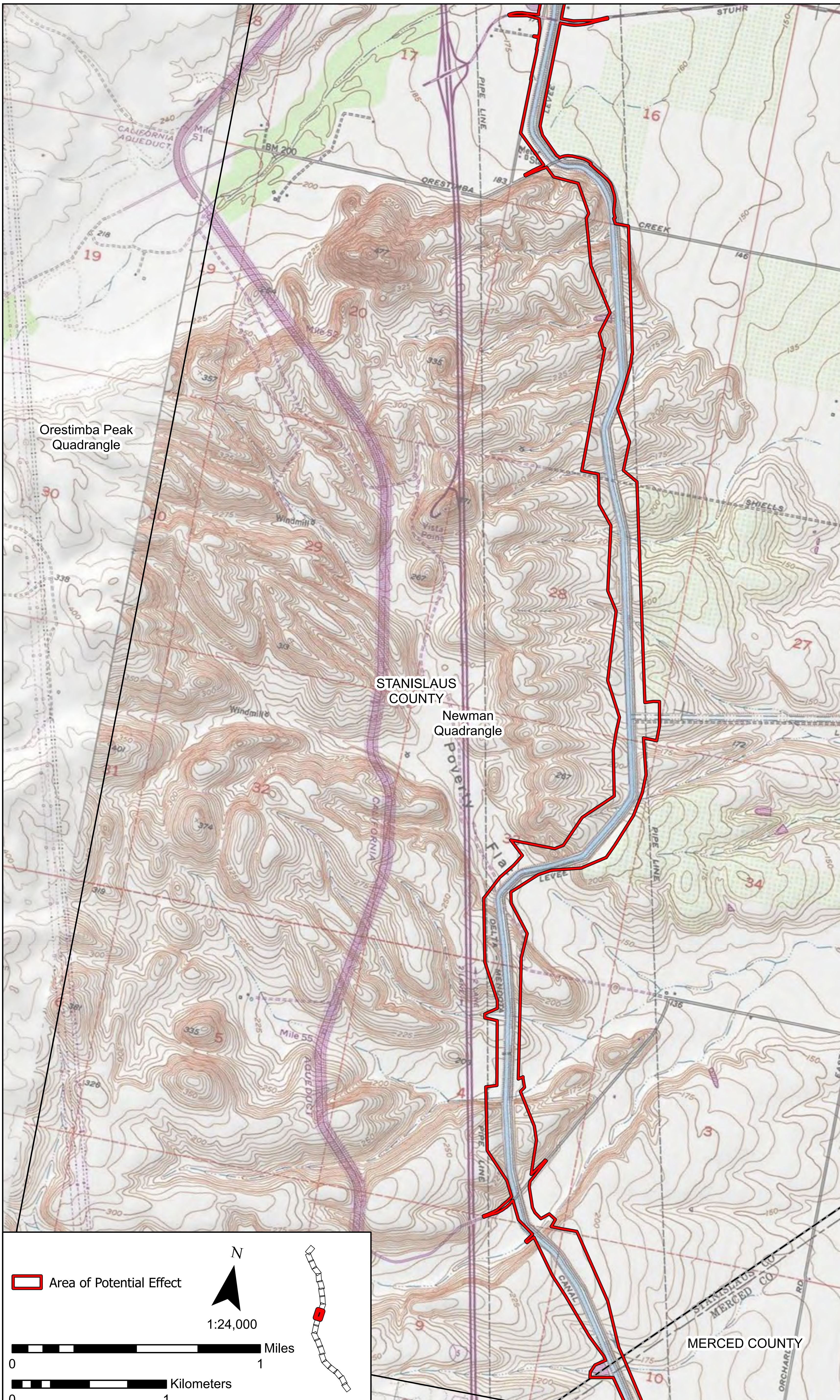

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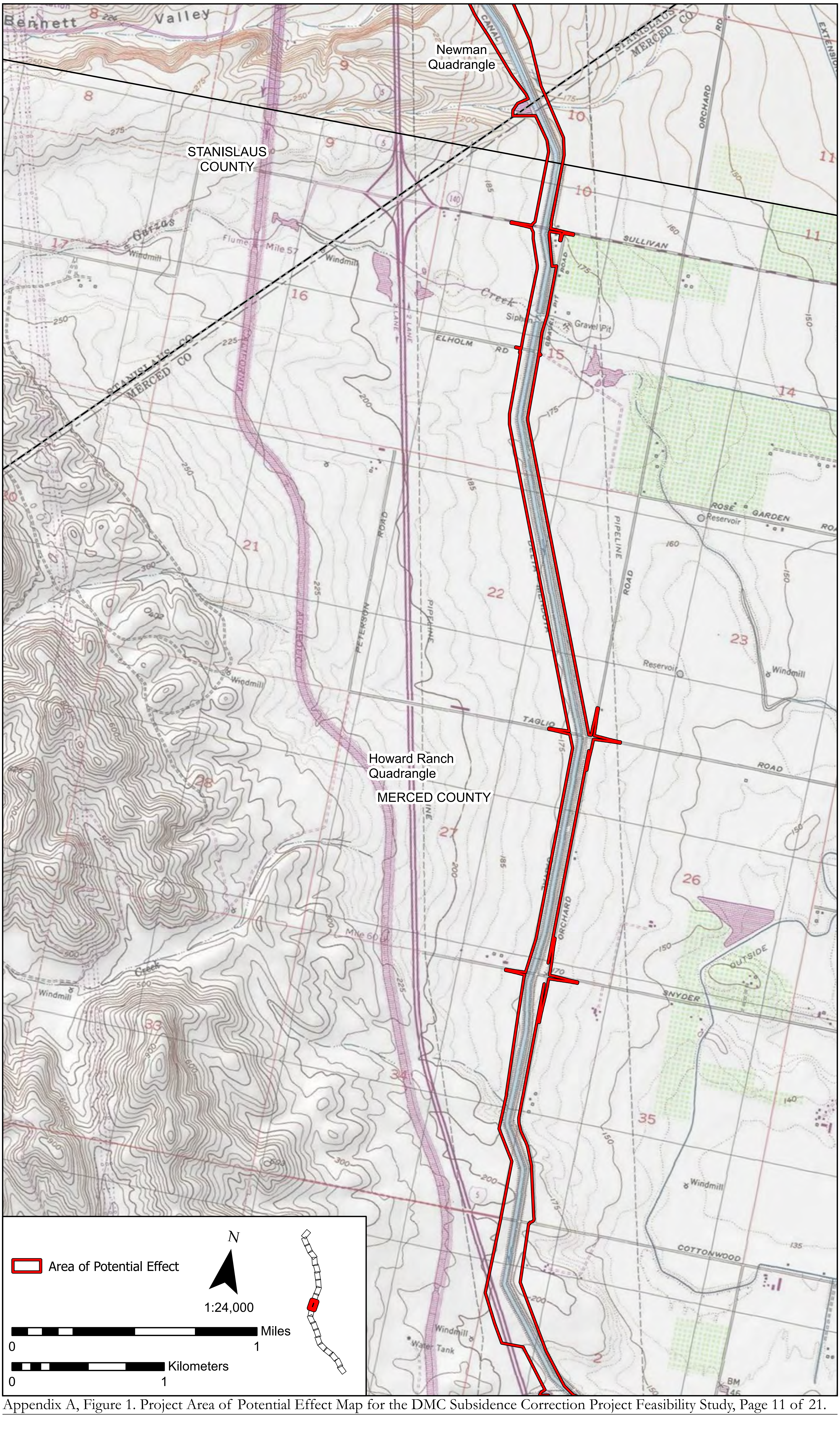

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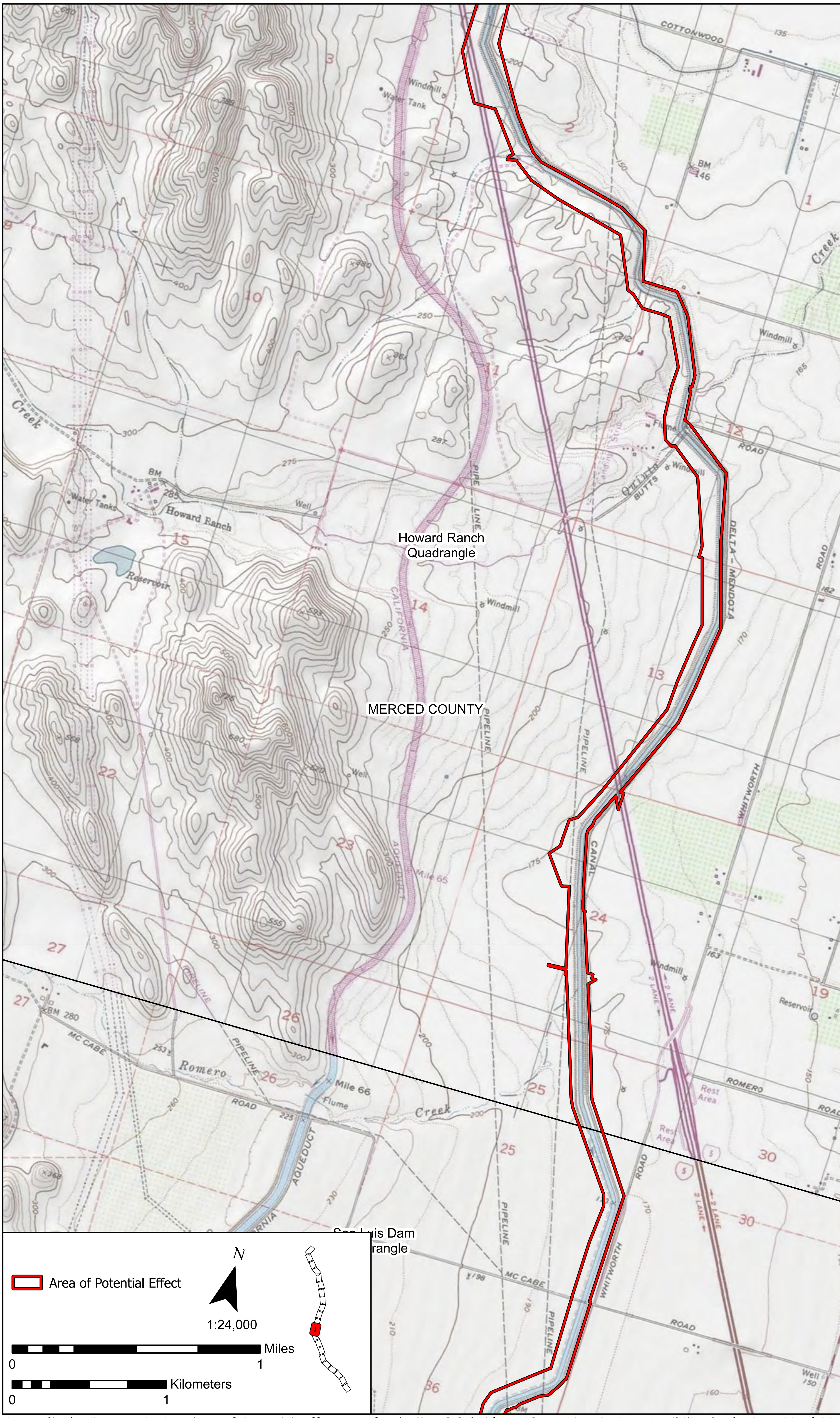
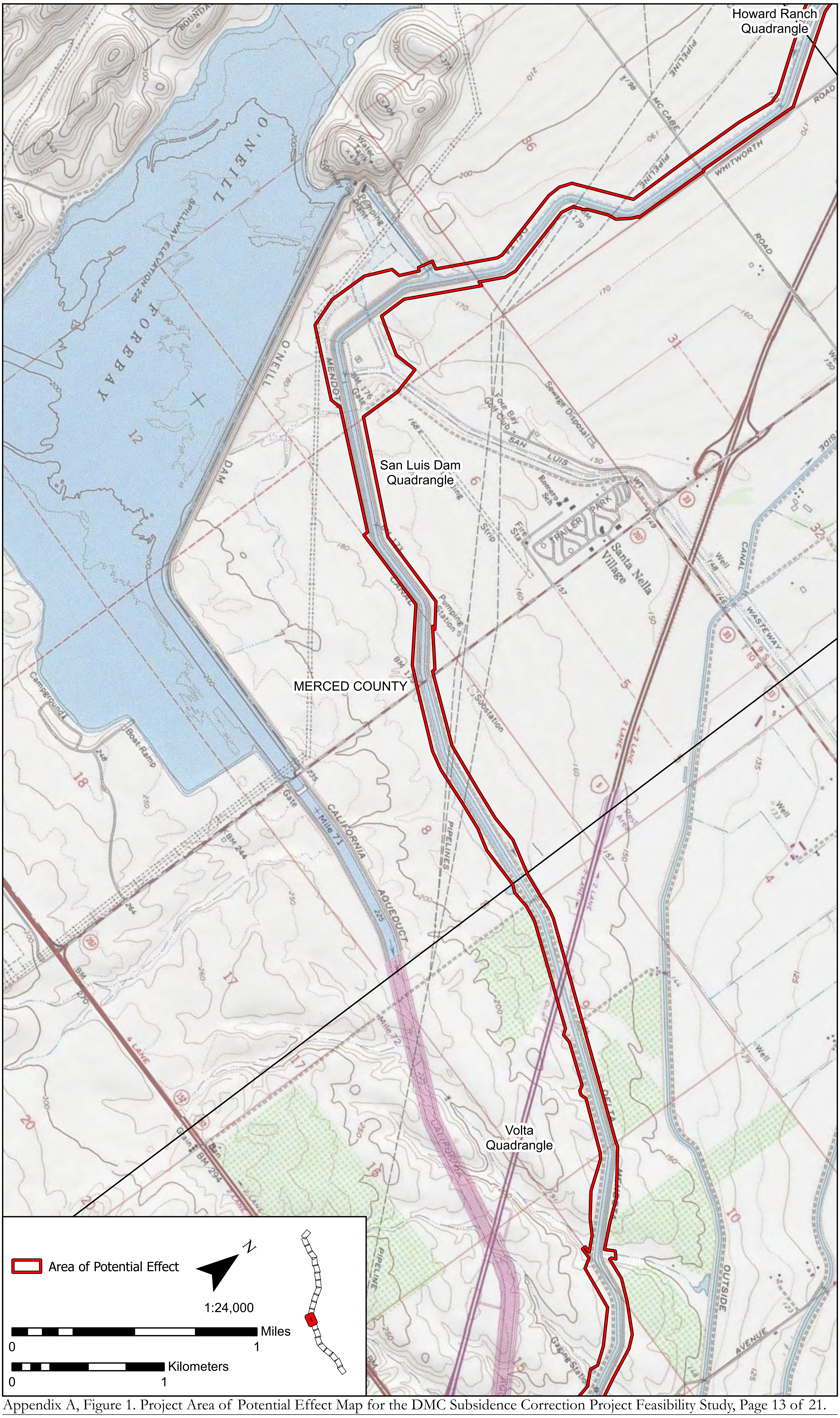
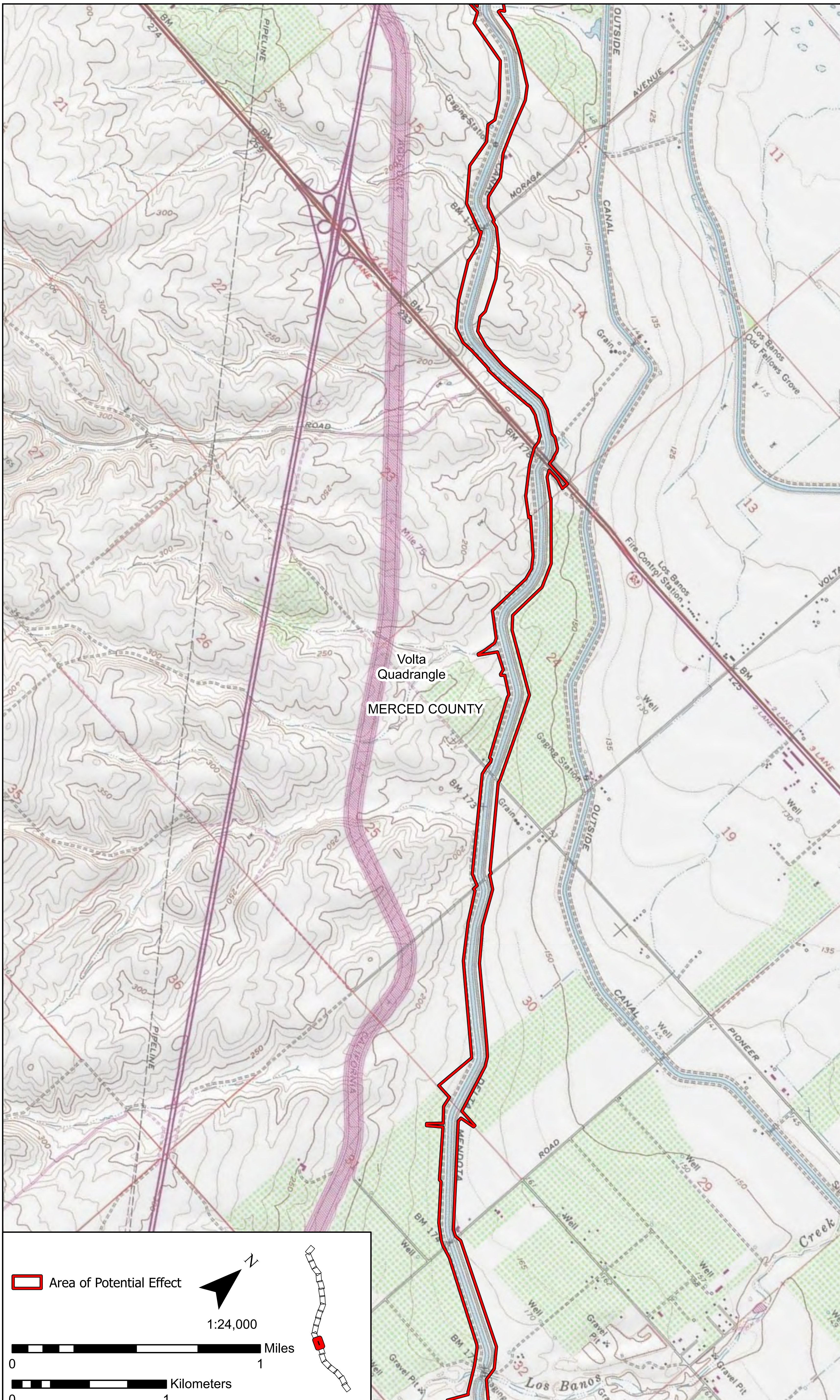


Appendix A, Figure 1. Project Area of Potential Effect Map for the DMC Subsidence Correction Project Feasibility Study, Page 12 of 21.



Appendix A, Figure 1. Project Area of Potential Effect Map for the DMC Subsidence Correction Project Feasibility Study, Page 13 of 21.



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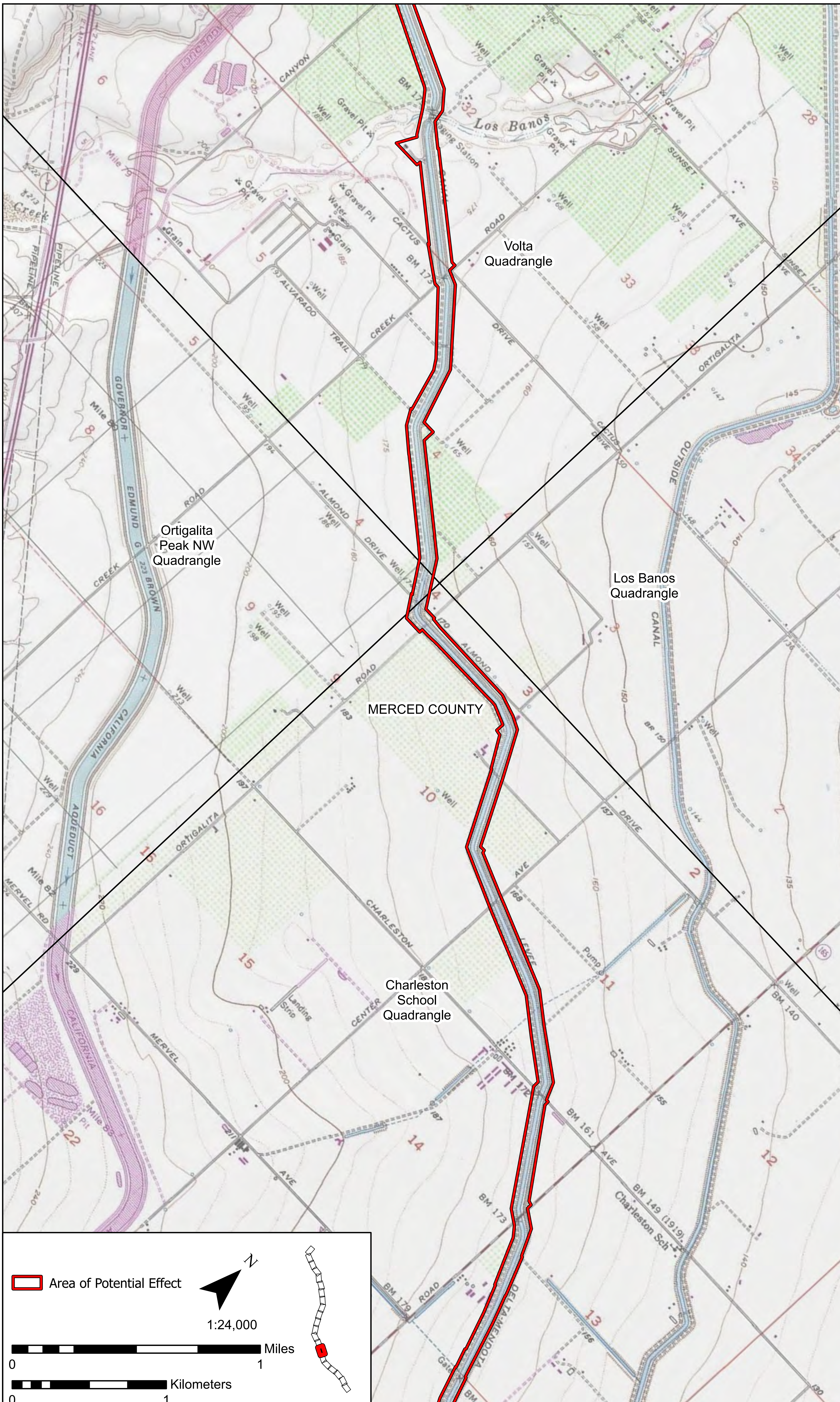

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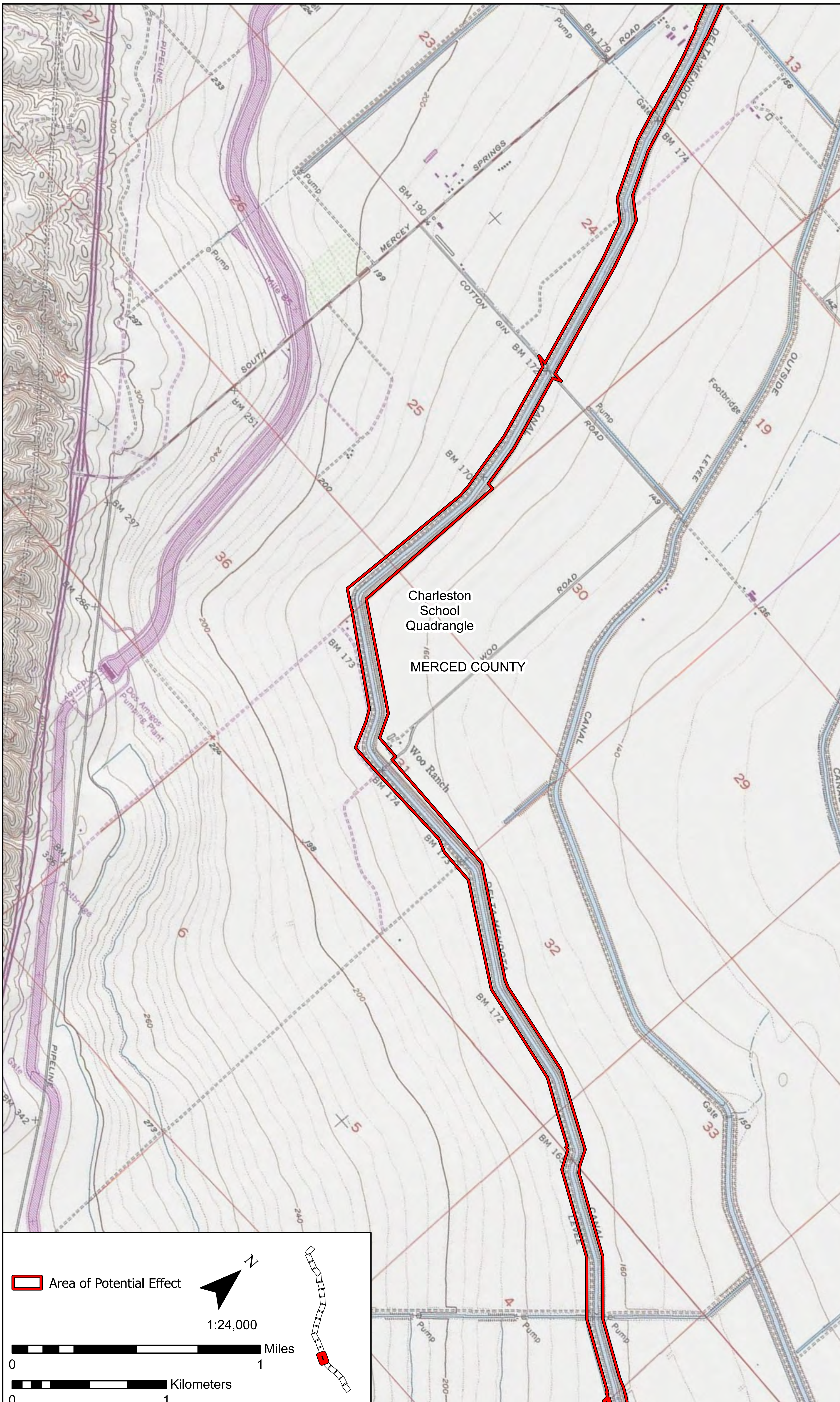

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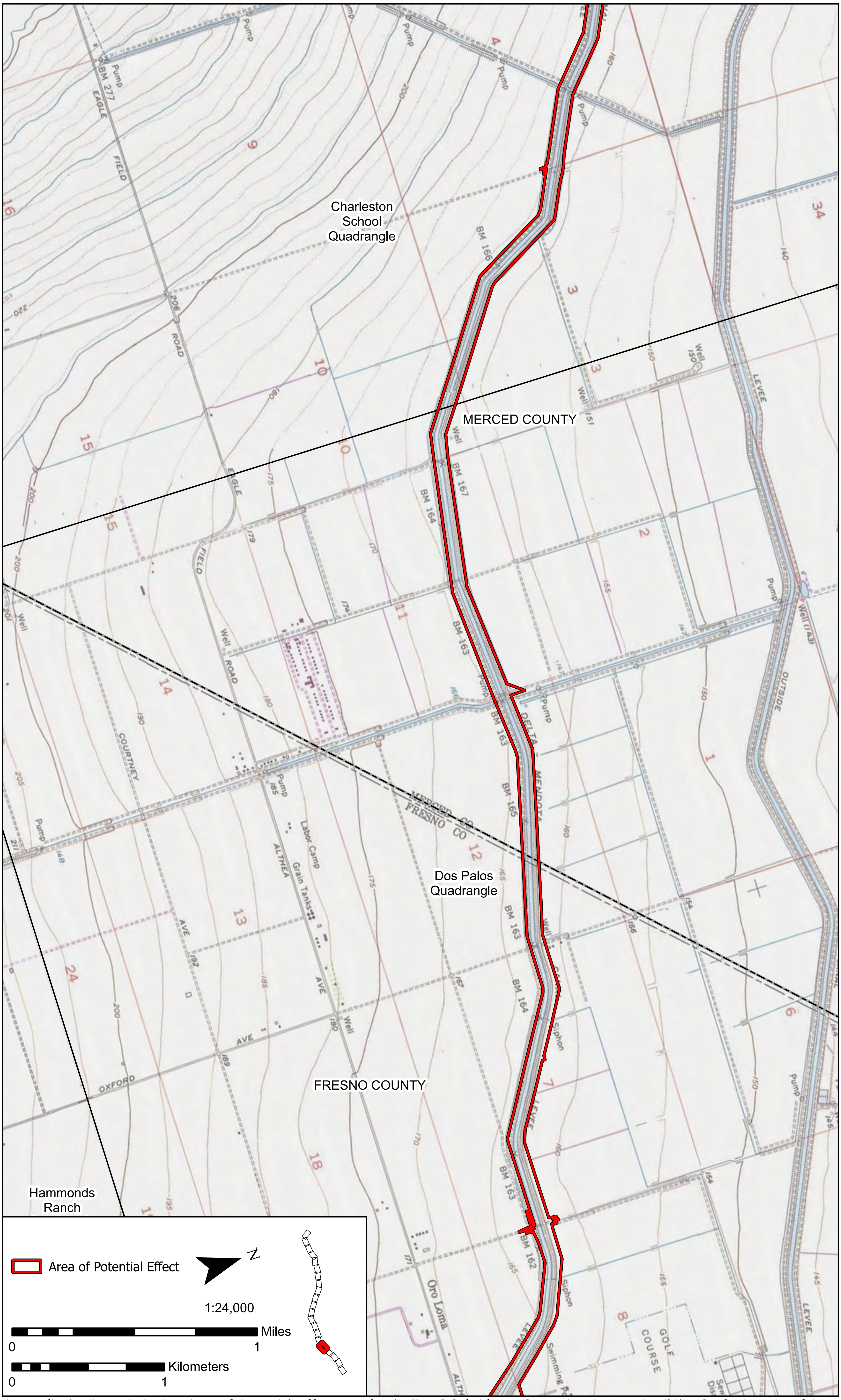
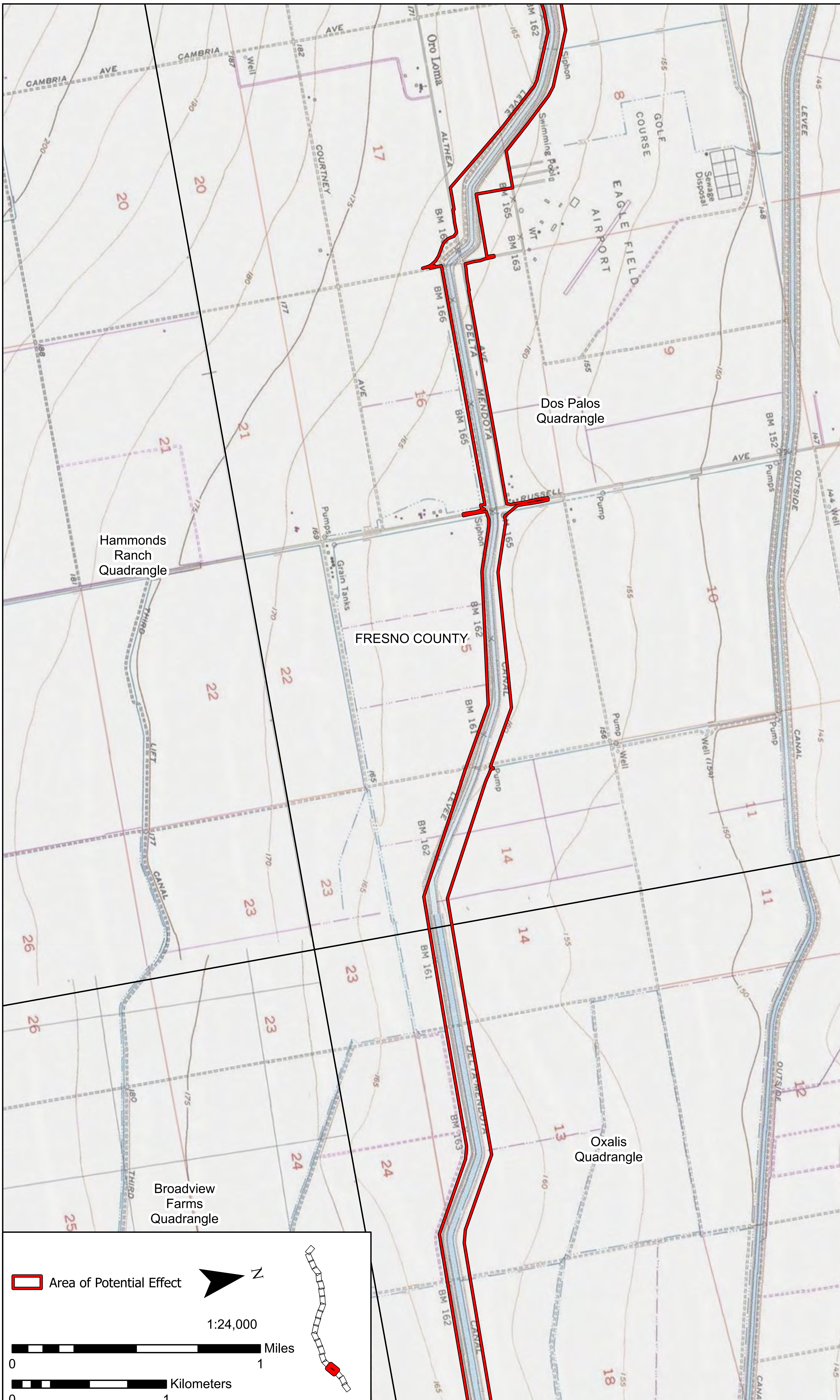


Appendix A, Figure 1. Project Area of Potential Effect Map for the DMC Subsidence Correction Project Feasibility Study, Page 17 of 21.



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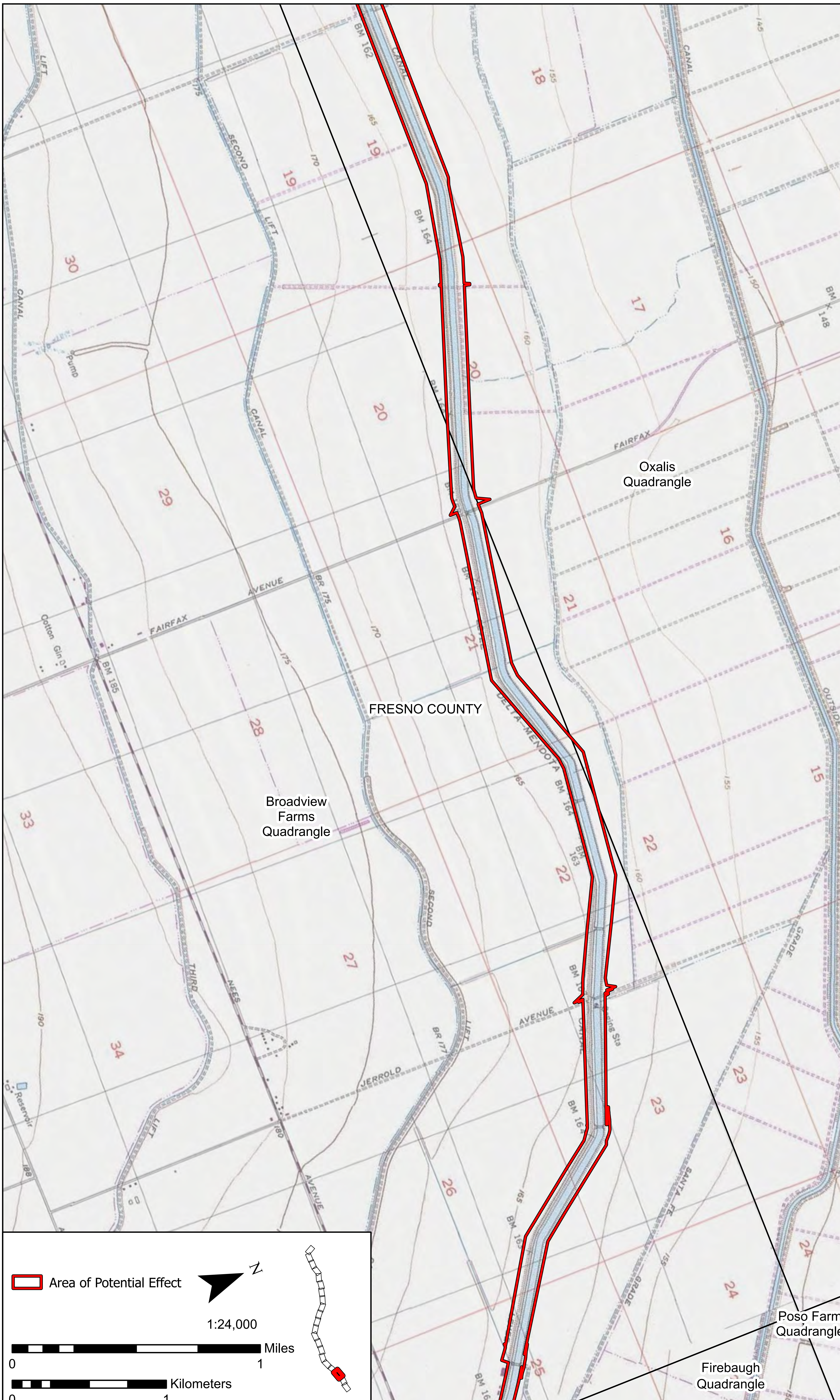

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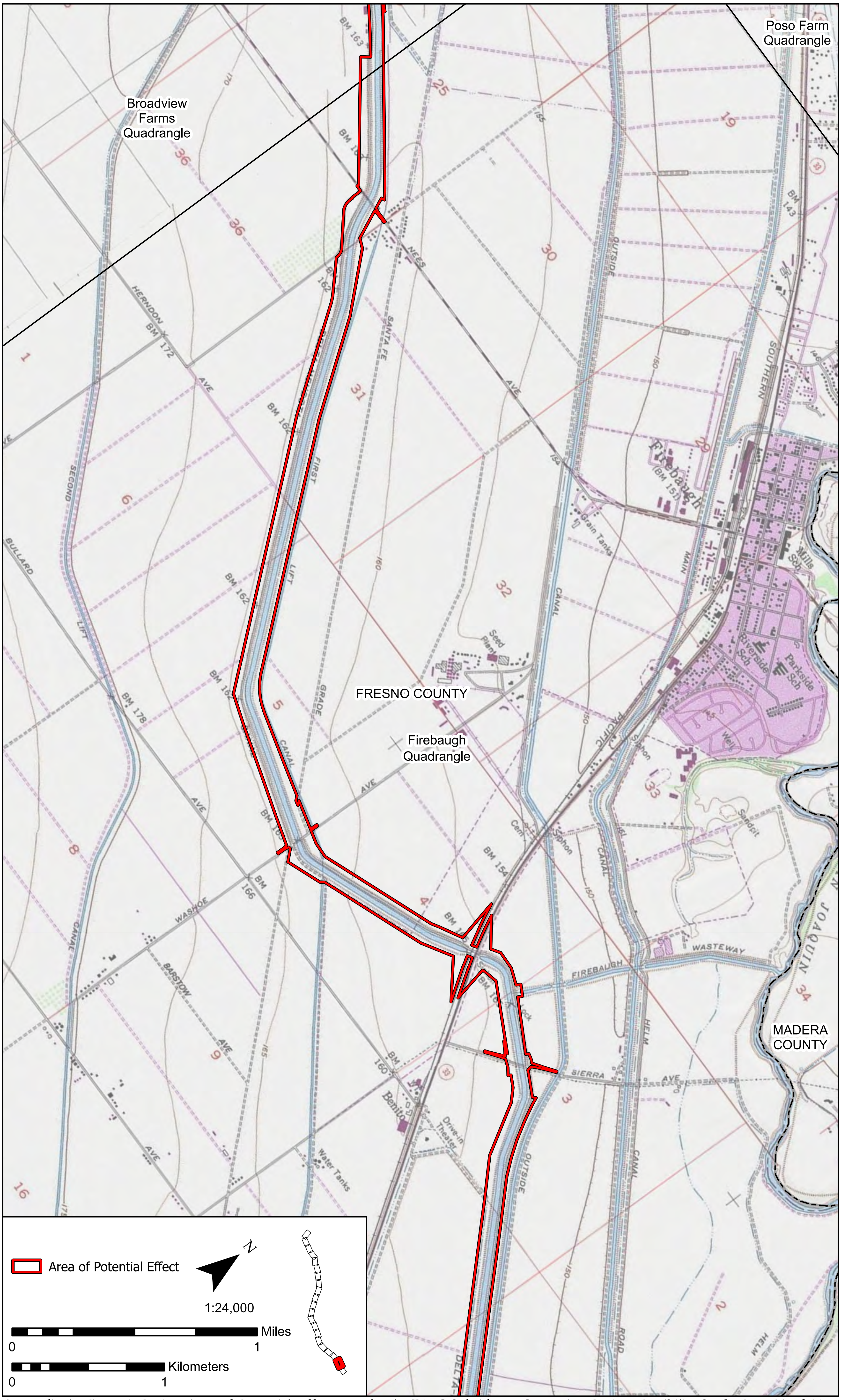

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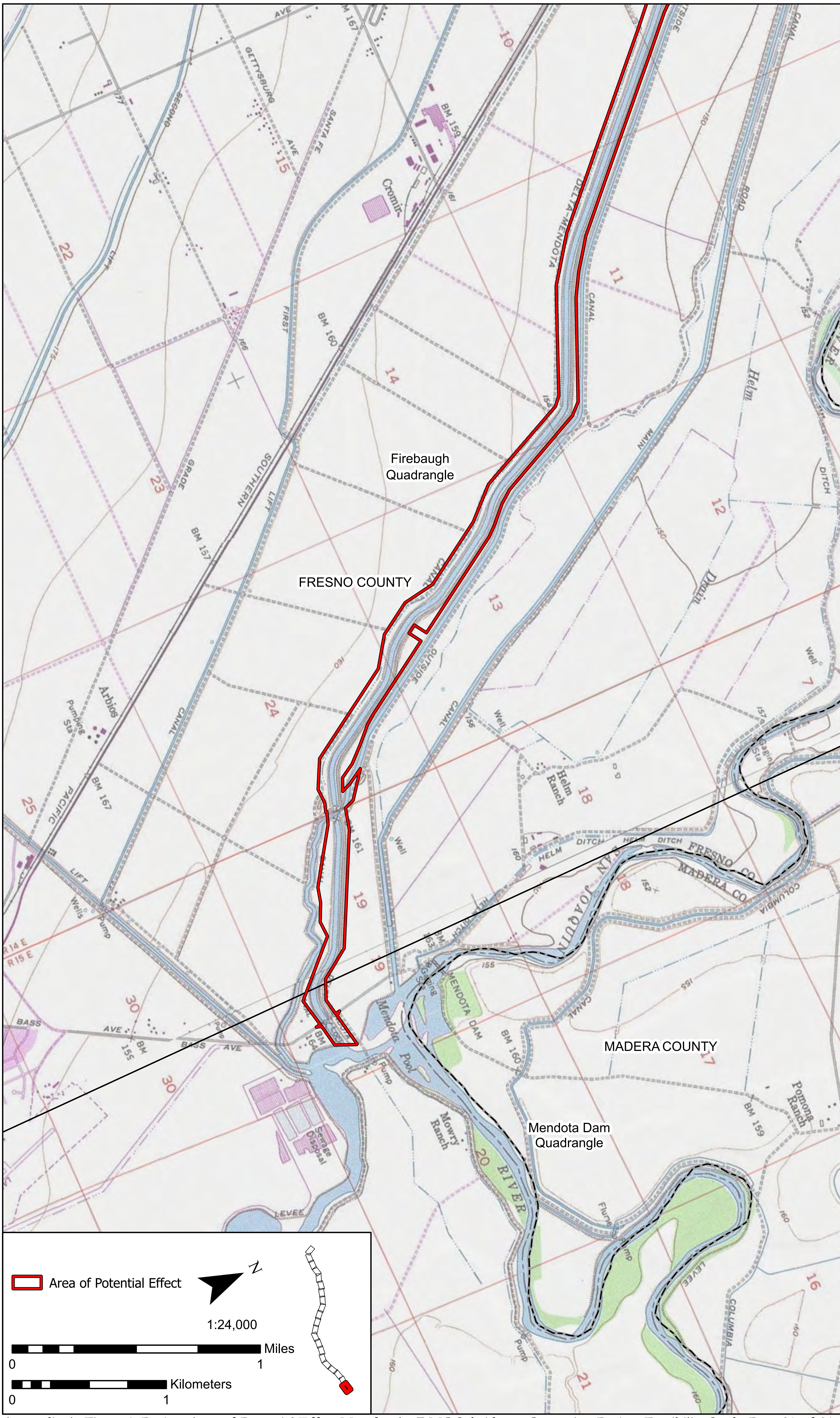
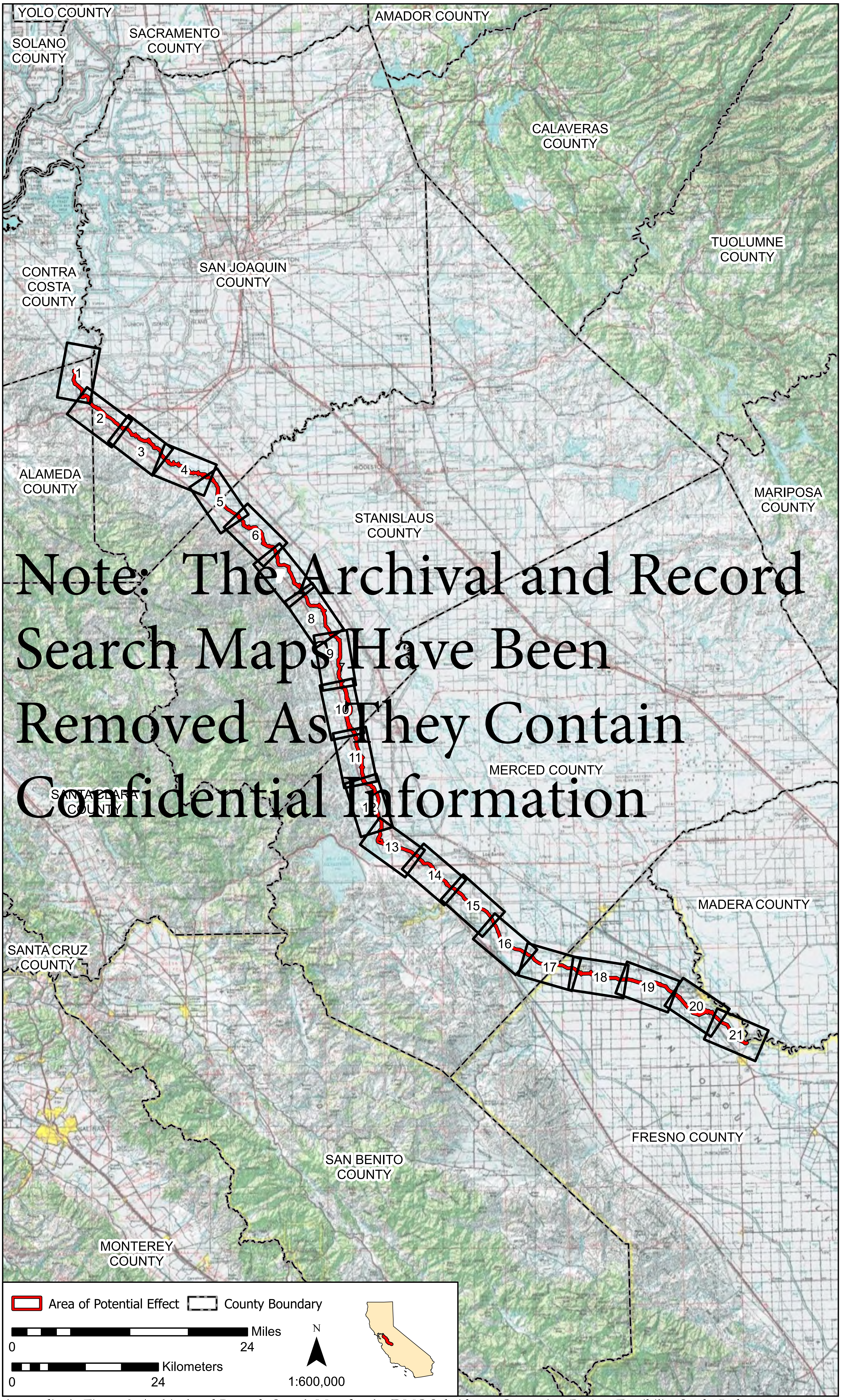
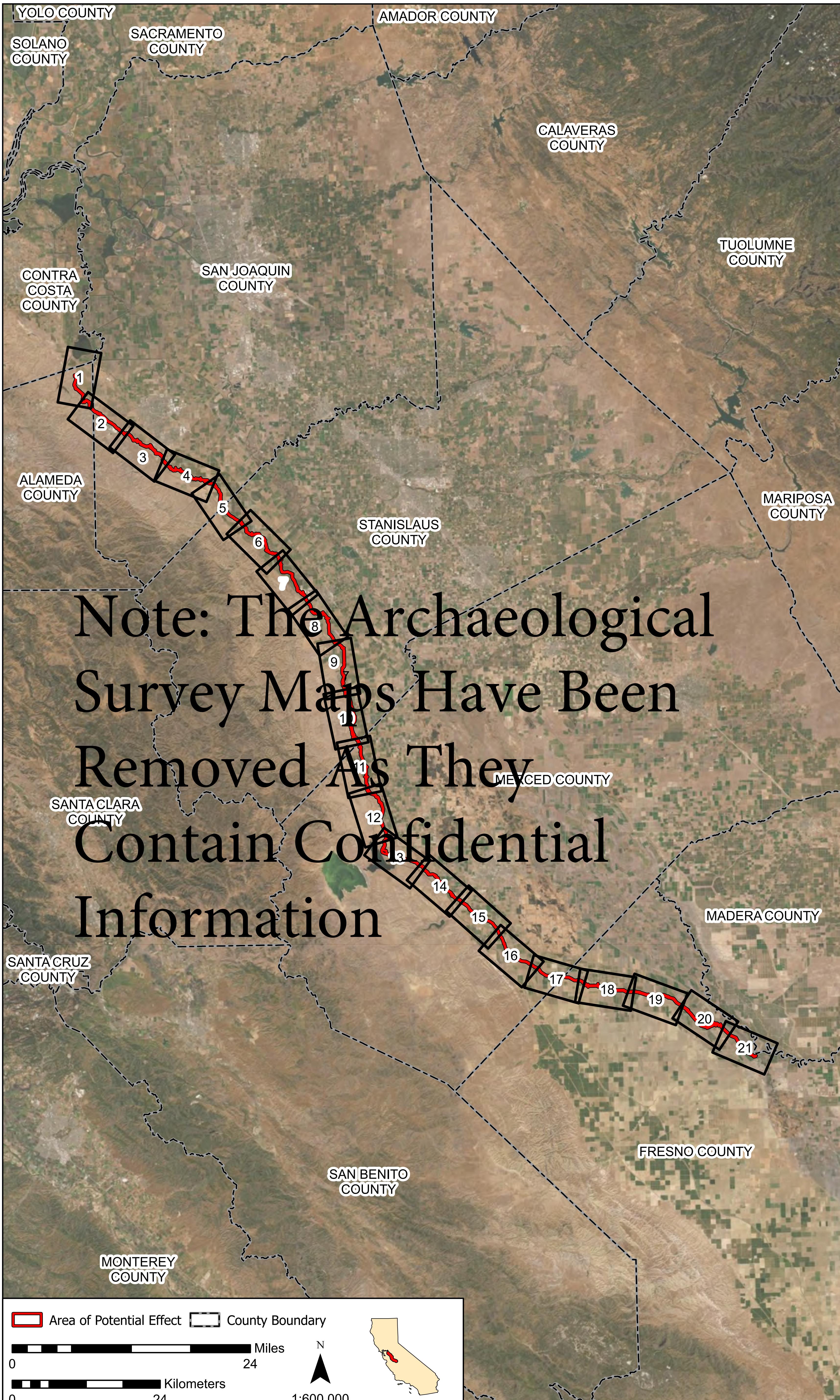


Appendix A, Figure 1. Project Area of Potential Effect Map for the DMC Subsidence Correction Project Feasibility Study, Page 21 of 21.



Appendix A, Figure 2. Archival and Records Search Map for the DMC Subsidence Correction Project Feasibility Study, Index.



Appendix A, Figure 3. Archaeological Survey Results for the DMC Subsidence Correction Project Feasibility Study, Index.

APPENDIX B – ARCHIVAL AND RECORDS SEARCH (REDACTED)

Note: This Appendix Has Been Removed As It Contains Confidential Information

APPENDIX C – NATIVE AMERICAN CONSULTATION

STATE OF CALIFORNIA Gavin Newsom, *Governor*

NATIVE AMERICAN HERITAGE COMMISSION

NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento,
California 95691
(916) 373-3710
nahc@nahc.ca.gov

April 20, 2022

Christopher Peske
Pacific Legacy, Inc.

Via Email to: peske@pacificlegacy.com

Re: 3950-01 Delta-Mendota Canal Feasibility Study Project, Alameda, Contra Costa, Fresno, Madera, Merced, San Joaquin, and Stanislaus Counties

Dear Mr. Peske:

A record search of the Native American Heritage Commission (NAHC) Sacred Lands File (SLF) was completed for the information you have submitted for the above referenced project. The results were positive. Please contact the tribes on the attached list for more information. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Attached is a list of Native American tribes who may also have knowledge of cultural resources in the project area. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated; if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call or email to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from tribes, please notify me. With your assistance, we can assure that our lists contain current information.

If you have any questions or need additional information, please contact me at my email address: Pricilla.Torres-Fuentes@nahc.ca.gov.

Sincerely,

Pricilla Torres-Fuentes

Pricilla Torres-Fuentes
Cultural Resources Analyst

Attachment

Native American Heritage Commission
Native American Contact List
Contra Costa, Madera, Fresno, Merced, Alameda,
San Joaquin, Stanislaus Counties
4/20/2022

Amah Mutsun Tribal Band
Valentin Lopez, Chairperson
P.O. Box 5272
Galt, CA, 95632
Phone: (916) 743 - 5833
vlopez@amahmutsun.org
Costanoan
Northern Valley Yokut

Amah MutsunTribal Band of Mission San Juan Bautista
Irene Zwierlein, Chairperson
3030 Soda Bay Road
Lakeport, CA, 95453
Phone: (650) 851 - 7489
Fax: (650) 332-1526
amahmutsuntribal@gmail.com
Costanoan

Big Sandy Rancheria of Western Mono Indians
Elizabeth Kipp, Chairperson
P.O. Box 337
Auberry, CA, 93602
Phone: (559) 374 - 0066
Fax: (559) 374-0055
lkipp@bsrnation.com
Western Mono

Buena Vista Rancheria of Me-Wuk Indians
Rhonda Morningstar Pope, Chairperson
1418 20th Street, Suite 200
Sacramento, CA, 95811
Phone: (916) 491 - 0011
Fax: (916) 491-0012
rhonda@buenavistatribe.com
Me-Wuk

Calaveras Band of Mi-Wuk Indians
Gloria Grimes, Chairperson
P.O. Box 899
West Point, CA, 95255
Phone: (209) 419 - 5675
calaverasband.miwukindians@gmail.com
Mi-wuk

Calaveras Band of Mi-Wuk Indians - Grimes
Debra Grimes, Cultural Resources Specialist
P.O. Box 1015
West Point, CA, 95255
Phone: (209) 470 - 8688
calaverasmiwukpreservation@gmail.com
Mi-wuk

California Valley Miwok Tribe
AKA Sheep Rancheria of Me-Wuk Indians of CA,
P.O. Box 395
West Point, CA, 95255
Phone: (209) 293 - 4179
l.ewilson@yahoo.com
Miwok

California Valley Miwok Tribe
14807 Avenida Central
La Grange, CA, 95329
Phone: (209) 931 - 4567
Fax: (209) 931-4333
Miwok

Chicken Ranch Rancheria of Me-Wuk Indians
Lloyd Mathiesen, Chairperson
P.O. Box 1159
Jamestown, CA, 95327
Phone: (209) 984 - 9066
Fax: (209) 984-9269
lmathiesen@crtribal.com
Me-Wuk

Cold Springs Rancheria of Mono Indians
Jared Aldern,
P. O. Box 209
Tollhouse, CA, 93667
Phone: (559) 855 - 5043
Fax: (559) 855-4445
csrepa@netptc.net
Mono

Cold Springs Rancheria of Mono Indians
Carol Bill, Chairperson
P.O. Box 209
Tollhouse, CA, 93667
Phone: (559) 855 - 5043
Fax: (559) 855-4445
coldsprgstribe@netptc.net
Mono

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed 3950-01 Delta-Mendota Canal Feasibility Study Project, Contra Costa, Madera, Fresno, Merced, Alameda, San Joaquin, Stanislaus Counties.

Native American Heritage Commission
Native American Contact List
Contra Costa, Madera, Fresno, Merced, Alameda,
San Joaquin, Stanislaus Counties
4/20/2022

Costanoan Rumsen Carmel Tribe
Tony Cerda, Chairperson
244 E. 1st Street
Pomona, CA, 91766
Phone: (909) 629 - 6081
Fax: (909) 524-8041
rumsen@aol.com
Costanoan

Dumna Wo-Wah Tribal Government
Robert Ledger, Chairperson
2191 West Pico Ave.
Fresno, CA, 93705
Phone: (559) 540 - 6346
ledgerrobert@ymail.com
Foothill Yokut
Mono

Dunlap Band of Mono Indians
Benjamin Charley, Chairman
P. O. Box 14
Dunlap, CA, 93621
Phone: (559) 338 - 2545
ben.charley@yahoo.com
Mono

Dunlap Band of Mono Indians
Dirk Charley, Tribal Secretary
5509 E. Mckenzie Avenue
Fresno, CA, 93727
Phone: (559) 554 - 5433
dcharley2016@gmail.com
Mono

Guidiville Indian Rancheria
Donald Duncan, Chairperson
P.O. Box 339
Talmage, CA, 95481
Phone: (707) 462 - 3682
Fax: (707) 462-9183
admin@guidiville.net
Pomo

Indian Canyon Mutsun Band of Costanoan
Ann Marie Sayers, Chairperson
P.O. Box 28
Hollister, CA, 95024
Phone: (831) 637 - 4238
ams@indiancanyons.org
Costanoan

Indian Canyon Mutsun Band of Costanoan
Kanyon Sayers-Roods, MLD Contact
1615 Pearson Court
San Jose, CA, 95122
Phone: (408) 673 - 0626
kanyon@kanyonkonsulting.com
Costanoan

Ione Band of Miwok Indians
Sara Dutschke, Chairperson
9252 Bush Street
Plymouth, CA, 95669
Phone: (209) 245 - 5800
consultation@ionemiwok.net
Miwok

Kings River Choinumni Farm Tribe
Stan Alec,
3515 East Fedora Avenue
Fresno, CA, 93726
Phone: (559) 647 - 3227
Foothill Yokut

Muwekma Ohlone Indian Tribe of the SF Bay Area
Monica Arellano, Vice Chairwoman
20885 Redwood Road, Suite 232
Castro Valley, CA, 94546
Phone: (408) 205 - 9714
marellano@muwekma.org
Costanoan

Nashville Enterprise Miwok-Maidu-Nishinam Tribe
Cosme Valdez, Chairperson
P.O. Box 580986
Elk Grove, CA, 95758-0017
Phone: (916) 429 - 8047
Fax: (916) 429-8047
valdezcome@comcast.net
Miwok

North Fork Mono Tribe
Ron Goode, Chairperson
13396 Tollhouse Road
Clovis, CA, 93619
Phone: (559) 299 - 3729
rwgoode911@hotmail.com
Mono

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Native American Heritage Commission
Native American Contact List
Contra Costa, Madera, Fresno, Merced, Alameda,
San Joaquin, Stanislaus Counties
4/20/2022

North Fork Rancheria of Mono Indians
Elaine Fink, Chairperson
P.O .Box 929
North Fork, CA, 93643
Phone: (559) 877 - 2461
Fax: (559) 877-2467
efink@nfr-nsn.gov
Mono

North Valley Yokuts Tribe
Katherine Perez, Chairperson
P.O. Box 717
Linden, CA, 95236
Phone: (209) 887 - 3415
canutes@verizon.net
Costanoan
Northern Valley Yokut

North Valley Yokuts Tribe
Timothy Perez,
P.O. Box 717
Linden, CA, 95236
Phone: (209) 662 - 2788
huskanam@gmail.com
Costanoan
Northern Valley Yokut

Picayune Rancheria of Chukchansi Indians
Claudia Gonzales, Chairwoman
P.O. Box 2226
Oakhurst, CA, 93644
Phone: (559) 412 - 5590
cgonzales@chukchansitribe.net
Foothill Yokut

Picayune Rancheria of Chukchansi Indians
Heather Airey, Tribal Historic Preservation Officer
P.O. Box 2226
Oakhurst, CA, 93644
Phone: (559) 795 - 5986
hairey@chukchansi-nsn.gov
Foothill Yokut

Salinan Tribe of Monterey, San Luis Obispo Counties
Patti Dunton, Tribal Administrator
7070 Morro Road, Suite A
Atascadero, CA, 93422
Phone: (805) 464 - 2650
info@salinantribe.com
Salinan

Santa Rosa Rancheria Tachi Yokut Tribe
Leo Sisco, Chairperson
P.O. Box 8
Lemoore, CA, 93245
Phone: (559) 924 - 1278
Fax: (559) 924-3583
Southern Valley Yokut

Southern Sierra Miwuk Nation
Sandra Chapman, Chairperson
P.O. Box 186
Mariposa, CA, 95338
Phone: (559) 580 - 7871
sandra47roy@gmail.com
Miwok
Northern Valley Yokut
Paiute

Table Mountain Rancheria
Bob Pennell, Cultural Resource Director
P.O. Box 410
Friant, CA, 93626
Phone: (559) 325 - 0351
Fax: (559) 325-0394
rpennell@tmr.org
Yokut

Table Mountain Rancheria
Brenda Lavell, Chairperson
P.O. Box 410
Friant, CA, 93626
Phone: (559) 822 - 2587
Fax: (559) 822-2693
rpennell@tmr.org
Yokut

The Ohlone Indian Tribe
Andrew Galvan,
P.O. Box 3388
Fremont, CA, 94539
Phone: (510) 882 - 0527
Fax: (510) 687-9393
chochenyo@AOL.com
Bay Miwok
Ohlone
Patwin
Plains Miwok

Traditional Choinumni Tribe
David Alvarez, Chairperson
2415 E. Houston Avenue
Fresno, CA, 93720
Phone: (559) 217 - 0396
Fax: (559) 292-5057
davealvarez@sbcglobal.net
Foothill Yokut

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Tule River Indian Tribe
Neil Peyron, Chairperson
P.O. Box 589 — Yokut
Porterville, CA, 93258
Phone: (559) 781 - 4271
Fax: (559) 781-4610
neil.peyron@tulerivertribe-nsn.gov

Tule River Indian Tribe
Kerri Vera, Environmental Department
P. O. Box 589 — Yokut
Porterville, CA, 93258
Phone: (559) 783 - 8892
Fax: (559) 783-8932
kerri.vera@tulerivertribe-nsn.gov

Tule River Indian Tribe
Joey Garfield, Tribal Archaeologist
P. O. Box 589 — Yokut
Porterville, CA, 93258
Phone: (559) 783 - 8892
Fax: (559) 783-8932
joey.garfield@tulerivertribe-nsn.gov

Tuolumne Band of Me-Wuk Indians
Andrea Reich, Chairperson
P.O. Box 699 — Me-Wuk
Tuolumne, CA, 95379
Phone: (209) 928 - 5300
Fax: (209) 928-1677
andrea@mewuk.com

Tuolumne Band of Me-Wuk Indians
Stanley Cox, Cultural Resources Director
P. O. Box 699 — Me-Wuk
Tuolumne, CA, 95379
Phone: (209) 928 - 5300
receptionist@mewuk.com

United Auburn Indian Community of the Auburn Rancheria
Gene Whitehouse, Chairperson
10720 Indian Hill Road — Maidu
Auburn, CA, 95603 — Miwok
Phone: (530) 883 - 2390
Fax: (530) 883-2380
bguth@auburnrancheria.com

Wilton Rancheria
Steven Hutchason, THPO
9728 Kent Street — Miwok
Elk Grove, CA, 95624
Phone: (916) 683 - 6000
Fax: (916) 863-6015
shutchason@wiltonrancheria-nsn.gov

Wilton Rancheria
Dahlton Brown, Director of Administration
9728 Kent Street — Miwok
Elk Grove, CA, 95624
Phone: (916) 683 - 6000
dbrown@wiltonrancheria-nsn.gov

Wilton Rancheria
Jesus Tarango, Chairperson
9728 Kent Street — Miwok
Elk Grove, CA, 95624
Phone: (916) 683 - 6000
Fax: (916) 683-6015
jtarango@wiltonrancheria-nsn.gov

Wuksache Indian Tribe/Eshom Valley Band
Kenneth Woodrow, Chairperson
1179 Rock Haven Ct. — Foothill Yokut
Salinas, CA, 93906 — Mono
Phone: (831) 443 - 9702
kwood8934@aol.com

Xolon-Salinan Tribe
Karen White, Chairperson
P. O. Box 7045 — Salinan
Spreckels, CA, 93962
Phone: (831) 238 - 1488
xolon.salinan.heritage@gmail.com

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Native American Heritage Commission
Native American Contact List
Contra Costa, Madera, Fresno, Merced, Alameda, San Joaquin, Stanislaus Counties
4/20/2022

Xolon-Salinan Tribe Donna Haro, Tribal Headwoman P. O. Box 7045 Spreckels, CA, 93962 Phone: (925) 470 - 5019 dhxolonaakletse@gmail.com	Salinan
The Confederated Villages of Lisjan Corrina Gould, Chairperson 10926 Edes Avenue Oakland, CA, 94603 Phone: (510) 575 - 8408 cvltribe@gmail.com	Bay Miwok Ohlone Delta Yokut
Tamien Nation Johnathan Wasaka Costillas, THPO PO Box 866 Clearlake Oaks, CA, 94523 Phone: (925) 336 - 5359 thpo@tamien.org	Costanoan
Tamien Nation Quirina Luna Geary, Chairperson PO Box 8053 San Jose, CA, 95155 Phone: (707) 295 - 4011 qgeary@tamien.org	Costanoan

This list is current only as of the date of this document. Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resource Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources assessment for the proposed 3950-01 Delta-Mendota Canal Feasibility Study Project, Contra Costa, Madera, Fresno, Merced, Alameda, San Joaquin, Stanislaus Counties.

Consulting Party Contact Information	Letter Sent	Delivered	Emailed/ Called	Comments
Andrea Reich, Chairperson **Tuolumne Band of Me-Wuk Indians** P.O. Box 699 Tuolumne, CA, 95379 Phone: (209) 928 - 5300 Fax: (209) 928 - 1677 andrea@mewuk.com	6/14/2022	6/21/2022	N/A	No reply as of 8/10/22
Andrew Galvan **The Ohlone Indian Tribe** P.O. Box 3388 Fremont, CA, 94539 Phone: (510) 882 - 0527 Fax: (510) 687 - 9393 chochenyo@aol.com	6/14/2022	6/21/2022	N/A	No reply as of 8/10/22
Ann Marie Sayers, Chairperson **Indian Canyon Mutsun Band of Costanoan** P.O. Box 28 Hollister, CA, 95024 Phone: (831) 637 - 4238 ams@indiancanyons.org	6/14/2022	6/25/2022	N/A	No reply as of 8/10/22
Benjamin Charley, Chairman **Dunlap Band of Mono Indians** P. O. Box 14 Dunlap, CA, 93621 Phone: (559) 338 - 2545 ben.charley@yahoo.com	6/14/2022	6/22/2022	N/A	No reply as of 8/10/22
Bob Pennell, Cultural Resource Director **Table Mountain Rancheria** P.O. Box 410 Friant, CA, 93626 Phone: (559) 325 - 0351 Fax: (559) 325 - 0394 rpennell@tmr.org	6/13/2022	6/15/2022: delivered, no confirmati on receipt	N/A	No reply as of 8/10/22
Brenda Lavell, Chairperson **Table Mountain Rancheria** P.O. Box 410 Friant, CA, 93626 Phone: (559) 822 - 2587 Fax: (559) 822 - 2693 rpennell@tmr.org	6/13/2022	6/15/2022: delivered, no confirmati on receipt	N/A	No reply as of 8/10/22

Consulting Party Contact Information	Letter Sent	Delivered	Emailed/ Called	Comments
California Valley Miwok Tribe P.O. Box 395 West Point, CA, 95255 Phone: (209) 293 - 4179 l.ewilson@yahoo.com			N/A	This address was provided by NAHC, no letter sent
Carol Bill, Chairperson **Cold Springs Rancheria of Mono Indians** P.O. Box 209 Tollhouse, CA, 93667 Phone: (559) 855 - 5043 Fax: (559) 855 - 4445 coldsprgstribe@netptc.net	6/14/2022	6/17/2022	N/A	No reply as of 8/10/22
Chadd Everyone, Administrator **California Valley Miwok Tribe** 2000 Allston Way #401 Berkeley, California, 94701	6/13/2022	6/23/2022: delivered, no confirmati on receipt	N/A	7/27/2022: This individual was not on the list from the NAHC but a letter was sent to him,
Claudia Gonzales, Chairwoman **Picayune Rancheria of Chukchansi Indians** P.O. Box 2226 Oakhurst, CA, 93644 Phone: (559) 412 - 5590 cgonzales@chukchansitribe.net	6/14/2022	6/17/2022	N/A	No reply as of 8/10/22
Corrina Gould, Chairperson **The Confederated VILLAGESS of Lisjan** 10926 Edes Avenue Oakland, CA, 94603 Phone: (510) 575 - 8408 cvltribe@gmail.com	6/14/2022	6/15/2022	Update mailed 8/18/22	June 17. 2022: Response received. Would like to be informed of the results of the NAHC sacred lands file search in Alameda, Contra Costa, and San Joaquin counties to determine whether consultation is necessary.

Consulting Party Contact Information	Letter Sent	Delivered	Emailed/ Called	Comments
Cosme Valdez, Chairperson **Nashville Enterprise Miwok-Maidu-Nishinam Tribe** P.O. Box 580986 Elk Grove, CA, 95758-0017 Phone: (916) 429 - 8047 Fax: (916) 429 - 8047 valdezcome@comcast.net	6/14/2022	6/17/2022	N/A	No reply as of 8/10/22
Dahlton Brown, Director of Administration **Wilton Rancheria** 9728 Kent Street Elk Grove, CA, 95624 Phone: (916) 683 - 6000 dbrown@wiltonrancheria-nsn.gov	6/14/2022	6/16/2022	Update sent to Venesa Kremer 8/18/22	7/28/22: Requested further information, participate in fieldwork, copies of records and reports. Email from Venesa Kremer but replies should go to cpd@wiltonrancheria-nsn.gov
David Alvarez, Chairperson **Traditional Choinumni Tribe** 2415 E. Houston Avenue Fresno, CA, 93720 Phone: (559) 217 - 0396 Fax: (559) 292 - 5057 davealvarez@sbcglobal.net	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Debra Grimes, Cultural Resources Specialist **Calaveras Band of Mi-Wuk Indians** P.O. Box 1015 West Point, CA, 95255 Phone: (209) 470 - 8688 calaverasmiwukpreservation@gmail.com	6/14/2022		N/A	7/27/2022: No confirmed delivery, in transit as of 7/13
Dirk Charley, Tribal Secretary **Dunlap Band of Mono Indians** 5509 E. Mckenzie Avenue Fresno, CA, 93727 Phone: (559) 554 - 5433 dcharley2016@gmail.com	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Donald Duncan, Chairperson **Guidiville Indian Rancheria** P.O. Box 339 Talmage, CA, 95481 Phone: (707) 462 - 3682 Fax: (707) 462 - 9183 admin@guidiville.net	6/14/2022	6/22/2022	N/A	No reply as of 8/10/22

Consulting Party Contact Information	Letter Sent	Delivered	Emailed/ Called	Comments
Donna Haro, Tribal Headwoman **Xolon-Salinan Tribe** P. O. Box 7045 Spreckels, CA, 93962 Phone: (925) 470 - 5019 dhxolonaakletse@gmail.com	6/14/2022	6/22/2022	N/A	No reply as of 8/10/22
Elaine Fink, Chairperson **North Fork Rancheria of Mono Indians** P.O .Box 929 North Fork, CA, 93643 Phone: (559) 877 - 2461 Fax: (559) 877-2467 efink@nfr-nsn.gov	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Elizabeth Kipp, Chairperson **Big Sandy Rancheria of Western Mono Indians** P.O. Box 337 Auberry, CA, 93602 Phone: (559) 374 - 0066 Fax: (559) 374 - 0055 lkipp@bsrnation.com	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Gene Whitehouse, Chairperson **United Auburn Indian Community of the Auburn Rancheria** 10720 Indian Hill Road Auburn, CA, 95603 Phone: (530) 883 - 2390 Fax: (530) 883 - 2380 bguth@auburnrancheria.com	6/14/2022	6/16/2022	N/A	June 30, 2022: Response received, indicated that APE was outside of their geographic area of traditional and cultural affiliations and would not be commenting on the project.
Gloria Grimes, Chairperson **Calaveras Band of Mi-Wuk Indians** P.O. Box 899 West Point, CA, 95255 Phone: (209) 419 - 5675 calaverasband.miwukindians@gmail.com	6/14/2022		N/A	7/27/2022: No confirmed delivery, in transit as of 7/13
Heather Airey, THPO **Picayune Rancheria of Chukchansi Indians** P.O. Box 2226 Oakhurst, CA, 93644 Phone: (559) 795 - 5986 hairey@chukchansi-nsn.gov	6/14/2022	6/17/2022	N/A	No reply as of 8/10/22

Consulting Party Contact Information	Letter Sent	Delivered	Emailed/ Called	Comments
Jared Aldern **Cold Springs Rancheria of Mono Indians** P. O. Box 209 Tollhouse, CA, 93667 Phone: (559) 855 - 5043 Fax: (559) 855 - 4445 csrepa@netptc.net	6/14/2022	6/17/2022	N/A	No reply as of 8/10/22
Jesus Tarango, Chairperson **Wilton Rancheria** 9728 Kent Street Elk Grove, CA, 95624 Phone: (916) 683 - 6000 Fax: (916) 683-6015 jtarango@wiltonrancheria-nsn.gov	6/14/2022	6/16/2022	N/A	7/28/22; reply from cultural department see other
Joey Garfield, Tribal Archaeologist **Tule River Indian Tribe** P. O. Box 589 Porterville, CA, 93258 Phone: (559) 783 - 8892 Fax: (559) 783-8932 joey.garfield@tulerivertribensn.gov	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Johnathan Wasaka Costillas, THPO **Tamien Nation** PO Box 866 Clearlake Oaks, CA, 94523 Phone: (925) 336 - 5359 thpo@tamien.org	6/14/2022	6/22/2022	N/A	No reply as of 8/10/22
Kanyon Sayers-Roods, MLD **Indian Canyon Mutsun Band of Costanoan** 1615 Pearson Court San Jose, CA, 95122 Phone: (408) 673 - 0626 kanyon@kanyonkonsulting.com	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Karen White, Chairperson **Xolon-Salinan Tribe** P. O. Box 7045 Spreckels, CA, 93962 Phone: (831) 238 - 1488 xolon.salinan.heritage@gmail.com	6/14/2022	6/22/2022	N/A	No reply as of 8/10/22

Consulting Party Contact Information	Letter Sent	Delivered	Emailed/ Called	Comments
Katherine Perez, Chairperson **North Valley Yokuts Tribe** P.O. Box 717 Linden, CA, 95236 Phone: (209) 887 - 3415 canutes@verizon.net	6/14/2022	6/16/2022	Update sent 8/18/22	June 18, 2022: Response received, requested to initiate AB52 consultation, participate in cultural fieldwork
Kenneth Woodrow, Chairperson **Wuksache Indian Tribe/Eshom Valley Band** 1179 Rock Haven Ct. Salinas, CA, 93906 Phone: (831) 443 - 9702 kwood8934@aol.com	6/14/2022	6/17/2022: no signature, received delivery confirmati on receipt	N/A	No reply as of 8/10/22
Kerri Vera, Environmental Department **Tule River Indian Tribe** P. O. Box 589 Porterville, CA, 93258 Phone: (559) 783 - 8892 Fax: (559) 783 - 8932 kerri.vera@tulerivertribe-nsn.gov	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Leo Sisco, Chairperson **Santa Rosa Rancheria Tachi Yokut Tribe** P.O. Box 8 Lemoore, CA, 93245 Phone: (559) 924 - 1278 Fax: (559) 924 - 3583	6/14/2022	6/17/2022	Update sent to Paige Berrgen on 8/18/22	July 27: Tribe has concerns and is asking to be retained as monitor for any ground disturbing activity. Cc Shana Powers and Samantha McCarty on any emails (emails provided in response)
Lloyd Mathiesen, Chairperson **Chicken Ranch Rancheria of Me-Wuk Indians** P.O. Box 1159 Jamestown, CA, 95327 Phone: (209) 984 - 9066 Fax: (209) 984 - 9269 lmathiesen@crtribal.com	6/14/2022	6/17/2022	N/A	No reply as of 8/10/22

Consulting Party Contact Information	Letter Sent	Delivered	Emailed/ Called	Comments
Monica Arellano, Vice Chairwoman **Muwekma Ohlone Indian Tribe of the SF Bay Area** 20885 Redwood Road, Suite 232 Castro Valley, CA, 94546 Phone: (408) 205 - 9714 marellano@muwekma.org	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Mr. Valentin Lopez, Chairperson **Amah Mutsun Tribal Band** P.O. Box 5272 Galt, CA, 95632 Phone: (916) 743 - 5833 vlopez@amahmutsun.org	6/14/2022	6/18/2022	N/A	No reply as of 8/10/22
Ms. Irene Zwierlein, Chairperson **Amah Mutsun Tribal Band of Mission San Juan Bautista** 3030 Soda Bay Road Lakeport, CA, 95453 Phone: (650) 851 - 7489 Fax: (650) 332 - 1526 amahmutsuntribal@gmail.com	6/14/2022	6/23/2022	N/A	No reply as of 8/10/22
Neil Peyron, Chairperson **Tule River Indian Tribe** P.O. Box 589 Porterville, CA, 93258 Phone: (559) 781 - 4271 Fax: (559) 781-4610 neil.peyron@tulerivertribe-nsn.gov	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Patti Dunton, Tribal Administrator **Salinan Tribe of San Luis Obispo and Monterey Counties** 7070 Morro Road, Suite A Atascadero, CA, 93422 Phone: (805) 464 - 2650 info@salinantribe.com	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Quirina Luna Geary, Chairperson **Tamien Nation** PO Box 8053 San Jose, CA, 95155 Phone: (707) 295 - 4011 qgeary@tamien.org	6/14/2022	7/1/2022	N/A	No reply as of 8/10/22

Consulting Party Contact Information	Letter Sent	Delivered	Emailed/ Called	Comments
Rhonda Morningstar Pope, Chairperson **Buena Vista Rancheria of Me-Wuk Indians** 1418 20th Street, Suite 200 Sacramento, CA, 95811 Phone: (916) 491 - 0011 Fax: (916) 491 - 0012 rhonda@buenavistatribe.com	6/14/2022	6/21/2022	N/A	No reply as of 8/10/22
Robert Ledger, Chairperson **Dumna Wo-Wah Tribal Government** 2191 West Pico Ave. Fresno, CA, 93705 Phone: (559) 540 - 6346 ledgerrobert@ymail.com	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Ron Goode, Chairperson **North Fork Mono Tribe** 13396 Tollhouse Road Clovis, CA, 93619 Phone: (559) 299 - 3729 rwgoode911@hotmail.com	6/14/2022	6/16/2022: delivered, no confirmati on receipt	N/A	No reply as of 8/10/22
Sandra Chapman, Chairperson **Southern Sierra Miwuk Nation** P.O. Box 186 Mariposa, CA, 95338 Phone: (559) 580 - 7871 sandra47roy@gmail.com	6/14/2022	6/27/2022	N/A	No reply as of 8/10/22
Sara Dutschke, Chairperson **Ione Band of Miwok Indians** 9252 Bush Street Plymouth, CA, 95669 Phone: (209) 245 - 5800 consultation@ionemiwok.net	6/14/2022	6/17/2022	N/A	No reply as of 8/10/22
Silvia Burley, Chairperson **California Valley Miwok Tribe** 14807 Avenida Central La Grange, CA, 95329 Phone: (209) 931 - 4567 Fax: (209) 931 - 4333	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22

Consulting Party Contact Information	Letter Sent	Delivered	Emailed/ Called	Comments
Stan Alec **Kings River Choinumni Farm Tribe** 3515 East Fedora Avenue Fresno, CA, 93726 Phone: (559) 647 - 3227	6/14/2022	6/18/2022: Returned, not delivered	N/A	No reply as of 8/10/22
Stanley Cox, Cultural Resources Director **Tuolumne Band of Me-Wuk Indians** P. O. Box 699 Tuolumne, CA, 95379 Phone: (209) 928 - 5300 receptionist@mewuk.com	6/14/2022	6/21/2022	N/A	No reply as of 8/10/22
Steven Hutchason, THPO **Wilton Rancheria** 9728 Kent Street Elk Grove, CA, 95624 Phone: (916) 683 - 6000 Fax: (916) 863-6015 shutchason@wiltonrancheriansn.gov	6/14/2022	6/16/2022	N/A	7/28/22: Cultural group replying, see other.
Timothy Perez **North Valley Yokuts Tribe** P.O. Box 717 Linden, CA, 95236 Phone: (209) 662 - 2788 huskanam@gmail.com	6/14/2022	6/16/2022	N/A	No reply as of 8/10/22
Tony Cerda, Chairperson **Costanoan Rumsen Carmel Tribe** 244 E. 1st Street Pomona, CA, 91766 Phone: (909) 629 - 6081 Fax: (909) 524 - 8041 rumsen@aol.com	6/14/2022		N/A	7/27/2022: Not delivered, package returning to sender according to tracking no.

From:	Park, Christopher
To:	John Holson; Lisa Holm
Cc:	Kashyap, Anusha V.
Subject:	FW: Delta - Mendota Canal Subsidence Project
Date:	Monday, June 20, 2022 8:27:14 AM

Morning John and Lisa,
This AB52 response just came in on the DMC Project. Please note the request for a discussion on how environmental review will consider effects on tribal cultural resources, and to have observers present for surveys. Should we have an internal call to talk through how to address this?

Chris Park I Planner I AICP I PMP
CDM Smith I www.cdmsmith.com I P: 916.576.7497

From: Pablo Arroyave <pablo.arroyave@sldmwa.org>
Sent: Monday, June 20, 2022 7:36 AM
To: Park, Christopher <ParkCE@cdmsmith.com>; Kashyap, Anusha V. <kashyapav@cdmsmith.com>; 'bbruce@usbr.gov' <bbruce@usbr.gov>
Subject: FW: Delta - Mendota Canal Subsidence Project

FYI, please let me know if there is someone else I should share this with.

Pablo R. Arroyave
Chief Operating Officer
209-832-6230

From: Katherine Perez <canutes@verizon.net>
Sent: Saturday, June 18, 2022 8:50 PM
To: Pablo Arroyave <pablo.arroyave@sldmwa.org>
Cc: Jacob Bejarano <jacob.bejarano@sldmwa.org>
Subject: Delta - Mendota Canal Subsidence Project

June 18, 2022

San Luis Bureau & Delta-Mendota Water Authority
United States Bureau of Reclamation
Pablo R. Arroyave
15990 Kelso Road

Byron, CA 94514
209.832.6200

RE: AB 52 Consultation Request for the Proposed Delta-Mendota Canal Subsidence Project, in the Central Valley.

Dear City of Freemont Representative,

Northern Valley Yokuts Tribe and Nototomne Cultural Preservation received a letter from San Luis & Delta-Mendota Water Authority dated June 08, 2022, formally notifying us of a proposed project, in the Central Valley, and an opportunity to consult under AB 52. This letter is notice that Northern Valley Yokuts Tribe and Nototomne Cultural Preservation would like to initiate consultation under AB 52.

We would like to discuss the topics listed in Cal. Public Resources Code section 21080.3.2(a), including the type of environmental review to be conducted for the project; project alternatives; the project's significant effects; and mitigation measures for any direct, indirect, or cumulative impacts the project may cause to tribal cultural resources. As consultation progresses, we may also wish to discuss design options that would avoid impacts to tribal cultural resources; the scope of any environmental document that is prepared for the project; pre-project surveys; and tribal cultural resource identification, significance evaluations and culturally-appropriate treatment.

This letter is also a formal request to allow Northern Valley Yokuts Tribe and Nototomne Cultural Preservation tribal representatives to observe and participate in all cultural resource surveys, including initial pedestrian surveys for the project. Please send us all existing cultural resource assessments, as well as requests for, and the results of, any records searches that may have been conducted prior to our first consultation meeting. If tribal cultural resources are identified within the project area, it is our policy that tribal monitors must be present for all ground disturbing activities. Finally, please be advised that our strong preference is to preserve tribal cultural resources in place and avoid them whenever possible. Subsurface testing and data recovery must not occur without first consulting with and receiving written consent from Northern Valley Yokuts Tribe and Nototomne Cultural Preservation.

In the letter you are identified as the lead contact person for consultation on the proposed project. I will be our point of contact for this consultation. Please contact me by phone 209.649.8972 or email at canutes@verizon.net begin the consultation process.

Thank you for involving Northern Valley Yokuts Tribe and Nototomne Cultural Preservation in the planning process at an early stage. We ask that you make this letter a part of the project record and we look forward to working with you to ensure that tribal cultural resources are protected.

Sincerely,

Nototome Cultural Preservation
Northern Valley Yokut / Ohlone / Patwin
Katherine Perez
P.O Box 717
Linden, CA 95236

Cell: 209.649.8972
Email: canutes@verizon.net

From:	Kashyap, Anusha V.
To:	Chris Peske; John Holson; Lisa Holm
Cc:	Park, Christopher
Subject:	FW: Delta-Mendota Canal Subsidence Project
Date:	Thursday, June 30, 2022 2:56:53 PM
Attachments:	image001.png

Please see email below from Auburn Rancheria.

Thank you,
Anusha Kashyap

From: Jacob Bejarano <jacob.bejarano@sldmwa.org>
Sent: Thursday, June 30, 2022 2:55 PM
To: Park, Christopher <ParkCE@CDMSmith.com>; Kashyap, Anusha V. <kashyapav@cdmsmith.com>
Cc: jaime.mcneil <jaime.mcneil@sldmwa.org>; Pablo Arroyave <pablo.arroyave@sldmwa.org>; Rebecca R. Akroyd <rebecca.akroyd@sldmwa.org>; Bruce, Brandee E <BBruce@usbr.gov>
Subject: FW: Delta-Mendota Canal Subsidence Project

Chris and Anusha,

Please share the below email with Pacific Legacy so they can mark this one off the list.

Thanks,

Jacob Bejarano, P.E.
Office: 209/832-6216

From: Anna Cheng <acheng@auburnrancheria.com>
Sent: Thursday, June 30, 2022 2:16 PM
To: Pablo Arroyave <pablo.arroyave@sldmwa.org>; Jacob Bejarano <jacob.bejarano@sldmwa.org>
Cc: Anna Starkey <astarkey@auburnrancheria.com>
Subject: Delta-Mendota Canal Subsidence Project

Dear Mr. Arroyave,

On behalf of the United Auburn Indian Community's Tribal Historic Preservation Department, thank you for the notification about the project referenced above. We have reviewed the project location and determined that it falls outside of the UAIC's geographic area of traditional and cultural affiliations. Therefore, we will not be commenting on the project.

I would like to also alert your attention to our preferred online submission portal linked below. Please use the following portal to submit all new and incoming notifications. It will provide an automatic response that the notification was received and provide a copy of the filled out form.

Please direct all incoming letters to our Cultural Regulatory Specialist, Ms. Anna Starkey, UAIC's Tribal Historic Preservation Officer, Mr. Matthew Moore, or UAIC's Tribal Chairman, Gene Whitehouse. Notifications via other methods may be missed or delayed. Please use the portal below for faster response. Thank you.

https://auburnrancheria.com/programs-services/tribal-preservation/

Best,
Anna Cheng

The United Auburn Indian Community is now accepting electronic consultation request, project notifications, and requests for information! Please fill out and submit through our website. Do not mail hard copy letters or documents. *https://auburnrancheria.com/programs-services/tribal-preservation* ***Bookmark this link!***

Anna Cheng
Tribal Heritage Coordinator
Tribal Historic Preservation Department | UAIC
10720 Indian Hill Road
Auburn, CA 95603
Direct Line: (530) 217-4083 | Cell: (530) 492-4822
acheng@auburnrancheria.com | www.auburnrancheria.com

From:	Kashyap, Anusha V.
To:	John Holson
Cc:	Park, Christopher; Quan, Jenna R.
Subject:	FW: Delta-Mendota Canal Subsidence Project
Date:	Saturday, June 18, 2022 8:15:09 AM

John,
See below for response on the AB-52 letters.

Thank you,
Anusha Kashyap

From: Pablo Arroyave <pablo.arroyave@sldmwa.org>
Sent: Saturday, June 18, 2022 8:08 AM
To: Brandee E Bruce <BBruce@usbr.gov>; Park, Christopher <parkCE@cdmsmith.com>; Kashyap, Anusha V. <kashyapav@cdmsmith.com>
Subject: Fwd: Delta-Mendota Canal Subsidence Project

FYI.

Sent from my iPhone

Begin forwarded message:

> **From:** Corrina Gould <cvltribe@gmail.com>
> **Date:** June 17, 2022 at 6:12:48 PM PDT
> **To:** Pablo Arroyave <pablo.arroyave@sldmwa.org>
> **Subject: Delta-Mendota Canal Subsidence Project**
>
>
>
> Thank you for your letter. As this project stretches through our Tribal territory we would like to be updated when you have received confirmation from the NAHC with Negative/Positive findings for the following counties, Alameda, Contra Costa, and San Joaquin. When the Tribe has received this information and has time to review it we will update whether consultation is necessary.
>
> **'Uni (Respectfully),**
>
> ***Corrina Gould, Tribal Chair***
> Confederated Villages of Lisjan Nation

SAMPLE REQUEST LETTER

June 8, 2022

Andrew Galvan
The Ohlone Indian Tribe
P.O. Box 3388
Fremont, CA, 94539

RE: Delta-Mendota Canal Subsidence Project

Dear Andrew Galvan:

The San Luis & Delta-Mendota Water Authority (Authority), in cooperation with the United States Bureau of Reclamation (Reclamation), is conducting environmental studies for the proposed Delta-Mendota Canal Subsidence Project in the Central Valley. Reclamation is the lead agency responsible for compliance with Section 106 of the National Historic Preservation Act (NHPA), while the Authority is the lead agency responsible for compliance with the California Environmental Quality Act (CEQA). Pursuant to CEQA, the Authority consults with Native American tribes on projects early in the planning process to identify and discuss relevant cultural resource issues and resolve concerns regarding historical and tribal cultural resources while allowing adequate time for consideration of such concerns. This letter is issued in compliance with Assembly Bill 52 (AB 52), which requires notification of the Native American community regarding the proposed project and consultation with interested stakeholders.

The Delta-Mendota Canal (DMC), a key feature of the Central Valley Project (CVP), was completed in 1952 and is owned by Reclamation. The Authority is party to a Transfer Agreement with Reclamation, under which the Authority is responsible for the operation, maintenance, and replacement of certain CVP facilities, including the DMC. Regional subsidence has been observed within the Central Valley of California and along the length of the DMC since its construction. As a result of subsidence, the available freeboard for the canal lining and the canal embankment, and clearances between water surface elevations and structures crossing the canal, no longer meet Reclamation standards. The project has been developed to analyze potential alternatives to restore the capacity of the DMC. A Feasibility Report must be

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completed prior to pursuing final project design. As part of the feasibility study, the cultural resources along the canal are being identified. The project area of potential effects (APE) is approximately 116.5 miles long, stretching the entire length of the DMC. The APE is located on multiple U.S. Geological Survey topographic quadrangle maps and within various Townships, Ranges, and Sections as shown in Exhibit 1. Reclamation's entire DMC right-of-way (ROW) is included in the APE and spans Alameda, Fresno, Merced, San Joaquin, and Stanislaus counties. All access and staging will occur within the ROW along existing DMC operations and maintenance access roads. The maximum depth of disturbance for the project will be 100 feet for geophysical testing (cone penetration testing and soil boring). The APE extends to either side of the DMC and is no more than 250 feet in width from the centerline of the canal.

Pacific Legacy, Inc., the Authority's qualified cultural resource consultant, received the results of a Sacred Lands File review from the Native American Heritage Commission (NAHC) for the APE on April 20, 2022. The NAHC review of the Sacred Lands File yielded positive results, though no locational data were given. The NAHC recommended contact with several Native American tribes to obtain further information regarding areas of concern within the DMC ROW. Pacific Legacy also received the results of an archival and records search of the California Historical Resources Information System (CHRIS) from the Southern San Joaquin Valley Information Center and the Central California Information Center in April 2020. Those results revealed two Native American archaeological resources within the project APE, one recorded along the Firebaugh Wasteway in Fresno County in 1951 and the other recorded along the Westley Wasteway in Stanislaus County in 1946. To date, Pacific Legacy has not yet received CHRIS results from the Northwest Information Center for Alameda and Contra Costa counties.

To support compliance with Section 106 of the NHPA, Reclamation is developing a programmatic agreement for the project with the State Historic Preservation Officer (SHPO). As part of its compliance efforts, Reclamation may have contacted your group about this effort.

Please consider this letter the initiation of the Authority's consultation under AB 52 and as formal notification of the proposed project as required under Public Resources Code (PRC) 21080.3.1 and Chapter 532 Statutes of 2014. If you would like to consult on this project, we respectfully request that you respond within 30 days of receipt of this letter pursuant to PRC 21080.3.1(d), by July 6, 2022. Please also provide a designated lead contact person for future communications.

The Authority is eager to discuss with you any concerns you might have regarding areas within the APE that may be important to your community. The Authority requests your participation in the identification and protection of cultural resources, sacred lands, and other heritage sites within the above-described APE with the understanding that you or other members of your community might possess specialized knowledge of the area.

If you or any of your tribal members have any questions or concerns regarding this project, please contact myself or Jacob Bejarano at 209.832.6200, pablo.arroyave@sldmwa.org or Jacob.bejarano@sldmwa.org.

Sincerely,

Pablo R. Arroyave
Chief Operating Officer

Attachments – Area of Potential Effects Maps

SAMPLE UPDATE LETTER

August 18, 2022

Katherine Perez
Nototome Cultural Preservation
Northern Valley Yokut / Ohlone / Patwin
P.O. Box 717
Linden, CA 95236
Sent via email: canutes@verizon.net

Dear Katherine Perez,

The purpose of this letter is to summarize archaeological survey and evaluation efforts for the Delta-Mendota Canal Subsidence Project in the Central Valley and provide an update on project status. This update is in regards to your request for Assembly Bill 52 (AB 52) consultation for the project. The U.S. Bureau of Reclamation is consulting separately pursuant to Section 106 of the National Historic Preservation Act. The current cultural resources identification effort for the project began in March 2022 with a records search request to the appropriate CHRIS Information Center and the Native American Heritage Commission. A notification letter was sent out in June of 2022 by the San Luis and Delta-Mendota Water Authority (Authority) in compliance with AB 52. Your response to that letter requesting consultation was received by the Authority in July of 2022.

On behalf of the Authority, Pacific Legacy Inc. completed a pedestrian survey of the Area of Potential Effect (APE) in July of 2022. The APE is approximately 97 miles long which has been reduced from the original 116 miles noted in our initial consultation letter based on consideration of potential project construction impacts. The APE for the proposed construction activities amounts to 5,899 acres in total and no eligible Native American resources have been identified, other than one isolated find noted within the current APE. The isolated find, DMC-CRP-ISO-001, is comprised of two crypto-crystalline silicate (CCS) flakes (artifact manufacturing debris) located near the San Luis Creek bank. Ground surface visibility at the find was 100%. Two newly identified archaeological sites, a historic period resource associated with an earlier canal and a historic debris scatter were recorded as archaeological resources during the survey. The two newly identified archaeological sites, DMC-CRP-001 and DMC-

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CRP-002, were evaluated for eligibility for the National Register of Historic Places (NRHP) and the California Register of Historical Places (CRHR) and were recommended as determined to be ineligible. However, that determination has not been reviewed by Reclamation. We anticipate that the final survey report will be completed in late September or early October depending on the timing of Reclamation's review.

Pacific Legacy, Inc., on behalf of the Authority, is currently planning to conduct a Geoarchaeological Assessment to identify potential buried cultural resources. The Geoarchaeological Assessment Workplan currently identifies 10 areas of geoarchaeological sensitivity based on modeling of soil profiles. These areas will be targeted for subsurface exploration. Subsurface exploration will consist of both trenching and coring, accompanied by soil stratigraphic analysis. The Geoarchaeological Assessment Workplan is currently under review by Reclamation and we are awaiting their permit to complete the work. The Authority will keep you informed of the field schedule.

While the pedestrian survey of the APE did not result in the identification of any Native American resources considered an archaeological site, the Authority will keep you informed of the progress of the geoarchaeological testing. Your previous concerns have been noted and once Reclamation has approved the survey report it will be available for your review. We do not have the funding for Native American monitors that were requested by some of the consulting parties. However, should you wish to monitor during the geotechnical fieldwork, the Authority's consultants can coordinate with you on the planning for that fieldwork. Please respond to this email indicating your interest in monitoring the geotechnical fieldwork. If you have any further comments or questions, please email my staff at jacob.bejarano@sldmwa.org and copy me at Pablo.arroyave@sldmwa.org. Thank you in advance for you continued interest in our project.

Best Regards,

Pablo Arroyave

Pablo Arroyave
Chief Operating Officer
San Luis and Delta-Mendota Canal Water Authority

APPENDIX D – ARCHAEOLOGICAL SITE RECORDS (REDACTED)

Note: This Appendix Has Been Removed As It Contains Confidential Information

APPENDIX E – ARCHAEOLOGICAL PHOTOGRAHIC DOCUMENTATION (REDACTED)

Note: Photographs Containing Confidential Information Have Been Removed

Appendix E: Photographic Documentation

Photograph No. 1

Direction: East

Date: 5/18/22

Photographer:
Ashley Schmutzler

Description:
Starting point at Sierra avenue (Frame AS014).

Photograph No. 2

Direction: North

Date: 5/19/22

Photographer:
Ashley Schmutzler

Description:
Overview from Helm Canal Rd. Location of P-10-000105. (AS024).

Photograph No. 3

Direction: North

Date: 5/19/22

Photographer: Ashley Schmutzler

Description: Overview from Jerold Avenue (Frame AS030).

Photograph No. 4

Direction: East

Date: 5/20/22

Photographer: Ashley Schmutzler

Description: Overview from North Russel Avenue (Frame AS037).

Appendix E: Photographic Documentation

Photograph No. 5

Direction: East

Date: 5/20/22

Photographer:
Ashley Schmutzler

Description:
Overview from W. Cambia Avenue (Frame AS040).

Photograph No. 6

Direction: East

Date: 5/20/22

Photographer:
Ashley Schmutzler

Description:
Overview from North Oxford Avenue (Frame AS043).

Appendix E: Photographic Documentation

Photograph No. 7

Direction: West

Date: 5/21/22

Photographer:
Ashley Schmutzler

Description:
Overview from N. Hamburg Avenue (Frame 46).

Photograph No. 8

Direction: East

Date: 5/21/22

Photographer:
Ashley Schmutzler

Description:
Private property within survey area , photo from South Woo Avenue (Frame AS048).

Appendix E: Photographic Documentation

Photograph No. 9

Direction: South

Date: 5/21/22

Photographer: Ashley Schmutzler

Description: Overview from Cotton Gin Road (Frame AS51).

Photograph No. 10

Direction: Northeast

Date: 5/21/22

Photographer: Ashley Schmutzler

Description: Overview of highway 165, bridge 84.38 (Frame AS57).

Appendix E: Photographic Documentation

Photograph No. 11

Direction: West

Date: 5/22/22

Photographer:
Ashley Schmutzler

Description:
Overview of S Creek Road (Frame AS64).

Photograph No. 12

Direction: Northeast

Date: 5/22/22

Photographer:
Ashley Schmutzler

Description:
Overview of Delta Mendota Canal sign at State route 152 (Frame AS067).

Appendix E: Photographic Documentation

Photograph No. 13

Direction: West

Date: 5/23/22

Photographer:
Ashley Schmutzler

Description:
Overview from Hilldale Avenue (Frame AS68).

Photograph No. 14

Direction: South

Date: 5/23/22

Photographer:
Ashley Schmutzler

Description:
Modern can scatter (Frame AS069).

Appendix E: Photographic Documentation

Photograph No. 15

Direction: North

Date: 5/23/22

Photographer:
Ashley Schmutzler

Description:
Historic period ditch, previously recorded as P-24-002194, addressed as built-environment (Frame AS070).

Photograph No. 16

Direction: -

Date: 5/23/22

Photographer:
Ashley Schmutzler

Description:
DMC-CRP-ISO-001 Artifact -01 (Frame AS076).

Photograph No. 17

Direction: -

Date: 5/23/22

Photographer:
Ashley Schmutzler

Description:
DMC-CRP-ISO-001 Artifact-02 (Frame AS077).

Photograph No. 18

Direction: Northeast

Date: 5/24/22

Photographer:
Ashley Schmutzler

Description:
Overview of DMC-CRP-ISO-001 location in maintenance yard (Frame AS087).

Appendix E: Photographic Documentation

Photograph No. 19

Direction: Southwest

Date: 5/25/22

Photographer:
Ashley Schmutzler

Description:
Private land between McCabe road and Snyder road. (Frame AS094).

Photograph No. 20

Direction: Northwest

Date: 5/25/22

Photographer:
Ashley Schmutzler

Description:
Overview of GSA-13 (Frame AS101).

Appendix E: Photographic Documentation

Photograph No. 21

Direction: West

Date: 6/9/22

Photographer:
Ashley Schmutzler

Description: Overview of GSA-6 (Frame 176).

Photograph No. 22

Direction: South

Date: 5/26/22

Photographer:
Ashley Schmutzler

Description: Overview of field north of Byron Highway with survey crew (Frame AS106)

Appendix E: Photographic Documentation

Photograph No. 23

Direction: East

Date: 5/26/22

Photographer: Ashley Schmutzler

Description: No trespassing sign off Finck Road (Frame AS108).

Photograph No. 24

Direction: North

Date: 6/6/22

Photographer: Ashley Schmutzler

Description: Delta-Mendota Canal, east of water authority entrance (Frame AS112).

Appendix E: Photographic Documentation

Photograph No. 25

Direction: South

Date: 6/6/22

Photographer:
Ashley Schmutzler

Description:
Delta-Mendota Canal near Water Authority office (Frame 116).

Photograph No. 26

Direction: Northeast

Date: 6/6/22

Photographer:
Ashley Schmutzler

Description:
Start of GSA-2 between Mountain House Road and Grant Line Road (Frame AS130).

Appendix E: Photographic Documentation

Photograph No. 27

Direction: North

Date: 6/6/22

Photographer:
Ashley Schmutzler

Description:
End of GSA-2 between Mountain House Road and Grant Line Road (Frame AS131).

Photograph No. 28

Direction: West

Date: 6/7/22

Photographer:
Ashley Schmutzler

Description:
Overview of GSA-3 at S Corral Hollow Road (Frame AS142).

Appendix E: Photographic Documentation

Photograph No. 29

Direction: North

Date: 6/7/22

Photographer:
Ashley Schmutzler

Description:
GSA-3 overview (Frame AS144).

Photograph No. 30

Direction: North

Date: 6/7/22

Photographer:
Ashley Schmutzler

Description:
Overview of GSA-3 end point (Frame AS145).

Appendix E: Photographic Documentation

Photograph No. 31

Direction: East

Date: 6/8/22

Photographer:
Ashley Schmutzler

Description:
DMC-AAS-ISO-001, an isolated historic period plow.
(Frame AS146)

Photograph No. 32

Direction: Plan

Date: 6/8/22

Photographer:
Ashley Schmutzler

Description:
DMC-AAS-ISO-001, B-865 stamp (Frame AS149).

Appendix E: Photographic Documentation

Photograph No. 33

Direction: West

Date: 6/8/22

Photographer: Ashley Schmutzler

Description: Overview of Corral Hollow Road (Frame 153).

Photograph No. 34

Direction: Northwest

Date: 6/8/22

Photographer: Ashley Schmutzler

Description: Overview from S. Bird Road (Frame AS157).

Appendix E: Photographic Documentation

Photograph No. 35

Direction: East

Date: 6/9/22

Photographer:
Ashley Schmutzler

Description:
Starting point of GSA-4 from S Bird (Frame AS159).

Photograph No. 36

Direction: Southwest

Date: 6/9/22

Photographer:
Ashley Schmutzler

Description: GSA-4, private land (Frame AS160).

Appendix E: Photographic Documentation

Photograph No. 37

Direction: West

Date: 6/9/22

Photographer:
Ashley Schmutzler

Description:
Overview of I-5, end of GSA-4 (Frame AS163).

Photograph No. 38

Direction: South

Date: 6/9/22

Photographer:
Ashley Schmutzler

Description:
Start of GSA-5
(Frame 165).

Appendix E: Photographic Documentation

Photograph No. 39

Direction: East

Date: 6/9/22

Photographer:
Ashley Schmutzler

Description:
Overview of GSA-5 from S Koster Road (Frame AS167).

Photograph No. 40

Direction: South

Date: 6/9/22

Photographer:
Ashley Schmutzler

Description: End of GSA-5 at W Gaffrey Road (Frame AS169).

Appendix E: Photographic Documentation

Photograph No. 41

Direction: East

Date: 6/9/22

Photographer:
Griffen Bragagnolo

Description:
Overview of start of GSA-6 (Frame AS172).

Photograph No. 42

Direction: North

Date: 6/9/22

Photographer:
Griffen Bragagnolo

Description:
Overview of end of GSA-6. (Frame AS173).

Appendix E: Photographic Documentation

Photograph No. 43

Direction: North

Date: 6/13/22

Photographer:
Ashley Schmutzler

Description: Overview of GSA-8 Del Puerto Creek (Frame AS181).

Photograph No. 44

Direction: Southeast

Date: 6/13/22

Photographer:
Chris Peske

Description:
Overview of GSA-8 (Frame AS182).

Photograph No. 45

Direction: West

Date: 6/14/22

Photographer:
Chris Peske

Description:
Field north of SR 140, private land (Frame AS183).

Photograph No. 46

Direction: Southeast

Date: 6/15/22

Photographer:
Chris Peske

Description:
View of fencing blocking access to the western edge of project area south of GSA-10 (Frame AS195).

Appendix E: Photographic Documentation

Photograph No. 47

Direction: West

Date: 6/15/22

Photographer:
Chris Peske

Description:
View of unsurveyed space on southern end of GSA-10 (Frame AS196).

Photograph No. 48

Direction: Northeast

Date: 6/15/22

Photographer:
Chris Peske

Description:
GSA-10 overview (Frame AS197).

Appendix E: Photographic Documentation

Photograph No. 49

Direction: North

Date: 6/15/22

Photographer:
Chris Peske

Description:
GSA-10 overview
(Frame AS198).

Photograph No. 50

Direction: Northwest

Date: 6/15/22

Photographer:
Chris Peske

Description:
GSA-10 overview
(Frame AS199).

Appendix E: Photographic Documentation

Photograph No. 51

Direction: Northwest

Date: 6/15/22

Photographer:
Chris Peske

Description:
GSA-10 wasteway (Frame AS200).

Photograph No. 52

Direction: Northwest

Date: 6/15/22

Photographer:
Chris Peske

Description:
GSA-10 wasteway (Frame AS201).

Photograph No. 53

Direction: East

Date: 6/15/22

Photographer:
Chris Peske

Description:
Drainage north of GSA-10 (Frame AS202).

Photograph No. 54

Direction: North

Date: 6/17/22

Photographer:
Chris Peske

Description:
GSA-09 wasteway (Frame AS205).

Appendix E: Photographic Documentation

Photograph No. 55

Direction: East

Date: 6/15/22

Photographer:
Chris Peske

Description:
GSA-09, viewing the Delta-Mendota Canal. (Frame AS206)

Photograph No. 56

Direction: South

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-002 site overview (Frame AS219).

Appendix E: Photographic Documentation

Photograph No. 57

Direction: -

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-002: A-01: Bottle base fragment with Owens-Illinois maker's mark ("I" within circle) (Frame AS209).

Photograph No. 58

Direction: -

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-002: A-02: Top fragment of "Sunny Brook" brand whiskey bottle (Frame AS210)

Photograph No. 59

Direction: -

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-002: A-03: Square bottle base with Obear-Nester Glass Co. maker's mark ("N" within square) (Frame AS212).

Photograph No. 60

Direction: -

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-002: A-04: Bottle base fragment with "4/5 quart" embossed on bottom (Frame AS213).

Appendix E: Photographic Documentation

Photograph No. 61

Direction: -

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-002: A-06: Top fragment of "Sunny Brook" whiskey bottle (Frame AS214).

Photograph No. 62

Direction: -

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-002: A-07: Bottle base fragment with Anchor-Hocking Glass Co. maker's mark (Frame AS216).

Appendix E: Photographic Documentation

Photograph No. 63

Direction: Northeast

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-001: Feature 1, ruins of flood dam (Frame AS220).

Photograph No. 64

Direction: North

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-001: Cut stone of ditch (Feature 2) in foreground, crew standing on Feature 4 (Frame AS221).

Appendix E: Photographic Documentation

Photograph No. 65

Direction: North-northwest

Date: 6/17/22

Photographer: Myra Jamison

Description: DMC-CRP-001: Site overview with berm (Feature 3) in middle and flood dam (Feature 1) at right (Frame AS222).

Photograph No. 66

Direction: Northeast

Date: 6/17/22

Photographer: Myra Jamison

Description: DMC-CRP-001: Cut stone of ditch (Feature 2) in foreground, crew standing on Feature 4 (Frame AS223).

Photograph No. 67

Direction: West

Date: 6/17/22

Photographer:
Myra Jamison

Description:
DMC-CRP-001: Unusual grasses (Feature 4) (Frame AS224).

APPENDIX F – HISTORIC RESOURCES INVENTORY AND EFFECTS ANALYSIS REPORT

Draft

Historic Resources Inventory and Effects Analysis Report for the Delta-Mendota Canal Subsidence Correction Project

Prepared for:

U.S. Department of Interior, Bureau of Reclamation
and
San Luis & Delta-Mendota Water Authority

Prepared by:

JRP Historical Consulting LLC

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August 2022

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Appendices

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- Project Vicinity & Location
- Area of Potential Effects (APE) Maps

Appendix B: DPR 523 Forms

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Front piece: Delta-Mendota Canal near milepost 28.96. Camera facing downstream, May 11, 2022.

1. Executive Summary

This report identifies and evaluates built environment resources within the Area of Potential Effects for the U.S. Bureau of Reclamation's Delta-Mendota Canal Subsidence Correction Project in accordance with Section 106 of the National Historic Preservation Act of 1966 (as amended) (54 U.S.C. 306108) and its implementing regulations (Title 36 Code of Federal Regulation Part 800), and Section 15064.5(a)(2)-(3) of the California Environmental Quality Act (CEQA) Guidelines, using the criteria outlined in Section 5024.1 of the California Public Resources Code and applies the criteria of effect pursuant to 36 CFR Part 800.5 for the project. The project location / vicinity map and the Area of Potential Effects (APE) map are provided in **Appendix A**.

Historic properties are built environment resources that meet the significance criteria for listing in the National Register of Historic Places (NRHP) and retain historic integrity. Historic properties that have been determined eligible for listing in the NRHP are also listed in the California Register of Historical Resources. This report identified three linear historic properties that cross over or under Delta-Mendota Canal and have been previously determined eligible for listing in the National Register of Historic Places: San Joaquin Pipelines/Hetch Hetchy Aqueduct, Santa Fe Grade, and Outside Canal. This report and concludes that two additional properties – Delta-Mendota Canal and San Luis Drain – meet the significance criteria for listing. See **Appendix B** for Department of Parks and Recreation (DPR) 523 form sets for built environment resources evaluated for this report.

Delta-Mendota Canal is a 116.4-mile-long canal that is a primary component of the US Bureau of Reclamation's (Reclamation) Central Valley Project (CVP). Completed in 1952, the canal transports water from C.W. Bill Jones Pumping Station (formerly Tracy Pumping Station) along the western side of the San Joaquin Valley for irrigation, for use at the San Luis Reservoir, and for recharging the San Joaquin River where water has been diverted at Friant Dam for the Friant-Kern system. The National Register of Historic Places (NRHP) and California Register of Historical Resources (CRHR) inventory and evaluation contained herein conclude that Delta-Mendota Canal meets NRHP Criterion A and CRHR Criterion 1 at the state level of significance because of its primary role in accomplishing the visionary goal of the CVP to transfer water between the Sacramento River and San Joaquin River basins. Delta-Mendota Canal is also individually eligible for listing in the NRHP and CRHR under Criterion C and Criterion 3 because its size and scale demonstrate the magnitude of the CVP's engineering and construction accomplishment, and because it demonstrates Reclamation engineer Oscar Boden's important contributions to design of the Delta Division of the CVP. Overall, the canal retains historic integrity to its period of significance, 1946-1951. **Table 1** and **Appendix C** provide a list of contributing and non-contributing components of Delta-Mendota Canal.

Table 1: Contributing Status of Component Parts of DMC.

Structure Type	Contributing Status
Farm Bridges	Non-Contributing
Railroad Bridge	Non-Contributing
Pipe Crossings	Non-Contributing
County Highway	Non-Contributing
Overchutes	Non-Contributing
Inlet Drains	Non-Contributing
Road Drains	Non-Contributing
Culverts	Non-Contributing
Cattle Guards	Non-Contributing
Pumps	Non-Contributing
Ladders	Non-Contributing
Gates	Non-Contributing
Check Structures	All are Contributing
Siphons	All are Contributing
Wasteways	4 are Contributing, 1 is not – see Master Table in **App. C**
CVP Signs	All are Contributing
Lining / Prism	Lining to original specifications contributes
Operating Bridges	Non-contributing; integrity loss
Turnouts	Some are contributing – see Master Table in **App. D**
Pumping Plants	C.W. Bill Jones Pumping Plant is Contributing

The San Luis Drain is an 88-mile, concrete-lined, trapezoidal interceptor drain constructed between 1969 and 1973 as part of the San Luis Unit: a joint state-federal expansion of the CVP to deliver water and provide drainage to the western San Joaquin Valley. From the southern terminus located near Five Points in Fresno County, the San Luis Drain extends in a northerly alignment where it historically collected subsurface irrigation wastewater from adjacent irrigation districts enroute to its northern terminus outside Gustine in Merced County. Here, the drain discharged drainage water into a complex of 12 evaporation ponds at the former Kesterson Reservoir until 1986, when use of the reservoir and drain was ultimately discontinued following the discovery of selenium toxicosis among various fish and waterfowl species at the Kesterson National Wildlife Refuge (which encompassed the reservoir). JRP recorded two point-observations and a linear segment in and around the APE between Mendota and Firebaugh and finds the San Luis Drain historically significant under NRHP Criterion A and CRHR Criterion 1, meeting the standards under NRHP Criteria Consideration G, for its important associations with the Kesterson Reservoir ecological disaster, an environmental crisis that drew national attention to the issue of toxic selenium contamination and contributed to a dramatic policy shift toward agricultural drainage disposal practices in the United States. The San Luis Drain is significant at the national level, with a period of significance spanning from 1982, when USFWS scientists first detected selenium toxicosis among various wildlife species at Kesterson, and 1988, when the U.S. Department of Interior--having discontinued use of the San Luis drainage facilities--remediated the selenium contamination problem at Kesterson by dewatering and infilling the evaporation ponds. The two point-observations and one linear segment recorded herein retain strong integrity to convey the San Luis Drain's period of significance.

In general, the character-defining features of the recorded segment of the San Luis Drain are its alignment, the size, shape, and dimensions of the canal prism, and its concrete lining material. Additionally, appurtenant structures that directly relate to the conveyance of subsurface irrigation drainage water like check structures and siphons all relate directly to the drain's significance and are therefore character defining. The boundaries of the San Luis Drain are the channel's right-of-way, encompassing the canal prism and two flanking embankments between the southern terminus--a point near Five Points in Fresno County--and the northern terminus at the former Kesterson Reservoir.

This report concludes that the project will have an adverse effect on Delta-Mendota Canal because the project proposes material demolitions and alterations that are not consistent with the SOI Standards. The project does not propose any actions that have the potential to adversely affect any other historic properties within the Area of Potential Effects.

2. Summary of Identification Efforts / Methodology

2.1. Area of Potential Effects

Reclamation established the APE for the DMC Subsidence Correction Project, with input from the Authority. The APE encompasses 5,948.6 acres and includes all areas that may be directly or indirectly affected by the Project. The APE includes the DMC ROW from PM 2.5 to PM 116.6 where staging, stock piling, borrow areas, and most project activities are located. Some areas of the DMC ROW are excluded where no project activities will occur and where non-Authority / Reclamation buildings / structures are located in, or have encroached into, the ROW, but where project activities have no potential to affect those resources. The APE also includes areas outside of the ROW where activities related to bridge replacements may impact bridge approach roads and areas adjacent to affected roadways, as well as the Authority's Operations and Maintenance Complex in Tracy adjacent to the C.W. Bill Jones Pumping Plant at the north end of the canal.

2.2. Identification

2.2.1. Records Search

Pacific Legacy submitted records searches to Southern San Joaquin Valley Information Center (File No. 22-107), Northwest Information Center (File No. 21-1476), and the Central California Information Center (Reference No. 12106ILN). The search results identified previously evaluated segments and appurtenant features of Delta-Mendota Canal. These resources are addressed in the NRHP/CRHR evaluation in **Section 4.4** below.

Information Center search results identified three linear historic properties that cross under or over Delta-Mendota Canal and have been previously determined eligible for listing in the NRHP, as well as nine additional linear built environment resources that cross under or over the DMC and have been previously determined not eligible for listing in the NRHP. See **Table 2** and APE maps for these previously evaluated historic linear resources.

Table 2: Previously evaluated built environment resources in APE

Primary String	Resource Name	OHP Status Code[1]	Status Notes	County Name
P-24-000082	CCID Main Canal; San Joaquin and Kings River Canal, Main Canal	2S2 (2018)	Criterion A	Merced
P-24-000083	Old Santa Fe Grade (Road)	2S2 (2017)		Merced
P-24-000434	Outside Canal	2S2 (2017)	Criterion A	Merced
P-24-000434	Outside Canal	2S2 (2017)	Criterion A	Merced
P-39-004860	San Joaquin Pipelines No. 1 & 2; Hetch Hetchy Aqueduct	3S (2007)	Criteria A & C	San Joaquin
P-10-003930	Southern Pacific Railroad	6Z		Fresno
P-10-007237	AE-4013-002; PG&E distribution line	6Z (2019)		Fresno
P-10-007240	AE-4013-005; power distribution line	6Z (2019)		Fresno
P-39-000002	Southern Pacific Railroad in San Joaquin County	6Z (2018)		San Joaquin
P-39-000098	Western Pacific Railroad/Union Pacific RR	6Z (2015)		San Joaquin
P-39-004289	Three sets of two transmission towers; TPP-5; PG & E Stanislaus-Newark Circuits #1 & 2	6Z (2001)		San Joaquin
P-39-004312	Byron Bethany Irrigation District Main Canal	6Z (2001)		San Joaquin
P-50-002328	Tesla-Salado-Manteca 115 kV Transmission Line	6Z (2017)		Stanislaus

[1] California Historical Resource Status Codes.
2S2: Individual Property determined eligible determined eligible for NR by a consensus through Section 106 process. Listed in the CR.
3S: Appears eligible for NR as an individual property through survey evaluation.
6Z: Found ineligible for NR, CR, or Local designation through survey evaluation.

Primary String	Resource Name	OHP Status Code[1]	Status Notes	County Name
P-01-010445	Byron Bethany Irrigation District Main Canal (No. 9)	6Z (2011)		Alameda

The following summarizes the eligibility conclusions of the previously identified historic properties that have been determined eligible for listing in the NRHP.

CCID Outside Canal

The Outside Canal is an earthen canal that delivers water from the San Joaquin River to farmland on the west side of the San Joaquin Valley near Los Banos. The Outside Canal was the second major canal built by the San Joaquin & Kings River Canal & Irrigation Company and the Miller and Lux Company, and is currently owned and operated by the CCID. The Main Canal crosses the APE at Mile Post 115.57. In 2017, the Outside Canal was evaluated and found eligible for listing in the NRHP/CRHR under Criterion A/1 at the local level for its association with Miller and Lux Company's reclamation and irrigation developments of western Merced County circa 1870 to 1925. The historic property boundary is the 37-mile canal structure. The period of significance is 1896–1897, the years the canal was built. Character-defining features of the Outside Canal are the unaltered portions of the canal, its setting in an agricultural community, its location and route, and its ability to convey water for flood control and irrigation. Non-contributing elements include the canal's design, workmanship, and operational components such as weirs, siphons, bridges, diversion gates, valves, and culverts. On July 1, 2019, SHPO concurred with this determination. Because the Main Canal was formally determined eligible for listing in the NRHP, it is automatically listed in the CRHR.

Old Santa Fe Grade

The Old Santa Fe Grade is a road grade that runs diagonally across wetlands near Los Banos in western Merced County. The grade is primarily an unpaved road, and in some locations the grade serves as a levee and access road. The Main Canal crosses the APE at Mile Post 110.12. In 2017, the Old Santa Fe Grade was evaluated and found eligible for listing in the NRHP/CRHR under Criteria A/1 at the local level as an important component of the Miller and Lux Company's early reclamation and development of western Merced County, and under Criteria B/2 for its direct association with both Henry Miller and Claus Spreckels. Its period of significance is 1890, the year the grade was constructed under the terms of the Miller and Lux Company's contract with Spreckels' rail company. The historic property boundary is the grade structure. Character-defining features are the road grade structure, its location and setting in western Merced County's reclaimed agricultural landscape, and its ability to function as a roadway. On July 1, 2019, SHPO concurred with this determination. Because the Old Santa Fe Grade was formally determined eligible for listing in the NRHP, it is automatically listed in the CRHR.

Hetch Hetchy Aqueduct San Joaquin Pipelines Nos. 1 & 2

The Hetch Hetchy Aqueduct San Joaquin Pipelines Nos. 1 & 2 (SJPL 1 & 2) are part of the City and County of San Francisco municipal water system. The pipelines run mostly underground and convey water east to west 47.5 miles across the San Joaquin Valley from the Oakdale Portal to the Tesla Portal. SJPL 1 & 2 were built in 1932 and 1953, respectively. Both pipelines are steel with diameters between 56 inches to 72 inches. The pipelines cross the APE at Mile Post 23.95. In 2007, SJPL 1 & 2 were evaluated and found eligible for the NRHP/CRHR under Criterion A/1 at the local level due to their association with the development of the San Francisco water system and associated growth and prosperity of the San Francisco Bay Area. Additionally, SJPL No. 1 was found eligible under NRHP/CRHR Criterion C/3 for the innovative engineering techniques used by the Youdall Company for its construction. The boundary of the SJPL 1 & 2 historic property is the entire 47.5-milc-long San Joaquin Pipeline right-of-way, including the lands surrounding both the Oakdale Portal and Tesla Portal. The period of significance is 1932-1953 and the character-defining features include the cylindrical shape throughout its length, the diameter of the pipes, the use to convey water by gravity flow, the parallel positioning of the pipelines, and the original construction materials. Because the Old Santa Fe Grade was formally determined eligible for listing in the NRHP, it is automatically listed in the CRHR.

2.2.2. Inventory and Evaluation

JRP staff recorded and evaluated five built environment resources in the APE: Delta-Mendota Canal, two rural residential properties, and two drainage canals. The NRHP evaluation conclusions for each of these resources is listed in **Table 3** below. See **Appendix B** for DPR 523 form sets for each of these resources.

Table 3: Built environment resources evaluated by this study.

Resource Name	Status Code[2]	Status Notes	County
Delta-Mendota Canal	2S2	Criteria A & C	Alameda, Contra Costa, San Joaquin, Stanislaus, Merced, Fresno
San Luis Drain	2S2	Criterion A Criteria Consideration G	Fresno
Drain U-121.2	6Z		Fresno
4500 South Lammers Road / (APN) 240-140-260	6Z		San Joaquin
27655 South Lammers Road / (APN) 251-050-120	6Z		San Joaquin

JRP staff recorded Delta-Mendota Canal by visually observing the entire 116-mile canal from its headworks at the inlet canal upstream from C.W. Bill Jones Pumping Station to its outlet at Mendota Pool. JRP recorded the canal with digital photography and field notes. In order to photographically capture the characteristics of the canal, JRP took photographs of all major structures – check structures, siphon inlets and outlets, overchutes, turnouts, and bridges – and photographed representative examples of common and ubiquitous minor structures like inlet drains, culverts, road drains, and ladders. JRP photographed representative examples of the canal prism at regular intervals no greater than one-half mile for the entire length of the canal.

JRP recorded Delta-Mendota Canal on a set of DPR 523 forms that consists of a Primary Record, a Building, Structures and Object Record, 22 DPR 523 Linear Feature Records, and a Site Map (**Appendix B**). The Primary Record consists of a descriptive overview of the canal, and a typology discussion of each of the major feature types and sub-types. The 22 Linear Feature Records describe the 22 segments of the canal between check structures, referring to the typology discussion to characterize repetitive resource types, and providing descriptions of resources unique to the particular segment. The DPR 523 Forms do not include photographs of each of the approximately 750 appurtenant structures on the canal but do include photographs of representative examples.

The DPR 523 Form set documents the physical attributes of the canal and provides evaluations under NRHP Criteria A – D, as well as the CRHR Criteria 1 – 4 for historic significance and

[2] California Historical Resource Status Codes.
2S2: Individual Property determined eligible determined eligible for NR by a consensus through Section 106 process. Listed in the CR.
6Z: Found ineligible for NR, CR, or Local designation through survey evaluation.

identifies canal components as contributing or non-contributing elements. A table of each of the approximately 750 appurtenant structures, organized by milepost, is appended to the end of the form set and notes if the structure contributes to the significance of the canal. A summary table noting the types of component elements that contribute and do not contribute to the significance of the historic property is presented in the introduction, **Section 1** and in the evaluation, **Section 5**. This recordation of historic properties has been carried out in a manner consistent with the Office of Historic Preservation's *Instructions for Recording Historical Resources;* Reclamation's Directives and Standards (D&S) 02-01; and the *Secretary of the Interior's Standards for the Treatment of Historic Properties*.

JRP recorded two rural residential properties and two drainage ditches on DPR 523 forms sets that provide descriptions of the resources and NRHP and CRHR evaluations.

3. Historic Context

3.1. Delta-Mendota Canal

When viewing a topographic map of California, one particularly outstanding geographic feature presents itself above all others: an immense oblong alluvial plain in the interior of the state that extends nearly 500 miles from north to south and varies from about 60 to 100 miles in width (**Figure 1**). This Great Central Valley Basin occupies more than one-third of the entire state. It covers 18,810 square miles and is bounded on the east by a pair of formidable mountain ranges and on the west by a less imposing coastal mountain range. The valley itself contains three major drainage areas. The northern one-third is drained by the southerly flowing Sacramento River and its tributaries. The Sacramento is the longest river in the state and the largest, contributing about one-third of the total outflow of all river systems in the state. The southern and largest portion of the valley is drained by the San Joaquin River and its tributaries. The San Joaquin River flows west and north and drains a larger, but much more arid region. The two major rivers converge in the "Sacramento-San Joaquin Delta," a 153 square-mile labyrinth of reclaimed tule islands, river channels, and sloughs. The Delta also receives freshwater inflows directly from other rivers draining the imposing central region of the Sierra Nevada range to the east. These watercourses include the Cosumnes, Mokelumne and Calaveras rivers along with numerous other minor rivers and creeks. The flow from all of these waterways move westerly through the Delta, entering Suisun Bay and, together with the Sacramento and San Joaquin rivers, flow through Carquinez Straits into San Francisco Bay, a salt water tidal basin, and ultimately through the Golden Gate into the Pacific Ocean.

3.1.1. Historic Background: Early Land and Water Utilization in the Central Valley

California's water supply and development challenges stretch back to the mid-nineteenth century gold rush decade when gold miners in the mountains and foothills of the Sierra Nevada began diverting water from streams to expose placer deposits in streambeds and to process gold using a variety of hydraulic methods. The gold rush caused many significant changes in riverine ecosystems of the Central Valley. Hydraulic mining destroyed miles of riparian vegetation and habitat. Debris formed sandbars in streams, impaired navigation, and elevated riverbeds leading to massive flooding and destruction of thousands of acres of agricultural land, while in the mountains and foothills the hydraulic giants left behind barren amphitheaters and miles of waste tailings. Nevertheless, mining remained the most important economic use of water in California for some three decades following the mass migration of gold miners from around the world to California starting in 1849.[3]

[3] Robert Kelley, *Gold vs. Grain: The Hydraulic Mining Controversy in California's Sacramento Valley* (Glendale, CA: Greenwood Press, 1979).

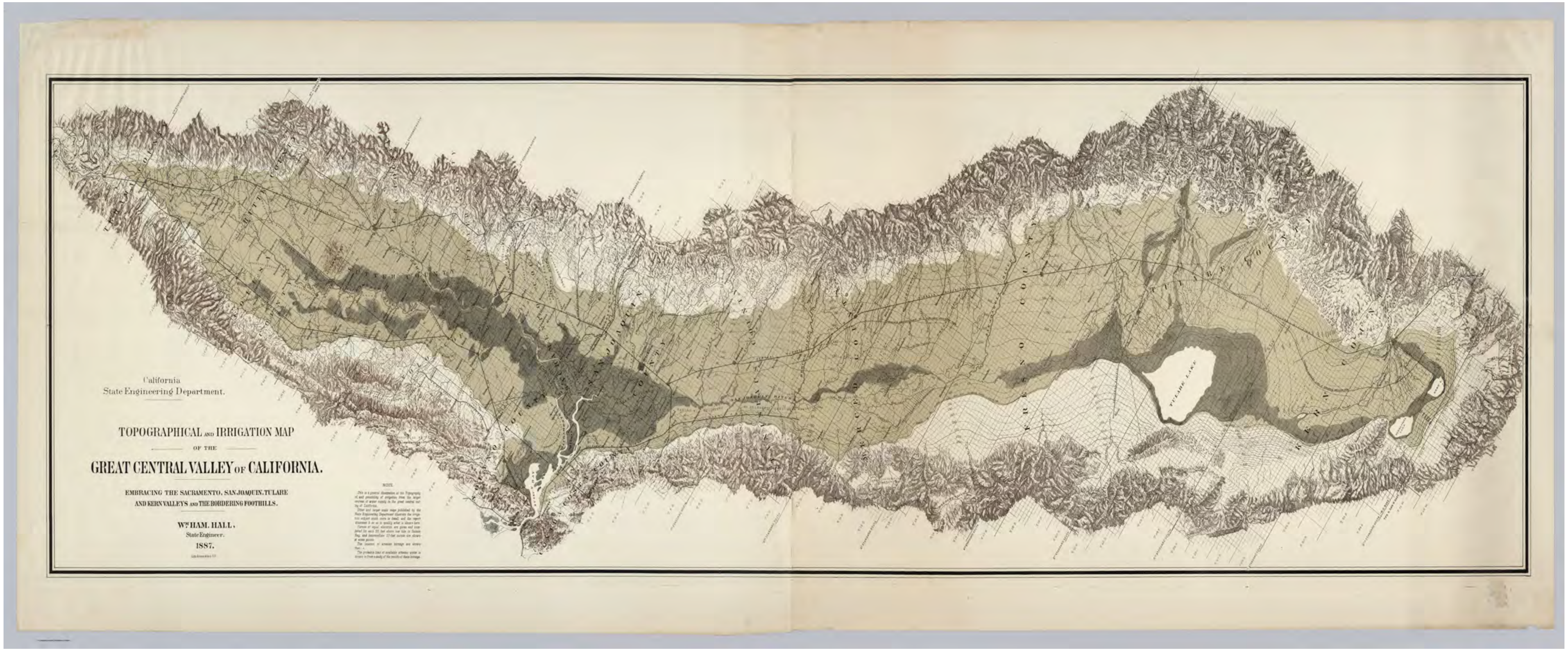

Figure 1: Great Central Valley of California, 1887.

Even during the height of the gold rush, some Californians already had begun to dream of converting the Central Valley into an agrarian wonderland. The Central Valley was a phenomenally rich and broad alluvial plain and was destined to become the state's most productive agricultural center. It was watered by streams flowing from the Sierra Nevada on the east and the coastal ranges on the west, but water was in short supply when needed the most during the rainless summer growing season. As a result, during the gold rush decade, open range grazing of sheep and cattle remained the principal land use on the natural pasture lands of the Great Central Valley.

In the middle to late 1860s, wheat culture emerged as an increasingly prominent land use and contributed to the decline, and later demise, of the open range cattle industry in the Central Valley in the ensuing decades. When planted in the fall and harvested in the spring, winter wheat and barley were two of only a handful of crops that could be successfully raised in the Central Valley without irrigation. All that was needed was access to a navigable stream or a railroad line to ship the grain to market and intermittent rainfall from November through April. In the San Joaquin Valley fifteen inches of rain produced bumper crops, although ten inches, if properly distributed, was enough to yield an acceptable harvest. The Great Valley offered rich, flat land that required little preparation, and grain farmers needed little farming experience because wheat or barley was easy to plant and virtually took care of itself. In many cases, grain farming did not even require a house, barn, or quarters. A remarkably diverse group of migrant workers, including down on their luck miners, performed the greatest portion of the required agricultural work. They were needed for only a span of three or four weeks during winter plowing and sowing and again in the summer for threshing and harvest. Most of these workers packed the necessities of life in a bindle and drifted between farms and agricultural districts. The wheat barons themselves mostly resided in the state's urban centers – Sacramento, Stockton, Oakland, and San Francisco – and left the comfort of their homes and families only to supervise the annual harvest or planting.[4]

Land speculators like E. H. Miller, George D. Roberts, William S. Chapman, Isaac Friedlander, Miller & Lux, and a host of others used generous federal and state land laws to monopolize land ownership in the Central Valley. For about three decades wheat was king in the valley, but its reign ended abruptly in the 1890s. Historians have identified numerous factors that explain the sharp decline of the California wheat industry, among them increasing competition in the international wheat market, soil exhaustion, new superior varieties of wheat, the increasing

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[4] Richard Allen Eigenheer, "Early Perceptions of Agricultural Resources in the Central Valley of California" (PhD dissertation in Social Geography, University of California, Davis, 1976), 325-349; David Igler, *Industrial Cowboys: Miller & Lux and the Transformation of the Far West, 1850-1920* (Berkeley: University of California Press, 2001); Richard S. Street, *Beasts of the Field: A Narrative History of California Farmworkers, 1769-1913* (Stanford, California: Stanford University Press, 2004), 89-177.

value of farmland devoted to irrigation and horticulture, and growing opposition to "land monopoly."[5]

As wheat production declined, farmers turned increasingly to irrigated crops. Irrigation grew steadily in California from 60,000 acres in 1860 to nearly 400,000 acres in 1880, and by the early years of the twentieth century it had become the dominant feature of California's agriculture with more than 2,644,000 acres under irrigation.[6] The Central Valley developed a virtual monopoly on several irrigated crops: cotton in the arid southern portion of the San Joaquin Valley; rice in the clay soils of the trough lands of the Sacramento Valley; vineyards or orchards on the alluvial fans on the east side of the Great Valley where water was accessible; truck crops in the Delta peat soils; grapes in eastern Fresno County and nuts and olives in the Sacramento Valley; and orange groves occupied the sheltered coves on alluvial fans up and down the eastern edge of the Great Valley.[7]

The greatest problems with agriculture in the Central Valley were two-fold: the regional unevenness of water supply and the Mediterranean-type of climate characterized by prolonged dry summers that required irrigation of summer maturing crops. The San Joaquin Valley has a hot desert climate, accentuated near the southern end, where there is a mean annual precipitation of less than five inches. Northward, rainfall increases through a transitional zone to a Mediterranean climate in the Sacramento Valley with hot summers. Exposed to cooling summer west winds through Carquinez Straits, the Delta has a cooler Mediterranean climate. A decrease in rainfall from north to south is also a prevailing condition of climate in California and this differential is exaggerated in the Central Valley. A rain shadow is also associated with the Coast Ranges, resulting in the eastern margins of the valley receiving on average 50 percent more precipitation than the west side of the valley. The regional distribution of streamflow is even more unequal because of the high elevation and long slope of the Sierra Nevada on the east side of the valley compared to the short slope of the lower Coast Ranges on the west side. These factors make it imperative that any valley-wide plan for irrigation development needed to store surplus winter water and make it available in the summer months, and that surplus northern and eastern water needed to be made

[5] Eigenheer, "Early Perceptions of Agricultural Resources in the Central Valley of California," 325-349; Igler, *Industrial Cowboys*, 60-91; William L. Preston, *Vanishing Landscapes: Land and Life in the Tulare Lake Basin* (Berkeley: University of California Press, 1981), 85-120.

[6] Harding, *Water in California*, 80; Donald J. Pisani, *From the Family Farm to Agribusiness: The Irrigation Crusade in California and the West, 1850-1931* (Berkeley: University of California Press, 1984), 54-77.

[7] Joseph A. McGowan, *History of the Sacramento Valley*, 3 vols. (New York: Lewis Publishing Company,1961); J. J. Haley, "California's Change to Irrigation from Dry Farming," *Western Construction News*, 3 (February 1928): 83-84; William Reich, "King Cotton in California," *Land* 9 (Spring 1950): 65-71; William S. Richards, "Geographical Aspects of Rice Cultivation in California" (M.A. thesis, University of California, Berkeley, 1969).

available for use in the southern and western portions of the valley, if irrigation of irrigable land was to be maximized in the Central Valley.[8]

Irrigation developed initially in the Central Valley under private initiative and financing, using the natural flow of local streams. These early projects were concerned with relatively small tracts of land and not with the valley, or even an entire watershed, as a unit. In general, irrigation grew earlier and was more extensive in the southern portion of the San Joaquin Valley where growing crops without the benefits of irrigation was more tenuous. Settlers along the south bank of the Merced River began to irrigate alfalfa land, vineyards, and orchards in the vicinity of Snelling in the early 1850s. Ditches on Mill Creek and the Kaweah River irrigated grain fields and gardens as early as 1853. Settlers along the Tule River constructed several small ditches between 1859 and 1865. Once the Southern Pacific Railroad laid its tracks down the east side of the San Joaquin Valley in the early 1870s more extensive irrigation development ensued and company officials became avid promoters of irrigation as an essential component of economic development and land subdivision. The first large regional diversion project to be constructed was the San Joaquin and Kings River Canal (1871) that ran northwest from the bend of the San Joaquin River where it turns northward. The plan included subsequent construction phases that would extend the canal to Suisun Bay and utilize Tulare Lake as a reservoir connecting to the canal by way of Fresno Slough. Just a few years later Charles Crocker, one of the founders of the Central Pacific Railroad that built the western portion of the transcontinental railroad, invested his private capital in the Crocker-Huffman Land & Water Company's irrigation and land subdivision project utilizing water from the Merced River to irrigate more than 20,000 acres in the vicinity of the town of Merced. In 1880 when State Engineer William Hammond Hall conducted the first statewide irrigation survey in California, it showed that the San Joaquin Valley with 188,000 acres was the most heavily irrigated region of the state with forty-seven percent of the irrigated acreage statewide. In contrast, the wetter Sacramento Valley remained mostly dry farmed with only 13,400 acres irrigated.[9]

Irrigation in the San Joaquin Valley proceeded under many forms of organization using surface water supplies flowing in creeks and rivers, artesian waters, and groundwater. While irrigation was achieved on a small scale within land colonies organized by land speculators, large areas of land were also amassed within former Mexican-era land grants, as swamp and overflowed land, railroad grant land, by use of land script, and a host of other methods under the public land laws. In the 1870s and 1880s, private irrigation companies developed the San Joaquin and

[8] Peveril Meigs, "Water Planning in the Great Central Valley, California," *Geographical Review* 29, no. 2 (April 1939): 252-273.
[9] William Hammond Hall, *The Irrigation Question in California: Appendix to the Report of the State Engineer to His Excellency George C. Perkins, Governor of California* (Sacramento: California State Printing Office, 1881).

Kings River Canal along San Joaquin River, along with canals diverting water from the Kern, Kings, and Merced rivers. The companies that succeeded in delivering water to farmers frequently did so at the price of creating unpopular land and water monopolies. Some farmers, with the encouragement of private canal companies, experimented with creation of "mutual water companies," owned by the farmers themselves who raised money and acquired rights to use water through the purchase of company "stock."[10]

Private irrigation companies enjoyed only limited success during the latter decades of the nineteenth century and the largest projects undertaken inevitably failed. These institutional efforts at planning and financing irrigation projects fell into four general categories: private water companies; land colonies, mutual water companies, and irrigation districts.[11] The economic turmoil of the era and high rate of failure of these irrigation efforts helped popularize other institutional alternatives, including a proposal for a unique unified, coordinated, and centralized canal network designed to be built and operated by the state. Efforts by private investors to build mammoth irrigation schemes such as the San Joaquin and Kings River Canal aroused the interest of Congress and in 1873 an act was passed directing the War Department to appoint an investigating committee to examine irrigation. "The Alexander Commission," led by Lieutenant Barton Stone Alexander, an U.S. Army Engineer, was organized in 1873 to conduct the first federally funded irrigation survey and plan for coordinated irrigation development of the Central Valley. This federal irrigation commission carried out what State Engineer Edward Hyatt, "father of the State Water Project," later called "one of the earliest attempts at water resources planning on a regional scale." As detailed surveys were lacking, the report was a mere sketch of a development plan. However, the first state water agency, the State Engineers Office under William Hammond Hall, labored from 1878 to 1888 to implement many of the basic recommendations suggested by the Alexander Commission.[12]

The Alexander Commission's federal irrigation survey was grossly underfunded and was conducted over a scant six weeks in the field, but the report contained much valuable information and captured the imagination of future generations of water resources planners in California. The Commission predicted that 8.5 million acres could be irrigated in the Central

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[10] Harding, *Water in California*, 79-83; JRP Historical Consulting Services and California Department of Transportation, *Water Conveyance Systems in California: Historic Context Development and Evaluation Procedures* (Sacramento: California Department of Transportation Environmental Program, Cultural Studies Office, December 2000), 8-15.

[11] Of these institutional models, the quasi-public irrigation district proved the most successful in development of large-scale irrigated tracts in California, but only a few of the irrigation districts organized under the original Wright Act of 1887 survived into the twentieth century. Changes in irrigation district law in 1911, gave these districts greater financial stability and irrigation districts had much greater success in the twentieth century.

[12] Edward Hyatt, "National Broadcast on California Agricultural Programs, Under the Auspices of the State Grange, NBC Studios, San Francisco, November 10, 1939," Edward Hyatt Papers 2, Water Resources Collection and Archives, University of California, Riverside.

Valley and 12 million if the low foothills surrounding the valley were included. The Commission proposed a complex network of canals. On the west side of the Central Valley, a north-south canal was suggested leaving the Sacramento River near Red Bluff, following the foot of the Coast Range to Fairfield with several west-east laterals irrigating land as it passed through Yolo County. From Antioch, the canal was to run south along the west side of the San Joaquin Valley connecting to Tulare, Buena Vista, and Kern lakes, three natural bodies of water fed by creeks, sloughs and rivers in Tulare and Kern counties. Because of the many streams flowing out of the Sierra Nevada, the commission did not favor a continuous canal down the east side of the Central Valley as the cost of siphons or aqueducts to bridge these streams was prohibitive. The report also paid little attention to construction of storage reservoirs, but did advocate damming many westerly flowing Sierra streams to raise water over the river bank into east-west distribution ditches running across the valley floor.

Because of the state's limited population and tax base, the Alexander Commission predicted that progress toward full construction of the massive water project would undoubtedly proceed at a slow pace and that it might take as long as 50 years to achieve full implementation. In other respects, the report was also prescient. The commissioners predicted that water conflicts would occur and require settlement before construction of any comprehensive water system and that the state needed to institute legal mechanisms to regulate the acquisition and distribution of water; that farmers be limited to "reasonable use" to reduce water waste; that drainage canals accompany construction of irrigation canals; and that a topographic and hydrologic survey precede adoption of a system of reclamation for the Central Valley. Finally, the Commission was prophetic in recognizing the fundamental principal behind the future State Water Project proposed in the late 1920s and the CVP launched by the federal government in the 1930s -- the need to transfer water from the water rich Sacramento Valley to the water deficient San Joaquin Valley.[13]

At the state level, the California legislature passed an act in 1878 providing for investigation regarding irrigation and appointment of a State Engineer. William Hammond Hall, another former officer in the U.S. Army Engineering Corps with experience as a hydrographer, draftsman and field engineer, was appointed California's first State Engineer. Over the next decade, Hall proposed an increasingly activist stance by the state in navigation improvement projects, flood control, water storage, irrigation and drainage, compilation of statewide data

[13] B. S. Alexander, C. H. Mendell, and George Davidson, *Report of the Board of Commissioners on the Irrigation of the San Joaquin, Tulare, and Sacramento Valleys of the State of California*, House Executive Document No. 290, 43rd Cong. 1st Sess. (serial no. 1615) (Washington, D.C.: Government Printing Office, 1874), 16-38; Pisani, *From the Family Farm to Agribusiness*, 102-128; W. Turrentine Jackson, Rand F. Herbert, and Stephen R. Wee, "Introduction," *Engineers and irrigation: Report of the Board of Commissioners on the Irrigation of the San Joaquin, Tulare, and Sacramento Valleys of the State of California, 1873: Engineer Historical Studies No. 5* (Fort Belvoir, Virginia: Office of History, U.S. Army Corps of Engineers, 1990), 1-36.

on rainfall and streamflow, public ownership and control of navigable waterways, and proposed regional and statewide water planning for development of water resources. In 1880, Hall published a report on the subject of irrigation that described the principal irrigation districts of the state and made recommendations on legislation to promote irrigation development in California, including recommendations for an “irrigation district bill.” Hall also prepared the first detailed map of the Central Valley (like the later one shown in **Figure 1**) depicting every stream correctly located, the topography of adjacent foothills, and the slope and fall of the plains where irrigation would occur. He also prepared a more detailed map of the San Joaquin Valley in ten sheets displaying every ditch and irrigation canal in the San Joaquin Valley and the extent of actual irrigation.[14]

Hall was reappointed four times as State Engineer serving until his resignation in 1889 when he was appointed Supervising Engineer of the United States Irrigation Investigation (predecessor of Reclamation), within the U.S. Geological Survey. The U.S. Geological Survey carried on the vital work of stream gauging and topographic mapping in the Central Valley. Following Hall’s departure, Robert B. Marshall, an experienced California geographer, became the chief champion of a statewide water program during the late nineteenth and early twentieth centuries. Marshall outlined a plan for the coordinated development of the Central Valley with a series of dams, canals, and aqueducts to bring water to twelve million acres of land. Marshall was determined to submit a plan that demonstrated its feasibility from an engineering perspective and spent twenty-five years perfecting his comprehensive state water development plan, gathering survey data and mapping proposed canals and reservoir locations.

Marshall arrived in California in 1891 and surveyed continuously in the state for the U.S. Geological Survey until 1903 when he was given administrative charge of topographic work in California. His duties spread to other arid western states working on proposed reclamation projects in Arizona, Oregon, Nevada, Washington, Idaho, and Utah. By 1908, at age 40, he had reached the pinnacle of his profession being appointed Chief Geographer in charge of the Topographic Branch of the U.S. Geological Survey with administrative charge of the entire United States. For years he directed the expenditures of the United States government in its geological surveys of California methodically putting together a plan of construction for his proposed system of canals and reservoir sites. Working co-operatively with the State of California, the U.S. Geological Survey, under Marshall’s guidance, precisely mapped the Sacramento and San Joaquin valleys, co-operatively gauged streams, made profiles, and

[14] William Hammond Hall, “Statement of William H. Hall of the U.S. Geological Survey, Supervising Engineer for the Pacific Coast, U.S. Irrigation Survey,” Report of the Special Committee of the U.S. Senate on the Irrigation and Reclamation of Arid Lands: Report of Committee and Views of the Minority, 51st Cong., 1st Sess., Senate Report No. 928 (Washington, D.C.: Government Printing Office, 1890), 208-220.

surveyed reservoir sites along the larger principal streams of the state, gathering all the field data necessary to begin the construction work. In the fall of 1919, he announced the main outlines of his one great comprehensive plan for statewide water development, including reclamation of the Central Valley of California:

> From a high dam to be built across the Sacramento River near Red Bluff water will be carried in large canals down each side of the Sacramento Valley and thence up each side of the San Joaquin Valley. These main canals will operate by gravity, siphons, or pumps, or through tunnels. . . . On the main West Side Canal . . . a large supply will be diverted for the use of the "San Francisco and Bay Cities Unit.". . . The main East Side Canal will be twice dropped and twice again started at new and higher levels on the east side of the San Joaquin Valley. . . . Separate in construction and operation from the two Valley of California Systems as above referred to, but necessarily co-operative in a State-wide sense, is a third system . . . "the Los Angeles unit." This system must always be dependent upon the Kern River, which will be diverted through a long tunnel for use in southern California. To offset the diversion of the Kern River waters from the San Joaquin Valley the Klamath River will be diverted below Klamath Falls and carried into the upper Sacramento River near Shasta Springs. Above all these grand canals the tributary streams will be drawn upon through reservoirs, to be built along their courses, and further flexibility of the total flow will be provided by additional storage below the canals.[15]

California and planning for irrigation therein changed greatly during the first decades of the twentieth century. Growing migration into the state brought increased tax revenue and an expanded political bureaucracy. Having suffered the effects of a succession of drought years from 1917-1920, California state government exhibited an interest in comprehensive water planning. In 1921, the governor directed the State Engineer to come up with a statewide water management proposal addressing conservation, flood control, storage, distribution, and uses for California water and an estimated cost for implementation of the plan. The legislature appropriated funds to investigate a statewide water resources development and management plan. While the initial report was completed in 1923, it was the more than a dozen detailed engineering reports on various aspects of water management and control made by State Engineer Edward Hyatt between 1920 and 1932 that formed the basis of what became known as "The State Water Plan." During this period, shifts in water use included increasing numbers of water storage and power projects in the Sacramento Valley and the northern portion of the San Joaquin Valley, while further south complex water rights issues and lack of surplus water available for storage led irrigators to substitute groundwater storage for on-stream surface storage in reservoirs.[16]

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[15] Col. Robert Bradford Marshall, *Irrigation of Twelve Million Acres in the Valley of California* (Sacramento: California State Irrigation Association, 1919), 6-12.
[16] Paul Bailey, *Supplemental Report on Water Resources in California, Bulletin No. 9*, California Department of Public Works, Division of Engineering and Irrigation (Sacramento: California State Printing Office, 1925); Paul

The expansion of irrigated acreage in the early twentieth century was achieved by using surface water supplies and groundwater. By the mid-1920s water shortages had initiated several privately funded storage projects paid for by the irrigators themselves on irrigation projects in the San Joaquin Valley, such as in the Modesto, Turlock and Merced irrigation districts. As a by-product of storage, these districts were able to generate hydroelectric power to pay for construction costs and expansion of their distribution systems. Storage and power development in the 1920s, however, did not extend to the southern portion of the valley. From the San Joaquin River south, the water rights situation was more complicated as streams had been developed early by multiple diverters complicating adjustment of water rights and financing of storage facilities. Furthermore, there was less unused surplus surface water and more of the Sierra Nevada's runoff reached the irrigated lands on the valley floor as groundwater. Realization that productivity of agriculture could be greatly increased by utilization of groundwater, the US Geological Survey and Reclamation issued a preliminary report in 1908 on the quality, occurrence, accessibility, character, and proper use of groundwater in the San Joaquin River basin.[17]

In the early twentieth century, underground water sources were used for an increasing amount of irrigation in California. From 1909 to 1919, land irrigated by these sources increased from 32,539 acres to 299,841 acres in the state. Many of the farms in what later became the Friant Division of the CVP were irrigated using a combination of groundwater and the limited supplies from local rivers and creeks. From 1919 to 1929 groundwater use in the southeastern San Joaquin Valley nearly tripled, increasingly relying on the capacity of pumped wells. With the exception of the Kern River and its alluvial fan, from the Kaweah River south and in the area from Mendota to Kettleman City, available local surface water supplies were negligible. Water for irrigation was primarily achieved through drilling thousands of large and deep irrigation wells. By 1930 overdraft on groundwater supplies and major land subsidence had become widespread along the eastside of the valley. A bit later subsidence became an issue on the westside of the San Joaquin Valley as much of its agricultural land came to rely on groundwater or conjunctive use of surface water and groundwater to meet irrigation needs.[18]

Bailey, *Summary Report on the Water Resources in California and a Coordinated Plan for their Development, Bulletin No. 12*, California Department of Public Works, Division of Engineering and Irrigation (Sacramento: California State Printing Office, 1927).

[17] W. C. Mendenhall, *Preliminary Report on the Groundwater of the San Joaquin Valley, California: U.S. Geological Survey Water Supply Paper No. 222* (Washington, D.C.: Government Printing Office, 1908); W. C. Mendenhall, *Report on the Groundwater in the San Joaquin Valley, California: U.S. Geological Survey Water Supply Paper No. 398* (Washington, D.C.: Government Printing Office, 1916).

[18] Poland, J. F., and Evenson, R. E., "Hydrology and Land Subsidence, Great Central Valley, California," in Bailey, E. H., ed., *Geology of Northern California,* Vol. 2. (Sacramento: California Division of Mines and Geology, Bulletin 190, 1966), 239-247; Mitten, H. T., *Groundwater Pumpage in San Joaquin Valley, California* (U.S. Geological Survey, Open-file Report, 1967-68); N.P. Prokopovich and D.J. Hebert, "Land Subsidence Along the Delta-Mendota

The nearly complete use of natural streamflow and overdraft of groundwater in areas not replenished from streamflow, focused local interests on more comprehensive plans for importing additional water supplies. Water shortages in the San Joaquin and Sacramento valleys had caused the State of California to initiate planning for major reservoir projects on the Kings, Tuolumne, San Joaquin, Kern, Merced, and Sacramento rivers between 1917 and 1924.[19] Legislative investigations of the State Water Plan that had begun in 1921 aimed to obtain a comprehensive inventory of water resources and an estimation of probable future water requirements in the Central Valley. As noted, this plan was first completed in 1923, and after further financial studies, the plans were revised in 1925, 1927 and 1929. These investigations led the state to consider plans for a coordinated water management and development program that resulted in the adoption of the CVP in the 1930s.[20]

The story of the development, planning, political background, and construction of the CVP is well known and often told. The CVP is widely recognized as one of the greatest pieces of water planning, engineering, and conservation development ever undertaken and represents one of the most ambitious and successful water development projects ever built. It significantly altered California's natural hydrologic system in order to enhance water supplies for irrigated agriculture, municipalities, and hydroelectric power. Within the contexts of hydraulic engineering, the politics of public works, state-federal conflict over reclamation policy, and the

Canal, California," *Journal American Waterworks Association*, 60, n. 8 (Aug. 1968): 915-920. Water levels in wells within the future service area of the Friant Kern Canal declined from 1921 to 1951 but showed signs of substantial recovery over the next two decades as a reduction of pumping within the canal's service area through imported supplies delivered by the canal caused a reduction in groundwater pumping and increased recharge of the aquifer. A number of U.S.G.S. Professional Papers have been published on the land subsidence issue in the San Joaquin Valley. Two examples of investigations valley-wide in scope that address the early beneficial impacts of the Friant Kern Canal are: J. F. Poland, G. H. Davis, and B. E. Lofgren, "Progress Report on Land Subsidence Investigations in the San Joaquin Valley, California, through 1957," (U.S. Geological Survey, 1958) and J. F. Poland, B. E. Lofgren, R. L. Ireland, and R. G. Pugh, *Land Subsidence in the San Joaquin Valley, California, As of 1972. USGS Survey Professional Paper 137-11* (Washington, D.C., United States Printing Office, 1975). Other studies are narrower in scope focusing on specific regions within the valley such as B. E. Lofgren and R. L. Klausing, *Land Subsidence Due to Groundwater Withdrawal, Tulare-Wasco Area, California. USGS Survey Professional Paper 437-B* (Washington, D.C., United States Printing Office, 1969). This study notes that within the southeastern portion of the study area subsidence nearly stopped in the late 1950s, as water levels recovered some 130 feed in response to reduced pumping and groundwater recharge from imported water delivered by the Friant Kern Canal.

[19] William L. Kahrl, *The California Water Atlas* (Sacramento: California Office of Planning and Research, Department of Water Resources, 1979).

[20] California Department of Public Works, Division of Engineering and Irrigation, *Water Resources of California: A Report to the Legislature of 1923, Bulletin No. 4* (Sacramento: California State Printing Office, 1923); Bailey, *Supplemental Report on Water Resources of California: A Report to the Legislature of 1925, Bulletin No. 9*; Paul Bailey, State Engineer, *Summary Report on the Water Resources of California and a Coordinated Plan for their Development: A Report to the Legislature of 1927, Bulletin No. 12*, California Department of Public Works, Division of Engineering and Irrigation (Sacramento: California State Printing Office, 1927); Edward Hyatt, State Engineer, *Report to the Legislature of 1931 on State Water Plan, Bulletin No. 25,* California Department of Public Works (Sacramento: California State Printing Office, 1930).

economics of large-scale irrigation, the CVP is recognized as a great achievement on the national and even the international scale, although every component of the CVP is located within the boundaries of California.

The concept of a CVP was originally devised by the State of California to resolve chronic intra-state water shortage problems, but ultimately it was built by the federal government. The "State Water Plan" that resulted from the studies undertaken by State Engineers Edward Hyatt and Paul Bailey between 1927 and 1930 called for a vast system of canals, massive dams, and reservoirs throughout the state, and a massive north to south water transfer plan including most of what became the CVP. The essential units of the Central Valley portion of the plan included Shasta dam and reservoir (originally called Kennett Dam) on the Sacramento River, one of the highest overflow dams in the world with a storage capacity of 4.5 million acre feet; a 50-mile long industrial and irrigation conduit in the Delta diverting water to supply areas in Contra Costa County; a cross canal in the Sacramento-San Joaquin Delta; pumping plants and canals in the San Joaquin River and valley; Friant Reservoir on the San Joaquin River in the foothills north of Fresno and canals running north from the reservoir to supply lands in Madera County and south to irrigate lands between the reservoir and Kern River. To implement the plan the state needed to purchase the so-called "grass land" water rights of riparian owners on the lower San Joaquin River between Friant and the mouth of Merced River. With these water rights of early priority and large quantity satisfied, practically the whole flow of the San Joaquin River at Friant would become available for diversion to other water deficient areas of the valley. Thus, the implementation of the initial Central Valley unit of the State Water Plan entailed these fundamental requirements: regulation of stream flow by means of storage, exportation of water between watersheds, and exchanges of existing water supplies for imported water. Subsequent units of the ultimate State Water Plan would be adopted over time as demand for additional water warranted.[21]

In 1933, California voters approved the "Central Valley Project" portion of the State Water Plan, but the state needed the federal government to bring this project to life. With the depressed financial circumstances of the period, the state was unable to borrow money at a low enough interest rate to market the bonds necessary to fund the plan. California officials responded by lobbying the federal government to undertake the project as a federal reclamation project. Up until this point, federal reclamation had little impact on California

[21] Pisani, *From Family Farm to Agribusiness*, 381-439; Norris Hundley, Jr., *The Great Thirst: Californians and Water, 1770s-1990s* (Berkeley: University of California Press, 1992), 232-248; Hyatt, *Report to the Legislature of 1931 on State Water Plan, Bulletin No. 25*, 177-180; Edward Hyatt, State Engineer, *Sacramento River Basin, 1931, Bulletin No. 26*, California Department of Public Works, Division of Water Resources, Sacramento (Sacramento: California State Printing Office, 1931); Edward Hyatt, State Engineer, *San Joaquin Basin, 1931*, *Bulletin No. 29*, California Department of Public Works, Division of Water Resources (Sacramento: California State Printing Office, 1931).

agriculture or state water policies. Now after nearly three decades, Reclamation finally got the chance to build the largest integrated water and power project ever undertaken in California. This occurred just as the doctrine of multiple use emerged, wherein federal agencies were mandated to serve various interests simultaneously, which freed Reclamation to build and operate the project for a wide variety of water interests both urban and rural. By 1935, the state and federal governments reached an agreement and Reclamation was charged with construction of the CVP.[22]

3.1.2. Reclamation Initiates Construction of the Central Valley Project

President Franklin D. Roosevelt, amenable to almost any job creation proposal that would diminish the severity of the Great Depression, was responsive to California's appeal for assistance in funding the proposed CVP. In 1935 President Roosevelt approved the Secretary of the Interior's feasibility report and released federal emergency relief funds in order to initiate survey and investigations of proposed project works.[23] What had begun as a state project now became a federal undertaking under the auspices of the Secretary of the Interior and Reclamation. During 1936 Reclamation established its administrative headquarters at Sacramento and three field division offices at Redding (Kennett Division) covering works on the upper Sacramento River; at Antioch (Contra Costa / Delta Division) covering surveys for the Contra Costa Canal; and Friant (Friant Division), located 20 miles northeast of Fresno, covering the Friant dam/reservoir site and surveys for the Madera and Friant-Kern canals. A year later, Congress gave Reclamation final authority to take over control of the construction of the massive public works project. Construction of the federal project proceeded on a piecemeal basis.[24]

Reclamation designed the CVP with five fundamental units, operating as an integrated system: Shasta Dam, Delta-Mendota Canal, Friant Dam, the Madera and Friant-Kern Canals, and the Contra Costa Canal. The smallest of the canals, the Contra Costa Canal in eastern Contra Costa County, provided irrigation and industrial water for the area south of Suisun Bay between

[22] Erwin Cooper, *Aqueduct Empire: A Guide to Water in California, Its Turbulent History, and Its Management Today* (Glendale, California: A. H. Clark Co., 1968); Hundley, *The Great Thirst, 243-252*.

[23] The proposed construction project by the federal government stirred up controversies over the Reclamation's 160-acre limitation imposed under the 1902 Federal Reclamation Act, ownership of water rights, public vs. private hydroelectric power generation, as well as state vs. federal ownership and operation of the project. Given the early history of the Central Valley as an area dominated by large cattle ranches and bonanza wheat farms, the 160-acre limitation was deemed as particularly egregious where, as one landowner's attorney noted, "10 per cent of the ranches contain 80 per cent of the land," "Big Water 'Transfusion' Operation Taking Shape: World's Longest Canal to Carry Much Needed Moisture Through Central Valley," *Los Angeles Times," March 16, 1947;* and Bassett*,* "Water Limit Fight Stirs San Joaquin: Controversy Over How Much Land One Owner May Irrigate Features Valley Project Work," *Los Angeles Times*, March 17, 1947.

[24] Pisani, *From Family Farm to Agribusiness*, 416-438; Hundley, *The Great Thirst*, 252-262; "Active Construction Nears on Central Valley Project," *Western Construction News*, January 1937, 22.

Antioch and Martinez. In 1937, the canal was the first facility to be undertaken and the 48-mile canal was completed by Reclamation in 1939. The core of the system, however, involved the coordinated operation of the other four units for the purposes of delivering Sacramento River water to the arid San Joaquin Valley and to impound the flow of the upper San Joaquin River for distribution on the east side of the San Joaquin Valley.[25]

Reclamation designed the project's main four units to operate in two groups of works. Shasta Dam and Delta-Mendota Canal operated together to store and deliver Sacramento River water on the westside of the San Joaquin Valley as far south as Fresno County, to irrigate new areas and to supply water for San Joaquin River diverters with riparian and senior appropriative water rights. Friant Dam, located on the San Joaquin River 25 miles northeast of Fresno, conserved and stored flood flows in Millerton Lake for release and diversion into the Madera and Friant-Kern canals. These three water-storage and conveyance features operated together to store and divert San Joaquin River water as far as the southern extremes of the San Joaquin Valley near Bakersfield (through the Friant-Kern Canal) and north to Ash Slough near Chowchilla (through the Madera Canal). As noted, these units worked in conjunction with one another, the Shasta Dam/Delta-Mendota Canal system providing "replacement water" to west side "Exchange Contractors" (senior holders of water rights from the San Joaquin and Kings River Canal and Irrigation Company and Miller & Lux's corporate descendants) for that which was transported southward and northward on the east side of the San Joaquin Valley by the Friant Dam/Friant-Kern Canal/Madera Canal system. Reclamation completed these five major units of the CVP by the early 1950s.[26]

Groundwater issues quickly became part of the Delta Division's management. As noted, much of the agricultural land in western San Joaquin Valley had relied upon groundwater or conjunctive use of surface water and groundwater to meet their irrigation needs before the CVP was built. According to one U.S. Geological Survey study in the mid-1950s, about 4,500,000 acres of land in the San Joaquin Valley was irrigated, with 50% of that land supplied solely with groundwater from wells and land subsidence had been noted.[27] Thus, almost immediately after water was turned in the newly completed Delta-Mendota Canal, land

[25] U.S. Department of the Interior (USDI), Reclamation, Central Valley Projects: Issues and Legislation, October 15-2018 – June 21, 2019, https://www.everycrsreport.com/reports/R45342.html#_Toc12259578.

[26] L. B. Christiansen and R. W. Gaines, *Central Valley Project: Its Historical Background and Economic Impacts* (Sacramento, California: USDI, Reclamation, Mid-Pacific Region, 1981).

[27] G.H. Davis, J. H. Green, F.H. Olmstead, and D. W. Brown, *Groundwater Conditions and Storage Capacity in the San Joaquin Valley California.* Geological Survey Water Supply Paper 1469 (Washington, Government Water Supply Paper No. 1469, 1959), III, 4, 8-10, 114-124, 129-131.

subsidence began to impact the structure, especially the downstream 40 miles, causing the need for repairs and extensive modifications to raise the height of canal structures.[28]

3.1.3. Delta-Mendota Canal

Reclamation designed Delta-Mendota Canal to carry out one of the key features of the CVP, exchanging water from the Sacramento River basin to the San Joaquin River basin. Delta-Mendota Canal was built to convey water from the Sacramento-San Joaquin Delta in a southerly direction along the west side of the San Joaquin Valley, replacing flows in the San Joaquin River to permit diversion of San Joaquin River water at Friant Dam for delivery in Madera Canal and Friant-Kern Canal (**Figure 2**). It was designed to serve a total of approximately one million acres of irrigable land on the west side of the San Joaquin Valley in San Joaquin, San Benito, Stanislaus, Merced, and Fresno counties. Reclamation designed DMC to deliver water to Mendota Pool and the planned San Luis Reservoir, as well as to water users along its route. At the upstream end, the canal was designed with a maximum capacity of 4,600 cubic feet per second, diminishing as it traverses the valley to its southern terminus. Original plans called for a series of lifts to advance the water south up the valley; however, Reclamation modified the design to a single pumping plant that lifted the water approximately 200 feet before discharging it into DMC. The north portion of the canal is lined with concrete and the sound is compacted earth. DMC was built with repetitive structure types like concrete checks, concrete siphons, culverts and overchutes, drainage inlets, irrigation turnouts, canal crossings, wasteway turnouts, highway and farm bridges, and much smaller number of discrete, specialized structures. For most of the major structures like wasteways and siphons, Reclamation engineers prepared site-specific designs and drawings. For structures installed repetitively along the canal like culverts, inlet drains, and farm bridges, Reclamation prepared standardized drawings for multiple applications. Through the DMC, availability of a more reliable water supply to parts of the San Joaquin Valley contributed significantly to the success of agriculture and industry in the region.[29]

[28] N.P. Prokopovich and D.J. Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," *Journal American Waterworks Association*, 60, n. 8 (Aug. 1968): 915-920.

[29] USDI, Bureau of Reclamation, *Delta-Mendota Canal,* Technical Record of Design and Construction (Denver: 1959), 1 and 13.

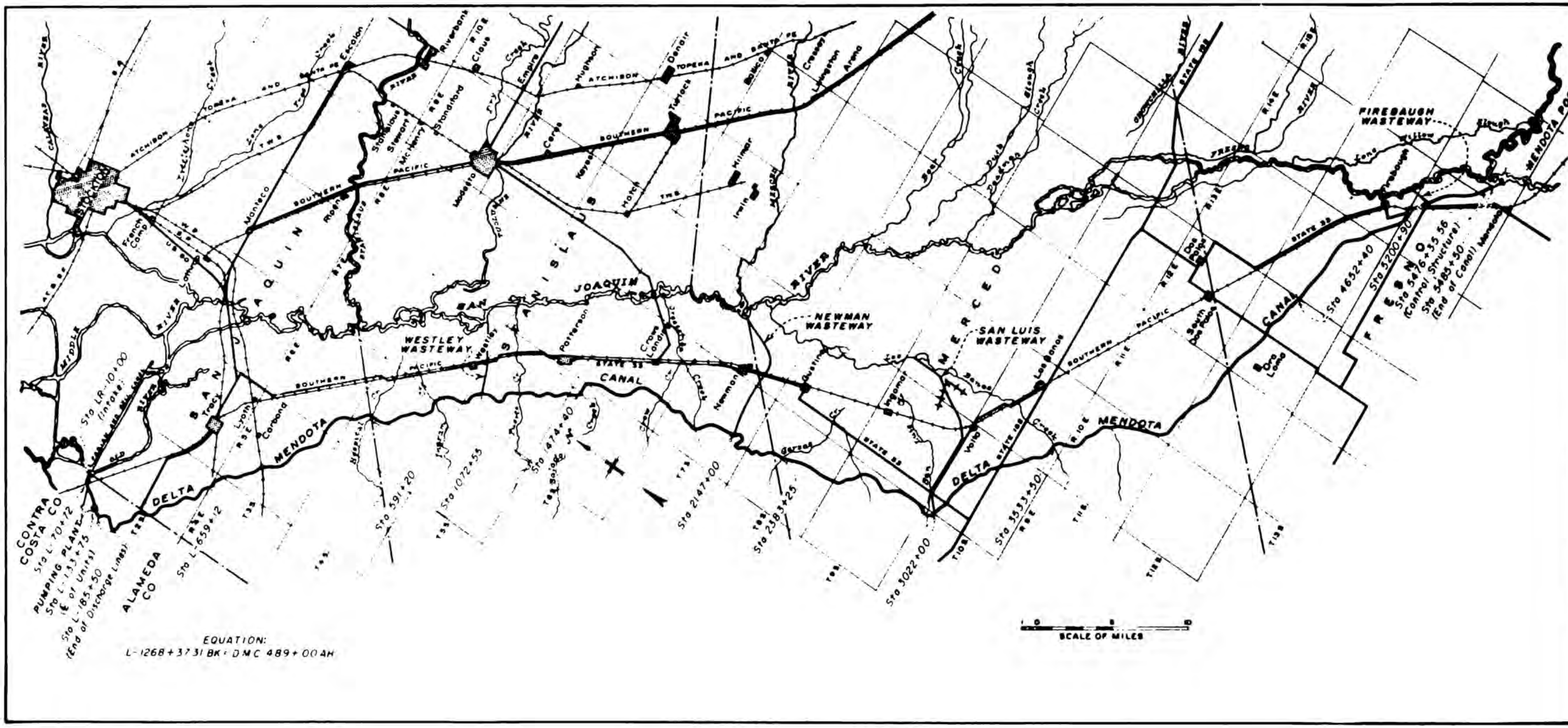

Figure 2: Location of Delta-Mendota Canal. Drawing 214-D-11164.

When completed, Delta-Mendota Canal was instrumental in accomplishing the goals of the CVP and it was second largest capacity canal in the state after the All-American Canal, which was an 80-mile-long aqueduct built in the 1930s conveying Colorado River water to Imperial Valley and several Southern California cities. Engineering and constructing Delta-Mendota Canal was a monumental task because of the natural and built features it had to traverse over a long distance: the alignment crossed multiple waterways, major roadways, and transmission lines; existing irrigation structures had to be tied in or crossed; and road and farm bridges, and major canal water control features like check structures and wasteways had to be built. In addition to the engineering challenges, Reclamation also had to negotiate the sale of project water delivered by Delta-Mendota Canal with various water users and address a complex right-of-way acquisition. Water first entered the canal for delivery to downstream users in 1951 but was not officially complete until April 9, 1952.[30]

One of the most renowned engineers employed by the Bureau of Reclamation, Oscar Boden spent sixteen years out of his forty-year-long tenure with the Bureau working in the Central Valley. Boden undertook the role of construction engineer for the Delta Division of the Central Valley Project (CVP) from 1935 until his death in June 1951. Born in 1885 in Kellogg, Iowa, Boden studied civil engineering at Iowa State University, graduating in 1910. Boden started at the Bureau of Reclamation in 1911 performing operation and maintenance work for the first five years of his career. From there, he moved on to survey work, lateral design, and lay-out of several irrigation projects in Wyoming and Nebraska. He also worked on projects in Idaho, Oregon, and Washington where he served as head of construction of various irrigation distribution systems. Dubbed “Mr. Canal” for his work supervising the construction of 76 miles of main canal and 200 miles of laterals for the Kittitas Project near Yakima, Washington in 1926, Boden’s prowess as a team leader eventually led him to the Central Valley. At the request of the supervising engineer for the CVP, Boden relocated to California in 1935, serving as the project’s first government construction engineer. Boden engineered surveys for the Friant-Kern and Contra Costa canals and led the construction of the Contra Costa Conduit. Boden’s acclaim increased during his role as engineering administrator who oversaw the construction of Delta-Mendota Canal structures and the Tracy pumping plant. Additionally, Boden took charge of the investigations, planning, and lay-out necessary for Delta-Mendota Canal’s features. Posthumously, Boden received nomination into the Reclamation’s Hall of Fame. In total, Boden is credited with the construction of 1500 miles of canal.[31]

[30] “First Contract on Friant-Kern Canal,” *Western Construction News* (Sept 1945): 112-113; US Department of the Interior, Bureau of Reclamation, *Delta-Mendota Canal,* Technical Record of Design and Construction (Denver: 1959), 5.

31 D. L. Goodman, “Oscar G. Boden – Builder of Lifelines,” *Reclamation Er*a vol. 38 (February 1952), 30-31, 38; “‘Mr. Canal’ Builds Miles of Them in His Life Project,” *Stockton Record* (California), May 15, 1951; “Pittsburg Ends

Delta-Mendota Canal's concrete lining extends down to Milepost 98.64. This portion of the canal has a 48-foot bottom width. The approximately 18 miles of canal between that point and the outfall at Mendota Pool are compacted earth-lined with bottom widths of 60, 62, and 84 feet at different reaches. After Tracy Pumping Plant lifts the water 200 feet, the water is moved down the canal at a gentle grade of 3 inches per mile, controlled by concrete check structures (**Figure 3**).[32] Specifications called for the concrete to be 4 inches thick and placed on the canal's 1 ½:1 side slopes. Check structures, placed an approximately 5-mile intervals along the canal, are composed of two standardized types. Three of the check structures are rectangular and the rest are trapezoidal in cross section.[33]

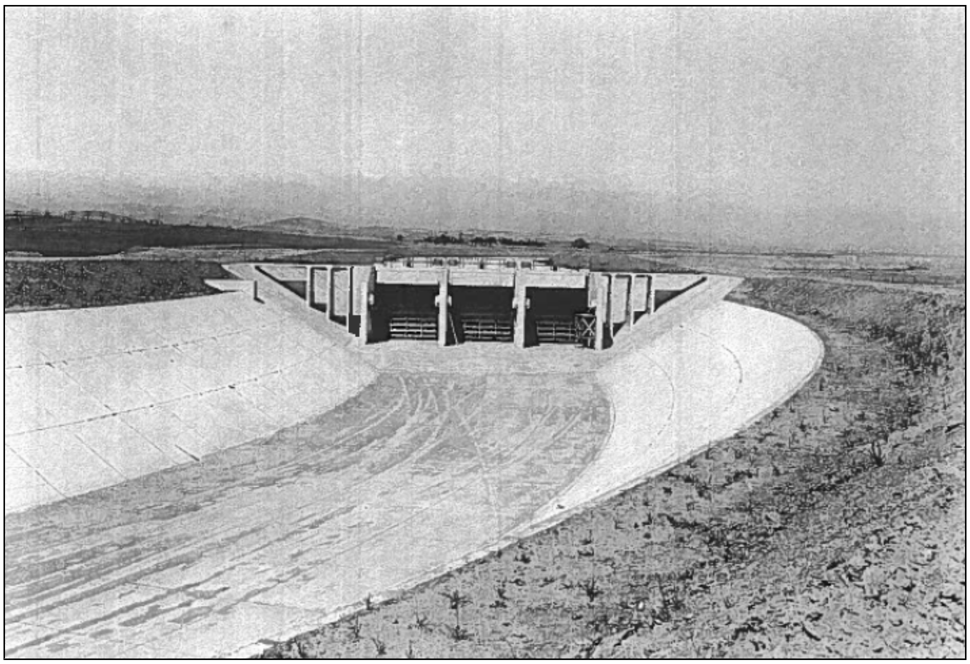

Figure 3: Complete check No. 1 (M.P. 11.35), camera facing upstream, April 18, 1949.[34]

Along its course, Delta-Mendota Canal is siphoned across streams, railroads, and irrigation canals. Siphons convey the water across seven streams, three railroad crossings, two highway crossings, one combined highway and railroad crossing, and one irrigation canal. The single siphon under an existing irrigation canal (Miller & Lux Outside Canal) was unique because all other existing irrigation ditches were siphoned under Delta-Mendota Canal. The Mountain

3 Dates of Fete," *Stockton Record* (California), October 15, 1940; "Boden Ranked High Among Canal Builders," *Tracy Press* (California), April 9, 1951.

[32] Martin H. Blote, "Water Runs Uphill," *Reclamation Era* (October 1947): 213.

[33] US Department of the Interior, Bureau of Reclamation, *Delta-Mendota Canal,* Technical Record of Design and Construction (Denver: 1959), 1.

[34] Morrison-Knudsen Company, Inc. and the M. H. Hasler Construction Company, *Final Report Contract No. I2r-16675 – Specifications No. 1435, Delta-Mendota Canal – Central Valley Project*, 1949, 22.

House Road Siphon carried Delta-Mendota Canal 1,200 feet through a monolithic concrete structure with an inside diameter of 24 feet 3 inches (**Figure 4**). Morrison-Knudsen and Hasler constructed the siphon under specifications No. 1435.

Figure 4: Construction of Mountain House Road Siphon showing concrete placement in progress, October 24, 1948. [130]

Wasteways to carry flood water out of Delta-Mendota Canal and to the San Joaquin River channel are among the largest appurtenant structures to the canal and were designed and constructed as part of the canal. Reclamation designed the canal's four wasteways to handle the full capacity of Delta-Mendota Canal at the turnouts into the wasteways in the event of flooding or canal failure. Studies of the topography and disposal of canal water informed the site selection of the wasteways. The wasteway turnouts were designed with radial gates to allow the flow of water into the channels. Westley Wasteway is a 3.9-mile long, mostly concrete-lined trapezoidal channel. Newman Wasteway is approximately 8.2 miles long, about 1.5 miles of which are concrete lined. Volta Wasteway (originally known as San Luis Wasteway) is 11.9 miles long and Firebaugh Wasteway is the shortest at 1.1 miles long.[35]

[35] USDI, Reclamation, *Friant-Kern Canal: Technical Record of Design and Construction*, 12; "Friant-Kern Canal – Myriad of Huge Structures Involved," *Western Construction News* (May 1948): 93.

3.1.4. Construction

Delta-Mendota Canal and all of its appurtenant structures were constructed by five contractors under 10 major construction specifications, starting in 1946 and completed in 1951. Hubert Everist, Sr. won the first contract and began work in June 1946. Each of the major contractors engaged many subcontractors to supplement their own work forces.

On April 30, 1946, bids opened for Specifications No. 1183, which comprised of two schedules including earthwork, concrete lining and structures (schedule one) and the construction of the Westley wasteway (schedule two). Everist placed the lowest bid, winning the contract for both schedules on June 14, 1946. His firm also served as the contractor for Specification 2460, the earthwork, concrete lining and structures from M.P. 25.88 to M.P. 40.72, and the timber operating bridge at M.P. 23.28. Educated as an engineer at Purdue Univeristy, Everist came from a family of leaders in the construction industry. Born in Beardstown, Illinois but raised in Sioux City, Iowa, Everist played an instrumental role in the growth of his family's company, L.G. Everist, Inc., as well as the establishment of two other businesses: Western Contracting Corp. based in Sioux City and Intercontinental Engineering and Manufacturing Corp. of Parkville, MO. Branches of all three businesses existed in the West. At the time of the bidding for Delta-Mendota Canal, Everist lived in San Francisco.[36]

On December 30, 1946, Morrison-Knudsen Company, Inc., partnering with the Los Angeles-based M.H. Hasler Construction Company, won the first of its four contracts for "earthwork, canal lining, and structures" along Delta-Mendota Canal. This first contract included a segment measuring approximately 11.15 miles, completed on April 18, 1949. Between October 1949 and April 1951, Morrison-Knudsen Co. and M.H. Hasler engaged in three other contracts pertaining to Delta-Mendota Canal. All the work involved earthwork, concrete lining and structures (**Figure 5**). The Morrison-Knudsen Company, headquartered in Boise, Idaho, specialized in construction of large civil and military projects. Founded in 1912 by Harry W. Morrison and Morris H. Knudsen, the firm had become the preeminent dam-building company after its successful contribution to the construction of Hoover Dam, contracted in 1931. In the ensuing decades, Morrison-Knudsen emerged as one of America's largest civil engineering contractors. The company's portfolio of work went on to include some of the world's biggest dams and bridges. During World War II, the company was in prime position to take on large contracts for construction of military bases and airfields. After the war, the company embraced opportunities created by the expansion of the American military presence overseas, as well as the push to rebuild and expand American infrastructure at home. By the end of the

[36] US Department of the Interior, Bureau of Reclamation, *Delta-Mendota Canal,* Technical Record of Design and Construction (Denver: 1959), 103; "Hubert H. Everist Sr Obituary," *Sioux City Journal,* July 20, 1990; L.G. Everist, Inc., "Company Overview," https://www.lgeverist.com/companies.php.

1950s, the company had diversified and expanded to various worldwide locations. Morrison-Knudsen's work along Delta-Mendota Canal is illustrative of the company's participation in domestic infrastructure expansion in the post-war period.[37]

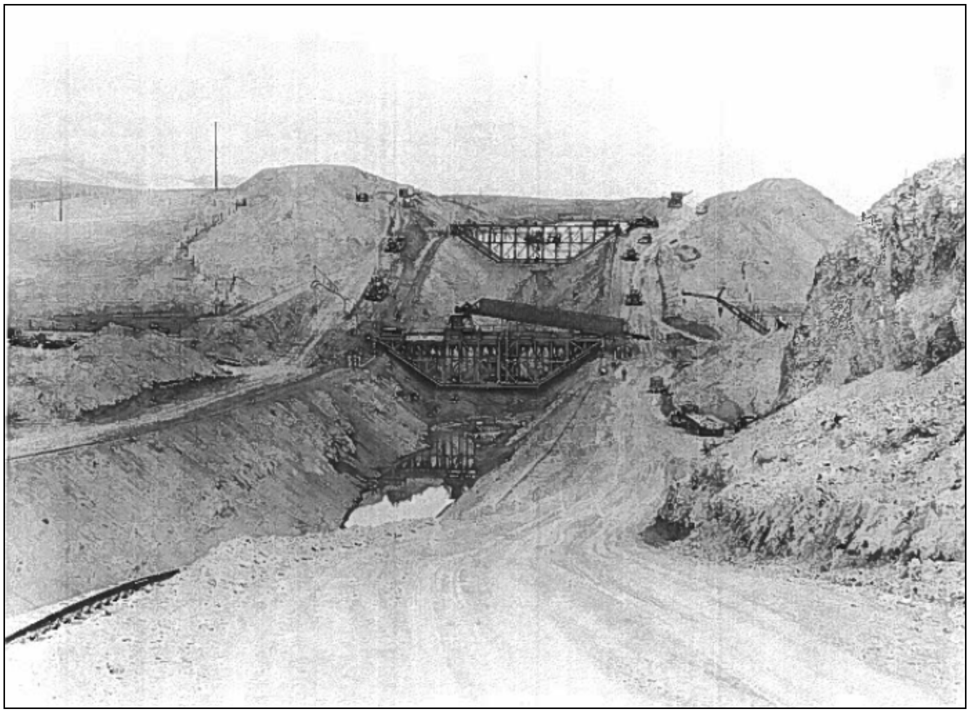

Figure 5: Morrison-Knudsen Company, Inc. and the M. H. Hasler Construction Company operating canal trimmer and slip form at Mountain House Road Siphon excavation, June 10, 1948.[38]

In addition to constructing four segments of Delta-Mendota Canal under Specifications 1435, 2197, 2732, and 2799, the Morrison-Knudsen Company, Inc. and the M.H. Hasler Construction Company also collaborated on multiple segments of the Central Valley Project's Friant-Kern Canal. In the late 1930s, M.H. Hasler also assisted Morrison-Knudsen in the construction of the All-American Canal and its branch Coachella Canal. Morrison-Knudsen and Hasler built over 75 miles of the 122-mile-long Coachella Canal between 1939 and 1941, including construction of 14 siphons, 31 double siphon boxes, one round barrel siphon, five checks, four automatic

[37] Donald E. Wolf, *Big Dams and Other Dreams: The Six Companies Story* (Norman: University of Oklahoma Press, 1996), 204, 254-265; "Earth Mover," *Time* (May 3, 1954): 86, 90-93; "Morrison Knudsen Corporation," Jay P. Pedersen, ed., *International Directory of Company Histories*, vol. 28 (Detroit, Michigan: St. James Press, 1999); "Morrison-Knudsen Company, Inc.," Harvard Business School Baker Library Historical Collections, Lehman Brothers Collection, Twentieth-Century Business Archives; "Top Twelve Hit Over $100 Million," *Engineering News-Record*, July 2, 1964, 53; "Construction's Man of the Year," *Engineering News-Record*, February 17, 1966, 99-106; David P. Billington and Donald C. Jackson, *Big Dams of the New Deal Era: A Confluence of Engineering and Politics* (Norman: University of Oklahoma Press. 2006).

[38] Morrison-Knudsen Company, Inc. and the M. H. Hasler Construction Company, *Final Report Contract No. I2r-16675 – Specifications No. 1435, Delta-Mendota Canal – Central Valley Project*, 1949, 12.

spillways, and five drainage inlets. During World War II, Hasler worked with the U.S. Army Corps of Engineers in building air bases at Blythe, Reno, and Kingman. The company's collaborative work on four segments of Delta-Mendota Canal between 1946 and 1951 appears to be illustrative of the general work performed by the M. H. Hasler Construction Company during this period.[39]

Another of Hubert Everist Sr.'s companies, Western Contracting Corporation, won the contract for earthwork, concrete lining, and structures for a 15.61-mile-long segment of Delta-Mendota Canal on June 22, 1949. The company completed the work on June 1, 1951. Additionally, on June 29, 1950, Western Contracting Corporation bid on and received Contract No. I2r-19060, for construction of the San Luis Wasteway and holding reservoir dike, split into two schedules (**Figure 6**). Western Contracting Corporation completed the work on April 9, 1952, and June 14, 1951, respectively. Everist established Western Contracting in 1917, headquartered in Sioux City, Iowa. For the work on Delta Mendota, the corporation operated out of an office in Westley, California. Today, the company predominantly constructs Army Corps of Engineer flood control, and wetland and river mitigation projects in the Midwest.[40]

In 1946, Reclamation Commissioner Straus authorized a contract of $5,888,000 for the two and a half mile long Delta-Mendota Intake Canal, which included the Tracy Pumping Plant (later renamed C.W. Bill Jones Pumping Plant) (**Figure 7** - **Figure 8**). Located nine miles northwest of Tracy, California, the pumping plant was to "lift water from the Delta-Mendota Intake Canal to a height of 200 feet and send it flowing for a distance of 120 miles" through the DMC to the west side of the San Joaquin Valley utilizing six 22,500 horsepower motors (**Figure 9**). With these motors, the plant had the capacity to lift 4,600 cubic feet of water per second. Construction of the pumping plant began September 2, 1947, through a joint venture between Stolte Inc., United Concrete Pipe Corporation, Duncanson-Harrelson Company, and Ralph A. Bell. The companies, all of which consolidated and operated under S.U.H.B. Company, completed the work on December 30, 1949. Construction engineers included Bureau of Reclamation's Oscar Boden and C.H. Spencer, both of whom spent a considerable portion of their careers working on the Central Valley Project. However, the location of the Tracy Pumping Plant created a unique problem for Reclamation; it aligned with the route that young salmon and bass are swept along by the early spring runoff in their migration towards the ocean. To prevent a detrimental loss in fish population, the Bureau of Reclamation and the

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[39] Eric A. Stone (edited by Brit Storey), *All-American Canal: Boulder Canyon Project,* (Denver: United States Bureau of Reclamation, December 2009), 6-28; USDI, Reclamation, *Technical Record of Design and Construction, Delta-Mendota Canal: Constructed 1946-1952, Central Valley Project – California* (Denver, June 1959), 103; "M. H. Haslers of Laguna Buy Walter Botthof Home," *Desert Sun (Palm Springs)*, May 19, 1950, 5.

[40] US Department of the Interior, *Delta-Mendota Canal:* Technical Report, 104; Associated General Contractors of Iowa, "Western Contracting Corporation," http://www.agcia.org/memberDetails.asp?memberID=19795.

U.S. Fish and Wildlife Service experimented to find the most promising solution. This experimentation resulted in a diversion using a series of vertical louver structures, which transferred the young fish to holding tanks and then onto tank trucks to be hauled "about 50 miles to waters destined for the ocean" (**Figure 10**). By 1959, the Tracy Pumping Plant operators collected and transported upwards of 250,000 fish a day, and a record 12 million for the entire year.[41]

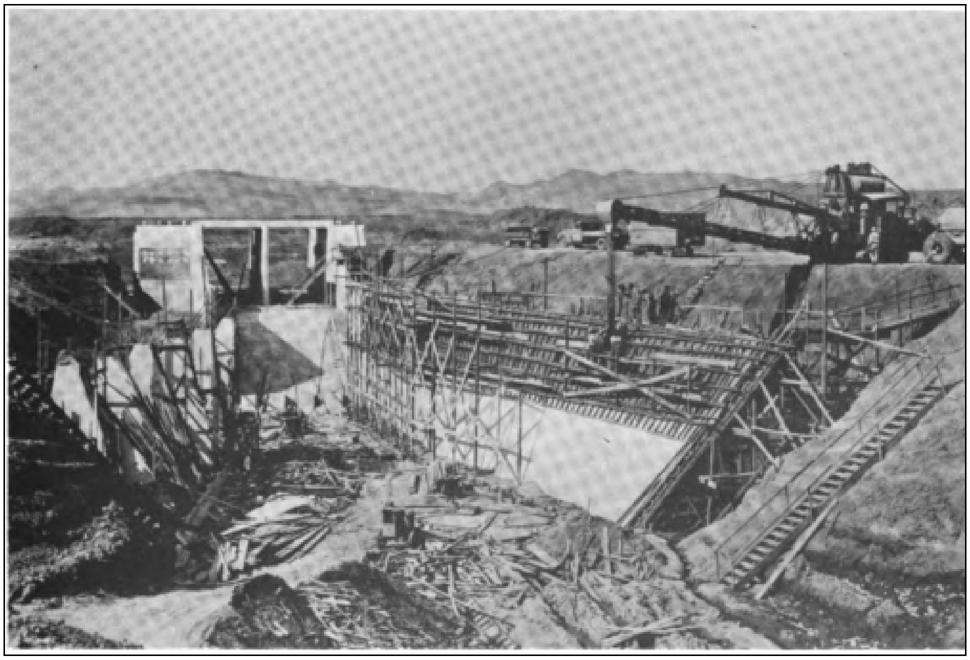

Figure 6: Placing concrete in transition walls of San Luis wasteway turnout, July 26, 1950.[42]

[41] USDI, Bureau of Reclamation, "Final Construction Report on Delta-Mendota Canal Intake and Tracy Pumping Plant and Discharge Lines," *Specifications No. 1810* – Central Valley Project (Denver: March 1952); USDI, Reclamation, "Commissioner Authorized to Award Top Value Contracts," *Reclamation Era* vol. 33, January 1947; USDI, Reclamation, "Fish and the Tracy Pumping Plant," *Reclamation Era* vol. 36, January 1950; USDI, Reclamation, "Well Worth Celebrating," *Reclamation Era* vol. 37, January 1951; USDI, Reclamation, "Reclamation Pioneers in Fish Conservation Techniques," *Reclamation Era* vol. 42, January 1956; USDI, Reclamation, "C.H. Spencer Succeeded by B.P. Bellport," *Reclamation Era* vol. 43, January 1957; USDI, Reclamation, "A Story about the USBR and Millions of Fish," *Reclamation Era* vol. 46, January 1960; "Construction Begins on Huge Central Valley Pump Plant," *Western Construction* vol. 22, no. 11, November 1947.

[42] [Photograph], DM-889-CV in USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal,* 123; At left are counterforts which were placed independently of the warped walls.

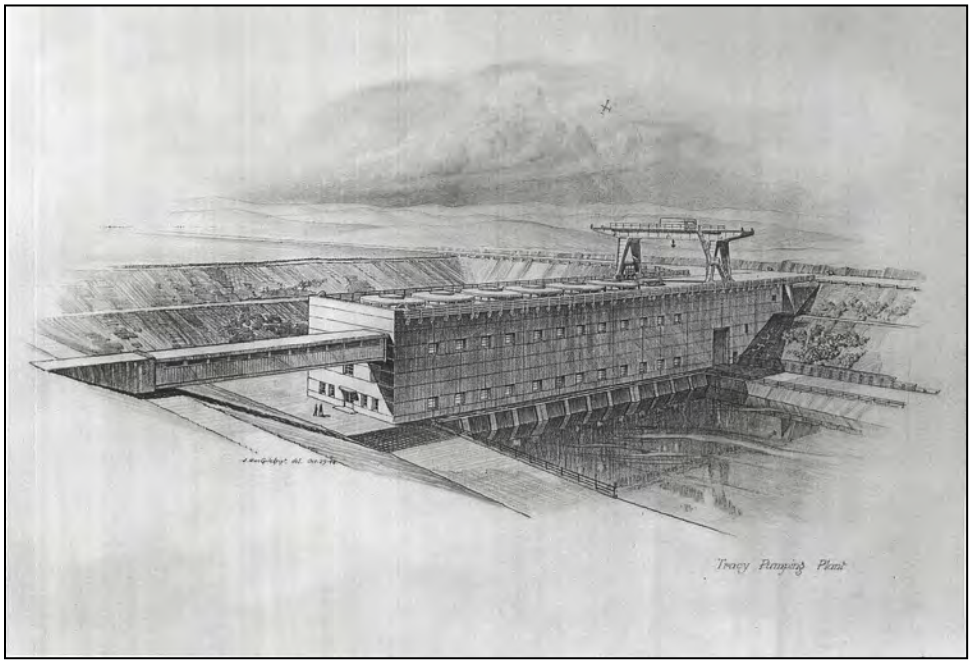

Figure 7: Artist rendering of Tracy Pumping Plant, 1948.

Figure 8: Tracy Pumping Plant, January 1951.[43]

[43] [Photograph] USDI, Reclamation, "Well Worth Celebrating," *Reclamation Era* vol. 37, January 1951.

Figure 9: One of six 84-in. vertical shaft bottom suction twin volute centrifugal pumps.[44]

On January 18, 1950, United Concrete Pipe Corporation and Vinnell Co. entered a joint contract to construct the earthwork and structures along Delta-Mendota Canal from M.P. 85.89 to M.P. 109.89, which spanned approximately 17.95 miles, and the Firebaugh wasteway, located at M.P. 98.50 (**Figure 11**). The government accepted the completed work on November 30, 1951. The two companies also worked together on the earthwork, concrete lining and structures, and service lateral, and part of the Newman Wasteway. They won this second contract on May 16, 1950 and finished the work on April 4, 1852. United Concrete Pipe Corporation can trace its origins to 1919 in Ventura, California. Serbia native Tom Polich started the company, first naming it Polich Construction Company until 1924, when he partnered with Steve Krai and B.J. Ukropina. Polich came to the United States in 1905 at the age of 17, and first entered the concrete business under the employ of Bent Brothers. Polich's first self-employed contract involved the installation of an irrigation system for the California Packing Corporation at their orchard at Tuttle. United Concrete Pipe Corporation went on to complete projects in Merced County such as the John Muir school building, concrete bridges and highways, sanitary sewers, and irrigation for the Merced Irrigation District. For this project, the Vinnell Company operated from a plant in Baldwin Park. Originally founded in 1931 by Allan S. Vinnell in Alhambra, the company began as a hauling and excavating contractor. The Vinnell Co. also constructed roads, buildings, portions of the Pan-American

[44] [Photograph] "A Pictorial Review of Tracy Pumping Plant Construction," *Western Construction News* vol. 26, no. 5, May 1951.

Highway and the Grand Coulee Dam. By the 1960s, the United States government employed Vinnell as contractors in Vietnam.[45]

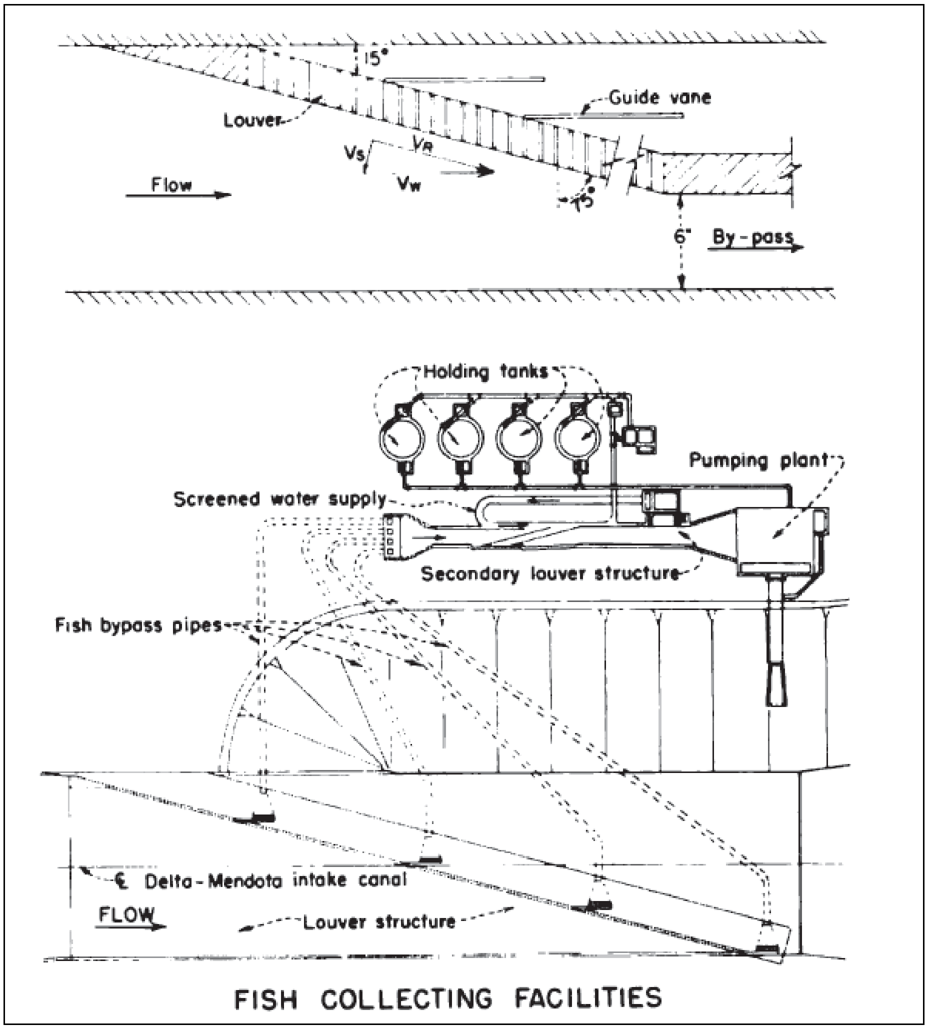

Figure 10: Fish Collecting Facilities at Tracy Pumping Plant, January 1956.[46]

[45]*Delta-Mendota Canal:* Technical Report, 105; John Outcalt, "Merced-Ventura-Los Angeles County CA Archives Biographies: Polich, Tom (Merced: 1925); "Dirt Lined Section of Delta-Mendota Canal Progresses," *Fresno Bee,* November 27, 1950.

[46] [Photograph] USDI, Reclamation, "Reclamation Pioneers in Fish Conservation Techniques," *Reclamation Era* vol. 42, January 1956; drawing at the top shows plan arrangement of louvers or slats; drawing at the bottom shows layout of permanent structure.

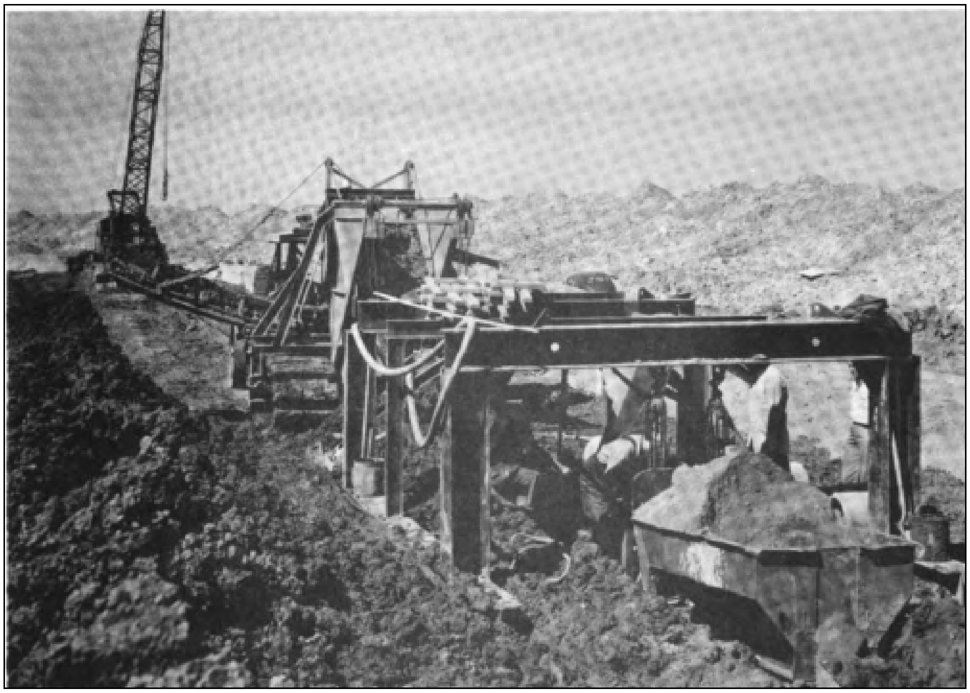

Figure 11: Converted ditcher and pipe laying machine used by United-Vinnell Co., March 1951.[47]

Construction of another small part of Newman wasteway and its service lateral went to A. Teichert and Sons, Inc., of Sacramento, California. The government awarded the contract on May 16, 1950, and Teichert completed the work on June 29, 1951. Both Teichert and United Concrete Pipe Corporation and Vinnell Company's portions of the Newman Wasteway fell under Specification 2951, albeit separate schedules. Teichert lined the wasteway by hand methods given the small size of the job (**Figure 12**). The company's founder, Adolph Teichert, immigrated to the United States in 1866 from Germany, finding success as a craftsman in San Francisco. He started his own business, Artificial Stone: Adolph Teichert, in 1887 in Sacramento. In 1912, Adolph Teichert Jr. joined his father as a partner in the concrete paving business under the name, A. Teichert and Son. The company played an integral role in the development of the road and highway system in Northern California, employed by the likes of the State of California Highway Department (later Caltrans) and the cities of Sacramento, Davis, Woodland, Placerville, and Fresno. In addition to paving roads, Teichert expanded its repertoire to include the production of rock product and ready-mixed concrete and the construction of dams, beginning with the North Fork Dam on the American River in 1938. A. Teichert and Son also partook in joint ventures with companies like United Concrete Pipe and Ralph A. Bell. In 1939, the companies worked together to construct tunnels and relocate

[47] [Photograph,] DM-1471-CV in USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal,* 115; Machine used for laying drains in the lower reaches of canal. The machine digs a trench and men working inside shield lay the drain pipe which is covered by gravel from the hopper.

telephone and railroad lines around the Shasta Dam. During World War II, A. Teichert and Son supported the war effort through the construction of airports; ammunition storage facilities; runways; and water, light, and fuel systems. By the early 1950s, the company's growth spurred the establishment of district offices in the Woodland/Davis area and in Stockton.[48]

Figure 12: Placing alternate panels of reinforced concrete in Newman wasteway, April 1951.[49]

On November 8, 1951, Johnson Western Constructors won the bid for construction of structures for distribution to water agencies along the canal rouate. The firm built the Columbia Pumping Plant No. 1, Mowry Pumping Plant, and their respective delivery systems. The work was broken into two schedules under Specification DC-3989. Headquartered in San Pedro, Johnson Western had additional offices in San Diego and Oakland. The company specialized in heavy engineering construction, waterfront construction, and gunite construction. Born in 1885, William Arthur began his career at age 21 at a small pipe company, working on construction projects there until he became president of the National Bank of Riverside. Johnson stayed at the National Bank from 1918 to 1923, at which time he established the Hall Johnson Company. Throughout his career, Johnson started numerous firms, including American Pipe, Johnson, Inc., and Johnson Western Constructors. His companies helped construct the Shasta Dam from 1938 to 1944. At the time of the

[48] *Delta-Mendota Canal:* Technical Report, 105; "Our History," *Teichert Way,* file:///J:/22-015%20Delta-Mendota%20Canal%20Subsidence/Research/Contractors/A.%20Teichert%20&%20Sons/Our%20History%20-%20Teichert.html.

[49] [Photograph], DM-1496-CV in USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal,* 128.

construction of Delta-Mendota Canal, Larry Sullivan of San Pedro served as president of Johnson Western.[50]

The government awarded Plainview Water District and Stolte Inc. Contract No. 14-06-D-542 which "covered construction of earthwork, pipelines, and structures, including pumping plants, laterals 8.7 to 20.0 inclusive, and sublaterals" on September 1, 1953. Divided into three schedules, the contract with Stolte, Inc. allocated $441, 893.11 for the work, but only "a portion of the costs [$81, 686.99] was chargeable to Delta-Mendota Canal." Plainview Mutual Water Company is based in Strathmore, California, and had been one of the first companies formed with the aim of negotiating with the Central Valley Project for irrigation water. At the time of the bidding, Plainview Water District fell under the Delta-Mendota Canal distribution system. The company formed in 1950, with an irrigation request of about 4,200 acres. Stolte Inc. can trace its origins to Ferdinand Charles Stolte, whose dreams of becoming a gentleman farmer were foiled by the stock market crash of 1929. Based in Alameda, Stolte Inc. began with specializing in homebuilding, but expanded to include work on hotels, medical facilities, high-rise commercial construction, and heavy construction like dams and tunnels. In 1932, engineer George Loorz joined Stolte Inc. as a partner, and the company went on to build Hearst Castle for William Randolph Hearst. In 1976, National Medical Enterprises purchased Stole Inc.[51]

Crest Contracting Company won the contract for construction of pump turnouts from mile 58.18 to mile 96.62 on May 2, 1958. Floyd Hardwick, a former Rio Vista city administrator, owned the company. While working on the Dela-Mendota Canal, Crest Contracting also undertook projects constructing culverts for Merced County.[52]

Contracts for "furnishing, hauling, and placing gravel" from various stations along Delta-Mendota Canal and the Westley wasteway were awarded to H. Sykes Construction Company. Under Specification R2-32, Sykes's company performed work along M.P. 12.99 to M.P. 25.88 and the start of the Westley wasteway to M.P. 0.37. The company specialized in road oiling, paving, and ready-mix concrete. Hubert Sykes headquartered his company in Patterson,

[50] Technical Report, 106; "Johnson, Shasta Dam Builder, Dies," *News Pilot,* San Pedro: May 11, 1956; "William A. Johnson, 71, Industrialist, Succumbs," *San Bernadino County Sun* May 11, 1956; "San Pedran Elected President of Johnson Western Company," *News Pilot,* December 2, 1950.

[51] Technical Report, 106; "County Ok's Tax Rate for New Plainview District," *Tracy Press,* May 4, 1951; "More Acreage Wanted in New Water District," *Tracy Press* October 2, 1950; Evelyn De Wolfe, "San Simeon Builder's Forgotten Notes : Cache Enriches Castle Lore," *LA Times,* January 25, 1985; "Carol Louise Stolte Paden," *Alameda Sun*, May 14, 2020.

[52] Technical Report, 106; "New Southbay Business Licenses," *The Redondo Reflex,* April 16, 1948; "Gasoline, TV Thefts Reported," *Merced Express,* January 29, 1959.

California. Born in England in 1895, Sykes came to Patterson in 1919, having become a naturalized US citizen in 1918.[53]

E.A. Pollard won the contract for the "erection of right-of-way fence," which cost the government $5,407. Prior to his work on the Delta Mendota Canal, Pollard and his employees worked in Martinez, constructing a bridge across Marsh Creek on County Road E-44 and in Mendocino, grading and improving roads in Wages Creek. Born in 1897 in Oregon, it is not clear when Pollard came to California and established a home in Richmond. He operated his business out of Fairfax.[54]

To aid in the furnishing, processing, hauling, and placing of gravel along stations, the government also developed contracts with M.J. Ruddy and Son of Modesto, California (**Figure 13**). The company emphasized the "prompt delivery" of sand and gravel, including washed concrete sand and crushed rock. Though the company's establishment dates to the 1930s, it did not file as a stock corporation until October 15, 1954. Other work done by M.J. Ruddy and Son involved highway bridges and overpasses from Firebaugh throughout the San Joaquin Valley, and paving on the Tuolumne-Sonora Road. At the time the government accepted the bid for the Delta Mendota Canal, M.J. Ruddy and Son's managers included M.J. Ruddy, Jr, project manager; Fred Sattler, chief engineer; Warren Shields, project superintendent; and Paul Snyder, office manager.[55]

The Claude C. Wood Company also won a bid for "furnishing or processing, hauling and placing gravel" for Delta-Mendota Canal. Based in Lodi, California, Claude C. Wood Co. operated a gravel plant which manufactured rock, sand, and gravel and offered ready-mix concrete for purchase. The company also provided asphalt road oils to eliminate dust on driveways along farmland. During World War II, the Claude C. Wood Co. supported the war effort by assembling parts for floating drydocks, operating under a sub-contract for the United States Navy. Wood himself led an active role in his community; he served as secretary-treasurer for the Turlock Exchange Club in the 1920s and served on the board of trustees for Galt High

[53] Technical Report, 147; "Advertisement," *West Side Index,* June 2, 1960; United States Federal Census, "Hubert Sykes," 1940 and 1950.

[54] Technical Report, 146; United States Federal Census, "E A Pollard," 1940; "Official Report of the Board of Supervisors," *Contra Costa Gazette,* May 6, 1949; "Mendocino Beacon Files," *Mendocino Coast Beacon,* January 2, 1959.

[55] Technical Report, 146; "Modestan's Bid On Road Work is Low," *Modesto Bee,* February 24, 1939; "Advertisement," *Modesto Bee,* February 26, 1947; "Supervising the Jobs," *Western Construction,* vol. 32 (Cornell: King Publications, Jan. 1957); Gene Phillips, "Obituary- Cirgus H. Rumbaugh," *Rogers County Archives,* November 28, 2006.

School in the 1940s. Trained as an engineer, Wood came to California from Wisconsin in 1905 at the age of 20.[56]

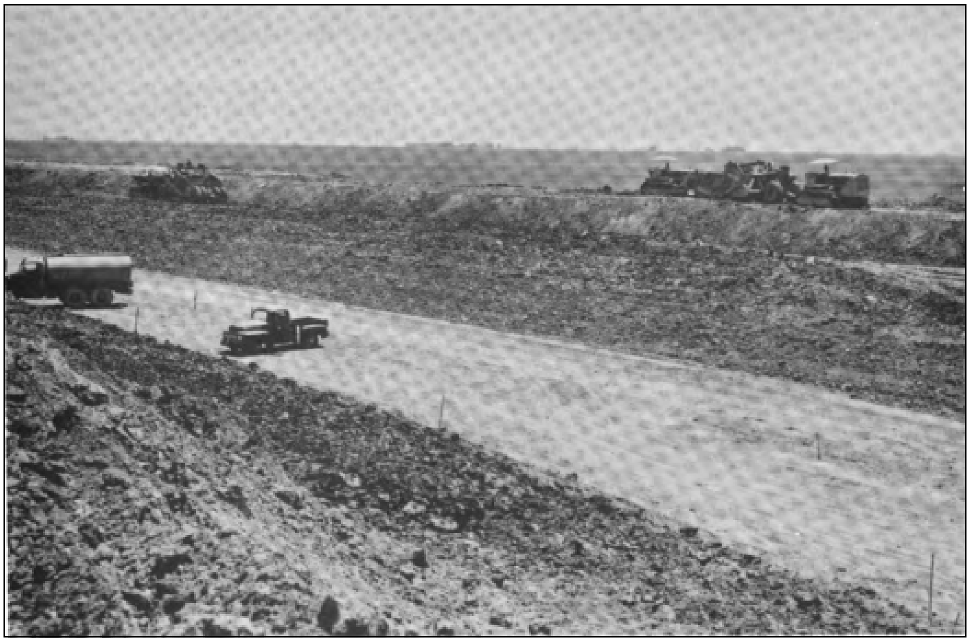

Figure 13: Placing and compacting lining material on side slope of canal, July 26, 1950.[57]

The high groundwater level, some large storms, and labor issues were among the biggest obstacles during construction. The high groundwater table caused water intrusion into the canal excavations and required contractors to de-watered those areas moving the water into a pilot ditch or other drain structures. Heavy storms in November and December 1950 also slowed progress when the deluge caused high water in Los Banos and San Luis creeks, which both breached constructed portions of Delta-Mendota Canal, causing damage to the canal and to some of the siphons. The storms also caused excess water in Garzas Creek to undermine an overchute pier and damaged some of the canal lining. After the delays caused by the storms and the subsequent repairs, a series of labor strikes in May 1951 halted constructed for about two weeks. Once the workforce returned the main branch of the canal was completed in

[56] Technical Report, 146; "Neel Re-elected Club President," *Modesto Bee,* July 2, 1926; "Farmers and Grape Growers Attention," *Lodi News-Sentinel,* April 27, 1943; "Wood Given Contract to Assist Navy," *Lodi News-Sentinel,* June 18, 1943; United States Federal Census, "Claude C. Wood," 1940; US City Directories, 1822-1995, "Claude C. Wood," 1905.

[57] [Photograph], DM-895-CV, in USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal,* 141.

summer 1951, but Delta-Mendota Canal was not considered complete until April 1952 when the San Luis Wasteway was completed (later renamed Volta Wasteway).[58]

3.1.5. Post-construction

Completion of the CVP was an economic boon to the Central Valley. In 1953, two years after the major canals of the project were complete, the project provided 1,500,000 acre-feet to irrigate nearly 720,000 acres of land. That year, the project delivered 134,000 acre-feet of irrigation water along Delta-Mendota Canal to districts composed of almost 120,000 acres. Reclamation planned for ultimate development of 225,000 acres in the Delta-Mendota service areas to be achieved upon the completion of Folsom Dam (1956) on the American River in Sacramento County and the Trinity Division in Trinity County (1959-1967), which transfers water from the Klamath River Basin into the Sacramento River Basin.[59]

Completion of the CVP also came with controversy. The century or so after California's Gold Rush witnessed exploitation of the Delta not only for irrigation purposes, but for other water resources, including chinook salmon. Canneries appeared in Sacramento as early as 1864, but the California Fish Commission noted a severe decline in fish populations by 1880 – attributed to overfishing and the prevalence of sediment in spawning beds from hydraulic mining. As detrimental as overfishing and mining were to the salmon runs, the most adverse effects came from the changes in the Delta landscape and ecosystem from the Central Valley Project and the State Water Project. Delta-Mendota Canal provided water to the west side of the San Joaquin Valley, but left "the 59-mile stretch of the river from Mendota upstream to Friant Dam with little water, and within this reach, the 23 miles directly above Mendota were completely dewatered." The dry river channel and the 319-foot-high concrete dam rendered the salmon helpless, with no way to continue their traditional migration and spawning runs. Not until 2009 did legislation pass to provide "substantial river channel improvements and sufficient releases from Friant Dam" to sustain the fish population from downstream to the Merced River, allowing water to flow freely through the San Joaquin River. The impacts of this San Joaquin River Restoration Settlement Act are still being observed.[60]

Further negative effects on the fish populations of the San Joaquin River system have been caused by altered hydrology, recirculation of water, and poor water quality caused by polluted runoff and dissolved oxygen. Though fish are entrained at the C.W. Bill Jones Pumping Plant

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[58] USDI, Reclamation, *Technical Record of Design and Construction: Delta-Mendota Canal,* 142-144.

[59] USDI, Reclamation, "The Contribution of Irrigation and the Central Valley Project to the Economy of the Area and the Nation," (Government Printing Office: Washington, 1956), XIII, 21.

[60] Philip Garone, "Managing the Garden: Agriculture, Reclamation, and Restoration in the Sacramento-San Joaquin Delta," in in Delta Protection Commission, Delta Narratives: Saving the Historical and Cultural Heritage of the Sacramento-San Joaquin Delta, prepared by the Center for California Studies, California State University, Sacramento (West Sacramento: Delta Protection Commission, 2015), 77-86.

(formerly Tracy Pumping Plant) to mitigate impact on the fish population, increased pumping alters the hydrodynamic conditions of the water, creating problems for fish who rely on habitat condition indicators to make their run. The Central Valley Project Improvement Act of 1992 allocated 800,000 acre-feet per year of CVP water "dedicated for anadromous fish enhancement and wildlife purposes," managed by the Sacramento division of the U.S. Fish and Wildlife department. A portion of this water is reserved to reduce pumping from the Jones plant, as efficient fish diversion via entrainment continues to decrease.[61]

By 1959 when Reclamation published its final report on Delta-Mendota Canal's construction, entitled *Delta-Mendota Canal Technical Record of Design and Construction*, most of the turnouts supplying water to individual water districts had been completed, nearly all according to Reclamation's standardized specifications. A few more, also designed according to specifications, were over the next several decades.[62] Individual water districts are responsible for maintaining turnouts into their own distribution systems and adding turnouts from Delta-Mendota Canal as needed and approved by Reclamation. Most of the physical changes made to Delta-Mendota Canal since its completion fall into five categories 1) maintenance, 2) capacity correction, 3) water district turnout additions and changes, 4) drainage / erosion control, 5) automation. Since October 1992 San Luis & Delta-Mendota Water Authority (Authority) has been responsible for maintenance of Delta-Mendota Canal.

The Authority is responsible for maintaining the concrete lining of the canal. Natural processes including land subsidence and soil characteristics cause deterioration of the concrete panels that line the canal. As noted, land subsidence and the damage it caused to Delta-Mendota Canal became apparent almost as soon as Reclamation turned water into the canal. Writing retrospectively about subsidence in 1968, geologist N.P. Prokopovich, and engineer D.J. Hebert noted that the most widespread soil bed in the upper part of the San Joaquin Valley was an "ancient lake bed known as the Corcoran or Blue Clay," in which a substantial storage of artesian groundwater lays. This groundwater reserve constituted a large portion of the irrigation supply before the CVP and continued to be a source even after the canal was built. Since 1960, the Bureau of Reclamation recognized a phase of subsidence caused by well-developed ground water overdraft, denoting it as "prominent and publicized." However, a

[61] USDI, Bureau of Reclamation, "Delta-Mendota Canal Recirculation Feasibility Study – Plan Formulation Report," (Sacramento: September 2010), 58-62; USDI, Reclamation, "Delta-Mendota Canal/California Aqueduct Interie – Final Environmental Impact Statement, vol 1: Main Report," (Sacramento: November 2009), 99-102.
[62] USDI, Reclamation, *Delta-Mendota Canal: Technical Record of Design and Construction;* USDI, Reclamation, "Milepost at Structure Sites Delta-Mendota Canal," 1985.

different phase of subsidence called "lag," which occurs even when the area experiences little or no pumping of groundwater, and despite a decrease or disappearance of overdraft.[63]

Prokopovich and Hebert explained that the last 30-40 miles of Delta-Mendota Canal offer a remarkable example of lag subsidence (**Figure 14**). Preconstruction and construction surveys had not recognized any land subsidence in the lower reaches of the DMC, and any changes in elevation were attributed to earthquakes. By 1952, however, professionals identified subsidence as responsible for past changes in elevation. At the time of article, Prokopovich and Hebert noted that 22 miles of the concrete-lined section and all 18 miles of earth-lined section were affected by subsidence, causing the linings to become submerged below the water. Bridges and pipe crossings showed extensive effects of subsidence, where their clearance to the water was reduced sometimes to within inches or none at all. In some cases, the subsidence caused timber bridges and pipe crossings to flood (**Figure 15**). Prokopovich and Hebert stated that subsidence had not negatively affect the capacity of the canal, nor was there damage to either canal linings or structures. Despite the lack of impacts to the canal's capacity and its linings and structures, subsidence caused enough of a maintenance and operations problem to warrant a plan to rehabilitate the canal that was proposed for the 1968-1969 fiscal year. Reclamation staff estimated that the lag subsidence would increase up to two feet a year.[64]

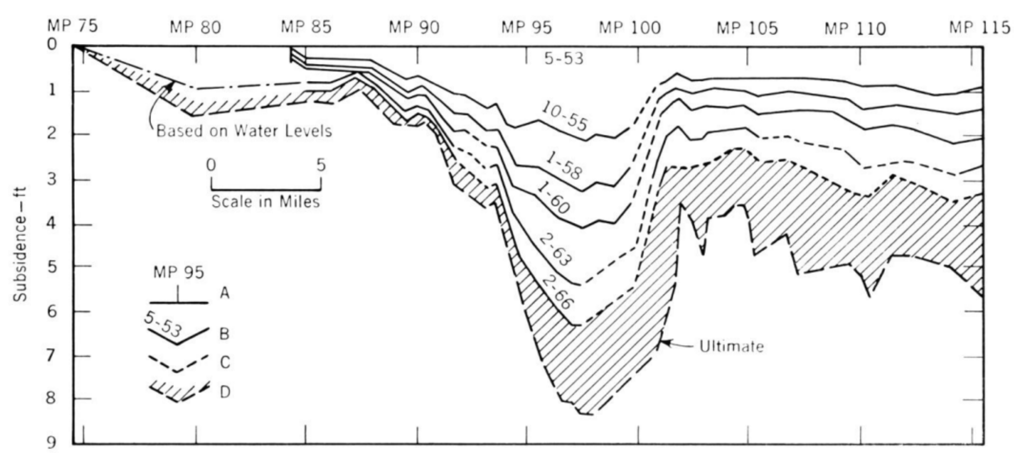

Fig. 5. Past and Future Land Subsidence in Downstream Reaches of the Delta-Mendota Canal

A is mile post (distance from intake); B is date of survey data; C is interpolations to bridge data gaps; D is predicted ultimate subsidence.

[63] N.P. Prokopovich and D.J. Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," *Journal (American Water Works Association)* vol. 60, no. 8, August 1968.
[64] N.P. Prokopovich and D.J. Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," *Journal (American Water Works Association)* vol. 60, no. 8, August 1968.

Figure 14: From Prokopovich and Hebert, graph showing past and future subsidence, 1968.[65]

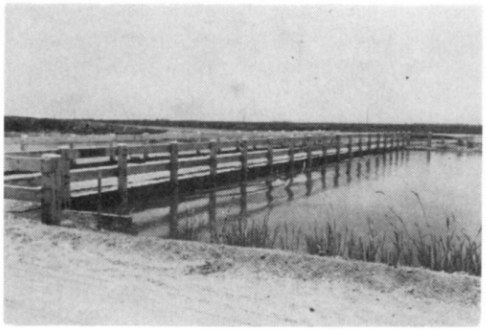

Fig. 7. Effect of Subsidence on Bridge at Near Capacity Flow

This is a partially submerged timber bridge at Mile Post 98.21, in an area affected by deep subsidence. Concrete lining of the canal is completely flooded.

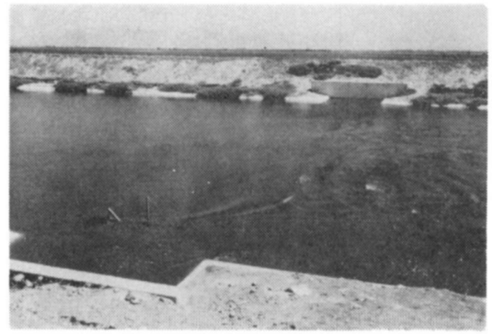

Fig. 9. Effect of Subsidence on Pipe Crossing at Near Capacity Flow

This is a submerged pipe crossing at Mile Post 91.71 in an area affected by deep subsidence.

Figure 15: Effects of subsidence on DMC, 1968.[66]

In December 1952, members of the canal's Central Valley Project Operations and Tracy Operations divisions conducted a biennial inspection of Delta-Mendota Canal, the first of which took place in October 1951, just a few months after the canal first delivered water. The report contained comments on the intake structure and intake canal; concrete and earth lining; and structures. It also provided recommendations and a general remark noting that "this was the first time the upper 100 miles of canal has been [dewatered] since water was turned in the canal in July 1951." The inspectors noted minor bank erosion and beaching on a curve of the canal near M.P. 0.5, no leakage in the discharge lines, and concrete and earth linings in good condition aside from "minor trouble spots" such as bulging and cracking and settlement of berms (**Figure 16**). Concerning the structures, the inspectors observed problems like leakage in the Mountain House Road siphon, canal silting at M.P. 42, drain pumps out of service, and inaccurate measurements from sparling meters.[67]

[65] [Photograph] in Prokopovich and Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," 917.
[66] [Photograph] in Prokopovich and Hebert, "Land Subsidence Along the Delta-Mendota Canal, California," 918.
[67] United States Department of the Interior, Bureau of Reclamation, Divisions of Design and Construction Operation and Maintenance, *Report on Inspection of Friant-Kern, Madera, Contra Costa, and Delta-Mendota Canals, 1-5.*

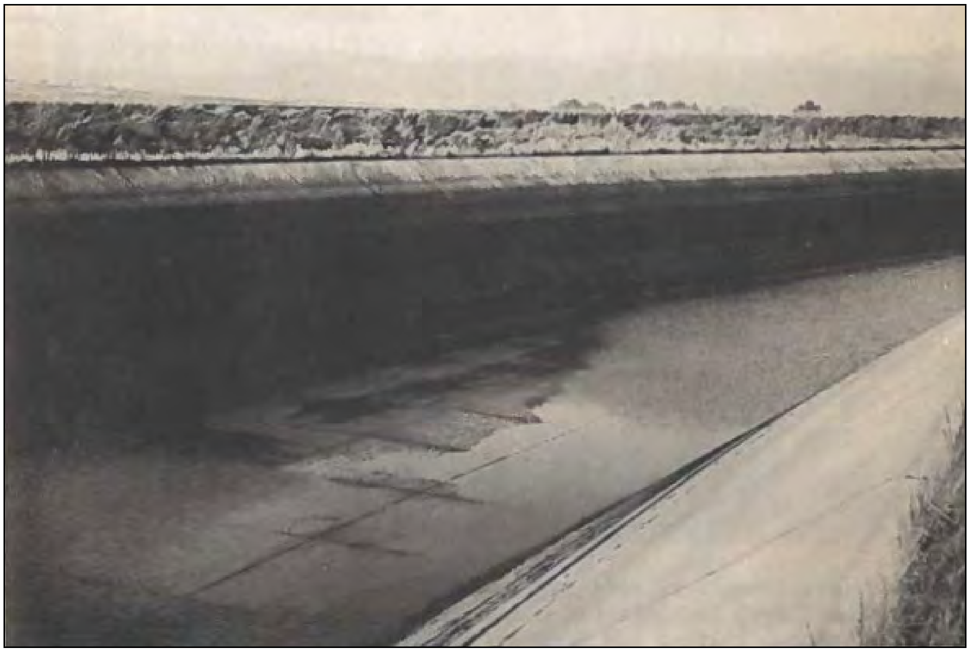

Figure 16: M.P. 11.15, concrete lining and heaving of bottom slab.[68]

In June 1965, the Bureau of Reclamation Chief of Engineers received a report on the condition of Delta-Mendota Canal, including Tracy Fish Collecting Facilities and Tracy Pumping Plant. Overall, the canal appeared to be in excellent condition at the time, including its structures, gates, and operating roads. Subsidence was described as "slow and not yet stabilized." At the time of the inspection, no maintenance issues caused by the subsidence presented themselves; therefore, no corrective action occurred. The report also mentioned that several bridges had been replaced, with others needing replacement as well, such as the bridge at M.P. 90.56 (**Figure 17**). The turnouts and gates and wasteways looked to be in good condition, only requiring minor aesthetic maintenance. The inspectors observed the Tracy Pumping Plant to be well-maintained and in excellent condition, but did note a horizontal crack in the wall along the construction joint on the discharge side of the motor room. However, the inspectors found no evidence of leakage. Regarding cross drainage siphons and channels, the examination team noticed some leakage that seems to decrease as the weather and water warm. To mitigate this leakage and degradation, baffled-apron drops were under construction (**Figure 18**). The report concluded with the recommendation that the unwatered canal be watched during the winter of 1965-1966 to determine the necessity of repairing the flap-valve underdrain outlets because that winter would likely be the last year of the "normal operating

[68] [Photograph], DM 2294 in USDI, Divisions of Design and Construction Operation and Maintenance, *Report on Inspection of Friant-Kern, Madera, Contra Costa, and Delta-Mendota Canals.*

procedure" because once the San Luis Unit began operations (built in the early 1960s), the canal would be in continuous use. [69]

Figure 17: Bridge, Mile 90.56, scheduled for replacement. May 14, 1965.[70]

[69] United States Department of the Interior, Bureau of Reclamation, *Condition of Major Irrigation Carriage Systems and Appurtenant Features – Central Valley Project* (Denver: June 21, 1965), 3-8.
[70] [Photograph], Photo No. 5, P214-D-48741 NA, in USDI, Reclamation *Condition of Major Irrigation Carriage Systems and Appurtenant Features,* 20.

Figure 18: Baffled apron drop under construction, May 12, 1965.[71]

The Bureau of Reclamation authored a similar report on June 5, 1970, examining "major irrigation structures and facilities operated and maintained by Tracy Field Division, Central Valley Project." Overall, the structures were found to be in good condition. The most pressing concern was the prevalence of people and expanding use of the canals for recreational activities like fishing. On Delta-Mendota Canal, the inspectors noted some erosion in the earth-lined section, but the concrete-lined sections appeared to be in excellent condition. As stated in previous inspection reports, some cracking in the lining on Mile 75 was evident but did not seem to be increasing. The examination team commented on the disruption of the canal by the public, including agricultural pipe crossings on the canal or farmers who discharged barnyard waste into the canal (**Figure 19**). The report recommended fencing around the checks to prevent fishing and any risk of people falling into the canal and drowning. The team found the overall condition of the canal's radial gates and turnouts and drain inlets to be

[71] [Photograph], Photo No. 9, P214-D-48732 NA, in USDI, Reclamation *Condition of Major Irrigation Carriage Systems and Appurtenant Features,* 21; baffled apron drop under construction to control retrogression at Coral Hollow Creek Siphon.

satisfactory and without need for repair but recommended the removal of cottonwood trees growing in the San Luis wasteway channel.

The 1970 inspection report did, however, note some issues concerning subsidence, seepage, and silt deposits. The team noticed subsidence in the lower reaches of the canal, below M.P. 70. At the time of the inspection, the reach was already scheduled for a lining raise, to alleviate the effects of future subsidence. The team also witnessed significant seepage at two locations along the canal, with the most detrimental between M.P. 56 and 57. According to the report, a prior inspection observed seepage; thus, the maintenance division added a layer of butyl rubber over the concrete lining sometime in 1966. This remedy proved to be insufficient and a plan to completely replace the concrete lining was in development. Silt deposits became more prevalent after the construction of the O'Neill Pumping Plant (at B.F. Sisk Dam and part of the San Luis Unit) and with the "increased operation of the check gates" downstream of the Tracy Pumping Plant (**Figure 20**). Due to a lack of funding for studies, no sufficient method of removing sediment existed in 1970 for the Tracy Field Division.[72]

Figure 19: Discharge of barnyard manure into the canal, May 16, 1970.[73]

[72] United States Department of the Interior, Bureau of Reclamation, *Condition of Major Irrigation Structures and Facilities – Central Valley Project – Report of Examination* (Denver 1970).
[73] [Photograph], 5-70-49D in USDI, Reclamation, *Condition of Major Irrigation Structures and Facilities – Central Valley Project – Report of Examination*, 14; government is starting legal action if this is not stopped by July.

Figure 20: Note rough silty water below gates at Check No. 19, May 16, 1970.[74]

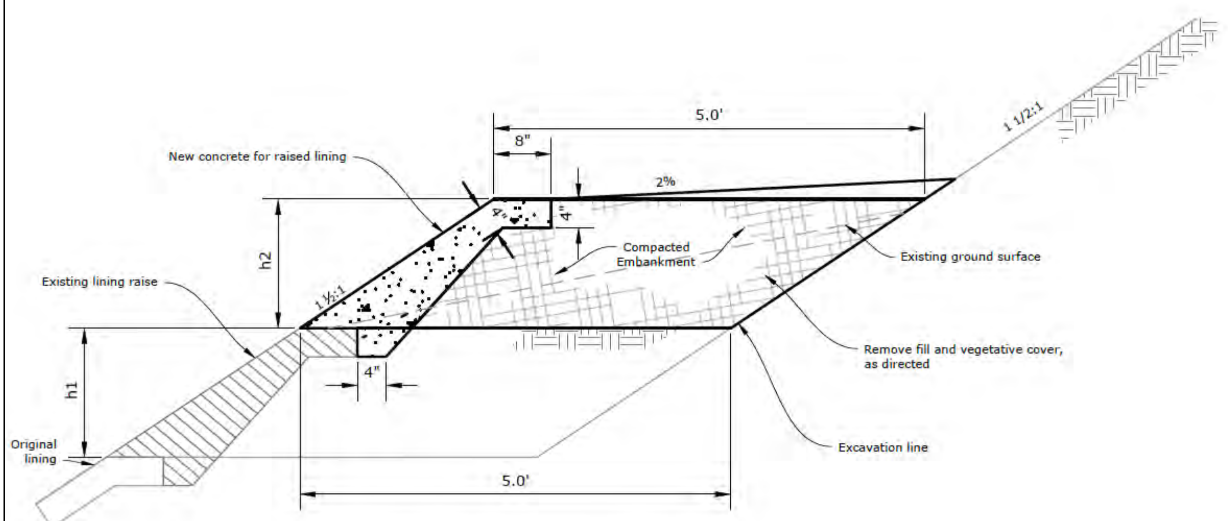

Figure 21: DMC typical cross section showing placement of original concrete lining, previous lining raise, and proposed lining raise.

[74] [Photograph] 214-D-67155 in USDI, Reclamation, *Condition of Major Irrigation Structures and Facilities – Central Valley Project – Report of Examination*, 16; gate pins partially submerged.

Over time various points along the canal have required modifications to correct the carrying capacity of the canal. Reclamation undertook one of the earliest, and most extensive capacity corrections in 1969, raising approximately 70 miles of the concrete-lined canal 18 inches and 24 inches.[75]

Wet conditions and soil characteristics make drainage and erosion control a perpetual issue that requires maintenance, the placement of drains where needed, and abandonment of drains that have become obsolete. As farming intensified around the canal following its completion, drainage water diminished as it was captured by surrounding farmlands. Many original concrete inlet drains have either become obsolete or have deteriorated.

Other changes have taken place to structures that span the canal like bridges and pipe crossings / overchutes since completion of Delta-Mendota Canal. In the 1960s, Reclamation undertook a bridge rehabilitation project that converted timber farm bridges piers from wood to concrete. Pipe crossings are changed frequently, and Reclamation maintains separate license agreements with utility companies for each crossing of water, oil, gas, transmission lines etc. Pipelines are removed, replaced with a new type of pipe, and added at new locations as dictated by local demand.

The massive length and capacity of Delta-Mendota Canal has largely been an obstacle to execution of a comprehensive modernization or upgrade plan because the cost would be prohibitive. Instead, the original design specifications have continued to serve as the basis for maintaining the canal, which has resulted in a high retention of many of the features and the overall character of Delta-Mendota Canal.

3.2. San Luis Drain

The San Luis Drain segment recorded for this report was constructed in sections between 1969 and 1973 as part of the San Luis Unit addition to the Central Valley Project, which expanded the federal water-distribution network to irrigators in the western San Joaquin Valley. The following provides a broad historical overview of the San Luis Unit, chronicles the development of the San Luis Drain, and discusses the significance and lasting impact of the Kesterson Reservoir ecological disaster in the early to mid-1980s.

Central Valley Project – San Luis Unit

The San Luis Drain was constructed as a critical element of the San Luis Unit, a joint state-federal expansion of the Central Valley Project (CVP) to distribute irrigation water to farmers on the west side of the San Joaquin Valley in the 1960s.

[75] USDI, Reclamation, *Designer's Operating Criteria*, 1971: 4-5, 26; Grimsley, J. O. and M. L. Barmettlor, *Condition of Major Irrigation Structures and Facilities*, Region 2, 1970, Appendix I – 3, 6.

As compared to the east side of the valley, agricultural development arrived comparably late to the arid west side of Merced, Fresno, and Kings counties. Through the turn of the twentieth century, the regional economy revolved around ranching—primarily sheepherding—with an economic boom period of oil and coal strikes, which attracted railroads and light municipal development to the area. Irrigation efforts were modest during this period, with farmers digging small canals from the San Joaquin River and repurposing abandoned mining ditches. But, beginning in the 1910s, an influx of local farmers, aided by advances in turbine pump technology, began to extract increasing quantities of high-quality groundwater, converting acres of former pasturage to irrigable lands and progressively pushing ranchers west into the Coast Range foothills. By 1922, 33,000 acres had been irrigated, and by 1948, following the introduction of cotton, hay, grain, alfalfa, and sugar beet crops to the region and boosted by wartime demand, that total had exponentially increased to 484,000 acres. At this time, regional irrigation farmers primarily discharged drainage wastewater into the San Joaquin River and/or its tributaries. However, this growing dependence on underground water resources severely depleted the groundwater table, leading to a 10-foot-per-year drop in the 1930s, with farmers drilling wells as deep as 2,000 feet below the surface. By the early 1950s, the aquifer overdraft reached 500,000 acre-feet per year, an increase from 100,000 annual acre-feet in 1929. In 1942, in response to the growing threat of water scarcity, landowners in western Fresno and Kings counties—among whom several owned over 1,000 acres each in the San Joaquin Valley—established the Westside Landowners Association and began petitioning the US Bureau of Reclamation (Reclamation) to divert surface water from the CVP to the west side of the valley. In response, Reclamation determined that water resources at existing facilities at Shasta Dam on the Sacramento River and Friant Dam on the San Joaquin River would be insufficient to meet the permanent needs of westside farmers and that the CVP would require expansion to meet this growing demand.[76]

To raise political support for transferring water resources to the western San Joaquin Valley, the Westside Landowners Association was reorganized in 1952 as the Westlands Water District (WWD). The new irrigation district was comprised of various incorporated interests—including the Southern Pacific Railroad Company, Standard Oil, and the J. G. Boswell Company, one of the largest agricultural entities in the world—with a service area stretching almost 70 miles between Mendota in Fresno County to Kettleman City in Kings County encompassing 399,000 acres, which was ultimately expanded to 600,000 acres in 1965 following a merger with the Westplains Water Storage District. In 1955, Reclamation released a feasibility study for

[76] Robert Autobee, "San Luis Unit, West San Joaquin Division, Central Valley Project" (Denver, Colorado: Bureau of Reclamation History Program, unpublished manuscript, 1995), 5-7, available at https://www.usbr.gov/projects/pdf.php?id=109 (accessed July 2022); Philip Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley* (Berkeley: University of California Press, 2011), 200-202.

delivering water to the westside, which it named the "San Luis Unit," and detailed an elaborate expansion of the existing CVP, whereby surplus water from the Sacramento-San Joaquin Delta would be delivered south via Delta-Mendota Canal and pumped into a new storage reservoir: the San Luis Reservoir, with a one-million-acre-foot storage capacity, to be located in the inner Coast Range foothills roughly due west from Los Banos in Merced County. The study likewise identified the need for drainage facilities, as the west side experienced poor drainage conditions resulting from the impermeable Corcoran clay layer. To meet increased drainage needs attendant with the expansion of the water-delivery system, Reclamation envisioned an intricate system of underground drains for roughly 96,000 acres of the San Luis service area that would drain saline subsurface groundwater away from low-lying croplands into an open surface interceptor drain (that became the San Luis Drain, recorded on this form), which would convey the water north for release into the Sacramento-San Joaquin Delta. During this same period, the California Department of Water Resources (DWR) produced the California Water Plan as part of the State Water Project (SWP). The water plan included the Feather River Project, which proposed erecting the Oroville Dam on the Feather River; developing a statewide aqueduct system to convey water to the San Francisco Bay Area, the west side of the San Joaquin Valley, and south to Southern California; and constructing a storage reservoir at the San Luis site. In addition to conflict between state and federal authorities concerning their overlapping systems, opposition to the westside expansion of the CVP arose from other contingents as well, namely: groups that argued that the project would serve an area dominated by large landowners in defiance of the 1902 Reclamation Act, which stipulated a 160-acre limit on all lands served by federal irrigation; and water agencies located downstream from the San Luis Unit's service areathat would receive the west side's drainage flows. Following years of negotiations, which included an explicit 160-acre limitation for all lands served by the San Luis Unit along with the inclusion of a drainage provision for affected water agencies, the U.S. Congress passed and U.S. President Dwight Eisenhower signed into law the San Luis Act in 1960, which authorized the annual export of about 1.25 million acre-feet of water to the western San Joaquin Valley to irrigate approximately 500,000 acres in Merced, Fresno, and Kings counties. The act likewise provided for the return of said irrigation water to the Sacramento-San Joaquin Delta as drainage wastewater via proposed interceptor drain (ultimately constructed as the drain recorded on this form).[77]

In 1961, Reclamation and the State of California, which had authorized the SWP with the passage of the Burns-Porter Act of 1959 and narrowly passed bond measures to fund its

[77] Autobee, "San Luis Unit," 7; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 202-205; U.S. Bureau of Reclamation (Reclamation), "San Luis Unit, Central Valley Project, California: A Report on the Feasibility of Water Supply Development" (Sacramento, California: Reclamation Region 2, 1955); Philip Garone, "The Tragedy at Kesterson Reservoir: A Case Study in Environmental History and a Lesson in Ecological Complexity," *Environs* 22, no. 2 (Spring 1999): 114-15.

construction in November 1960, officially resolved the overlapping areas of the CVP and SWP by entering into an agreement to jointly operate the San Luis Unit (**Figure 22**). Reclamation would construct and DWR would operate and maintain the San Luis Dam and Reservoir, now to be enlarged to over two million acre-feet—the largest off-stream reservoir in the United States—to accommodate both projects. In 1963, Morrison-Knudsen Company, Inc., Utah Construction and Mining Company, and Brown and Root, Inc. won the joint contract to build the dam and reservoir, which they completed in August 1967. Transporting SWP water from the Sacramento-San Joaquin Delta to the reservoir, the California Aqueduct would be known as the San Luis Canal where it delivered federal water to the San Luis Unit service area between the reservoir and Kettleman City, south of which it would resume its SWP designation and function: to supply irrigation water to farmers in Kings and Kern counties and in Southern California. Under Reclamation in the San Luis Unit, the San Luis Canal was constructed in five reaches between 1963 and 1968, when water released near Los Banos was finally received in Kettleman City. The San Luis facilities continue to serve the SWP and CVP, and presently comprise of the Governor Edmund G. Brown California Aqueduct / San Luis Canal; B. F. Sisk San Luis Dam; San Luis Reservoir; O'Neill Forebay and Dam, where CVP water from Delta-Mendota Canal is impounded for distribution; the William R. Gianelli Pumping-Generating Plant, which pumps water from O'Neill Forebay into San Luis Reservoir for distribution via the San Luis Canal; the Dos Amigos Pumping Plant, a secondary pumping facility on the San Luis Canal; and the Los Banos and Little Panoche detention dams and reservoirs, which provide flood protection for the San Luis Canal, Delta-Mendota Canal, and various populated areas. Federal-only facilities include the O'Neill Pumping Plant and Intake Canal; Coalinga Canal, a distribution structure erected to sustain the local mining industry, encourage local agriculture, and provide clean drinking water to the city of Coalinga; Pleasant Valley Pumping Plant, which pumps CVP water into the Coalinga Canal; and the San Luis Drain, discussed below.[78]

[78] Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 208-209; Autobee, "San Luis Unit," 9, 14-17; California Department of Water Resources, "San Luis," 2022, https://water.ca.gov/Programs/State-Water-Project/SWP-Facilities/San-Luis (accessed August 2022).

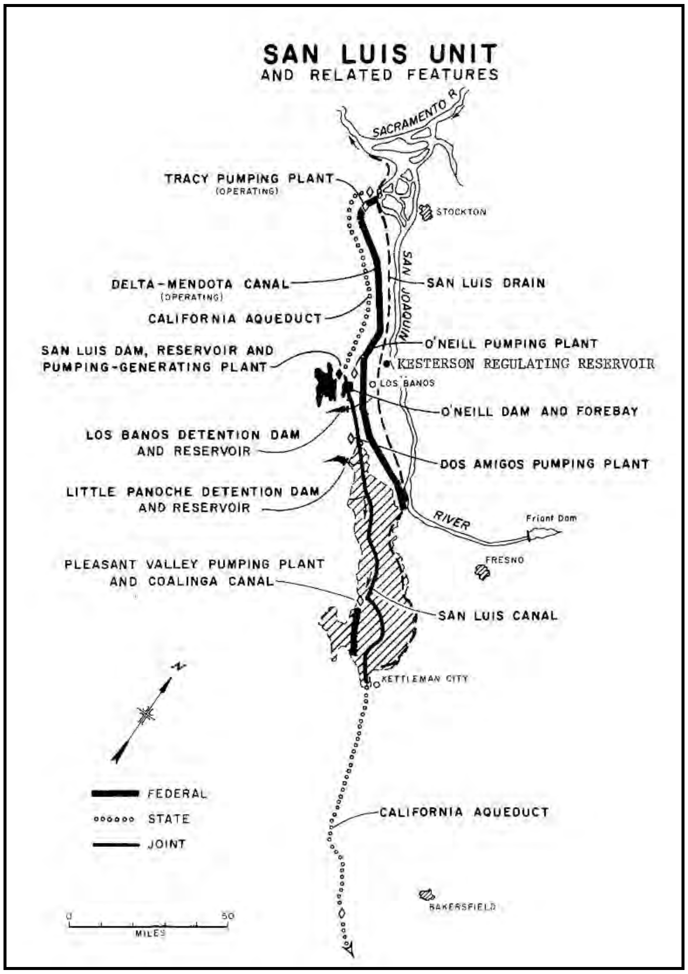

Figure 22: Map of "San Luis Unit and Related Features," ca. 1972.[79]

San Luis Drain

While construction forged ahead on the water storage and distribution elements of the joint state-federal San Luis Unit, the development of drainage facilities lagged. According to the San Luis Act of 1960, drainage infrastructure would either be built by DWR as a "master drain" for the entire San Joaquin Valley or by Reclamation as a smaller interceptor drain for those lands in the San Luis service area. Initially opting out of constructing the master drain, DWR reversed its position in 1964, proposing an approximately 280-mile, concrete-lined structure to extend north from Bakersfield in Kern County to a discharge point near the city of Antioch in Contra Costa County in the Sacramento-San Joaquin Delta, thereby serving the entire western San Joaquin Valley. Construction was stalled, however, when the Contra Costa County Water Agency objected to the plan because it would discharge nitrogen-rich saline drainage that may

[79] U.S. Bureau of Reclamation, "San Luis Unit and Related Features" (March 1972), dwg. no. 805-208-1947, reprinted in W. Turrentine Jackson and Alan M. Paterson, "The Sacramento-San Joaquin Delta: The Evolution and Implementation of Water Policy, an Historical Perspective" (Davis: California Water Resources Center, University of California, Davis, Contribution No. 163, June 1977), 137.

also contain pesticide residues into its freshwater resources. State and federal officials drafted several alternatives to the Antioch outfall, which included diluting discharge flows in natural streams like the San Joaquin River and Salt Slough or storing drainage in evaporation ponds. Reclamation and other supporters of the drain in the San Joaquin Valley did not accept these alternatives, however, because they failed to remove salt from the region, or they continued to utilize the San Joaquin River as a drain. Meanwhile, opposition to the Antioch outfall spread throughout the San Francisco Bay / Sacramento-San Joaquin Delta region, where congressional representatives called for investigations into the drain's pollution potential. In response, in early 1965 U.S. President Lyndon Johnson removed the San Luis Drain from the federal budget while requesting a $300,000 appropriation to fund an environmental investigation into a joint state-federal master drain by the U.S. Public Health Service. Two years later, the Federal Water Pollution Control Administration, subsequently tasked with the investigation, issued a comprehensive report that conditionally endorsed the drain, identifying fertilizer-derived nitrogen as the most dangerous pollutant and discounting subsurface drainage as a source of toxic pesticide residue. While nitrogen treatment and removal studies continued, the report advised partial construction of the San Luis Drain to enable drainage storage, which continued to threaten groundwater resources and agricultural output. In 1967, following the election of Ronald Reagan as California governor, DWR again reversed its position on the drain, finding no political support among San Joaquin Valley farmers for repayment rates at $18 per acre-foot and lacking even 25 percent of the upfront capital drainage construction costs. Responsibility for maintaining compliance with the San Luis Act of 1960 was retained by Reclamation alone, which was then being sued by the Central California Irrigation District for failing to provide drainage in accordance with the act; meanwhile, water deliveries were slated to begin as early as 1968.[80]

Following DWR's abandonment of the regionwide master drain, Reclamation set about designing and constructing an interceptor drain, initially conceived as a 188-mile structure to serve the area between Kettleman City in Kings County to the south and an undetermined discharge point in the Sacramento-San Joaquin Delta to the north. Until a final outfall location was made available, the drain was to empty into Kesterson Reservoir— a proposed complex of 12 interim storage ponds outside of Gustine in Merced County used to store and partially evaporate drainage flows (discussed below). This drainage network was to be developed alongside a drainage collection system constructed by Reclamation for the WWD, which would be comprised of underground concrete pipelines that gathered irrigation drainage from buried drainage pipes installed on private farms. In 1968, Reclamation began SLD's first phase of construction between Tranquility in Fresno County and Kesterson Reservoir. That March, the

[80] Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 209-212; Jackson and Paterson, "The Sacramento-San Joaquin Delta," 139-143.

Sacramento-based Darkenwald Construction Company, Inc. won the first contract for a seven-mile stretch of drain excavation along with 11 irrigation crossings, five road crossings, and two encasement pipes between Highway 180 and Adams Avenue in Fresno County (south of the study area). That October, Menlo Park-based firms, Oscar C. Holmes, Inc. and Holmes-Clair, Inc., won the joint contract to construct precast concrete pipe portions of siphons below the Laguna, Main, Outside, and Bass Avenue / Intake canals, and—in the study area described above—Delta-Mendota Canal (M.P. 121.50). In January 1969, San Mateo-based contracting company, Carl W. Olson & Sons, Inc., was awarded the contract to construct roughly 15 miles of earthwork, concrete lining, and structures between Dos Palos in Merced County and Firebaugh—including Check 37 recorded herein (M.P. 119.31). Work was slated to begin that April and involved a unique construction method to accommodate for the groundwater level located above the drain floor.[81] As explained by journalist Joe Thome, "Although several excavation techniques were tried and varying ones are being used, the best method has proven to be a sled system developed and built right on the job. It is called a 'pre-trimmer [(Error! Reference source not found.)].'" Thome continues:

> The 'pre-trimmer' is pulled along the drain alignment as it excavates the drain to within six inches of the final cut. It also simultaneously excavates three trenches, each 14 inches wide, extending below the rough cut [sic] drain bottom. The center trench, extending about 30 inches below the drain bottom, is used by the contractor to 'de-water' the immediate drain route to allow further excavation and placing of the lining. The two trenches, which run along each edge of the eight-foot wide [sic] bottom, will function to collect and hold water and keep it from lifting the lining out of the ground. In the center trench the contractor lays a 4-inch perforated plastic pipe, which is covered with gravel, and ground water is pumped out at points 1,000 feet apart. The outer trenches, similarly built but only 15 inches deep, will be connected to the canal portion by weep valves, spaced 10 feet apart. This will allow water to seep into the canal through these valves, when it builds up in the trench, and will thus relieve uplift

[81] Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 210; Jackson and Paterson, "The Sacramento-San Joaquin Delta," 144; "Major Recent Contract Awards," *Reclamation Era* 54, no. 2 (May 1968): 54; U.S. Bureau of Reclamation, "San Luis Unit, Central Valley Project: Plan for Disposal of Subsurface Agricultural Drainage" (Sacramento, California: USBR Region 2, June 1969), 17-21, on file at USBR Library, Sacramento, California; U.S. Bureau of Reclamation, Office of Design and Construction, "Designers' Operating Criteria: San Luis Drain, San Luis Unit, West San Joaquin Division, Central Valley Project, California" (Denver, Colorado: USBR, January 1975), 4; Memo Re: Field Inspection for Transfer from Construction to O&M Status for: Stage 1 Kesterson Reservoir and the Three Completed Reaches of the San Luis Drain—Specification Nos. DC-6611, DC-6681, DC-6703, DC-6823—San Luis Unit, CVP, California (December 17, 1973), ff. San Luis Drain (Spec. No. DC-6611), on file at USBR Library, Sacramento, California; "Major Recent Contract Awards," *Reclamation Era* 55, no. 1 (February 1969): n.p.; "Bureau Awards Contract for San Luis Drain," *The Fresno Bee* (January 17, 1969): 12A; "Reservoir Job Contract Due Danville Firm," *Salinas Californian* (March 7, 1969): 13; "Work on First Section of San Luis Drain Begins," *The Modesto Bee* (April 6, 1969): C4.

> pressure which could 'float' the concrete lining. The action of the valve will, however, prevent drain water from going from the drain canal back into the trench.[82]

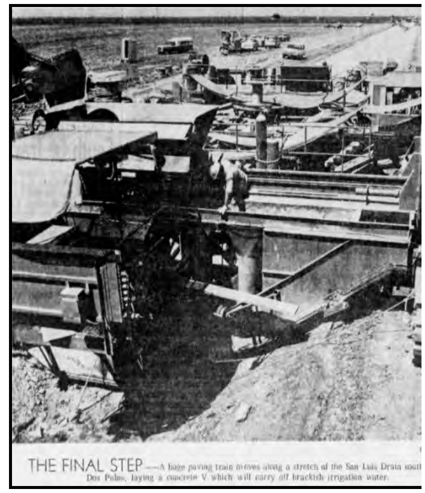

Figure 23: Published photographs of San Luis Drain construction between Dos Palos and Firebaugh, 1969.[83]

Progress on the construction of San Luis Drain, however, was stalled by budget cuts. In April 1969, U.S. President Richard Nixon slashed $2 million from the San Luis Drain budget (among other cuts to the CVP), pushing the timeline back one year, with Carl Olson & Sons (discussed above) completing construction of their section in January 1970. That July, Gordon H. Ball, Inc., based in Danville, Contra Costa County, won the contract for the northernmost 26-mile stretch of earthwork, concrete lining, and structures between Gustine and Dos Palos, along with the 1,283-acre, 12-pond, Kesterson Reservoir, all outside the study area. As mentioned, while the drain's discharge point in the Delta was debated, Kesterson continued to function as a drainage detention and evaporation facility.[84] Aided by advanced technology, Ball reportedly streamlined the canal excavation method employed by Carl Olson & Sons, Inc. (described above), as reported in *Construction Methods & Equipment*, "By mounting a specially-designed digging unit on a canal trimmer, [Gordon H. Ball, Inc.] gained a one-pass machine that

[82] Joe Thome, "San Luis Drain Paving Begins Near South Dos Palos," *The Modesto Bee* (August 18, 1969): B2.

[83] Bee Photos, published in Thome, "San Luis Drain Paving Begins Near South Dos Palos."

[84] Memo Re: Field Inspection for Transfer from Construction to O&M Status for: Stage 1 Kesterson Reservoir and the Three Completed Reaches of the San Luis Drain—Specification Nos. DC-6611, DC-6681, DC-6703, DC-6823—San Luis Unit, CVP, California (December 17, 1973), ff. San Luis Drain (Spec. No. DC-6611), on file at USBR Library, Sacramento, California; Michael Green, "Budget Cut Costs CVP $11.7 Million," *The Modesto Bee* (April 16, 1969): A2; "San Luis Drain May be Finished in 6 or 7 Years," *The Fresno Bee* (April 4, 1970): 6B; "San Luis Drain is Year Ahead," *The Modesto Bee* (October 1, 1970): C1.

simultaneously excavates canal finger drains, trims slopes and bottom, lays continuous plastic pipe, backfills, and screeds drains level with the slopes. Any area passed over by the machine is immediately ready for concreting."[85] In June 1972, Ball, Ball & Brosamer of Danville won construction contracts for an approximately 18-mile stretch of earthwork, concrete lining, and structures comprising the bulk of the study area (M.P. 119.33 – 137.77), along with the southernmost segment terminating at Five Points, outside the study area. For much of the segment in the study area, Reclamation adapted a preexisting earth-lined drainage canal originally dug by the Firebaugh Canal Company around the same time that Delta-Mendota Canal was built, rerouting the earth-lined drain (Drain U-121.2, recorded and evaluated on a separate DPR 523 form attached to this report in **Appendix B**) immediately adjacent to the San Luis Drain segment (**Figure 24**). Ball, Ball & Brosamer completed all work the following year, when construction on the San Luis Drain was halted altogether (**Figure 25**).[86]

Collectively, Gordon H. Ball, Inc., and Ball, Ball & Brosamer constructed 69.51 miles of the extant San Luis Drain, nearly 80 percent of the completed structure, along with the Kesterson Reservoir evaporation ponds. Hailing from a contracting family, Gordon H. Ball began his career working for his father, N. M. Ball, an early proponent of underground concrete irrigation construction who branched out into highway building in the 1920s. Following his father's death in 1935, Gordon Ball partnered with his two brothers forming N. M. Ball Sons, which took on numerous military projects during World War II, including 200 miles of roads for the Hanford Atomic Energy Plant in Hanford, Washington. In the early 1950s, Gordon split off from his brothers, ultimately incorporating as Gordon H. Ball, Inc., in 1957, and was active throughout California, Oregon, Washington, and Hawaii, specializing in concrete paving, as well as highway and bridge construction. In addition to the company's work on the San Luis Drain and Kesterson Reservoir, other CVP work included the Tehama-Colusa Canal and preliminary work for the proposed but never built Auburn Dam (the contract for which issued to Auburn Constructors, a joint venture between Gordon H. Ball, Inc., Guy F. Atkinson

[85] David C. Etheridge, "Hybrid Rig is Versatile Canal Builder," *Construction Methods & Equipment* (October 1972): 61.

[86] Memo Re: Field Inspection for Transfer from Construction to O&M Status for: Stage 1 Kesterson Reservoir and the Three Completed Reaches of the San Luis Drain—Specification Nos. DC-6611, DC-6681, DC-6703, DC-6823—San Luis Unit, CVP, California (December 17, 1973), ff. San Luis Drain (Spec. No. DC-6611), on file at USBR Library, Sacramento, California; Michael Green, "Budget Cut Costs CVP $11.7 Million," *The Modesto Bee* (April 16, 1969): A2; "San Luis Drain May be Finished in 6 or 7 Years," *The Fresno Bee* (April 4, 1970): 6B; Declaration of Taking, United States of America vs. Redfern Ranches, No. F-232, October 4, 1968, 5629 O.R. 444, Fresno County Recorder, Fresno, California; Aero Exploration Co., Flight ABI, Frame ABI-18G-51, February 13, 1950, 1:20,000, flown for U.S. Department of Agriculture (USDA) – Production and Marketing, available at http://malt.lib.csufresno.edu/MALT/ (accessed July 2022); Cartwright and Company, Flight ABI-1957, Frame ABI-29T-138, June 22, 1957, 1:20,000, flown for USDA – Commodity Stabilization Service, available at https://mil.library.ucsb.edu/ap_indexes/FrameFinder/ (UCSB; accessed July 2022); "San Luis Drain Takes Shape in Fresno County," *The Fresno Bee* (September 16, 1973): C1.

Company, and the Arundel Corporation). By 1975, the company had been purchased and operated as a subsidiary of Dillingham Corporation. Some later projects included: the Woodburn-Hayesville Interchange on Interstate 5 between Salem and Portland, Oregon; the Stapleton International Airport runway in Denver, Colorado; runways at Mather and McLellan air force bases in Sacramento; a cofferdam and forebay for a powerhouse at Grand Coulee Dam in Washington; a subway tunnel for the Washington Metropolitan Area Transit Authority (jointly built with the J. F. Shea Company, Inc., and Norair Engineering); and numerous sections of highway throughout California and Oregon, including California State Route 99 in Bakersfield, and Interstate 5 north of Los Angeles.[87] Ball, Ball & Brosamer was formed as joint venture between Gordon H. Ball's two sons, Gordon N. Ball and Dennis W. Ball, and Robert G. Brosamer. In addition to its work on the San Luis Drain, other CVP work includes rehabilitation of a portion of the Friant-Kern Canal, with other works for Reclamation including installation of the Gallegos Canyon Siphons as part of the Navajo Indian Irrigation Project in New Mexico and the Sonoqui Dike in Arizona. As with Gordon H. Ball, Inc., Ball, Ball & Brosamer was most actively involved in heavy highway construction. Gordon N. Ball went on to form Gordon N. Ball, Inc., and Robert Brosamer formed R & L Brosamer, Inc, both active firms based in the San Francisco Bay Area.[88]

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[87] "Small Staff Takes on Big Highway Program," *Contractors and Engineers* (January 1965): 35; "Major Recent Contract Awards," *Reclamation Era* 58, no. 2 (May 1972): 33; "Scrapers are Modified to Haul 26-yd Payloads," *Construction Methods & Equipment* 43, no. 9 (September 1961): 86; "Slip-form Machine Paves Three Lanes in One Pass," *Contractors and Engineers* 60, no. 7 (July 1963): 64; "80-ton Bottom-dump Trains Clock Million Yards Monthly," *Roads and Streets* 112, no. 8 (August 1969): 40; "How Ball Handles Maintenance on Oregon's Biggest Highway Job," *Western Construction* 50, no. 10 (October 1975): 24; "Slipform Lanes 50 Feet Wide and 18 Inches Deep," *Western Construction* 50, no. 12 (December 1975): 26; "Aggregate Base and CTB Mixed in Pugmill Plant," *Contractors and Engineers Magazine* 69, no. 5 (May 1972): 16; "Auburn Dam," *Compressed Air Magazine* 80, no. 11 (November 1975): 18; "Blaw-Knox Road and Airport Duo-forms Speed Air Base Paving," *Construction Methods & Equipment* 41, no. 5 (May 1959): 241; "Loaders, Trucks, and Scrapers Move Million Yards a Month," *Contractors & Engineers Magazine* 67, no. 11 (November 1970): 11; "Subway Contractors Overcome Poor Soil Conditions," *Contractors & Engineers Magazine* 68, no. 1 (January 1971): 18;

[88] "Irrigation Trickles," *Irrigation Journal* 27, no. 3 (May-June 1977): 34; "Contractors," *Western Construction* 50, no. 7 (July 1975): 127; U.S. Department of Interior, *Decisions of the United States Department of the Interior Vol. 93, January-December 1986* (Washington, D.C.: U.S. Government Printing Office, 1987), 144; "County Repays FAA $480,000 for False Billing," Los Angeles Times (June 29, 2000): B1; "Gordon N. Ball, Inc.," NewBayBridge.org, n.d. https://www.newbaybridge.org/the_builders/gordon_ball/ (accessed August 2022); "Featured Projects," Gordon N. Ball Inc., 2017, http://ballconco.com/featured-projects/ (accessed August 2022); Robert L. "Bob" Brosamer, "Message from Bob Brosamer," R & L. Brosamer, Inc. [newsletter] (Spring 2001): 2, available at https://www.thenewsletterguy.com/samples/CustomerNewsletters/RLBrosamer.pdf (accessed August 2022).

Figure 24: Excerpt of 1957 aerial photograph, with Firebaugh Canal Company drain (indicated by arrows) in same alignment as San Luis Drain, adjacent to Delta Mendota Canal.[89]

Figure 25: Archival photograph of Ball, Ball & Brosamer constructing outlet transition at UPRR / SR 33 siphon undercrossing, September 20, 1973. San Luis Drain indicated by arrows. Note Delta-Mendota Canal next to the SLD in the middle ground.[90]

[89] Cartwright and Company, Frame ABI-29T-138, 1957, UCSB.

[90] F. A. Shrader, Photograph No. CN805-243-9106NA: San Luis Drain, San Luis Unit, Bureau of Reclamation, Central Valley Project, California (August 20, 1973), available at U.S. Bureau of Reclamation, California-Great Basin Digital Library, https://usbr.contentdm.oclc.org/digital/collection/p15911coll7/id/3074/rec/7 (accessed August 2022).

The San Luis Drain was ultimately built out to about half of its proposed alignment, extending from a point near Five Points in Fresno County north to Kesterson Reservoir, when construction was halted in 1973 (**Figure 26**). Construction of the southernmost 29 miles of canal between Five Points and Kettleman City was impeded by a federal spending freeze that year and funding was never reinstated for its completion. The northernmost 75 miles between Kesterson Reservoir and the proposed Delta discharge outfall faced mounting opposition, not only from environmentalists in the San Francisco Bay Area, who claimed that nitrate-rich drainage water would cause algal blooms and compromise regional ecology, but also over half of all landowners along the proposed canal route between Kesterson and Antioch, most of whom saw the open canal as a loss to their property for the benefit of farmers further south. As a result, the San Luis Drain remained unfinished, and the 12 evaporation ponds at Kesterson Reservoir functioned as the ultimate discharge terminus through 1986, when use of the reservoir and drain was ultimately discontinued following the ecological disaster at Kesterson, discussed below.[91]

As discussed above, the ultimate build-out of the San Luis drainage system terminated at Kesterson Reservoir, a roughly 1,283-acre complex of 12, roughly 100-acre evaporation and seepage ponds separated by earthen berms with a combined storage capacity of 4,330 acre-feet (**Figure 27**). Completed in 1971, Kesterson Reservoir was contained within the larger Kesterson National Wildlife Management Area, created via joint agreement in 1970 between Reclamation and the U.S. Fish and Wildlife Service (USFWS), which would manage the area as a wildlife refuge. Historically, the area contained within Kesterson had been used for cattle ranching and waterfowl hunting, a popular area among local duck clubs. With about half of the fall and winter marsh acreage comprised of seasonally flooded grasslands and other copious food sources, Kesterson was a key stopping point on the Pacific Flyway for migratory birds and other grazing animals. As a partial remediation for summer water scarcity, the Grasslands Water District, under contract with Reclamation, was to furnish several thousand acre-feet of water per year. At the same time, surface agricultural drainage water began flowing into the Kesterson Reservoir via the San Luis Drain in 1972—one year prior to the completion of construction of the reaches further south. Diluted with irrigation-quality water supplied by the Grasslands Water District, the discharge initially produced high-quality wetland habitat between 1972 and 1978, fostering breeding activities among various duck species that nested there in the spring. In 1975, Reclamation officially changed the status of Kesterson from a regulating reservoir to a terminal holding reservoir for storing and concentrating drainage water for release into the San Joaquin River during sufficiently high flows. Meanwhile, in

[91] Jackson and Paterson, "The Sacramento-San Joaquin Delta," 144; William Schiffman, "San Luis Project is Dwindling," Merced *Sun-Star* (October 29, 1973): 2; "Landowners Oppose San Luis Interceptor Drain as Proposed," Newman *Index* (December 14, 1972): 8.

compliance with the San Luis Act of 1960, Reclamation developed the WWD Drainage Collector System, comprised of a network of plastic drains lain six-to-eight feet below the ground surface, between 1976 and 1980. In 1978, for the first time, Reclamation began conveying subsurface irrigation drainage water to Kesterson Reservoir, and by 1981, virtually all the inflow that the SLD conveyed to Kesterson consisted of subsurface water, which contained higher concentrations of trace elements, saline, and other contaminants leached into the soil than surface drainage.[92]

For about a decade prior to the development of the San Luis drainage facilities, state and federal agencies had warned against reusing drainage water. As early as 1960, DWR had identified irrigated agricultural drainage as a key source of water quality degradation in the lower San Joaquin Valley, specifically regarding drainage waters in the Panoche Fan area of the WWD (located in the vicinity west of Firebaugh and Mendota) as "unusable for beneficial purposes" (**Figure 28**).[93] Four years later, DWR discovered selenium in water sampled from this area. As discussed below, selenium is the natural mineral trace element that later caused the ecological disaster at Kesterson Reservoir. In 1961, scientists with the U.S. Department of Agriculture reported on the high probability of selenium in alkali soils, such as those prevalent in the arid San Joaquin Valley. The USFWS warned Reclamation the following year about the risks of toxins bioaccumulating in various organisms exposed to agricultural drainage, as well as the potential harms posed to humans that consumed them. In 1963, the USFWS likewise warned that agricultural contaminants rendered irrigation drainage water unsuitable for wetlands habitat restoration. That same year, the agency further warned that impounded agricultural irrigation drainage water would likely contaminate groundwater, a warning reissued in 1977 by the California State Water Resources Control Board (SWRCB), which determined that the groundwater below Kesterson would ultimately be contaminated should the area continue to serve as the terminus of the San Luis Drain.[94]

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[92] Reclamation, "Designers' Operating Criteria: San Luis Drain," 7; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 212-213; S. M. Benson, M. Delamore, and S. Hoffman, "Kesterson Crisis: Sorting Out the Facts" (prepared for the U.S. Department of Energy under Contract Number DE-AC03-76SF00098, July 1990), 2; U.S. Department of the Interior, "Kesterson Reservoir Closure and Cleanup Plan: State Water Resources Control Board Order No. WQ 85-1 for Cleanup and Abatement of Kesterson Reservoir" (July 5, 1985), 2-3; Arnold Schultz, "Background and Recent History," in *Selenium and Agricultural Drainage: Implications for San Francisco Bay and the California Environment, Proceedings of the Second Selenium Symposium, March 23, 1985, Berkeley, California* (Berkeley, California: Bay Institute of San Francisco, 1986), 6.

[93] DWR, "Lower San Joaquin Valley Water Quality Investigation: Bulletin No. 89" (Sacramento: California Department of Water Resources, 1960), 95, qtd. in Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 215.

[94] H. W. Lakin, "Geochemistry of Selenium in Relation to Agriculture," in Selenium in Agriculture" (Washington, D.C.: U.S. Department of Agriculture, Agricultural Research Service, Agriculture Handbook No. 200, 1961), 12; S. B. Moore, "Fish and Wildlife Resources and Agricultural Drainage in the San Joaquin Valley, California: Vol. 1"

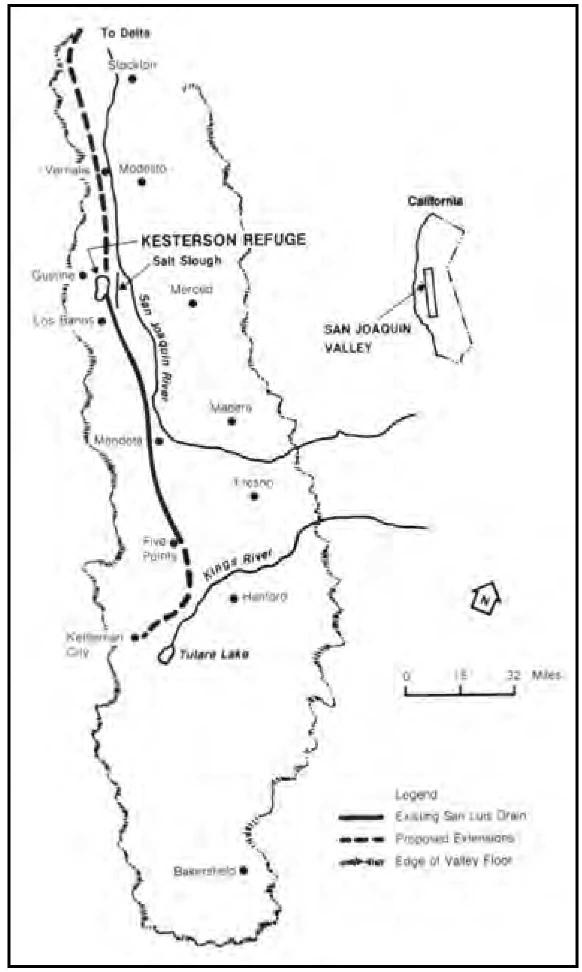

Figure 26: Location of the completed San Luis Drain, from Five Points to Kesterson Reservoir, with proposed segments at north and south ends, no date.[95]

(Sacramento: San Joaquin Valley Drainage Program, 1990), 3-6; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 215.

[95] U.S. Bureau of Reclamation, untitled map of San Luis Drain, no date, reprinted in Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 211.

Ecological Disaster at Kesterson Reservoir[96]

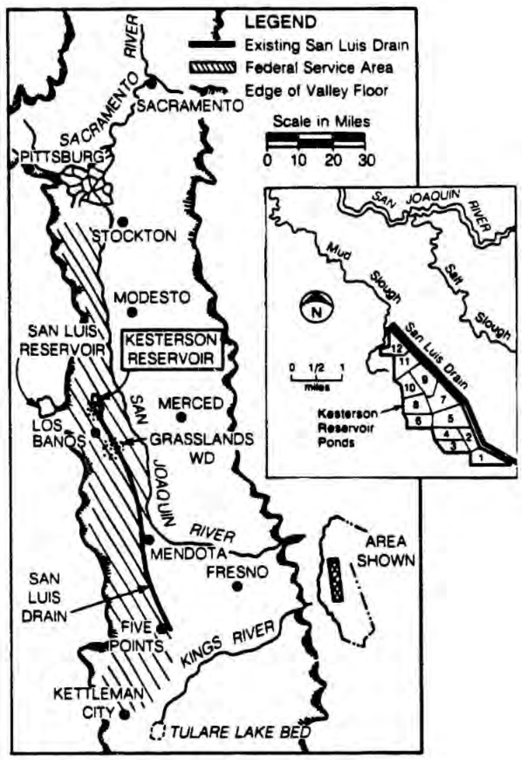

Figure 27: Location map of Kesterson Reservoir, Merced County, showing 12 evaporation ponds in inset, ca. 1990.[97]

[96] The following provides an overview of the ecological disaster at Kesterson Reservoir in the mid-1980s. For a detailed scholarly account, see: Philip Garone, "The Tragedy at Kesterson Reservoir: A Case Study in Environmental History and a Lesson in Ecological Complexity," *Environs* 22, no. 2 (Spring 1999): 107-144; and the expanded chapter, "Tragedy at Kesterson Reservoir" in Philip Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley* (Berkeley: University of California Press, 2011). For a journalistic account, see: Russell Clemings, *Mirage: The False Promise of Desert Agriculture* (San Francisco: Sierra Club Books, 1996); and Tom Harris, *Death in the Marsh* (Washington, D.C.: Island Press, 1991). Since the closure of the Kesterson Reservoir, Reclamation and recipients of CVP irrigation water in the western San Joaquin Valley have struggled with the issue of drainage up to the present. However, this study does not discuss this ongoing aspect of the history of the San Luis Drain. For more information on the evolution of Reclamation's drainage policies in the twenty-first century, see: Kathleen Nitta, "A Tale of Two Water Districts: The Future of Agriculture in California's San Joaquin Valley Lies in Compromise Over Drainage," *Golden Gate University Environmental Law Journal* 5, no. 2 (May 2012): 439-480; and Nigel W. T. Quinn, "Policy Innovation and Governance for Irrigation Sustainability in the Arid, Saline San Joaquin River Basin," *Sustainability* (2020), available at https://escholarship.org/uc/item/7dn0w5g2 (accessed July 2022).
[97] Benson, Delamore, and Hoffman, "Kesterson Crisis," 2.

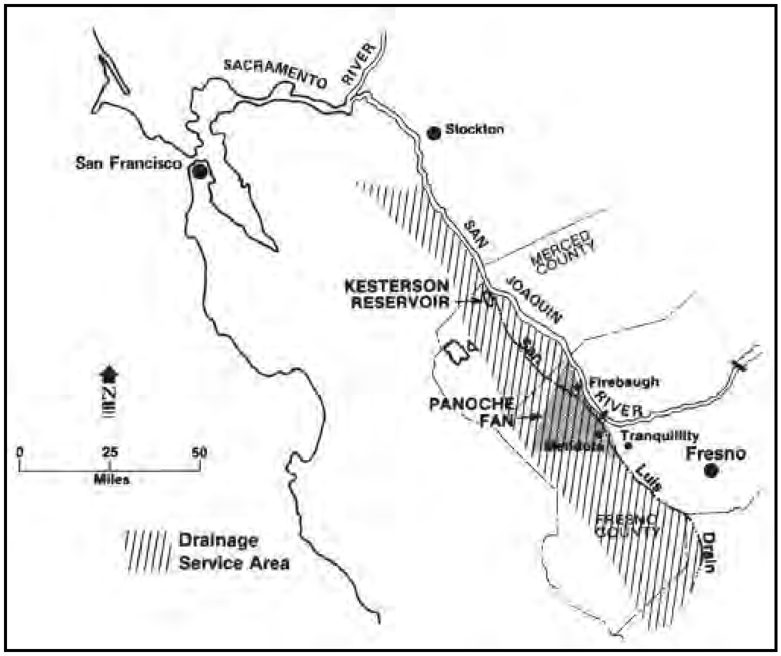

Figure 28: Map of San Luis drainage service area, showing Panoche Fan area—source of high quantities of selenium that contaminated Kesterson Reservoir.[98]

As various agencies had warned, discharging subsurface irrigation drainage via the SLD for indefinite storage in the wetland habitat at Kesterson had disastrous consequences. In 1982 following four years of receiving WWD wastewater in the SLD that was sent to Kesterson Reservoir, perennial cattails were dying off, algal blooms were present throughout the pond complex, the migratory bird population had decreased substantially, and all but one fish species—the mosquitofish—had completely died off. Scientists found the highest recorded selenium concentrations of any living fish among Kesterson mosquitofish. The following summer, USFWS biologists reported that roughly 10 percent of all nests among Kesterson's resident waterfowl breeding populations contained one or more chicks with various developmental deformities. Noting multiple similarities between these deformities and those reported among chicken populations in South Dakota raised on seleniferous soils in the 1930s, the USFWS issued a series of memoranda calling attention to the growing crisis at Kesterson and expressing concern over using agricultural wastewater for habitat management. Around this time, the USFWS closed the Kesterson wildlife refuge to the public and began a hazing program to ward off migrating waterfowl. The following year, scientists also found adult birds dead from selenium poisoning, with one final estimate of at least 1,000 migratory birds, including adults, chicks, and embryos having died of selenium toxicosis from bioaccumulation between 1983 and 1985; scientists have since come to refer to these symptoms of selenium poisoning as the "Kesterson Syndrome." In August 1983, U.S. Geological Survey (USGS) scientists conducted tests in the Kesterson collection ponds, the San Luis Drain, drainage

[98] U.S. Bureau of Reclamation, untitled map of San Luis drainage service area, no date, reprinted in Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 207.

effluents, and shallow groundwater, finding dangerous levels of selenium—140-1,400 micrograms per liter (µ/L), as opposed to that found in typical freshwater, 0.2-0.4 µ/L. Additional testing by the USGS found elevated levels of selenium throughout the WWD service area, from Los Banos to Kettleman City. In September, regional media picked up the Kesterson story and followed the unfolding saga for the next few years—the story even featured on CBS' *60 Minutes*, which fueled public outrage with graphic images of deformed birds and reports of bureaucratic negligence. In March 1984, adjoining landowners, discovering sick and deformed birds on their property, petitioned the Central Valley Regional Water Quality Control Board and ultimately, the SWRCB to take enforcement action against Reclamation.[99]

Compelled by state authorities, Reclamation finally addressed the crisis at Kesterson. Following two hearings in December 1984 and February 1985, and under the authority of the state Porter-Cologne Water Quality Control Act and the Toxic Pits Cleanup Act of 1984, the SWRCB issued Cleanup and Abatement Order No. WQ 85-1, which required the U.S. Department of Interior to resolve the problems at Kesterson and ordered Reclamation to submit a cleanup and abatement plan within five months. The following month, at a House Subcommittee on Water and Power Resources congressional hearing in Los Banos, the Department of Interior dramatically announced its decision to close Kesterson Reservoir and the San Luis Drain and to immediately cease all irrigation water deliveries to the WWD service area that drained into Kesterson for fear of violating the Migratory Bird Treaty Act. Shortly thereafter, Department of Interior amended this arrangement with WWD, which pledged to reduce the export of drainage wastewater by 20 percent every two months beginning in September 1985, plugging all subsurface drains by July 1986. In October 1986, Reclamation, in cooperation with the USFWS and the U.S. Army Corps of Engineers, submitted its environmental impact statement for the Kesterson cleanup project, which offered four solutions, ordered least to most expensive: a flexible response plan; an immobilization plan; a wetland restoration / onsite disposal plan; and an offsite disposal plan.[100] Reclamation proposed a phased approach, graduating from the flexible response plan to the onsite disposal plan as necessary. The SWRCB rejected the phased approach and ordered Reclamation to implement the onsite disposal plan, which called for the excavation, disposal, and replacement of the uppermost six-inch soil layer, including vegetation. However, subsequent studies showed that selenium had

[99] Michael K. Saiki, "Concentrations of Selenium in Aquatic Food Chain Organisms and Fish Exposed to Agricultural Tile Drainage Water," in *Selenium and Agricultural Drainage: Implications for San Francisco Bay and the California Environment, Proceedings of the Second Selenium Symposium, March 23, 1985, Berkeley, California* (Berkeley, California: Bay Institute of San Francisco, 1986), 6; Theresa S. Presser and Ivan Barnes, "Selenium Content in Waters Tributary to and in the Vicinity of Kesterson NWR" (Menlo Park, California: U.S. Geological Survey, 1984), 16; Deborah Blum, "Mineral is Linked to Bird Deformities," *The Fresno Bee* (September 21, 1983): 1; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 217-231.

[100] U.S. Bureau of Reclamation, "Final Environmental Impact Statement, Kesterson Program, Merced and Fresno Counties, California" (Sacramento: U.S. Department of the Interior, Bureau of Reclamation, 1986).

concentrated in shallow groundwater at comparable levels to the drainage ponds, indicating that their release into the wetland would render the ponds as toxic as before. Therefore, in July 1988 the SWRCB ordered Reclamation to fill all low-lying areas where ephemeral pools formed six inches above the expected seasonal groundwater level by January 1, 1989. By November 1988, Reclamation contractors had filled about 710 low-lying acres of the former reservoir with 1,050,437 cubic yards of imported earth, converting the former wetland to an upland habitat and attracting a variety of terrestrial bird species. By the early 1990s, selenium concentrations among plants and animals at Kesterson had stabilized.[101]

The Kesterson disaster fundamentally transformed scientific understanding of selenium-contaminated irrigation drainage, spurring advances in environmental research, wetlands preservation, and governmental policy. Prior to Kesterson, selenium contamination research was largely confined to problems at the individual farm scale, such as how the trace element contaminates crops and impairs livestock. However, following the demonstrated dangers of high selenium concentrations in irrigation drainage at Kesterson, environmental scientists better understood the problem to be an environmental protection issue at the watershed scale with major consequences for irrigation management throughout the western United States. California emerged (and remains) as a global center for selenium contamination research and environmental management. As early as 1985, government scientists began proactively testing for selenium concentrations throughout the Central Valley, with USFWS biologists detecting high rates of selenium poisoning among plants, insects, birds, and fish in the Tulare Basin. Around that same time, as part of the Department of Interior's National Irrigation Water Quality Program, scientists investigated all federal irrigation and drainage facilities for concentrated toxins, finding Kesterson-level rates of selenium toxicosis at five sites in the western United States. By the early 1990s, scientists had established firm links between human activity and high selenium concentrations, identifying sites of irrigated agriculture, mining, and fossil fuel refinement as areas of particular concern. Researchers likewise noted intensified rates of bioaccumulation and biomagnification in aquatic ecosystems, particularly wetland habitats like Kesterson, where selenite—one of the element's primary dissolved forms—was observed to readily concentrate in stagnant areas among various invertebrates and fish species before spreading up the food chain and throughout the ecosystem.[102]

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[101] Garone, "The Tragedy at Kesterson Reservoir," 122-123; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 229.

[102] Matteo Francesco Kausch, "From Soil Aggregate to Watershed, from California's Central Valley to the Salton Sea – Agricultural Selenium Contamination Across Ecosystems, Scales, and Disciplines" (PhD. diss., University of California, Berkeley, Spring 2013), 9-13; Arnold Schultz, "Highlights Since Selenium II," in *Selenium and Agricultural Drainage: Implications for San Francisco Bay and the California Environment, Proceedings of the Third*

In response to heightened awareness and a more refined understanding of aquatic selenium contamination, environmental managers in California and elsewhere developed new water quality regulations and environmental management strategies. In 1987, the U.S. Environmental Protection Agency (EPA) established new criteria for imposing maximum limits for selenium concentrations in freshwater and saltwater environments, based partly on observed laboratory results and partly on field studies—including those conducted at Kesterson Reservoir. These standards were made legally binding for 14 states, including California, with the promulgation of the 1992 Water Quality Standards. Noting excessive selenium concentrations in the area surrounding Kesterson, between 1988 and 1990 the California Legislature added 8,224 acres of grasslands watershed marshes, a section of the lower San Joaquin River downstream from subsurface drainage, Salt Slough, and Mud Slough to California's Clean Water Act section 303(d) list of impaired waters. In 1996, Reclamation and the San Luis & Delta-Mendota Water Authority developed the Grasslands Bypass Project to rectify this problem in accordance with total maximum daily load limits for selenium and best management practices introduced that same year by the Central Valley Regional Water Quality Control Board. The Grasslands Bypass Project incorporates the northernmost 28 miles of the San Luis Drain in Merced County to discharge drainage water into Mud Slough for release into the San Joaquin River. Discharges are closely and regularly monitored for selenium, salinity, boron, molybdenum and various nutrients by the USFWS, California EPA, the Central Valley Regional Water Quality Control Board, and California Department of Fish and Wildlife.[103] According to Reclamation, "Since the implementation of the [Grasslands Bypass Project], all discharges of drainage water from the Grassland Drainage Area into wetlands and refuges have been eliminated. The Project has reduced the load of selenium discharged from the Grassland Drainage Area by 61 percent (from 9,600 lbs. to 3,000 lbs.)."[104] Perhaps most importantly, the disaster at Kesterson illustrated an urgent ecological need to reform the CVP—which had historically served the interests of agribusinesses—to incorporate environmental stewardship among its mandates. In 1992, the U.S. Congress passed the Central Valley Project Improvement Act (CVPIA) into law, which mandated reform of the CVP to better

Selenium Symposium, March 15, 1986, Berkeley, California, ed. Alice Q. Howard (Berkeley, California: Bay Institute of San Francisco, 1989), 5, 7; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 231-235.

[103] Kausch, "From Soil Aggregate to Watershed, from California's Central Valley to the Salton Sea," 9-13; Garone, *The Fall and Rise of the Wetlands of California's Great Central Valley*, 231-235; U.S. Environmental Protection Agency, "Ambient Water Quality Criteria for Selenium – 1987" (EPA-440/5-87-006, September 1987), 25, available at https://www.epa.gov/sites/default/files/2019-03/documents/ambient-wqc-selenium-1987.pdf (accessed August 2022); U.S. EPA, "Section 319: Nonpoint Source Program Success Story – California Grasslands Bypass Project Reduces Selenium in the San Joaquin Basin" (September 2011), https://www.epa.gov/sites/default/files/2015-10/documents/ca_sanjoaquin.pdf (accessed August 2022).

[104] U.S. Bureau of Reclamation, "Grassland Bypass Project," July 29, 2020, https://www.usbr.gov/mp/grassland/ (accessed August 2022).

protect, restore, and enhance fish and wildlife habitat by placing environmental goals on par with irrigation and domestic water usage. Some environmental policy changes implemented under the Act include: the dedication of 800,000 acre-feet of water per year to fish and wildlife along with firm water commitments to Central Valley wildlife refuges; the restoration of anadromous fish populations; the establishment of a habitat restoration fund financed by water and power users; and the installation of mitigative technology at various sites, including temperature control devices and fish passage infrastructure. The Act also stipulates that the CVP would establish no new contracts until it had achieved its environmental goals. Since the passage of the CVPIA, Reclamation, in partnership with various federal, state, and local agencies, has implemented aquatic habitat improvement projects on the American, Stanislaus, Yuba, and Upper Sacramento rivers and Clear, Mill, and Deer creeks; provided annual water allotments and upgraded or built conveyance facilities to 19 federal, state, and private managed wetlands; and funded independent restoration programs on the San Joaquin and Trinity rivers through the habitat restoration fund.[105]

[105] U.S. Bureau of Reclamation, " Central Valley Project Improvement Act (CVPIA)," April 27, 2022, https://www.usbr.gov/mp/cvpia/ (accessed August 2022); U.S. Bureau of Reclamation, "Central Valley Project Improvement Act: Fact Sheet," October 2021, https://www.usbr.gov/mp/mpr-news/docs/factsheets/cvpia.pdf (accessed August 2022); U.S. Bureau of Reclamation, "CVP Habitat Restoration," February 2022, https://www.usbr.gov/mp/mpr-news/docs/factsheets/habitat-restoration.pdf (accessed August 2022); California Department of Fish and Wildlife, "Refuge Water Supply Program," n.d., https://wildlife.ca.gov/Conservation/Watersheds/Refuge-Water (accessed August 2022).

4. NRHP / CRHR Evaluation

4.1. Criteria for Evaluation

The eligibility criteria for designating historic properties under federal and state criteria are essentially the same. The criteria for listing properties in the National Register of Historic Places (NRHP) are codified in 36 CFR 60 and expanded upon in numerous guidelines published by the National Park Service. Buildings, structures, objects, sites, and districts listed in, eligible for listing in, or that appear eligible for listing in the NRHP are considered historic properties under the regulations for Section 106 of the National Historic Preservation Act (NHPA) (36 CFR Part 800). Eligibility for listing buildings, structures, objects, sites, and districts (i.e., historic properties) in the NRHP rests on twin factors of *historic significance* and *integrity*. A resource must have both significance and integrity to be considered eligible. Loss of integrity, if sufficiently great, will overwhelm the historic significance a property may possess and render it ineligible. Likewise, a property can have complete integrity, but if it lacks significance, it must also be considered ineligible. Historic significance is judged by applying the NRHP criteria, identified as Criteria A through D. The NRHP guidelines state that a historic property's "quality of significance in American history, architecture, archeology, engineering, and culture" must be determined by meeting at least one of the four main criteria. Properties may be significant at the local, state, or national level. The NRHP criteria are:

Criterion A: association with "events that have made a significant contribution to the broad patterns of our history;"

Criterion B: association with "the lives of persons significant in our past;"

Criterion C: resources "that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values;"

Criterion D: resources "that have yielded, or may be likely to yield, information important to history or prehistory."[106]

Integrity is determined through applying seven factors to the historic resource: location, setting, design, workmanship, materials, feeling, and association. These seven can be roughly grouped into three types of integrity considerations. Location and setting relate to the relationship between the property and its environment. Design, materials, and workmanship, as they apply to historic buildings, relate to construction methods and architectural /

[106] USDI, National Park Service, *Guidelines for Applying the National Register Criteria for Evaluation, National Register Bulletin 15* (Washington, D.C.: USDI, National Park Service, 1990, rev. 1997).

engineering details. Feeling and association are the least objective of the seven criteria and pertain to the overall ability of the property to convey a sense of the historical time and place in which it was constructed.

4.2. Central Valley Project Draft Multiple Property Listing

In 2009 Reclamation prepared a *Draft National Register of Historic Places Multiple Property Documentation Form: Central Valley Project* (CVP MPL); Reclamation updated the draft in 2018.[107] The CVP MPL identifies the period of significance for the CVP as 1935 when the project received its first authorizations to 1956 when the last of the major project components was completed. The document provides registration criteria regarding NRHP significance and integrity. The subsections of the registration requirements relied upon for this evaluation of Delta-Mendota Canal for individual eligibility for listing in the NRHP are the subsection for "Main Canals," and for "Appurtenant Canal Features," as quoted below. The NRHP and CRHR evaluation of Delta-Mendota Canal contained in this report utilizes the framework provided in the CVP MPL.

The following is excerpted from the CVP MPL:

Main Canals

Construction on the first main canal of the CVP, the Contra Costa Canal of the Delta Division, commenced in 1937 and was completed in 1948. In 1940, construction began on the Madera Canal of the Friant Division, with construction completed in 1945. In 1945, construction on the Friant-Kern Canal began. The following year, construction on Delta-Mendota Canal commenced. Finally, in 1950, construction on the Delta Cross Channel began. The Friant-Kern Canal, Delta-Mendota Canal, and Delta Cross Channel were all completed in 1951-1952. The longest main canal is the Friant-Kern Canal at 151.8 miles, while the shortest is the Delta Cross Channel at 1.2 miles. All main canals are located on Reclamation fee title or easement land.[108]

Significance

In conjunction with the storage and diversion dams, canals form the CVP's backbone. They provide the means to transfer, transport, and deliver water through the system and ultimately to the water users. Traversing across hundreds of miles, the canals form a significant feature of the physical landscape and define the geographical limits of the project. In keeping with the original CVP plan of large-scale water transfers, canals are the primary means behind the

[107] Jim Bailey, "National Register of Historic Places Multiple Property Documentation Form, Central Valley Project: Planning and Construction of the First Four Divisions, 1935-1956," draft prepared for Reclamation, 2009, updated 2018.

[108] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 106.

geographical redistribution of fresh water from the valley's wetter northern reaches to the drier southern stretches.[109]

Registration Requirements for CVP Canals

The period of significance for historic CVP water conveyance structures begins in 1937 with the initial construction of the first CVP canal, the Contra Costa Canal, and ends in 1951 with the completion of the Friant-Kern, Delta-Mendota, and Delta Cross Channel canals. Like the CVP's dams (Shasta, Friant, Folsom, Keswick, and Nimbus dams), these canals are part of the initial CVP authorizations. The main canals within the period of significance for this historic context are all considered individually eligible (if they retain sufficient historic integrity) because of their primary role in operating the CVP. The main canals can be individually eligible for the National Register under one or more of the criteria, as follows:[110]

Criterion A: They have had a significant impact on the settlement, agricultural economy, or development patterns of the project area; they have been defining elements in the evolution of the cultural landscape; they are directly associated with important events.

Criterion B: They are the result of the direct efforts of a prominent individual associated with the CVP and are the most prominent feature associated with that individual.

Criterion C: They represent the distinctive characteristics of Reclamation canal design and/or methods of construction used on the CVP; they involved challenging engineering design problems due to topography, grade, length, natural obstacles, and resulted in complex or innovative solutions; they are among the best or a rare surviving example of a distinctive type of water conveyance structure; they represent the evolving technology in the engineering, design, and construction of water conveyance structures; they were identified during the construction period as an individually significant feature; or they embody the work of a significant engineer or builder.

Criterion D: They have the ability to yield information important to understanding the history of the CVP.[111]

Integrity

The need for continual maintenance and repairs to canals requires special consideration of integrity. Irrigation systems are constantly evolving as features are upgraded, repaired, or replaced. Alterations made to canals during the period of significance, and even subsequent to

[109] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 106.
[110] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 107.
[111] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 108.

that may not nullify eligibility if a canal retains certain key qualities. Most important are integrity of location, association, and overall design configuration of the conveyance prism (i.e., depth and width) and water control features. A canal which has retained its original form and associated appurtenant features has a high degree of integrity. It is not uncommon for canal lining to be replaced, or for previously unlined segments to be lined. Such changes may not preclude a canal's eligibility if replacement features are in-kind, or they do not significantly damage the canal's historic association or its overall design. If in addition to integrity of association, location, and overall design, the historical setting and feeling of a canal are maintained, then the likelihood is even higher that an altered canal could remain eligible. On the other hand, if an entire canal is piped, it would no longer convey any of its original design, workmanship, materials, or historical association and would not be contributing. Conversely, partial piping of a significant canal may not preclude eligibility if a majority of a canal is still open and intact.[112]

Appurtenant Canal Features

Although appurtenant canal features are all operationally and thematically related to canals, each feature type serves a specific purpose. These features can be divided into five categories of structures: conveyance, regulating, protective, water measurement, and bridges. The first four of these types were built to function as part of the canal, while the bridges were built to function independently of the canal.[113]

1. *Conveyance Structures*

Conveyance structures are features such as inverted siphons, drops, chutes, flumes, tunnels, and pipelines that are used to safely transport water from one location to another traversing various existing natural and manmade topographic features along the way. There are two types of pipelines, those that carry water below ground and those that transport water above ground.[114]

2. *Regulating Structures*

Regulating structures are used to raise, lower, or control the release and volume of the water flow. Regulating structures that are located at the source of the water supply include headworks and turnouts. Headworks control the release of water into the canal and are often located downstream from a major diversion or storage facility. Regulating structures located along the course of a canal include turnouts, checks, check-drops, radial gates, reservoirs, and

[112] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 108-109.
[113] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 109.
[114] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 109.

diversion structures. The smaller regulating structures like checks and turnouts are basic components of an irrigation system.[115]

3. *Protective Structures*

Protective structures protect the canal system and adjacent property from damage which would result from uncontrolled storm runoff or drainage water, or an uncontrolled excess of flow within the canal. Several different types of structures perform this function, including overchutes, drainage inlets, siphon spillways, and wasteways.[116]

4. *Water Measurement Structures and Objects*

Water measurement structures are used to gauge water flow and ensure its equitable distribution. Many different types of water measurement structures are used in irrigation systems. The type most commonly used in Reclamation's systems are Parshall flumes, weirs, open-flow meters, and constant head orifices.[117]

5. *Miscellaneous Structures*

a. Bridges

Bridges crossing CVP canals include single lane bridges, multi-lane highway bridges, farm bridges, pedestrian bridges, and maintenance bridges. Most of the bridges constructed within the period of significance were built by Reclamation according to standard designs. Ownership of the bridges were turned over upon their completion to other entities, including city, county, or state transportation agencies. There are also many bridges not constructed by Reclamation that have been added over CVP canals and were built outside the period of significance for this historic context. Additionally, some original bridges built by Reclamation have been replaced.[118]

b. Gauging or Recording Stations

Several types of small structures were built in association with gauging or recording stations to measure canal flows. The most common are small circular plan, sheet metal structures called "tin whistles" or "silver bullets" that provide enclosure for recording devices. A second type of shelter is small reinforced concrete "houses." When gauging or recording stations are located over the canal, simple wooden footbridges with wood handrails were constructed to permit the taking of measurements. In some cases, the original bridges have been replaced with

[115] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 109-110.
[116] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 110.
[117] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 111.
[118] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 111.

concrete or metal ones, which are easier to maintain. Many of the gauging or recording structures are built on concrete pads, adjacent to the canal, on the canal berm.[119]

<u>Drains</u>

Drains are water conveyance structures (either open channels or buried pipes) that carry excess water away from irrigated agricultural fields to prevent rising water tables. A drain classification was instituted by Reclamation in 1920 that categorized drains into three classes according to their size and relative importance. Class I or "deep drains" are the largest and most significant, with Class III being the smallest and least significant.[120]

Significance Methodology

Secondary to the canals in distributing water are the thousands of appurtenant features. With the exception of bridges, these appurtenant features are important to the overall operation of the main canals, yet are too small in size and repetitive in design to merit individual eligibility.

Even though bridges cross canals and can be physically tied to the canal prism, bridges have no connection to the operation of the CVP and therefore merit separate evaluation from other appurtenant features. In addition, most of the bridges were either constructed by Reclamation and ownership was turned over to a different entity or they were constructed by a different entity. Because of these reasons, bridges would rarely be individually eligible for the National Register in association with this historic context.[121]

Registration Requirements

The period of significance for historic appurtenant canal features begins in 1937 with the initial construction of the first CVP canal, the Contra Costa Canal, and ends in 1951 with the completion of the Friant-Kern, Delta-Mendota, and Delta Cross Channel canals. CVP appurtenant canal features can be eligible for the National Register for the following reasons:[122]

<u>Criterion A:</u> They are directly associated with important events that occurred along canals;

<u>Criterion B:</u> not applicable;

<u>Criterion C:</u> They are among the best or a rare surviving example of a distinctive type of appurtenant canal feature; they represent the evolving technology in the design of appurtenant canal features; they represent a unique design solution developed in response to

[119] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 111.
[120] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 124.
[121] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 112.
[122]Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 112.

a difficult engineering challenge; they were identified during the construction period as an individually significant feature;

Criterion D: They have the ability to yield information important to understanding the history of the CVP.[123]

Integrity

As with canals, many appurtenant features are upgraded, altered, or even replaced over time due to the constant ongoing maintenance needs. Integrity of a structure's historic materials, workmanship and design is essential for National Register eligibility under any criterion. Because location is of primary importance under Criterion A, a structure will rarely qualify under this criterion if it does not remain on its historic site along its associated canal. Location can also have importance under Criterion C, but this association is less vital.[124]

4.3. Evaluation of Delta-Mendota Canal

Portions of Delta-Mendota Canal and some of its appurtenant features have been subject to previous NRHP evaluations. In 2009, Reclamation historian Jim Bailey prepared a draft NRHP nomination form that concluded that Delta-Mendota Canal meets NRHP Criterion A with a period of significance from 1946-1951. Bailey also evaluated Tracy Pumping Plant in 2009, concluding that it meets NRHP Criterion A and C with a period of significance of 1951. Other appurtenant features of the canal that have been previously evaluated are listed in **Table 4** below with the updated status codes provided by this evaluation.[125]

Table 4: Previously evaluated segments and appurtenant features of Delta-Mendota Canal.

Primary String	Resource Name	Status Code – Previous	Status Code – Updated by this evaluation	County
P-10-005165	Delta-Mendota Canal Bridge	3D	6Z	Fresno
P-10-006215	Sierra Avenue Bridge (42C0281); Sierra Avenue Bridge over Delta-Mendota Canal	3D	6Z	Fresno
P-10-006649	Bridge 42C0074; Nees Avenue Bridge over Delta-Mendota Canal	3D	6Z	Fresno

[123] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 112-113.
[124] Excerpted from Bailey, draft CVP MPL (2009, updated 2018), 113.
[125] California Historical Resource Status Codes.
2S2: Individual Property determined eligible determined eligible for NR by a consensus through Section 106 process. Listed in the CR.
3D: Appears eligible for NR as a contributor to a NR eligible district through survey evaluation.
3S: Appears eligible for NR as an individual property through survey evaluation.
6Z: Found ineligible for NR, CR, or Local designation through survey evaluation.

Primary String	Resource Name	Status Code – Previous	Status Code – Updated by this evaluation	County
P-24-001703	Delta Mendota Canal	2S2	2S2	Merced
P-24-001848	San Luis Wasteway (part of Delta-Mendota Canal)	2S2	2S2	Merced
P-39-000089	Delta Mendota Canal	3D	2S2	San Joaquin
P-50-001904	Delta Mendota Canal	2S2	2S2	Stanislaus
P-01-010442	Tracy Pumping Station (No. 11a)	3S	2S2	Alameda
P-07-002983	Tracy Fish Collection Facility	6Z	6Z	Contra Costa

The following presents the evaluation of Delta-Mendota Canal for individual eligibility for listing in the NRHP and CRHR under the theme presented in the draft CVP MPL.

Criteria A and 1

The CVP fundamentally altered California's landscape and economy by moving water over a long distance from basin to basin and providing more reliable irrigation water to regions previously prone to scarcity of both surface water and groundwater. Delta-Mendota Canal, an integral component of the Delta Division of the CVP, allowed continued delivery of water to irrigators on the San Joaquin River so that water could be diverted further south to areas with a lower water supply. While its benefits to agriculture cannot be overstated, Delta-Mendota Canal is also at the center of the controversy over replacing impounded and re-routed San Joaquin River water that no longer flows through historic salmon and steelhead spawning grounds.

Whether viewed as beneficial or harmful, Delta-Mendota Canal is an instrumental component in accomplishing the objective of the CVP, bringing irrigation water from the wetter northern state to the arid regions of the San Joaquin Valley. At 116 miles long, stretching from C.W. Bill Jones Pumping Plant (Tracy Pumping Plant) in the Delta to Mendota Pool on the San Joaquin River, Delta-Mendota Canal demonstrates the purpose of the CVP, and the scale of the transformation it generated. The canal has had a lasting legacy on California agriculture, providing a reliable water source to support immensely successful agricultural enterprises. Delta-Mendota Canal meets NRHP Criterion A and CRHR Criterion 1 at the state level because of its primary role in accomplishing the visionary goals of the CVP to transfer a substantial portion of the San Joaquin River water supply from its historical route to the arid lands of the southern San Joaquin Valley. Delivery of San Joaquin River water away from its historical water users was not a tenable proposition without the provision for replacement water delivered by Delta-Mendota Canal. The period of significance under these criteria is from the awarding of the first construction contract in 1946 to 1951 when water was first turned down the canal to provide a replacement supply of water.

Criteria B and 2

The CVP was the result of the efforts of many individuals and agencies over many years and no one person or group of people rises in the historical record as playing a direct role in its implementation in a way that would be best demonstrated by Delta-Mendota Canal; therefore, Delta-Mendota Canal is not individually eligible for listing in the NRHP under Criterion B or in the CRHR under Criterion 2.

Criteria C and 3

Delta-Mendota is individually eligible for listing in the NRHP and CRHR under Criterion C and Criterion 3 because its size, scale, and purpose demonstrate the magnitude of the CVP's engineering and construction accomplishment. The largesse of the vision required an outsized engineering effort and no other component part of the CVP better demonstrates the vision than Delta-Mendota Canal, designed to provide water to replace the flow of the San Joaquin River. Construction of any long-distance linear infrastructure requires extensive planning and engineering, large-scale construction, and coordination among jurisdictions and agencies. As one contemporary observer noted, the "quantity of earth moved is equivalent in mass to more than three times that of Grand Coulee Dam – world's largest concrete structure – and the quantity [*sic.*] of concrete placed for the 97-mi. concrete-lined portion of the canal is more than sufficient to build a sidewalk 3 ft. wide and 4in. thick between San Francisco and New York City."[126] The scale of the project and the sheer number of obstacles present along the 116-mile alignment made its design and construction a monumental undertaking. The canal's significance, however, is not tied to the engineering or construction of any of its individual components or appurtenant parts, but rather to its ability to demonstrate the scale of the project by the long-distance conveyance of water for the purpose of transferring water between watersheds. Delta-Mendota Canal is individually eligible at the state level under NRHP Criterion C and CRHR Criterion 3 because it demonstrates the visionary engineering achievement that redistributed the flows of major rivers between basins in California. The period of significance under these criteria is the period of construction of Delta-Mendota Canal, 1945-1951.

[126] "Concrete Lining Complete for Delta-Mendota Canal," *Western Construction* 25, n. 12 (Dec. 1950), 81.

Morrison-Knudsen Company, Inc., who won four construction contracts for Delta-Mendota Canal in partnership with M.H. Hasler Construction Company, built the largest share of the canal. Morrison-Knudsen should be considered a master builder for their large body of work and extensive experience with large infrastructural construction projects both in the United States and worldwide since the 1930s that included among other civil and military works, very large dam projects like Hoover Dam on the Colorado River. While construction of Delta-Mendota Canal was a large undertaking for the company, it does not best represent their body of work. They were most known during the pre- and post-World War II period for construction of military installations, bridges, and large dams. Delta-Mendota Canal would not best represent the work of any of the other contractors who won contracts for the canal because their contributions to the project were only to a small fraction of the overall project.

Delta-Mendota Canal also meets NRHP Criterion C and CRHR Criterion 3 because of its direct association with the contributions of renowned Reclamation engineer Oscar Boden who headed the investigation, planning, and siting of the Delta Division of the CVP, including Delta-Mendota Canal. Delta-Mendota Canal, a principal element of the CVP, is an historically important example of this master engineer's work. The period of significance for this canal is its period of construction, 1946-1951.

Criteria D and 4

Delta-Mendota Canal is not eligible under NRHP Criterion D or CRHR Criterion 4 for information potential because it was designed and built according to well-documented practices, and the project is well documented through drawings, textual records, and photographs.

4.3.1. Character-defining Features and Integrity of Delta-Mendota Canal

In general, the character-defining features of Delta-Mendota Canal are its location, its relationship to C.W. Bill Jones Pumping Plant (Tracy Pumping Plant), the size, shape, and dimensions of the canal prism, its lining material (approximately 95 miles of concrete and 18 earthen miles), and the direction of water flow from C.W. Bill Jones Pumping Plant downstream to Mendota Pool. Individual elements that contribute to the significance of Delta-Mendota Canal along its 116.4 miles are those structures that are directly related to its significance under NRHP Criterion A / CRHR Criterion 1 and NRHP Criterion C / CRHR Criterion 3, i.e., structures that directly relate to the conveyance of CVP water from the pumping plant to Mendota Pool. Structures like C.W. Bill Jones Pumping Plant, check structures and siphons that convey and control the water's southerly flow from the pumping plant, and structures like turnouts that direct the water to users along its route and wasteways the control excess flows all relate directly to the canal's significance and purpose and therefore contribute to the significance of the historic property. Structures that accommodate pre-existing uses or conditions like pipe crossings, siphon undercrossings, culverts, drains, overchutes, and most bridges do not contribute to the historic significance of this linear historic property because they are not directly related to the conveyance of CVP water, and instead serve ancillary purposes. Similarly, ancillary features like gauging stations or salinity stations do not relate to the historic significance and are not character defining. Operating bridges that are used specifically for the operation of the canal, as opposed to farm bridges or county road bridges that simply cross the canal and have no relationship to its functioning as a CVP water conveyance, have potential to contribute to Delta-Mendota Canal's significance; however, none of this category of bridges crossing Delta-Mendota Canal retain historic integrity. See **Table 2** below and **Appendix C** for contributing status of component elements of Delta-Mendota Canal.

Table 5: Contributing Status of Component Parts of Delta-Mendota Canal.

Structure Type	**Contributing Status**
Farm Bridges	Non-Contributing
Railroad Bridge	Non-Contributing
Pipe Crossings	Non-Contributing
County Highway Bridges	Non-Contributing
Overchutes	Non-Contributing
Inlet Drains	Non-Contributing
Road Drains	Non-Contributing
Culverts	Non-Contributing
Cattle Guards	Non-Contributing
Pumps	Non-Contributing
Ladders	Non-Contributing
Gauging Stations	Non-Contributing
Gates	Non-Contributing
Check Structures	All are Contributing
Siphons	All are Contributing
Wasteways	4 are Contributing, 1 is not – see Master Table in **App. D**
CVP Signs	All are Contributing
Lining / Prism	Lining to original specifications is Contributing
O&M Roads	Contributing (roads on canal embankments)
Operating Bridges	Non-contributing; integrity loss
Turnouts	Some are contributing – see Master Table in **App. D**
Pumping Plants	C.W. Bill Jones Pumping Plant is Contributing

The character-defining features and integrity of contributing elements are discussed below, followed by a discussion of the overall integrity of Delta-Mendota Canal. See **Appendix C** for the contributing status of individual components of the historic property.

<u>Canal Prism, Embankments, Maintenance Roads</u>

The character-defining features of Delta-Mendota Canal prism are its original material composition, and original design. Specifically, this includes: its concrete- and earth-lined construction; its original dimensions – height, width, and shape, side slopes, embankments, and O&M roads; and its alignment (**Figure 29**- **Figure 32**).

Those sections of Delta-Mendota Canal prism that have a high degree of integrity and, therefore, contribute to the significance of the historic property are those that retain all or most of their character-defining features. While some concrete-lined stretches of the canal have been altered by the raising of the lining, this modification only constitutes a minor loss of integrity of design, as the work included appropriate materials (concrete) and the elevated extensions were clearly differentiated from the original by a concrete seam above the original lining. As such, these alterations were made in accordance with standards set forth by the *Secretary of the Interior's Standards for the Treatment of Historic Properties* and do not disqualify those sections with raised concrete lining from contributing to the significance of Delta-Mendota Canal.[127] Similarly, those originally earth-lined sections that have been altered by the addition of rip-rap only suffer slightly diminished loss of integrity of designs or materials; however, the rip-rap itself is considered a non-contributing element.[128] While the majority of the surrounding setting remains rural in nature as it was at the time of Delta-Mendota Canal's period of significance, 1946-1951, suburban development radiating out from Mountain House, Tracy, and Patterson have started to alter the characteristic setting. The canal itself in these areas retains its other character-defining features and thus contributes to the significance of Delta-Mendota Canal as a whole. As Delta-Mendota Canal has remained in its original alignment, it retains a high degree of integrity of location throughout the entirety of its alignment.

[127] Kay D. Weeks and Anne E. Grimmer, *Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings*, revised by Anne E. Grimmer (Washington D.C.: USDI, National Park Service, Technical Preservation Services, 2017).

[128] The *Secretary of the Interior's Standards for the Treatment of Historic Properties* favor protecting historic properties with temporary materials while planning for repairs that meet the standards.

Figure 29: View of concrete-lined section of canal from approximately M.P. 91.36; camera facing upstream from left bank, June 14, 2022.

Figure 30: View of earth-lined section of canal from approximately M.P. 104.22; camera facing downstream from left bank, June 14, 2022.

Figure 31: View of embankment and concrete-lined section of canal; camera facing downstream from left bank, June 14, 2022.

Figure 32: View of embankment and maintenance road along earth-lined section; camera facing downstream from left bank, June 15, 2022.

C.W. Bill Jones Pumping Plant (Tracy Pumping Plant)

The Tracy Pumping Plant complex is made up of the Delta-Mendota Intake Canal (M.P. 0.0-2.52), the Tracy Pumping Plant facility (now called "C.W. Bill Jones Pumping Station") (M.P. 2.53), three (3) 15-foot (inside) diameter, 4,822-foot long concrete discharge pipes, a concrete-block siphon breaker house with a flat, overhanging roof at the end of the discharge lines (M.P. 3.49), and a concrete inlet structure that releases the water from the Plant into the concrete-lined section of the DMC, at M.P. 3.50. Each of these features is character defining of the Tracy Pumping Plant.

The Delta-Mendota Intake Canal contains fish collection facilities (M.P. 0.09) and a three-barrel siphon under Byron-Bethany Road and a single track for Union Pacific Railroad (formerly Southern Pacific Railroad) (M.P. 1.36/ M.P. 1.41). The character-defining features of the Intake Canal include: the fish collection facilities; the three-barrel siphon; and its loose-earth construction.

The Pumping Plant is a semi-outdoor facility. The building has a two-story rectangular plan, made of concrete, with a flat, parapet roof with inset handrails. The treatment of the concrete walls creates a rectangular pattern on the north, south, and east façades and the windows and doors of the north and south façades are symmetrically arranged and centered on their respective sides. The character-defining features of the Pumping Plant include: the aforementioned form and massing; concrete construction; the windows on the north façade; the accordion doors on the south façade; the inset handrails on the roof and north façade; the six circular, removable hatches on the roof; the six vertical-shaft pumping units symmetrically arranged in pairs within the three eastern sections of the building; and the inlet transition walls.

Figure 33: Tracy Pumping Plant; camera facing southwest, May 9, 2022.

Figure 34: Tracy Pumping Plant; camera facing east, May 9, 2022.

Siphons

The population of Delta-Mendota Canal siphons comprises 13 concrete structures (see **Appendix C** for a listing of all appurtenant DMC structures). Siphons are defined by their concrete construction, with sloped-to-vertical transitional wingwalls, concrete box inlets and outlets, and one-, two-, three, or four-barrel underground concrete channels that transport Delta-Mendota flows beneath waterways, railroads, highways, and an irrigation canal.

The Delta-Mendota Canal siphons retain historic integrity to their period of significance, 1946-1951, and therefore appear eligible for inclusion in the NRHP and CRHR as contributing features of Delta-Mendota Canal. In terms of integrity of design and setting, the Delta-Mendota Canal siphons all remain in their original locations—at the sites of waterways, roadways, railroad crossings, and an irrigation canal. These locations and settings appear largely unaltered. In terms of design, materials, and workmanship, research did not reveal that any substantial modifications have been made to any of the character-defining features of the siphons that would reduce their integrity. The siphons all retain their basic concrete construction, single- and multiple-barrel conveyance structure, and transitional wingwalls, and they all continue to transport Delta-Mendota Canal flows beneath major appurtenant crossings.

Figure 35: Three-barrel siphon inlet headwall at M.P. 13.67; camera facing downstream from left bank, May 10, 2022.

Figure 36: Four-barrel siphon outlet headwall at M.P. 16.34; camera facing upstream from left bank, May, 10, 2022.

Check Structures

The population of Delta-Mendota Canal check structures consists of 21 concrete structures composed of two types (see **Table 1** in DMC DPR 523 form in **Appendix B** for list of DMC check structures, and **Appendix C** for listing for all appurtenant DMC structures). Check structures are characterized by their predominately poured-in-place concrete construction, with sloped transitional wingwalls that contract and expand as Delta-Mendota Canal leads into and away from the check. All checks feature narrow equipment platforms with mechanical gate-hoisting equipment in metal encasements; the concrete platforms are framed with metal pipe railing and most have metal lampposts with umbrella shades. Concrete block check structure houses are later additions after the period of significance and are not character defining of the historic-era canal.

The character-defining features of the Delta-Mendota Canal check structure population retain historic integrity to their period of significance, 1946-1951, and therefore appear eligible for inclusion in the NRHP and CRHR as contributing features of Delta-Mendota Canal. In terms of integrity of design and setting, the Delta-Mendota Canal check structures all remain in their original locations in a setting characterized by adjacent San Joaquin Valley farmlands. Moreover, those check structures constructed near siphon inlets and wasteway turnouts retain their spatial relationships with other components of the canal. In terms of design, materials, and workmanship, research and field observations did not reveal that substantial modifications have been made to any of the character-defining features that would reduce the integrity of these structures. The later addition of the concrete block check houses does not constitute a loss of historic integrity because the structures are small and unobtrusive into the setting of the canal. Moreover, the historic-period population of Delta-Mendota Canal check structures continues to regulate Delta-Mendota Canal flows throughout the span of the canal.

Figure 37: Check No. 16 at M.P. 85.09; camera facing downstream from left bank, June 14, 2022.

Figure 38: Check No. 11 at M.P. 58.28; camera facing downstream from left bank, June 13, 2022.

Wasteways

Wasteways function as escape structures to protect the canal system by diverting water out of the canal and preventing it from overtopping the banks of the canal, minimize the damage resulting from a break in the canal, or by preventing additional damage from a washout or failure of the canal. This class of structures requires an accompanying waste channel from the canal to a point of discharge into a natural drainage channel. The wasteway channels are not in the APE for this project; however, the turnouts into the wasteways are integrated into Delta-Mendota Canal and are within the APE.

There are four primary wasteways and associated wasteway turnout structures along Delta-Mendota Canal and one overspill apron wasteway on the right bank of the canal (see **Appendix C** for a listing of all appurtenant DMC structures). Wasteways turnouts are defined by poured-in-place concrete construction, two rectangular gate sections, two equally sized radial gates, and narrow equipment platforms with mechanical gate-hoisting equipment in metal encasements. The size of the gates is dictated by the capacity of the canal at the turnout. The concrete platforms are framed with metal pipe railing and feature metal lampposts with umbrella shades, though some umbrella shades are missing.

The four wasteway channels – Westley, Newman, Volta, and Firebaugh – are defined by their locations, size and shape of the excavation, concrete and earth lining, and outfalls into the San

Joaquin River channel. Culverts and bridges along the wasteway are not directly related to the historical significance of Delta-Mendota Canal and are not character-defining features.

The Delta-Mendota Canal wasteway turnouts and turnout channels retain a good degree of historic integrity of design, materials, workmanship, setting, location, association, and feeling.

The character-defining features of the Delta-Mendota Canal wasteway turnouts and wasteway channels retain historic integrity to their period of significance, 1946-1951, and therefore are contributing features of Delta-Mendota Canal. In terms of integrity of design and setting, the Delta-Mendota Canal wasteways all remain in their original locations, the setting of which remains defined by adjacent San Joaquin Valley farmlands. Moreover, all wasteway turnouts retain their spatial relationships with other components of the canal, which include the canal lining, and the wasteway channels. In terms of design, materials, and workmanship, research and field observations did not reveal that any substantial modifications have been made to the character-defining features that would reduce the integrity of these structures. The population of Delta-Mendota Canal wasteways continues to function as it did historically to regulate Delta-Mendota Canal flows into natural waterways.

Figure 39: Radial gates at Firebaugh Wasteway's inlet structure; camera facing upstream from wasteway's right bank, June 14, 2022.

Figure 40: View of Newman Wasteway; camera facing upstream from right bank, June 13, 2022.

Turnouts

Turnouts function to deliver water into the local distribution systems of water users along the canal and those that have a high degree of integrity and, therefore, contribute to the significance of Delta-Mendota Canal are those that retain all or most of their character-defining features (**Figure 41**). Minor alterations to some of these turnouts such as conveyor-type debris screens across the channel openings, replacement gear mechanisms, and modern railing or fencing do not prevent the turnouts from conveying significance and they contribute to the canal's historical significance. Those turnouts added to the DMC after the initial period of construction that were designed in accordance with Reclamation's original design specifics and possess those character-defining features enumerated above may also be considered contributors to the DMC's significance. However, those turnouts that have been so heavily altered from their original design that they no longer have sufficient integrity to convey their significance are those that have had the original pedestal and geared hoist mechanism removed and replaced, or the concrete equipment decks raised or entirely replaced. These substantial alterations have diminished the integrity of design, materials, workmanship, and feeling to such a degree that these structures no longer convey the significance of the canal. Additionally, those turnouts that have been added that were designed divergently from Reclamation's original design specifications—such as steel-pipe turnouts and turnouts with automated electronic gate-hoisting equipment—are likewise not considered contributors to the DMC's significance (**Figure 42**).

The character-defining features of the turnouts are those materials, equipment, and design aspects that are part of the original construction of these structures, built according to the original design specifications. Specifically, this includes the concrete construction of the structure; shape and size of the water channels or barrels; metal grate debris screens over the openings; original gate hoisting mechanism; gates; concrete deck, railing, and steps; and the position of the turnout deck just above the canal lining.

Figure 41: Turnout at M.P. 45.35; camera facing downstream from left bank, May 12, 2022.

Figure 42: Two turnouts at M.P. 38.14; camera facing downstream from left bank, May 12, 2022.

Because the vast majority of the contributing elements of Delta-Mendota Canal retain historic integrity of the character-defining features, overall Delta-Mendota Canal retains integrity to its period of significance, 1946-1951, and is eligible for listing in the NRHP and CRHR under Criteria A / C and 1 / 3. The boundary of the historic property is from outside toe to outside toe from the inlet canal at M.P. 0.09 to the outlet at Mendota Pool at M.P. 116.61 because this encompasses all of the features of Delta-Mendota Canal that contribute to its significance.

4.4. Evaluation of San Luis Drain

The following evaluates two point-observations and one linear segment of the San Luis Drain together for individual eligibility for listing in the NRHP and CRHR under the themes and within the framework presented above. This evaluation concludes that the San Luis Drain is historically significant under NRHP / CRHR Criterion A / 1 at the national level for its important association with the ecological disaster at Kesterson Reservoir, an historically significant event that profoundly impacted subsequent governmental policies toward drainage and wildlife habitat management. While this evaluation concludes that the San Luis Drain meets NRHP and CRHR criteria, it does not conclude that the entire multi-component resource is eligible for listing in the NRHP and CRHR because assessing the integrity of any part of the San Luis Drain beyond the APE for the project is outside the scope of this project. This evaluation assesses the historic integrity of one linear segment and two point-observations of the San Luis Drain in and adjacent to the APE and concludes that they retain historic integrity to their period of significance, 1982-1988, and would be contributing elements of the overall San Luis drainage system if the entire linear resource is found to possess sufficient integrity to be listed.

Criteria A and 1

The San Luis Drain does not possess significance under these criteria for its involvement with the CVP. The San Luis Drain, an integral but short-lived component of the San Luis Unit of the CVP, returned subsurface irrigation drainage water from irrigation districts within the San Luis service area between 1972 and 1986. Following decades of lobbying by agricultural interests in the region, Reclamation was authorized in 1960 to deliver irrigation water to the western San Joaquin Valley with the formation of the San Luis Unit, a first in federal-state joint-use facilities. In addition to rallying support for supplementing their depleted groundwater sources with CVP surface water, local irrigators also lobbied for the addition of critical drainage facilities, as the rising groundwater table of highly saline subsurface irrigation wastewater threatened to drown crops and sterilize thousands of acres of valuable agricultural lands. During planning, the San Luis Drain sparked controversy among residents in the San Francisco Bay Area and Sacramento-San Joaquin Delta, where the drain was originally planned to discharge near Antioch in Contra Costa County. Following years of negotiations and federal budgetary constraints, the San Luis Drain was ultimately built out to about half of its intended length, roughly 88 miles, and rather than discharging into the Delta, irrigation wastewater containing high levels of toxic selenium was instead pooled in a complex of evaporation ponds at Kesterson Reservoir near Gustine in Merced County. Following high rates of deformity and death among migratory and nesting waterfowl and other wetland species at Kesterson (discussed below), Reclamation discontinued use of the San Luis Drain and reservoir. The San Luis Drain failed to meet the drainage needs of the San Luis service area, was effectively retired, and is thus not eligible for listing in the NRHP or CRHR under these criteria for its involvement with the CVP.

However, under these same criteria, the San Luis Drain possesses significance for its important association with the ecological disaster at Kesterson Reservoir in the early to mid-1980s and the associated subsequent advances in environmental research / wetlands preservation, along with shifts in governmental reclamation policies and the broadening of CVP's attention to encompass ecological issues that went well beyond its previous focus centered on the interests of agribusiness in the western San Joaquin Valley. According to *National Park Service National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, properties like San Luis Drain, the significant associations of which have occurred within a period of less than 50 years ago, must also meet Criteria Consideration G. To meet Criteria Consideration G, the property needs to show that its associations within the last 50 years are of "exceptional importance."[129] The San Luis Drain appears to meet this high threshold, and sufficient historical perspective exists to demonstrate this significance. In the early 1980s, USFWS scientists began to discover high rates of embryonic and infant deformity and adult mortality among various plant, fish, and waterfowl species at Kesterson Reservoir, which they soon traced to toxic exposure to selenium, and as the tragedy unfolded, ultimately culminating in the retirement of the San Luis drainage system in 1986, the ecological crisis at Kesterson Reservoir garnered national attention. The disaster was dubbed an "avian holocaust," and it illustrated the extreme environmental risks posed by selenium-contaminated irrigation drainage, reframing the problem from an individual farm-scale issue to a watershed-level environmental protection crisis.[130] California emerged as a global center for selenium-contamination research and environmental management during this period, with scientists establishing firm links between human activity and sites of selenium concentration. In response, environmental managers at the federal, state, and regional levels instituted a growing body of water quality regulations that established maximum daily load limits for selenium among discharges of agricultural drainage, as illustrated by the Grasslands Bypass Project—a joint-state federal drainage program that monitors drainage for trace elements in the Central Valley Grasslands. Perhaps most importantly, the disaster at Kesterson dramatically illustrated the ecological burden that decades of unrestrained and federally subsidized agriculture had placed on the region, leading reformers to fundamentally transform the CVP—which had historically served the interests of agribusinesses—to incorporate environmental stewardship among its mandates. In 1992, the Central Valley Project Improvement Act (CVPIA) was passed into law, which, for the first time, placed wildlife habitat management on equal footing with the agricultural and industrial goals of the CVP. Since the passage of the CVPIA, Reclamation and its federal, state, and local partner agencies have implemented habitat improvement projects on the American, Stanislaus, Yuba, and Sacramento rivers and delivered CVP water to federal, state, and private managed wetlands throughout the state. Most importantly, it has ceased all drainage discharges into wildlife refuges.

As the structural vehicle for delivering selenium-contaminated subsurface irrigation drainage water to Kesterson Reservoir, the San Luis Drain possesses strong and meaningful associations with the Kesterson disaster, an environmental calamity of exceptional historical significance for the critical role it played in transforming governmental policy. Thus, the two point-observations and one linear segment of the San Luis Drain recorded on this form contribute to its significance under these criteria. The period of significance under these criteria dates from

[129] National Park Service, *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, 1990, rev. 1995, 41, 43.
[130] Harold E. Thomas, "Ode to the San Luis Drain," *Groundwater* 24, no. 1 (January 1986): 79.

1982, when USFWS scientists first detected selenium toxicosis among various plant and animal species at Kesterson, and 1988, when the U.S. Department of Interior—having discontinued use of the San Luis drainage facilities—remediated the selenium contamination problem at Kesterson by dewatering and infilling the evaporation ponds.

Criteria B and 2

The CVP was the result of the efforts of many individuals and agencies over many years and no one person or group of people rises in the historical record as playing a direct role in its implementation in a way that would be best demonstrated by San Luis Drain; therefore, San Luis Drain is not individually eligible for listing in the NRHP under Criterion B or in the CRHR under Criterion 2.

Criteria C and 3

San Luis Drain does not possess individual eligibility for listing in the NRHP and CRHR under Criterion C or Criterion 3. While the San Luis Drain is a rare structural type (interceptor drain) within the CVP, construction of the structure was ultimately not completed to its full schematics, and it failed to adequately remedy the regional drainage problem (which persists to the present). Originally planned to span 188 miles between Kettleman City in Kings County to a discharge point near Antioch in Contra Costa County, construction on the San Luis Drain was impeded by political opposition and budgetary constraints, and it was ultimately built out to 88 miles—less than half the intended span—from a point near Five Points in Fresno County to the Kesterson Reservoir outside of Gustine in Merced County. The structure is a largely non-operational concrete-lined trapezoidal channel with numerous appurtenant structures—such as checks, siphons, and crossings. The San Luis Drain was designed and built to receive and convey subsurface drainage water from regionally distributed drainage collector systems that were operated by irrigation districts, which in turn collected drainage from underground pipe networks lain on private farms. The San Luis drainage system has largely been retired as designed. It not only was not built out to its full extent, but it also did not meet its the drainage objectives, and thus does not possess significance for its engineering.

Under these same criteria, the San Luis Drain is likewise not significant for its construction methodology. Reclamation had employed large industrial trimmers for canal excavation for decades prior to the construction of the drain recorded on this form. During construction of Delta-Mendota Canal in particular, contractors navigated the same issues relating to the regional groundwater table elevated above the canal trench. While construction on the San Luis Drain innovated upon and in many ways streamlined earlier methods, this effort did not introduce fundamentally new technologies or methodologies. Therefore, the drain recorded on this form does not possess individual significance in this regard.

Also considered under these criteria, San Luis Drain does not represent the important work of a master engineer or builder. Lead project engineer for San Luis Drain, Edward J. Brannan joined Reclamation in 1937 as a transitman on the Columbia Basin Project before he was promoted to construction engineer on the Spokane Valley Project in Washington in 1965 and ultimately the San Luis Drain in the late 1960s and early 1970s. Brannan does not appear to have developed new designs but rather follow the standardized designs drafted earlier by Reclamation engineer Harry Raymond McBirney.[131] Additionally, Gordon H. Ball, Inc., and Ball, Ball & Brosamer, who collectively won three construction contracts for San Luis Drain comprising nearly 80 percent of the extant structure (69.51 miles) in addition to Kesterson Reservoir, were the companies responsible for the largest share of the drain's construction. While they were prolific contractors, there is insufficient evidence to support Gordon H. Ball and Ball, and Ball & Brosamer, as master builders. Moreover, both firms appear to have specialized in heavy highway construction, not canal building. While construction of San Luis Drain was a large undertaking for the companies, it does not best represent their body of work. They were most known during the 1960s and 1970s for construction of highways, runways, and general concrete work. San Luis Drain would not best represent the work of any of the other contractors who won contracts for San Luis Drain because their contributions to the project were only to a small fraction of the overall project. For these reasons, the drain recorded on this form is not individually eligible for listing in the NRHP or CRHR under these criteria.

Criteria D and 4

San Luis Drain is not eligible under NRHP Criterion D or CRHR Criterion 4 for information potential because it was designed and built according to well-documented practices, and the project is well documented through drawings, textual records, and photographs.

4.4.1. Character-defining Features, Integrity, and Boundary of San Luis Drain

In general, the character-defining features of the recorded segment of the San Luis Drain are its alignment, the size, shape, and dimensions of the canal prism, and its concrete lining material. Individual elements within the study area that contribute to the significance of San Luis Drain along the approximately five-mile recorded segment are those structures that are directly related to its significance under NRHP Criterion A / CRHR Criterion 1, i.e. structures that directly relate to the conveyance of subsurface irrigation drainage water from the southern terminus in Fresno County north to Kesterson in Merced County. Structures like check structures and siphons that convey and control the water's northerly flow all related directly to the drain's significance and purpose and therefore contribute to the significance of the historic property. Structures in the study area that accommodate pre-existing uses like the

[131] "Water Project Post is Filled," *Spokane Daily Chronicle* (February 16, 1965): 3.

Drain U-121.2 undercrossing and trapezoidal road crossing do not contribute to the historical significance of this linear historic property because they are not directly related to the conveyance of subsurface irrigation wastewater, and instead serve ancillary purposes.

The recorded segment of the San Luis Drain along with its contributing structures all retain historic integrity to their period of significance, 1982-1988, and would contribute to the overall resource if the San Luis Drain possesses sufficient integrity throughout its span. In terms of design and setting, the recorded segment of the San Luis Drain remains in its original location, the setting of which remains defined by flat rural farmland. In terms of design, materials, and workmanship, research did not reveal that any substantial modifications have been made to any of the character-defining features that would reduce the integrity of this segment of the study property. While it is unclear when some inlets were added to the structure, these additions are comparably minor and do not detract from the overall feeling of the resource. The recorded drain segment suffers diminished integrity of association because it is no longer operational.

The boundaries of the San Luis Drain are the channel's right-of-way, encompassing the canal prism and two flanking embankments, between the southern terminus—a point near Five Points in Fresno County—and the northern terminus at the former Kesterson Reservoir.

4.5. Summary evaluation of ineligible built environment resources

In addition to Delta-Mendota Canal and San Luis Drain, this report evaluated three other built environment resources within the APE and concluded that none met any of the NRHP or CRHR significance criteria. These properties consist of two rural residential properties on Lammers Road (APN 251-050-120 and 240-140-260) in San Joaquin County and a drainage canal that is part of Firebaugh Canal Water District in Fresno County.

5. FINDING OF EFFECT

Under Section 106 of the NHPA, Reclamation is required to consider the effects of the proposed project on historic properties. Delta-Mendota CanalAn adverse effect, as defined in 36 CFR Part 800.5(a)(1), is found "when an undertaking may alter, directly or indirectly, any characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association."

The historic properties in the APE are Delta-Mendota Canal, San Luis Drain, San Joaquin Pipelines of the Hetch Hetchy Aqueduct, Santa Fe Grade, and Outside Canal. This section presents information regarding the criteria of adverse effects followed by analysis of project impacts to each of the historic properties.

5.1. Criteria of Adverse Effects

The NHPA Section 106 regulations state that if there are historic properties in the APE that may be affected by a federal undertaking, the agency official shall assess adverse effects, if any, in accordance with the Criteria of Adverse Effects defined in 36 CFR Part 800.5. These regulations state an "adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association." Application of the Criteria of Adverse Effects assesses how an undertaking will affect those features of a historic property that contribute to its eligibility for listing in the NRHP. Effects can be direct, indirect, and cumulative. Direct effects include physical destruction or damage, the introduction of visual, auditory, or vibration impacts as well as neglect to a historic property. Indirect effects are reasonably foreseeable effects caused by the undertaking that may occur at a future date or be farther removed in distance. Cumulative effects are the impacts of a project taken into account with known past or present projects, as well as foreseeable future, projects.

The following are examples of adverse effects listed in 36 CFR Part 800.5(a)(2):

i. Physical destruction of or damage to all or part of the property;

ii. Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation, and provision of handicapped access, that is not consistent with the Secretary of the Interior's (SOI) standards for the treatment of historic properties (36 CFR Part 68) and applicable guidelines;

iii. Removal of the property from its historic location;

iv. Change of the character of the property's use or of physical features within the property's setting that contributes to its historic significance;

v. Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;

vi. Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and

vii. Transfer, lease, or sale of property out of federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

The *Secretary of the Interior's Standards for the Treatment of Historic Properties* (SOI Standards) provides guidance on the preservation and protection for cultural resources listed in or eligible for listing in the National Register of Historic Places. Four types of treatments – Preservation, Rehabilitation, Restoration, and Reconstruction – comprise the SOI Standards. Rehabilitation would be the most relevant treatment to apply to this project because the treatment type emphasizes repairing a historic structure while preserving its character-defining features.

The SOI Standards for Rehabilitation are:

1. A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces, and spatial relationships.

2. The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces, and spatial relationships that characterize a property will be avoided.

3. Each property will be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.

4. Changes to a property that have acquired historic significance in their own right will be retained and preserved.

5. Distinctive materials, features, finishes, and construction techniques or examples of craftsmanship that characterize a property will be preserved.

6. Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture, and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.

7. Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

8. Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

9. New additions, exterior alterations, or related new construction will not destroy historic materials, features, and spatial relationships that characterize the property. The new work shall be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.

10. New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

5.2. Application of Adverse Effects

The Delta-Mendota Canal Subsidence Correction Project would adversely affect Delta-Mendota Canal, but would not adversely affect the other historic properties in the APE. This conclusion is the same for both Alternative 1 and Alternative 2. Overall, the project would cause an adverse effect; however there are aspects of the project that meet SOI Standards.

The following analyzes the potential adverse effects caused by the proposed project actions under Alternative 1 and Alternative 2.

5.2.1. Alternative 1

Delta-Mendota Canal

Alternative 1 would adversely affect Delta-Mendota Canal through physical destruction of components of the historic property, as well as through alteration of the historic property in a manner that is inconsistent with the SOI Standards. Characteristics of the historic property that qualifies it for inclusion in the NRHP would be altered such that its integrity of design, materials, workmanship, feeling, and association would be diminished, impacting Delta-Mendota Canal's ability to convey its significance.

Alternative 1 would not cause the removal of Delta-Mendota Canal from its historic location and thus it would retain integrity of location. It would not change the character of Delta-Mendota Canal's use or physical features within the its setting that contributes to its historic significance, and thus Delta-Mendota Canal would retain integrity of setting. The alternative would also not introduce visual, atmospheric, or audible elements that diminish Delta-Mendota Canal's historic integrity, nor would it lead to negelect of Delta-Mendota Canal that would cause it to deteriorate. Furthermore, the alternative would not lead to the transfer, lease, or sale of property out of federal ownership or control. Under the SOI Standards for Rehabilitation, Delta-Mendota Canal would continue to be used as it has been historically, no features would be added that could create a false sense of history, and no chemical treatments are planned that would cause damage to historic materials.

Alternative 1 would impact the following character-defining features of Delta-Mendota Canal: canal prism, lining, embankments, maintenance roads, turnouts, and wasteway gates.

Raising the concrete lining along 86 miles of the canal would be an alteration of the historic property that is consistent with SOI Standards because the raise would be materially appropriate – concrete – placed at the slope ratio called for in the original specifications. The new concrete would be differentiated from the prior concrete raises with a horizontally placed seal. Additionally, the lining raise would rehabilitate the capacity of the canal to its original design specifications.

Raising the earth embankment at deficient bank segments along approximately 70 miles of the canal would be an alteration of the historic property that is consistent with SOI Standards because it would use fill materially from nearby borrow areas that is consistent with the original material construction, it would not substantially alter the shape or cross section of the embankment and would rehabilitate the embankment to support the lining raise which would restore the original capacity of the canal.

Installing an asphalt chip seal to the left bank maintenance road would be a minor material alteration from the existing compacted gravel road surface that would not alter the character of the historic property.

Stabilizing the earth-lined 18 miles of the canal by lowering the water depth and excavating two-foot deep sections of earthen material would alter the character-defining dimensions of the canal prism in a manner that is not consistent with SOI Standards. This proposed action would alter the original design dimensions and would be a demolition of the compacted earth lining of this segment of the canal.

Repairing distressed concrete lining at eight locations by removing damaged lining would be a material demolition of character-defining features of the canal and as such would cause integrity loss of design and original materials.

The proposed modifications to 17 of the check structures by raising gates and applying FRP wrap would be an alteration that does not meet the SOI Standards. Project design does not yet include detailed description or drawings of the gate raise; however, alteration of the gates would cause an historic loss of integrity of design and materials. Replacement of the hoist systems would cause a material loss of historic integrity.

Like the check structures, project design for wasteway turnout gates is not complete; however, raising the structures would be an alteration that does not meet the SOI Standards. This action would cause a loss of historic integrity of design and materials. Replacement of the hoist systems would cause a material loss of historic integrity.

The project description indicates that 82 turnouts along the left bank of Delta-Mendota Canal would require raising, presumably within the 86 miles that would be subject to raising the concrete lining. The project description does not indicate which turnouts would be subject to this modification; some of the 97 turnouts identified in **Appendix C** that are on the left bank within these segments may not be subject to modification. Those that would be modified would presumably suffer a loss of historic integrity of design and materials by demotion of material and loss of historic integrity of design.

San Luis Drain

Alternative 1 does not propose any actions that have potential to impact the portion of San Luis Drain within the APE. The project does not propose to make any alterations to the siphon that carries San Luis Drain across Delta-Mendota Canal.

San Joaquin Pipelines, Hetch Hetchy Aqueduct

Delta-Mendota Canal is siphoned under the San Joaquin Pipelines. Alternative 1 does not propose any alterations to any of the Delta-Mendota Canal siphons, therefore, the project would not impact this historic property. There are no proposed project actions that would materially alter this historic property.

Santa Fe Grade

Alternative 1 does not propose any actions that have potential to impact the short segment of Santa Fe Grade witin the APE. The grade is located outside of the Delta-Mendota Canal embankment and would not be impacted by modifications made to the embankemnt.

Outside Canal

Delta-Mendota Canal is siphoned under the Outide Canal. Alternative 1 does not propose any alterations to any of the Delta-Mendota Canal siphons, therefore, the project would not impact this historic property. There are no proposed project actions that would materially alter this historic property.

5.2.2. Alternative 2

Delta-Mendota Canal

Like Alternative 1, Alternative 2 would adversely affect Delta-Mendota Canal through physical destruction of components of the historic property, as well as through alteration of the historic property in a manner that is inconsistent with the SOI Standards. Characteristics of the historic property that qualifies it for inclusion in the NRHP would be altered such that its integrity of design, materials, workmanship, feeling, and association would be diminished, impacting Delta-Mendota Canal's ability to convey its significance.

This alternative would not cause the removal of Delta-Mendota Canal from its historic location and thus it would retain integrity of location. It would not change the character of Delta-Mendota Canal's use or physical features within the its setting that contributes to its historic significance, and thus Delta-Mendota Canal would retain integrity of setting. The alternative would also not introduce visual, atmospheric, or audible elements that diminish Delta-Mendota Canal's historic integrity, nor would it lead to negelect of Delta-Mendota Canal that would cause it to deteriorate. Furthermore, the alternative would not lead to the transfer, lease, or sale of property out of federal ownership or control. Under the SOI Standards for Rehabilitation, Delta-Mendota Canal would continue to be used as it has been historically, no features would be added that could create a false sense of history, and no chemical treatments are planned that would cause damage to historic materials.

Alternative 2 proposes many of the same actions as Alternative 1; however, this alternative reduces the concrete lining raise to 73 miles and the embankment raise to 56 miles. This alternative proposes more alterations to the earth-lined segment of Delta-Mendota Canal.

Alternative 2 of the proposed project would impact the following character-defining features of Delta-Mendota Canal: canal prism, lining, embankments, maintenance roads, turnouts, and wasteway gates.

Raising the concrete lining along 73 miles of the canal would be an alteration of the historic property that is consistent with SOI Standards because the raise would be materially appropriate – concrete – placed at the slope ratio called for in the original specifications. The new concrete would be differentiated from the prior concrete raises with a horizontally placed seal. Additionally, the lining raise would rehabilitate the capacity of the canal to its original design specifications.

Raising the earth embankment at deficient bank segments along approximately 56 miles of the canal would be an alteration of the historic property that is consistent with SOI Standards because it would use fill materially from nearby borrow areas that is consistent with the original material construction, it would not substantially alter the shape or cross section of the embankment and would rehabilitate the embankment to support the lining raise which would restore the original capacity of the canal.

Modifying the earth-lined 18 miles of the canal by lowering the water depth, excavating two-foot deep sections, and placing a geocomposite liner at the bottom of the canal would materially demolish the earth lining of the canal and alter the original design and materials of this segment of the canal. This proposed action would cause a loss of historic integrity of materials and design in a manner that is not consistent with SOI Standards. This proposed action would alter the original design dimensions and would be a demolition of the compacted earth lining of this segment of the canal.

Repairing distressed concrete lining at three locations by removing damaged lining would be a material demolition of character-defining features of the canal and as such would cause integrity loss of design and original materials.

The proposed modifications to 17 of the check structures by raising gates and applying FRP wrap would be an alteration that does not meet the SOI Standards. Project design does not yet include detailed description or drawings of the gate raise; however, alteration of the gates would cause an historic loss of integrity of design and materials. Replacement of the hoist systems would cause a material loss of historic integrity.

Like the check structures, project design for wasteway turnout gates is not complete; however, raising the structures would be an alteration that does not meet the SOI Standards. This action would cause a loss of historic integrity of design and materials. Replacement of the hoist systems would cause a material loss of historic integrity.

The project description indicates that 82 turnouts along the left bank of Delta-Mendota Canal would require raising, presumably within the 86 miles that would be subject to raising the concrete lining. The project description does not indicate which turnouts would be subject to this modification; some of the 97 turnouts identified in **Appendix C** that are on the left bank within these segments may not be subject to modification. Those that would be modified would presumably suffer a loss of historic integrity of design and materials by demotion of material and loss of historic integrity of design.

San Luis Drain

Alternative 2 does not propose any actions that have potential to impact the portion of San Luis Drain within the APE. The project does not propose to make any alterations to the siphon that carries San Luis Drain across Delta-Mendota Canal.

San Joaquin Pipelines, Hetch Hetchy Aqueduct

Delta-Mendota Canal is siphoned under the San Joaquin Pipelines. Alternative 2 does not propose any alterations to any of the Delta-Mendota Canal siphons, therefore, the project would not impact this historic property. There are no proposed project actions that would materially alter this historic property.

Santa Fe Grade

Alternative 2 does not propose any actions that have potential to impact the short segment of Santa Fe Grade witin the APE. The grade is located outside of the Delta-Mendota Canal embankment and would not be impacted by modifications made to the embankemnt.

Outside Canal

Delta-Mendota Canal is siphoned under the Outide Canal. Alternative 2 does not propose any alterations to any of the Delta-Mendota Canal siphons, therefore, the project would not impact this historic property. There are no proposed project actions that would materially alter this historic property.

6. Preparers' Qualifications

Christopher D. McMorris and Heather K. Norby of JRP Historical Consulting, LLC, prepared this report. Mr. McMorris is a Principal and Architectural Historian at JRP. He holds a M.S. in Historic Preservation from Columbia University in New York. He has more than 24 years of experience conducting a wide variety of historical research and cultural resource management projects. He served as the project manager for this project, coordinating with CDM Smith, Reclamation, and the Authority, directing the JRP team, and editing this report and its components. Ms. Norby is a Senior Historian / Architectural Historian. She holds an M.A. in History from the University of California, Berkeley and has more than 14 years of experience in the field. Ms. Norby conducted fieldwork and research, and is the lead author of this report. She has contributed to numerous technical reports and architectural survey and evaluation projects related to architectural and engineering works including large dams, hydroelectric power plants, and Reclamation's Friant-Kern Canal. Senior Historian / Architectural Historian Steven J. "Mel" Melvin also assistant with review of the DPR 523 forms prepared for this project. Mr. McMorris, Ms. Norby, and Mr. Melvin meet the US Secretary of the Interior's Professional Qualification Standards under History and Architectural History.

Research Assistant Abigail E. Lawton assisted with the DPR 523 forms, fieldwork, and research. Ms. Lawton completed coursework for an M.A. in Historic Preservation Planning at Cornell University (degree expected December 2022). Research Assistant Andrew T. Young also assisted with the DPR 523 forms, fieldwork, and research. Mr. Young is a graduate student at California State University, Sacramento, earning a M.A. in Public History. Ms. Rebecca Flores prepared graphics for this report and assisted with database management tasks. She holds a A.S. in Geographic Information Systems from American River College, Sacramento.

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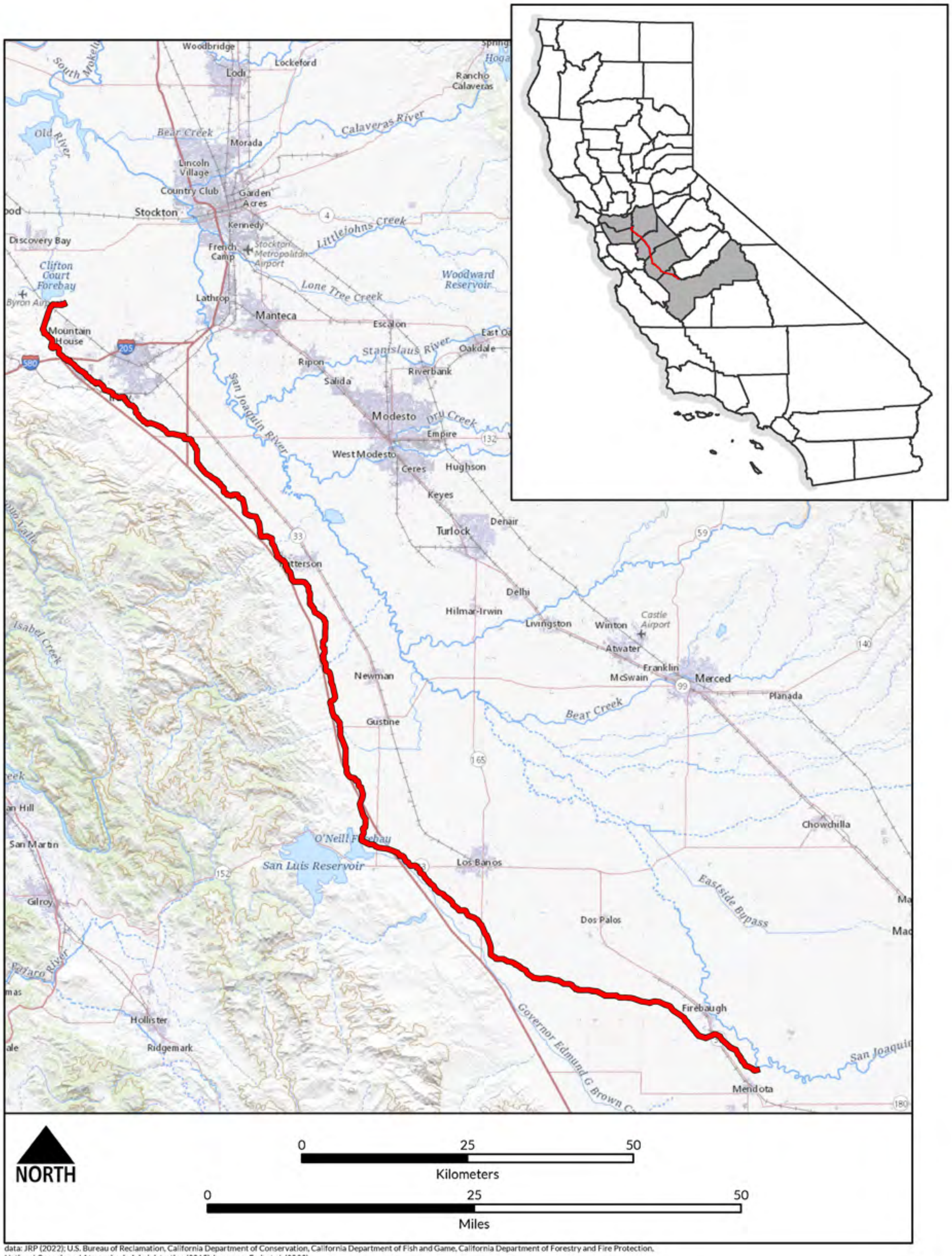
Appendix A: Maps

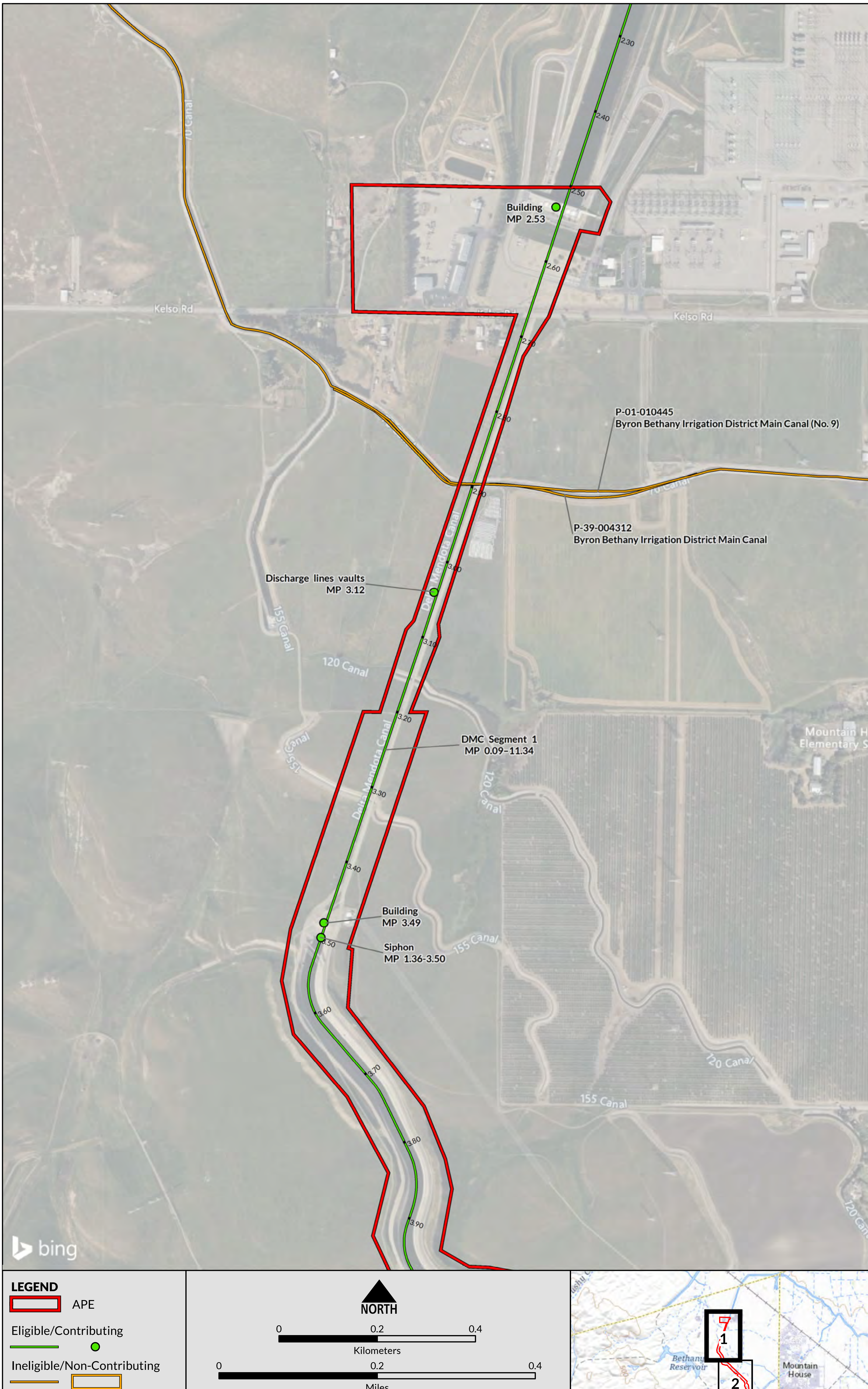
Project Location & Vicinity

Area of Potential Effects (APE) Maps



Project Vicinity & Location Map

source: JRP (2022); Bing (2022); Esri, et al. (2022).



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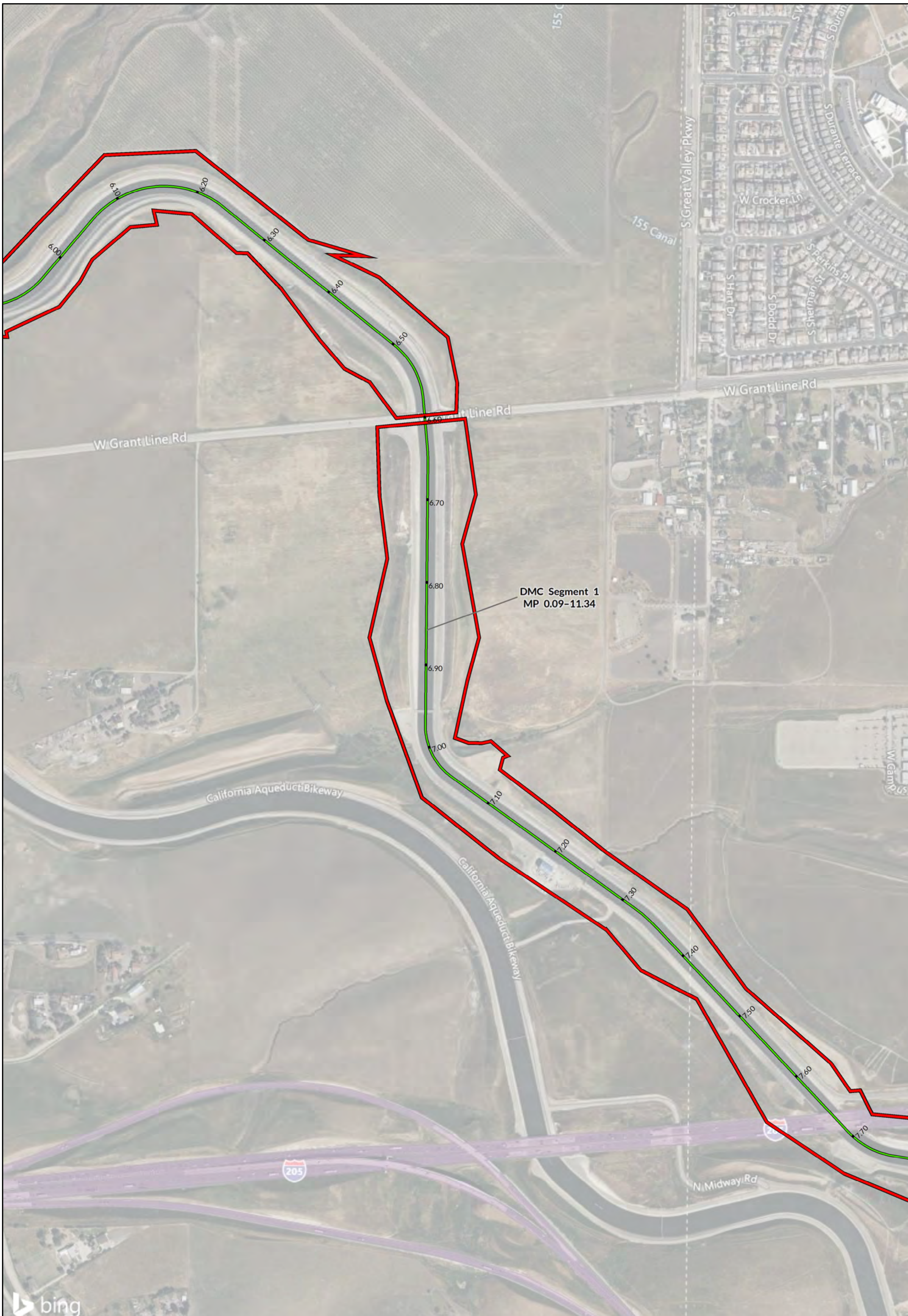
source: JRP (2022); Bing (2022); Esri, et al. (2022).



LEGEND

APE

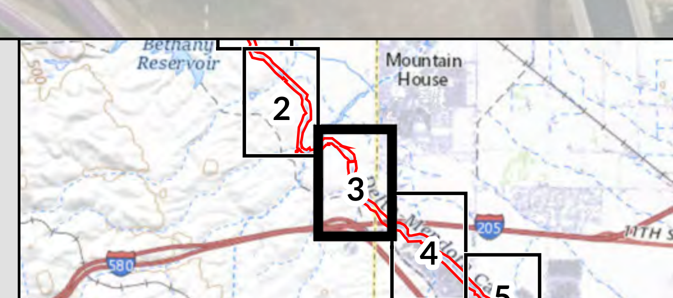
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4
Kilometers

0 0.2 0.4
Miles



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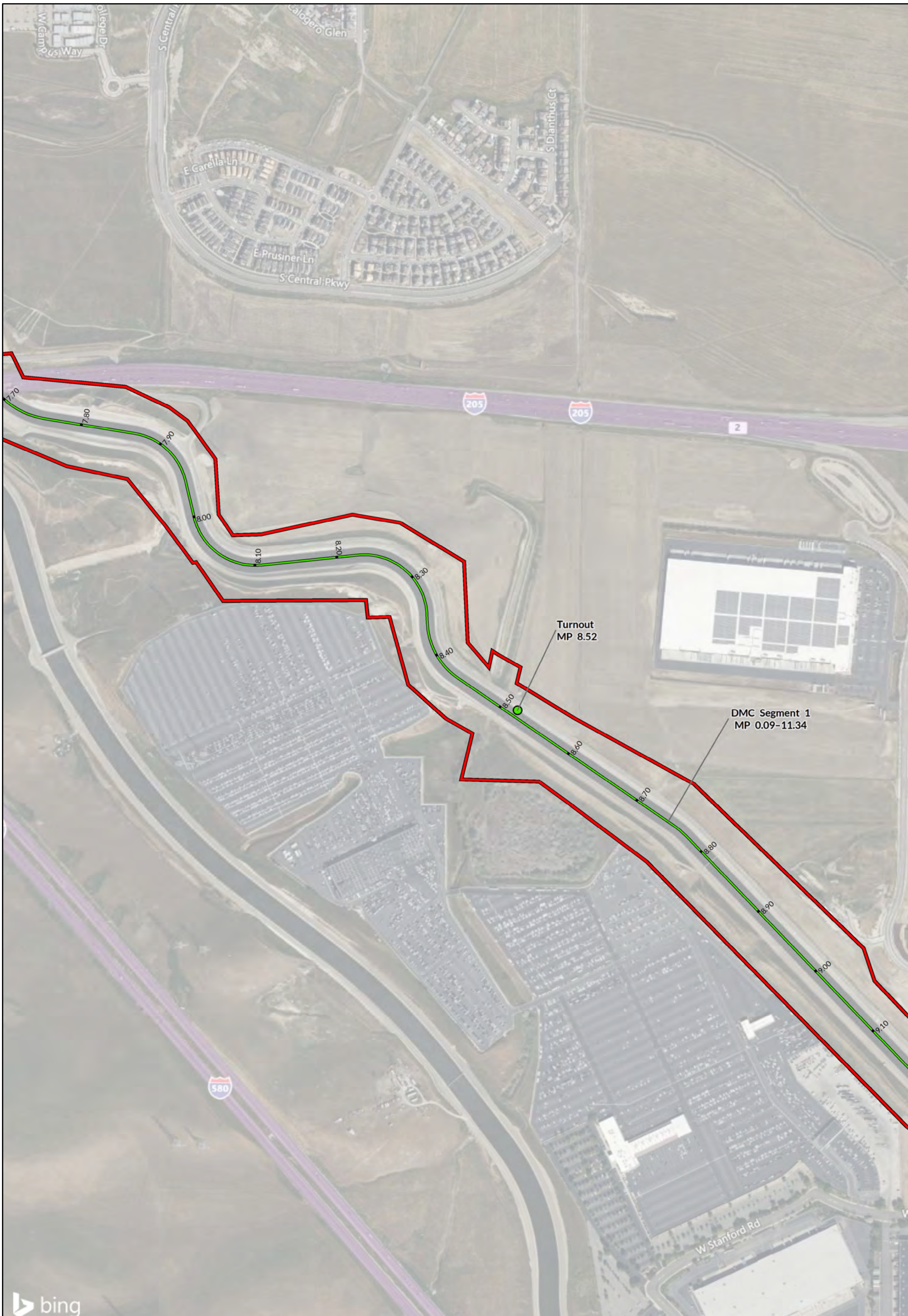


LEGEND

APE

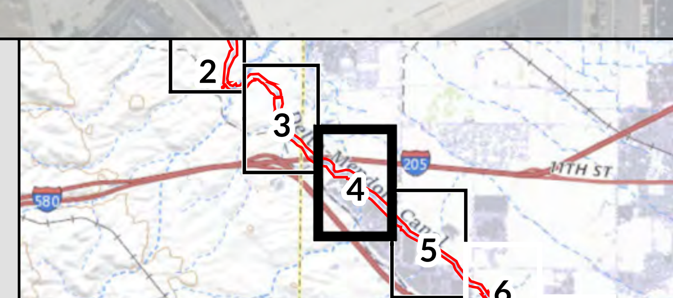
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4
Kilometers

0 0.2 0.4
Miles



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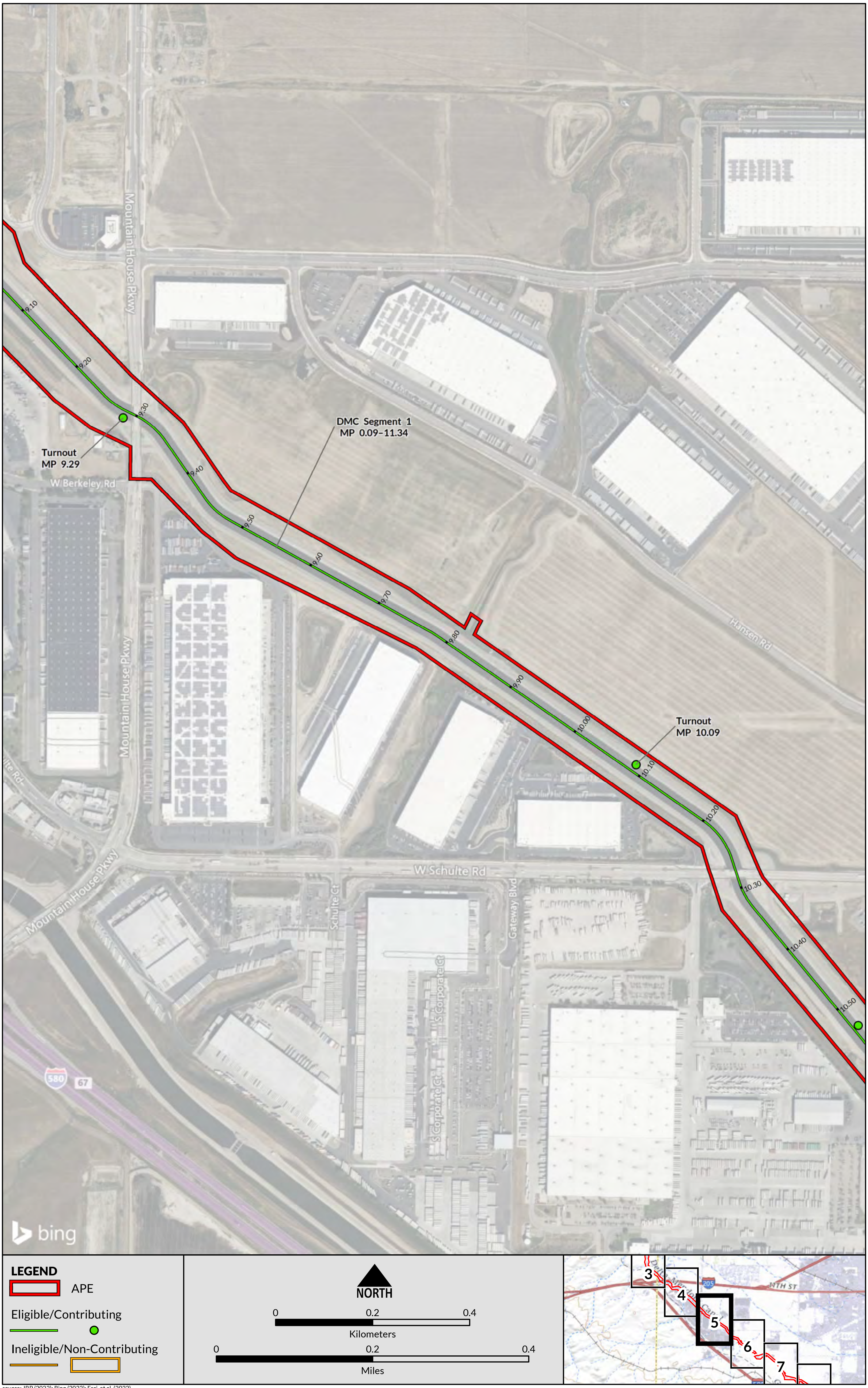

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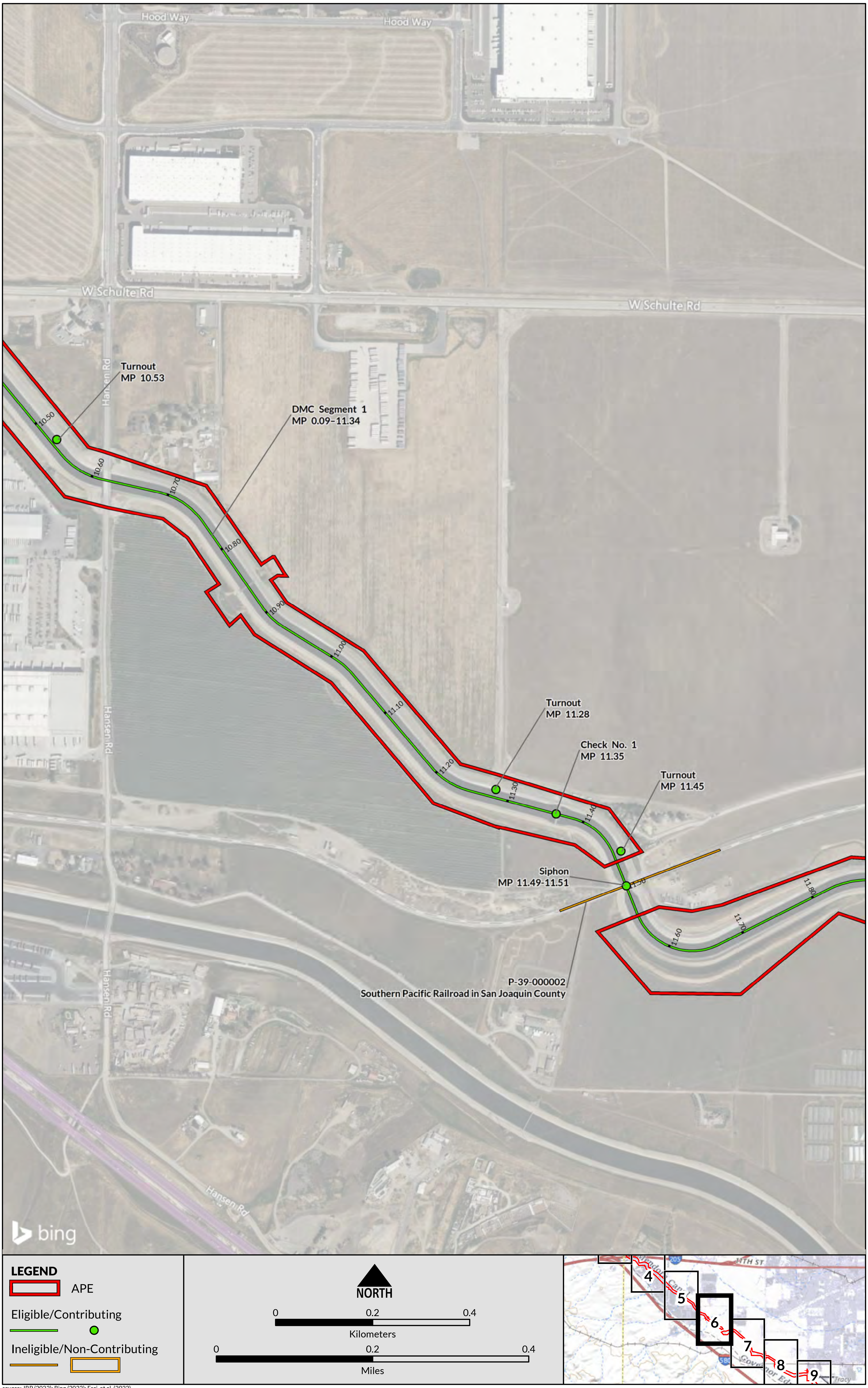

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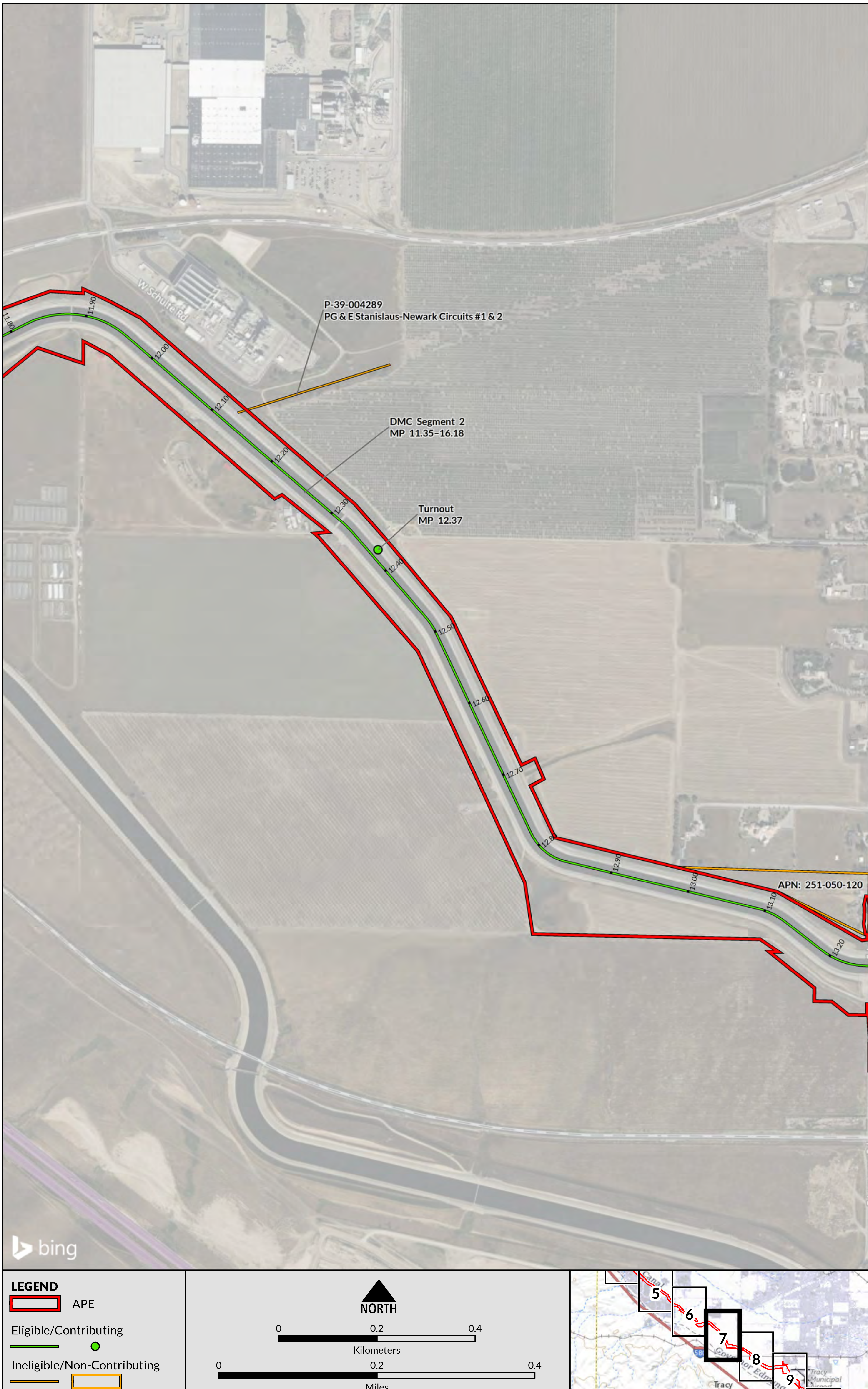

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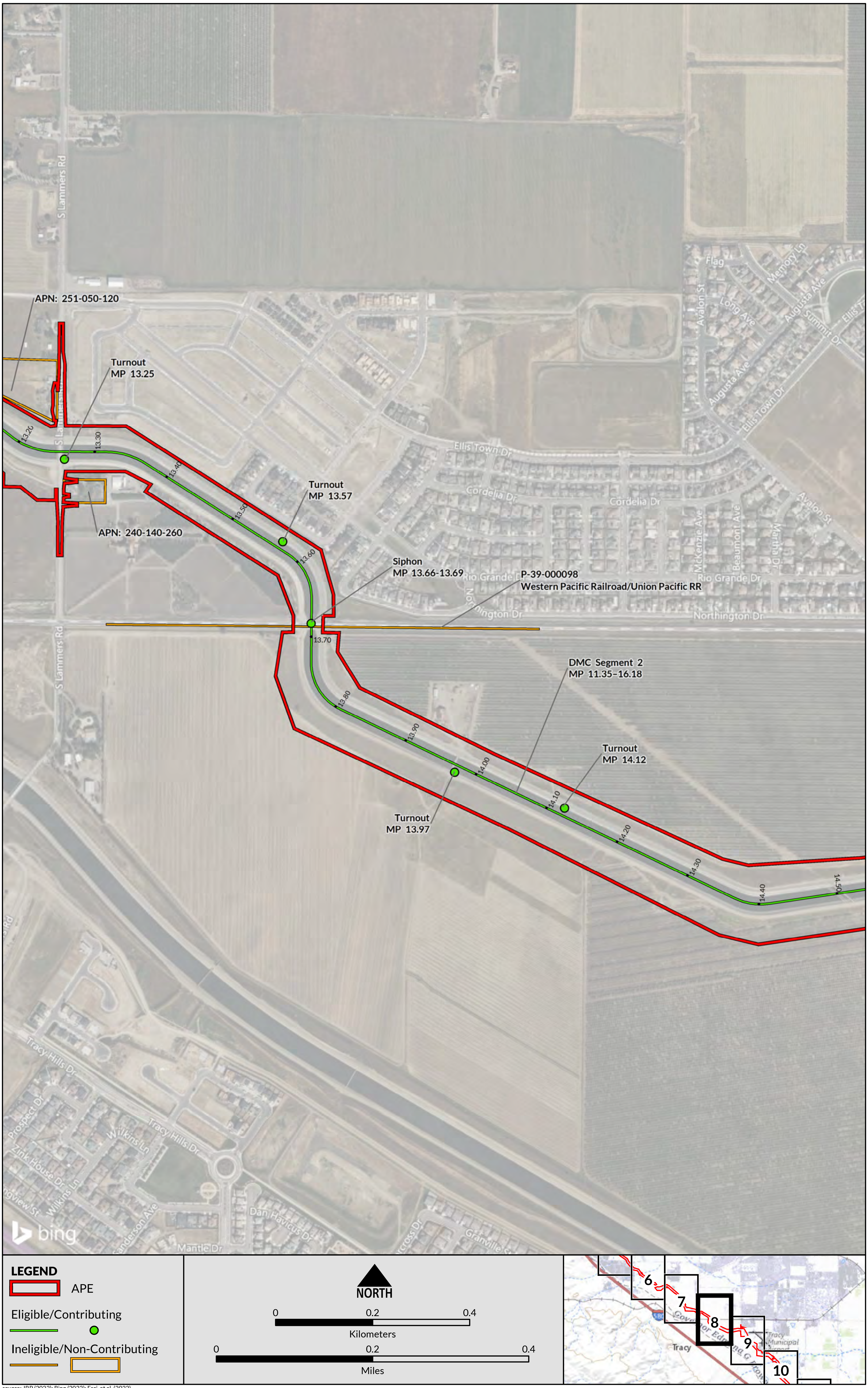

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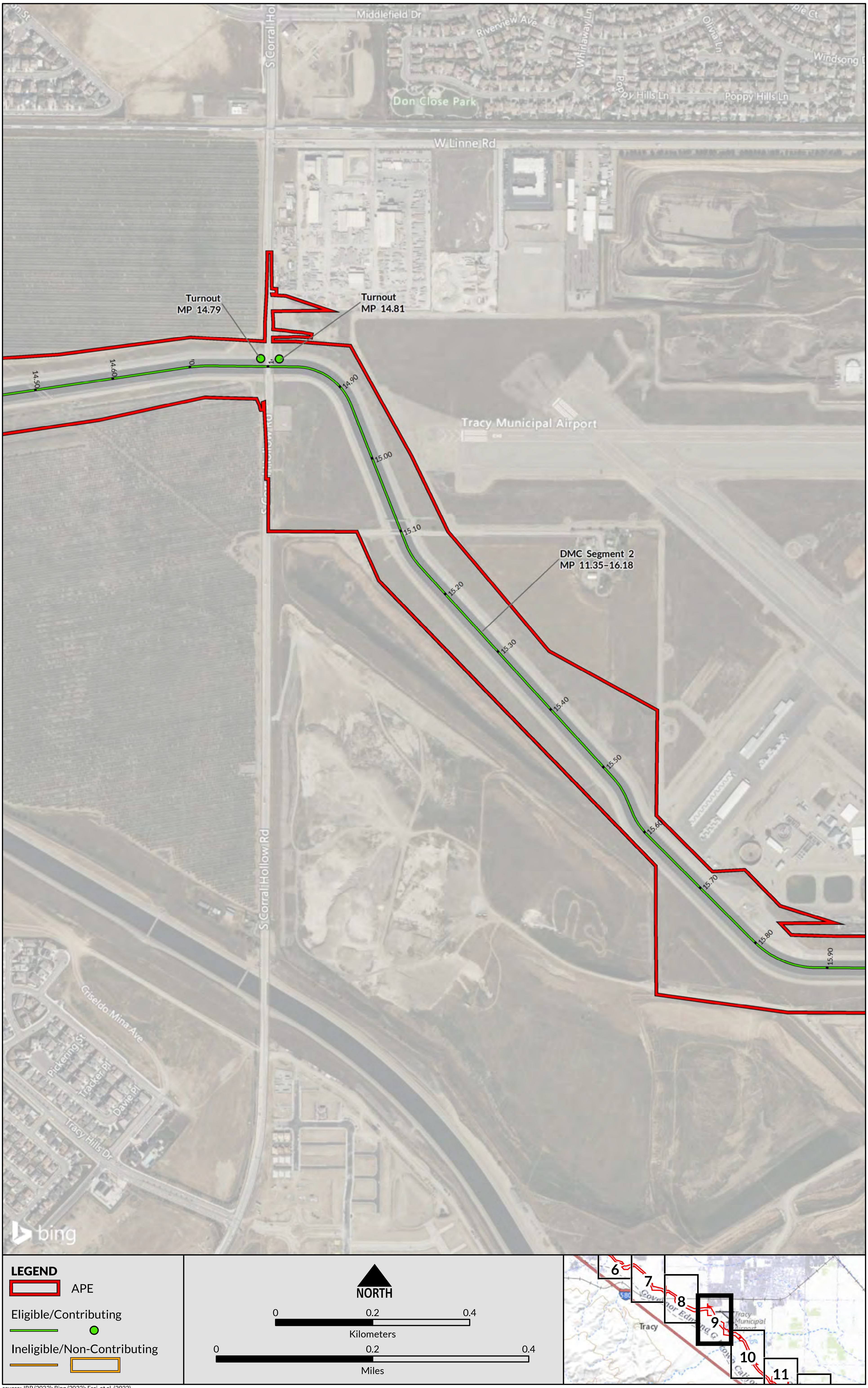

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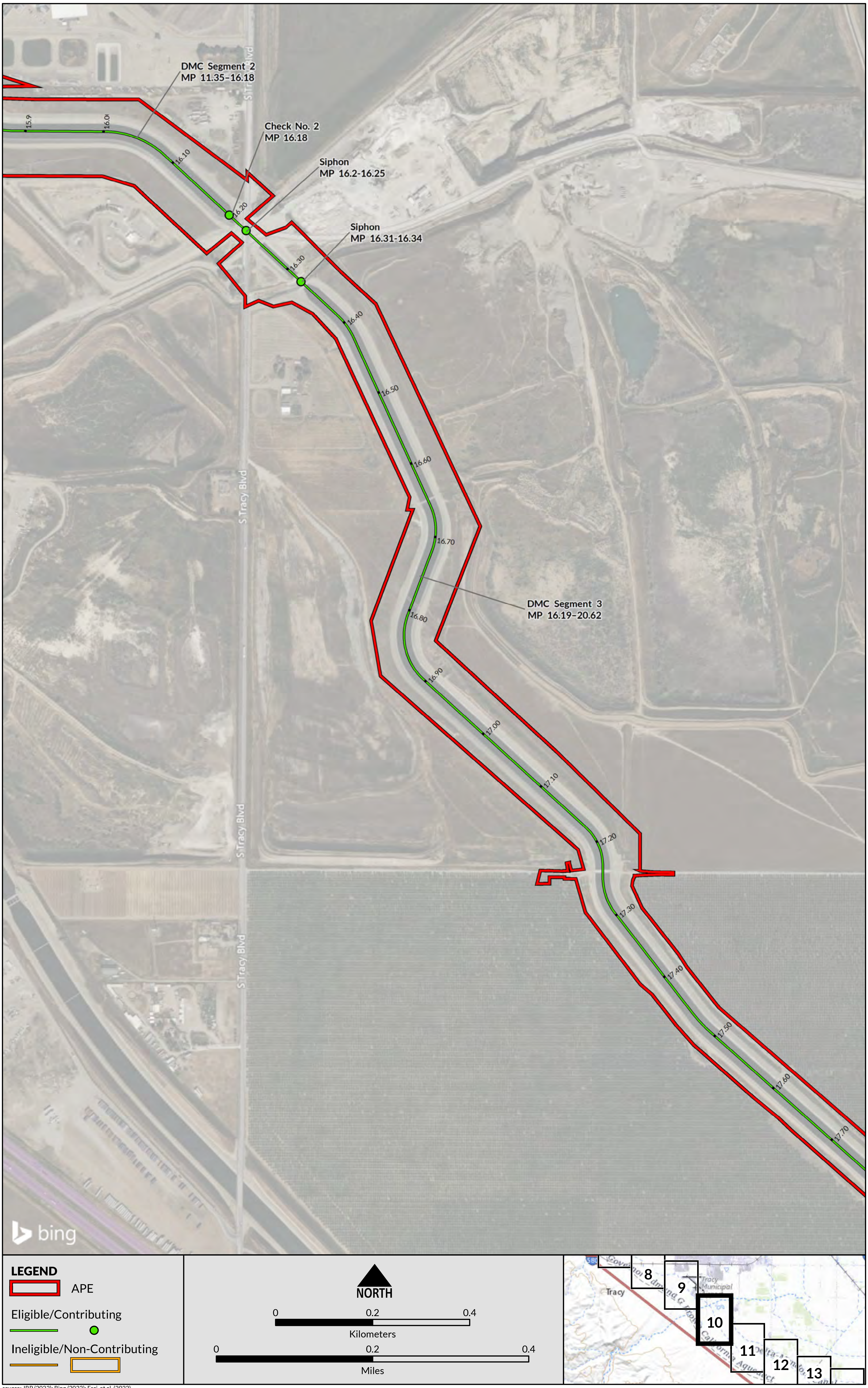

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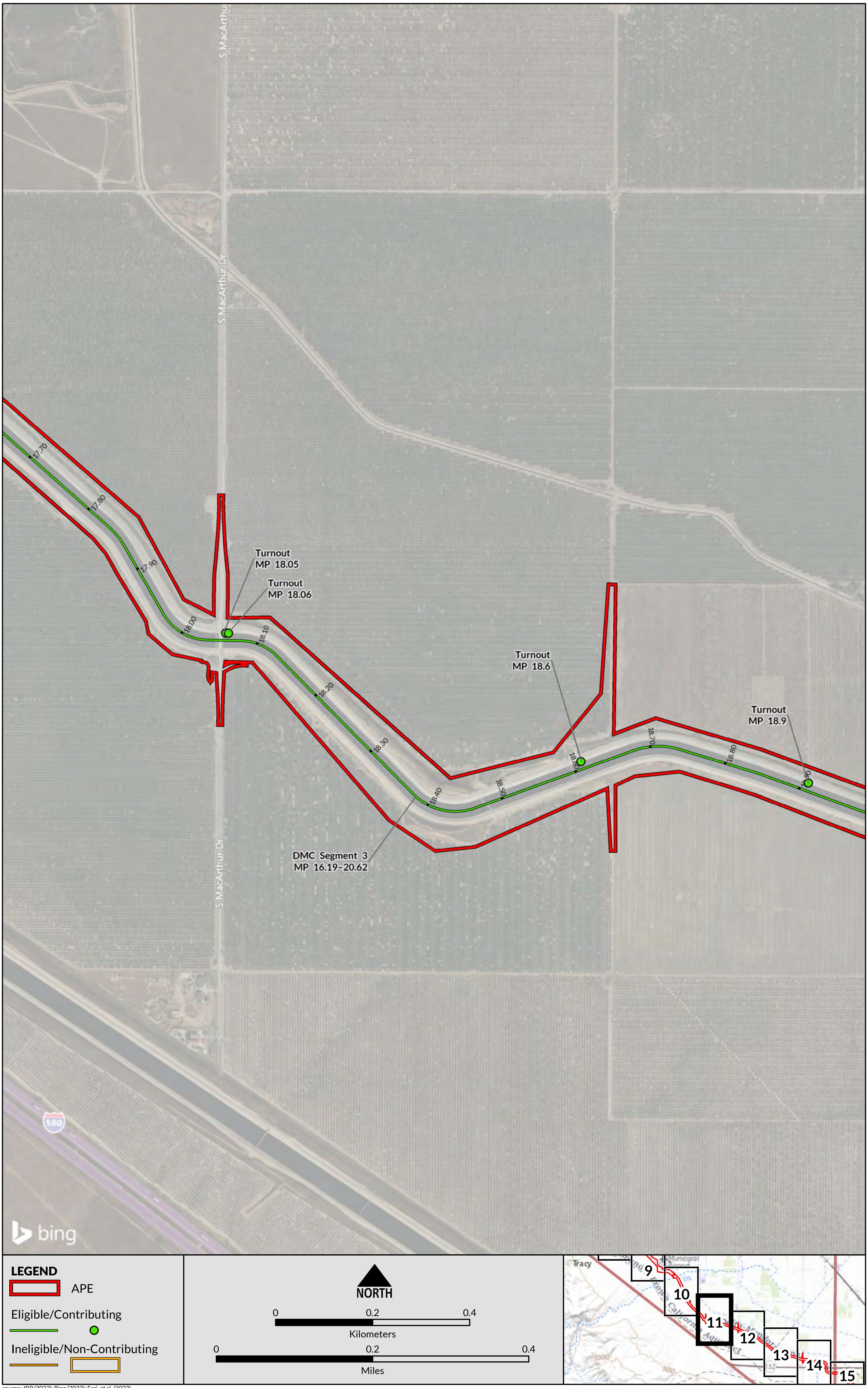

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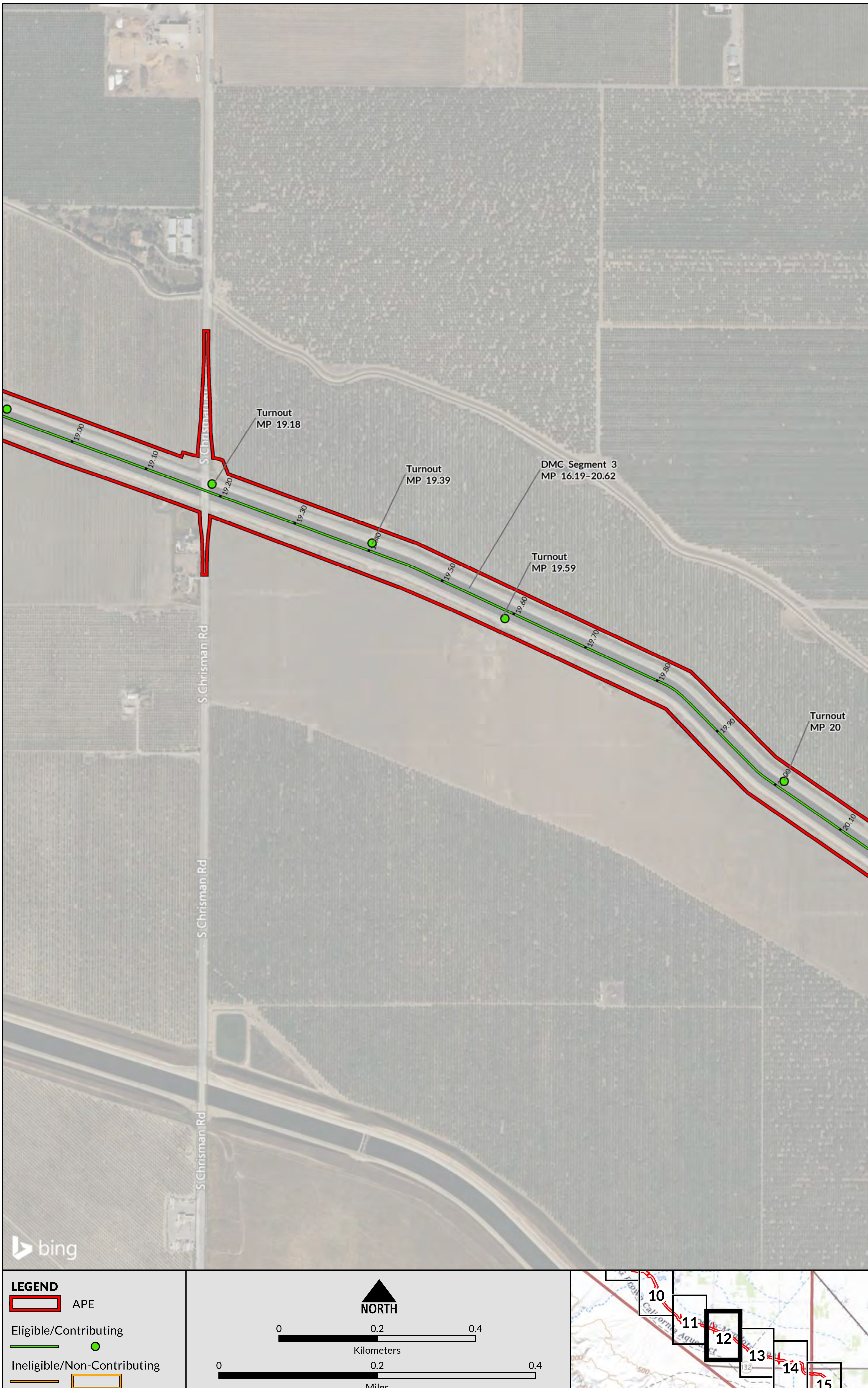

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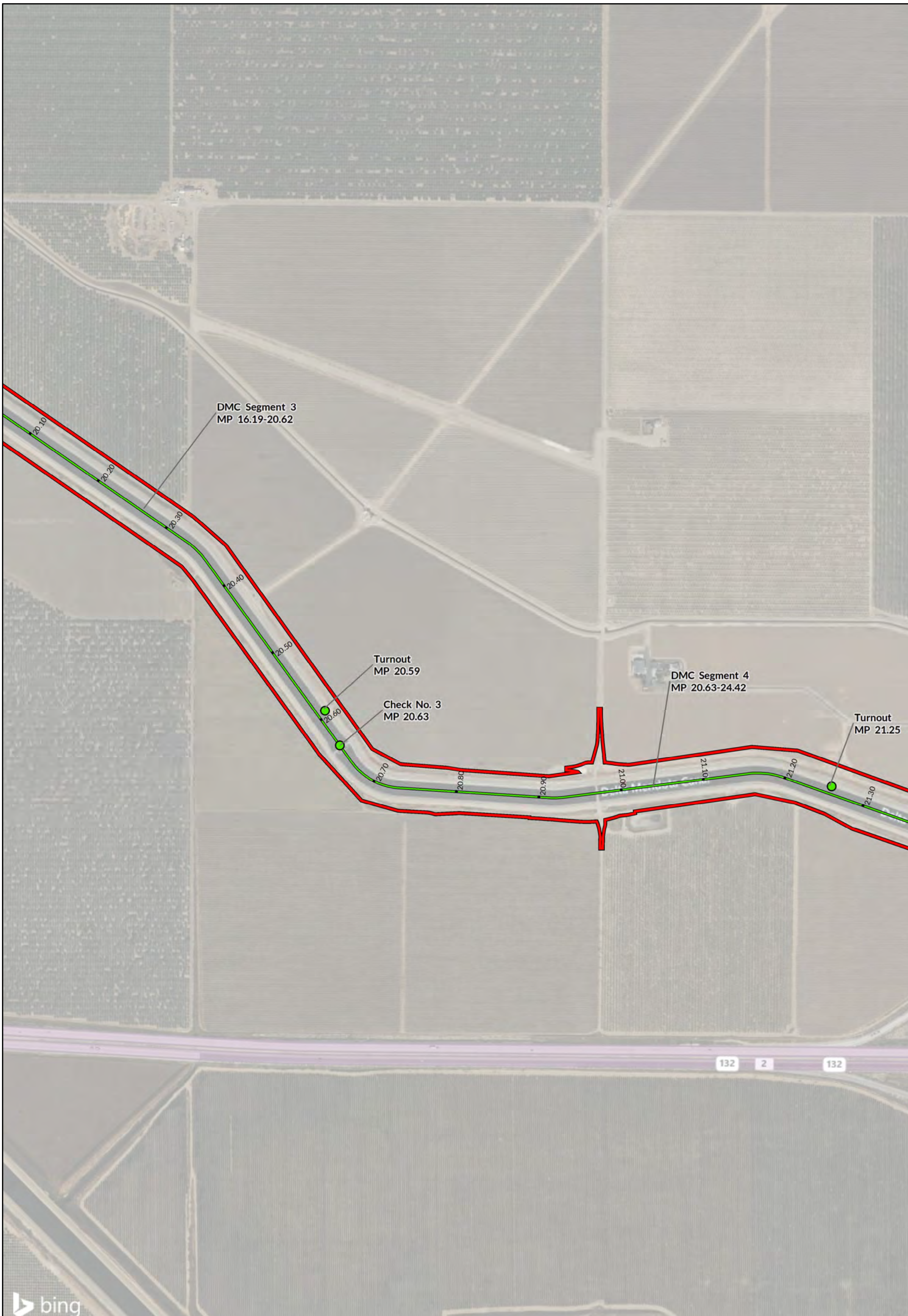


LEGEND

APE

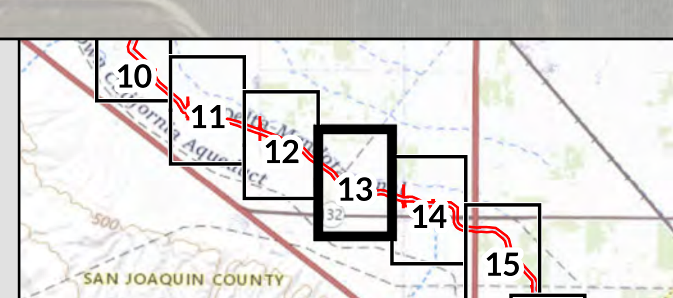
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4 Kilometers

0 0.2 0.4 Miles



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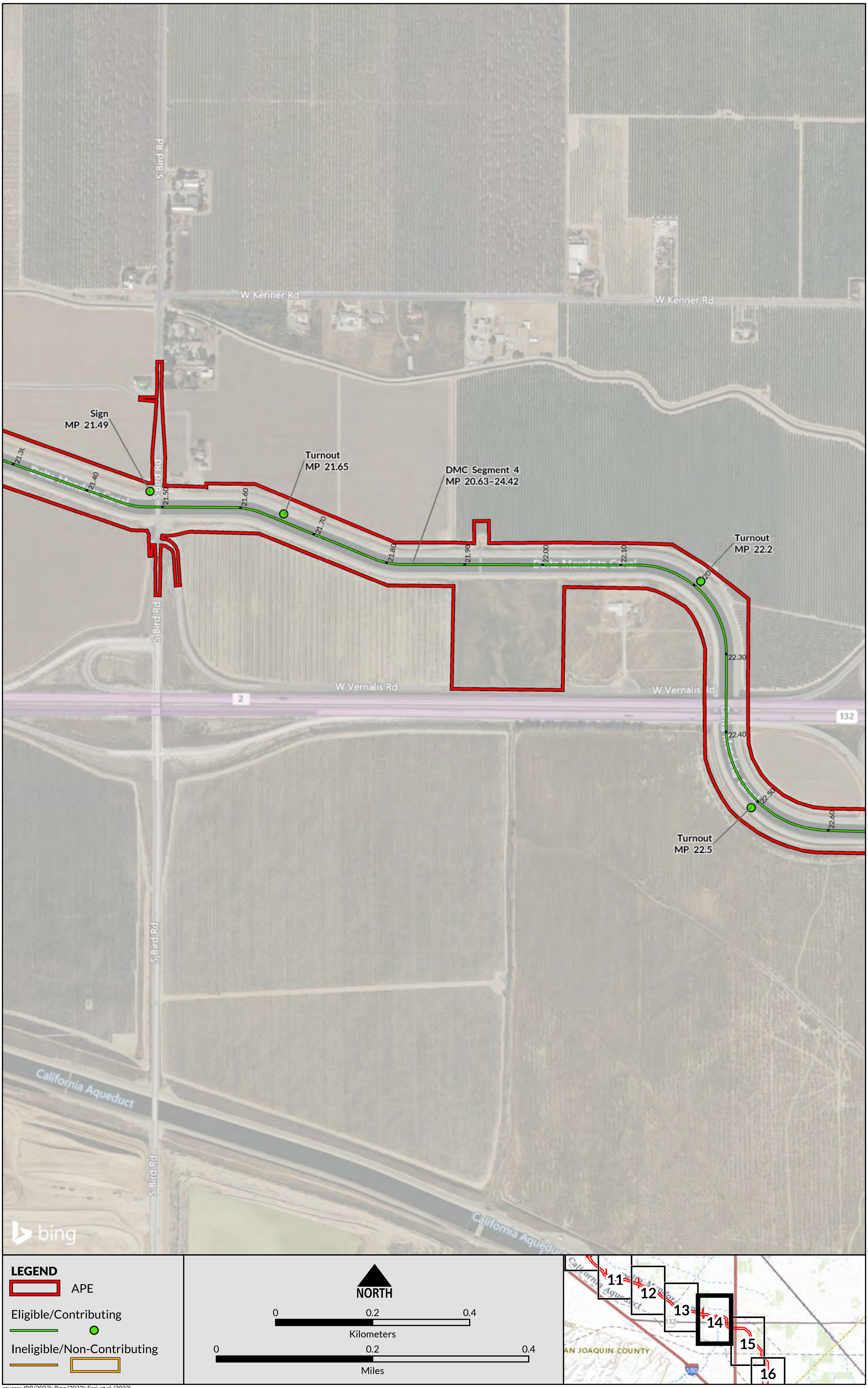

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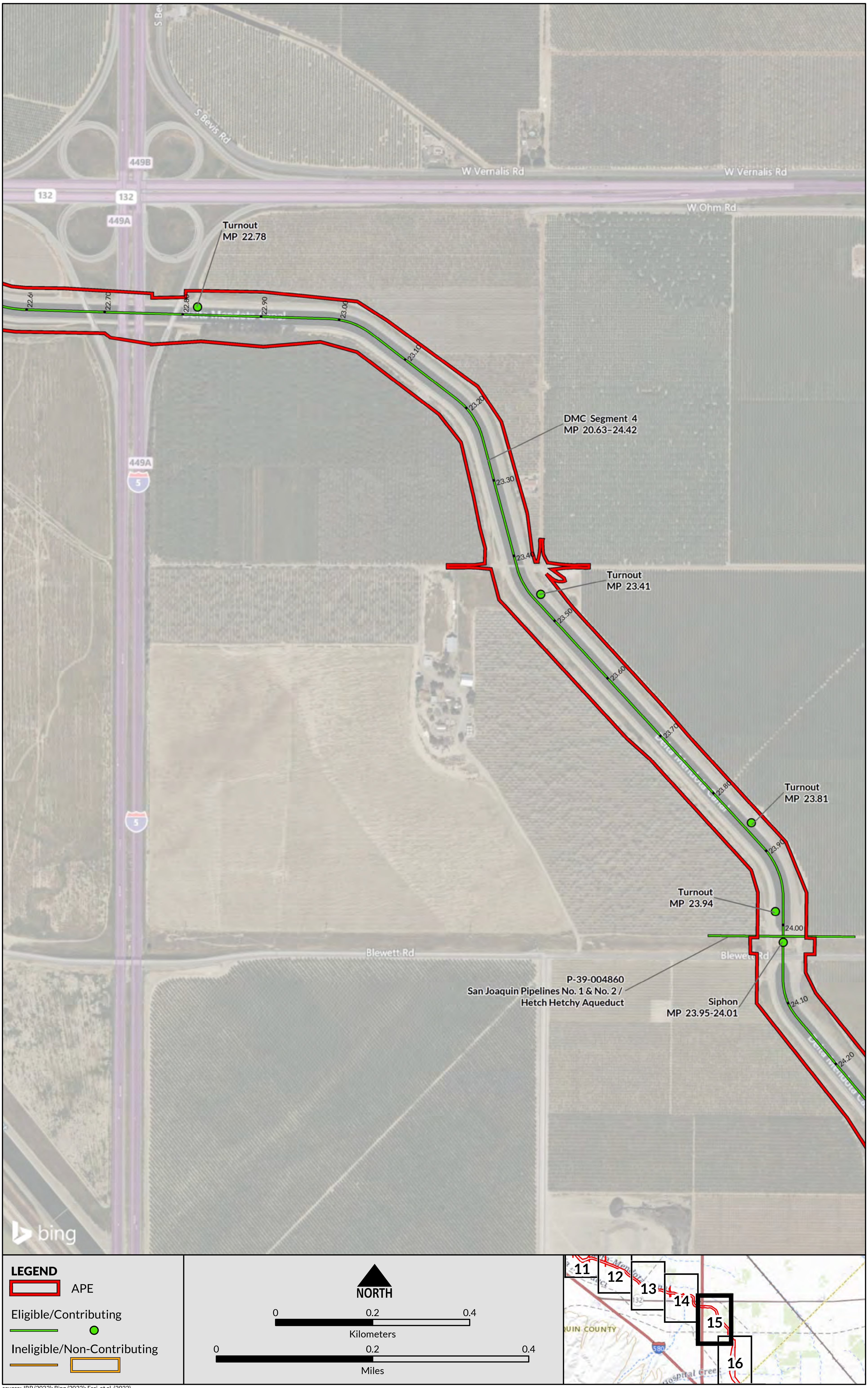

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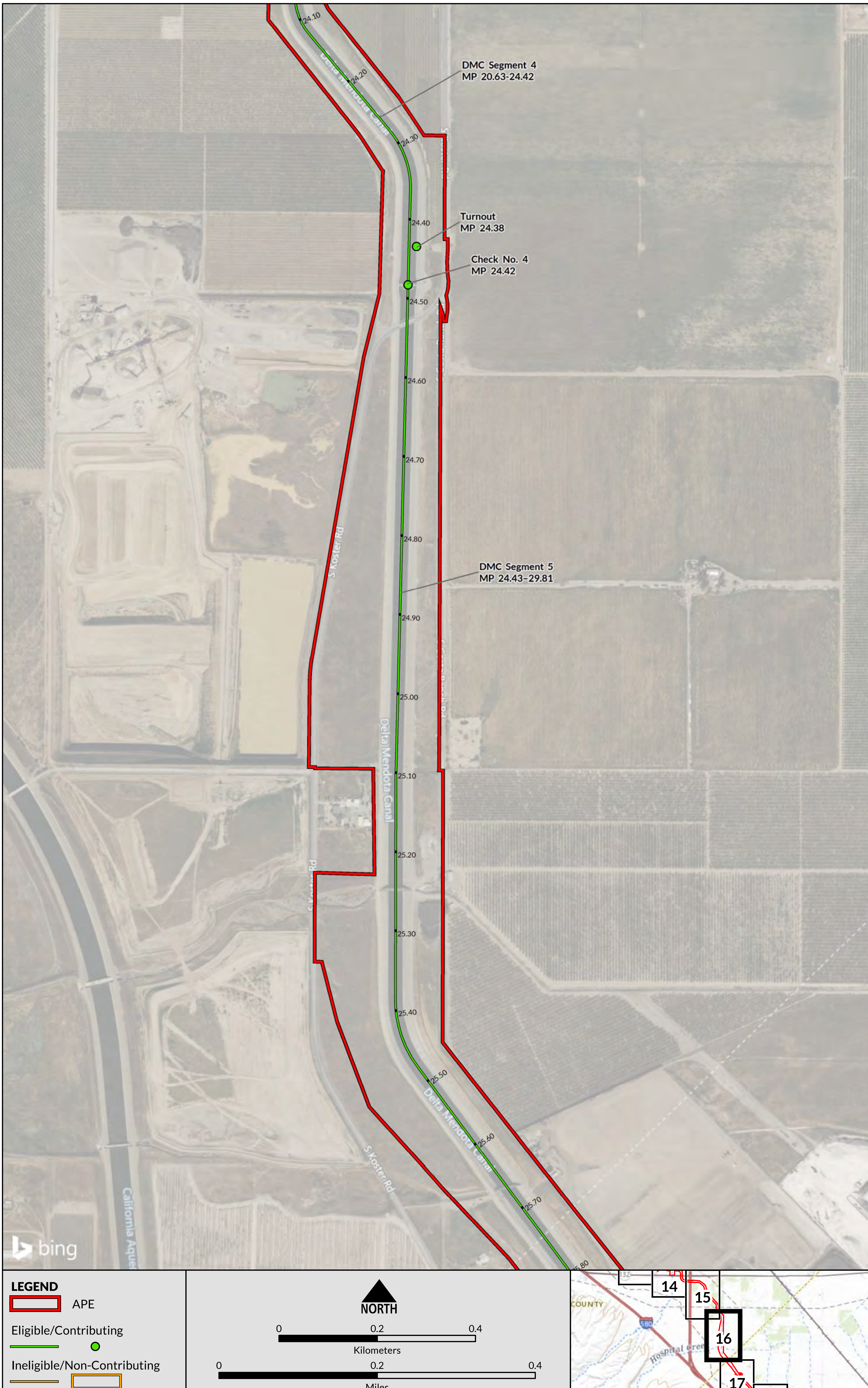

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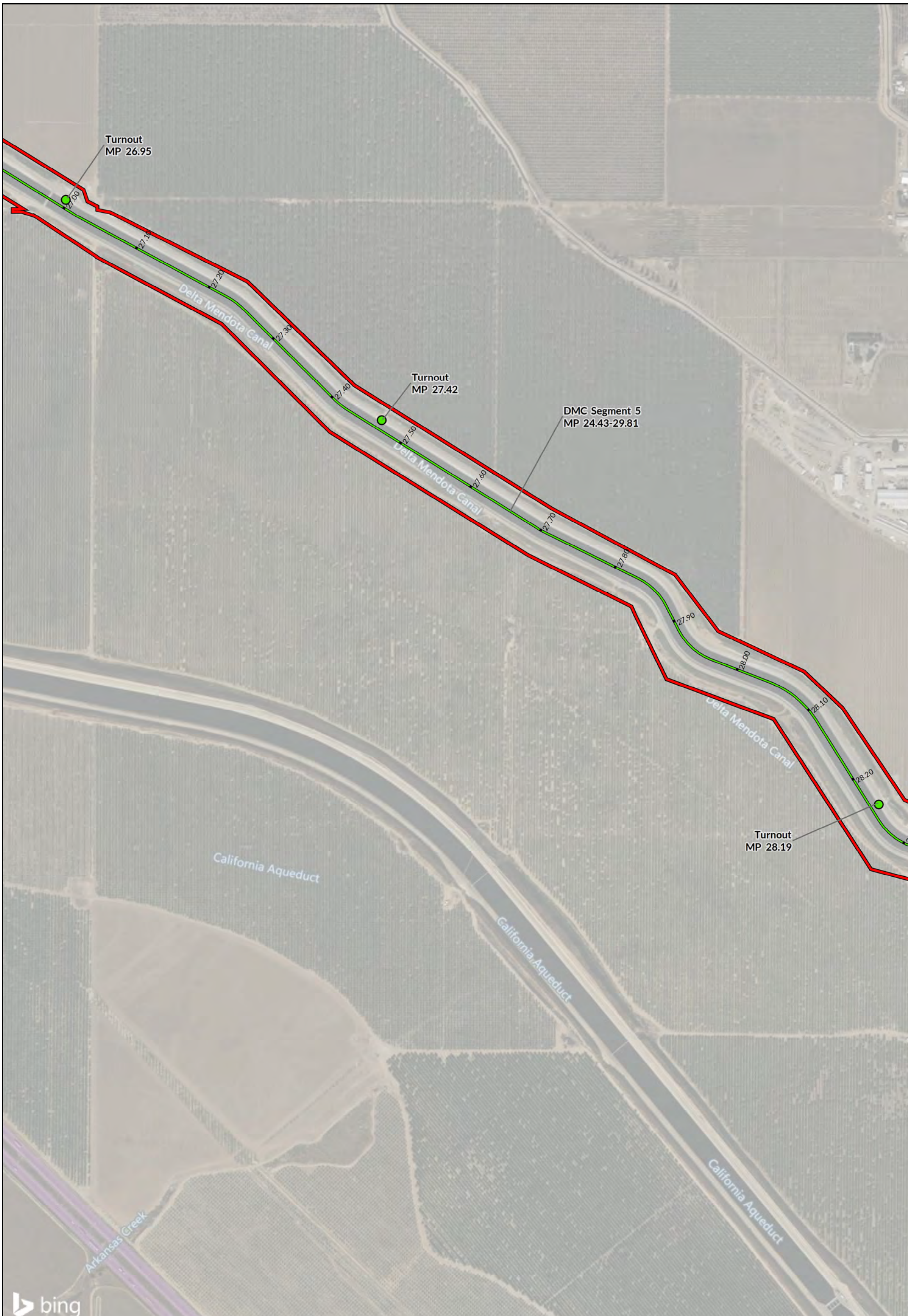


LEGEND

APE

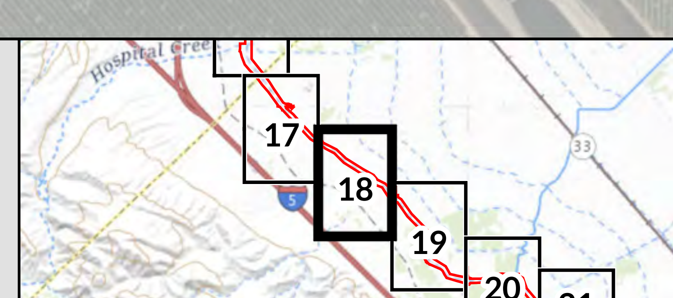
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4
Kilometers

0 0.2 0.4
Miles



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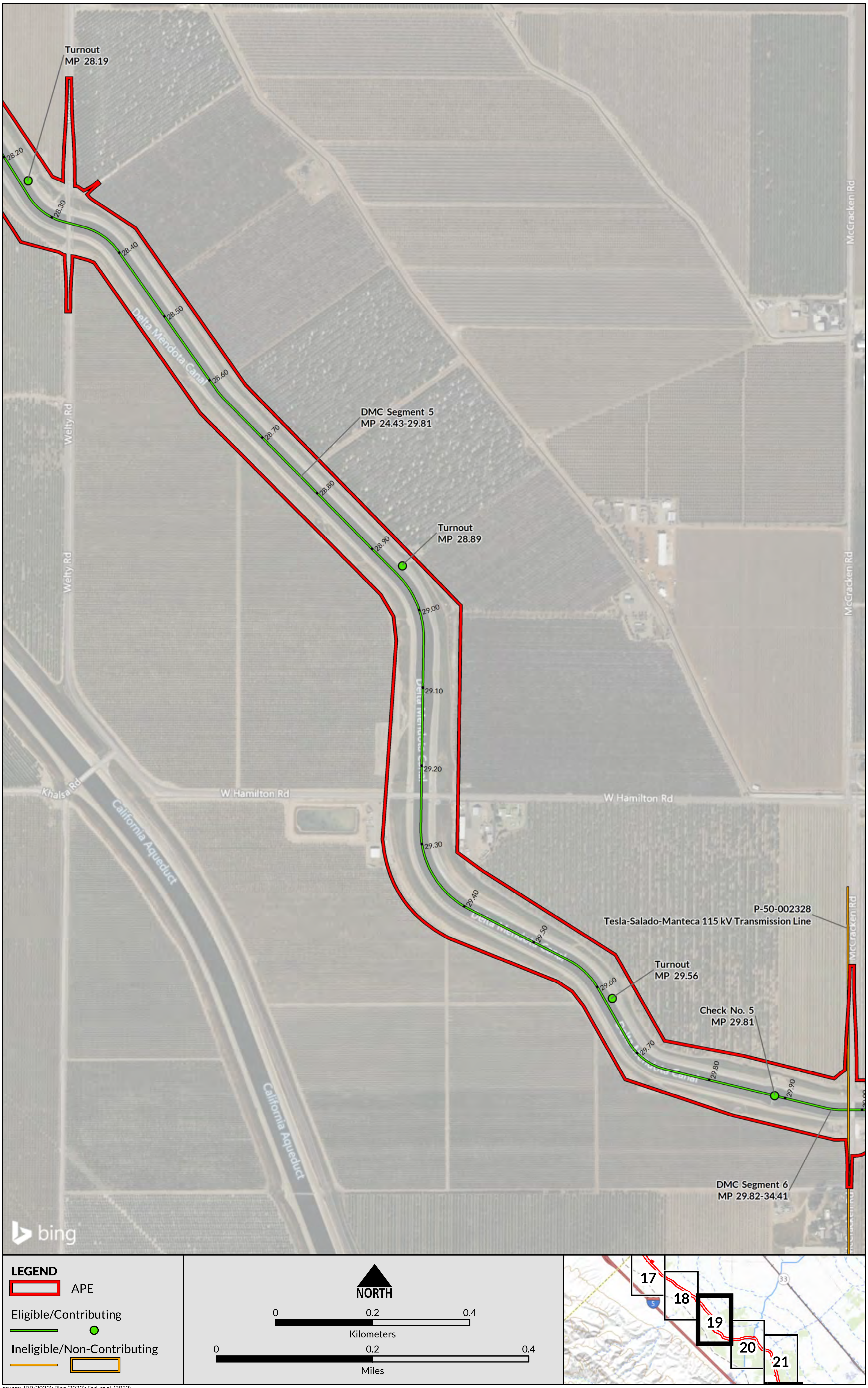

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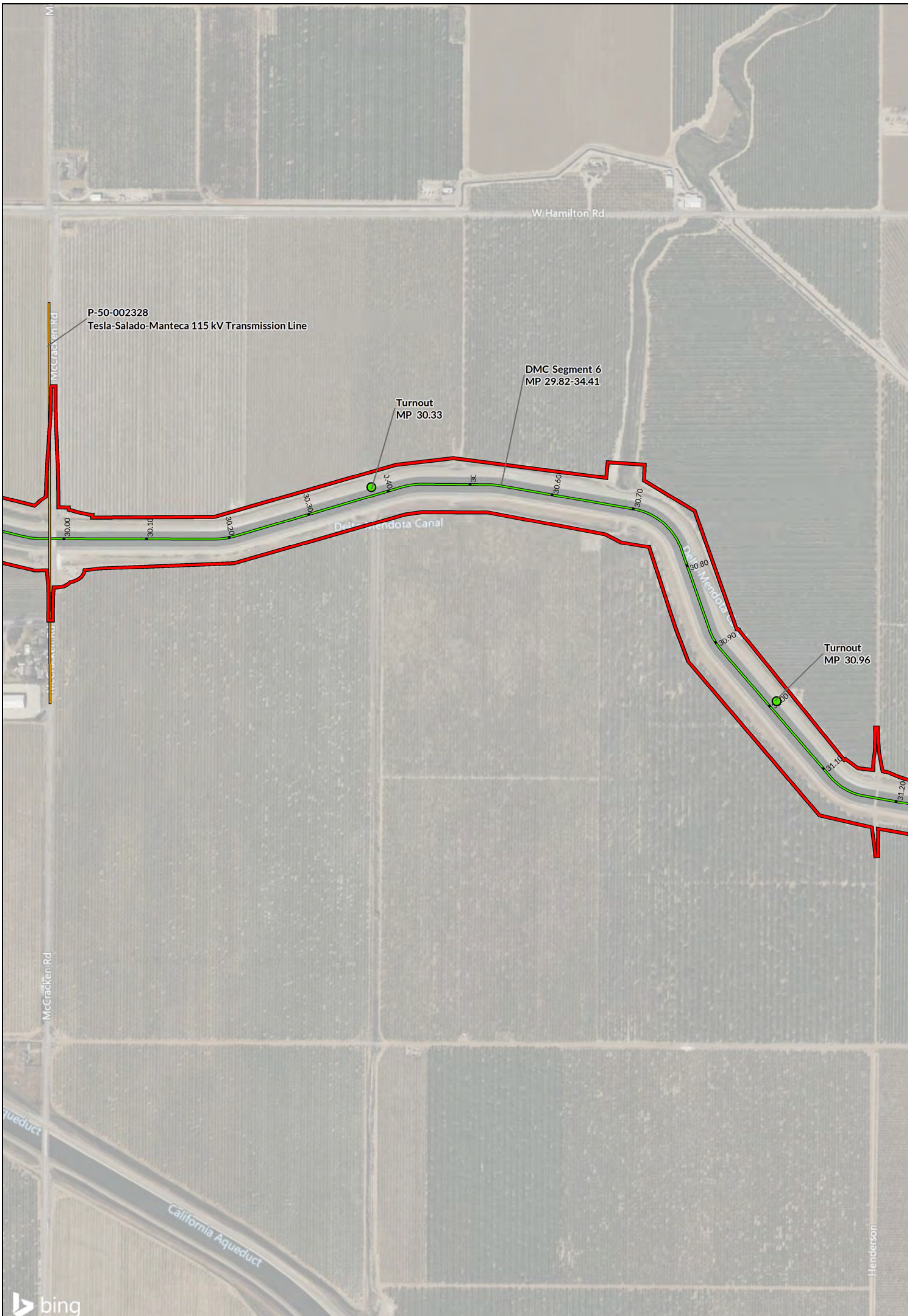


LEGEND

APE

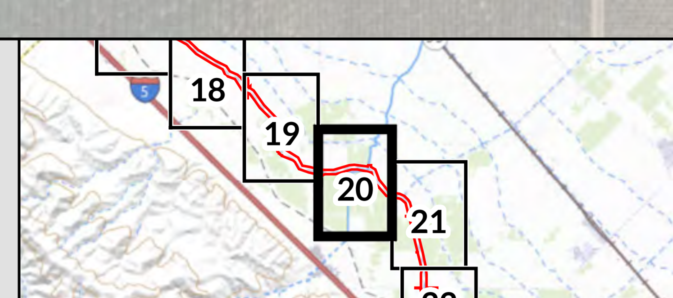
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4
Kilometers

0 0.2 0.4
Miles



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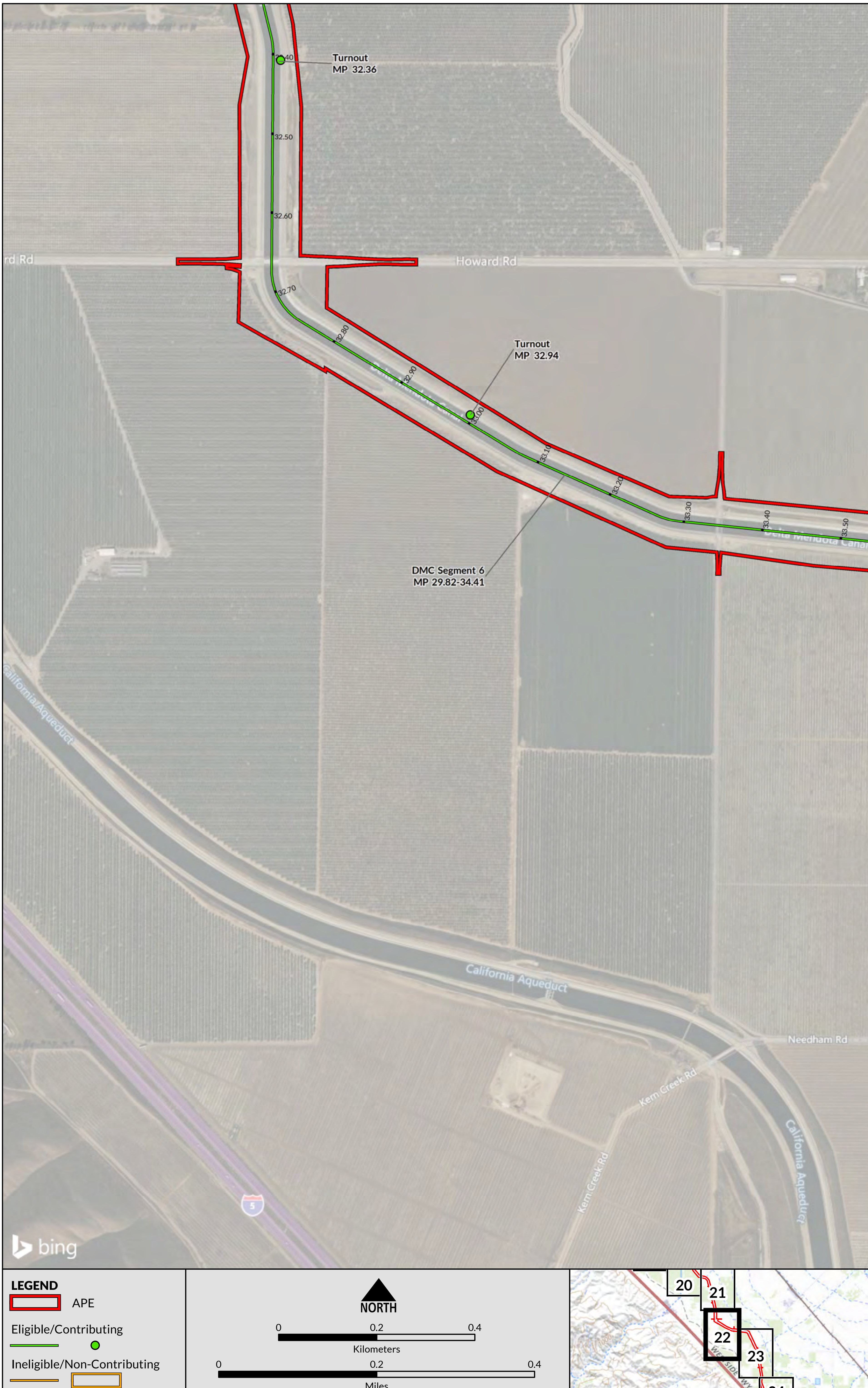

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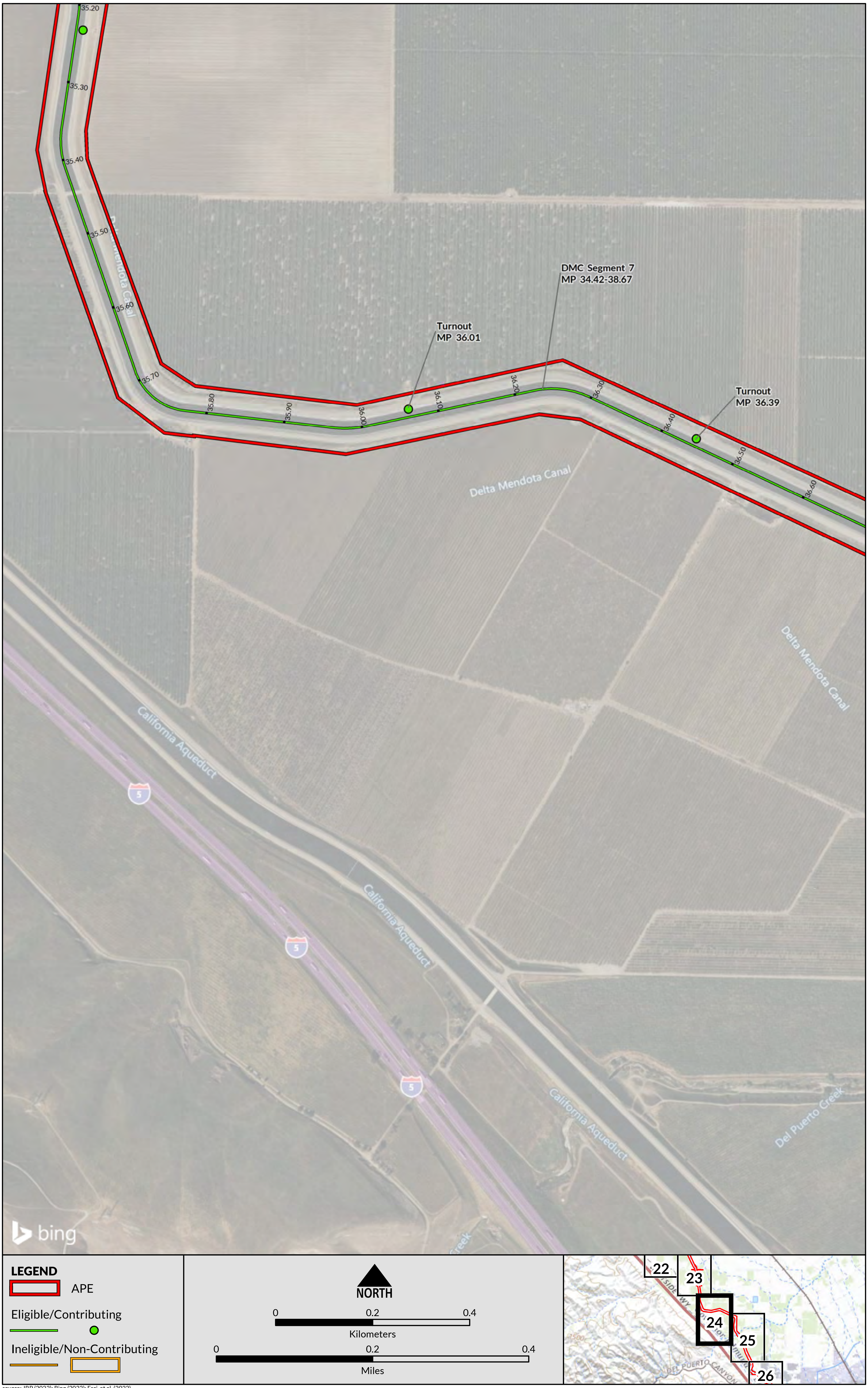

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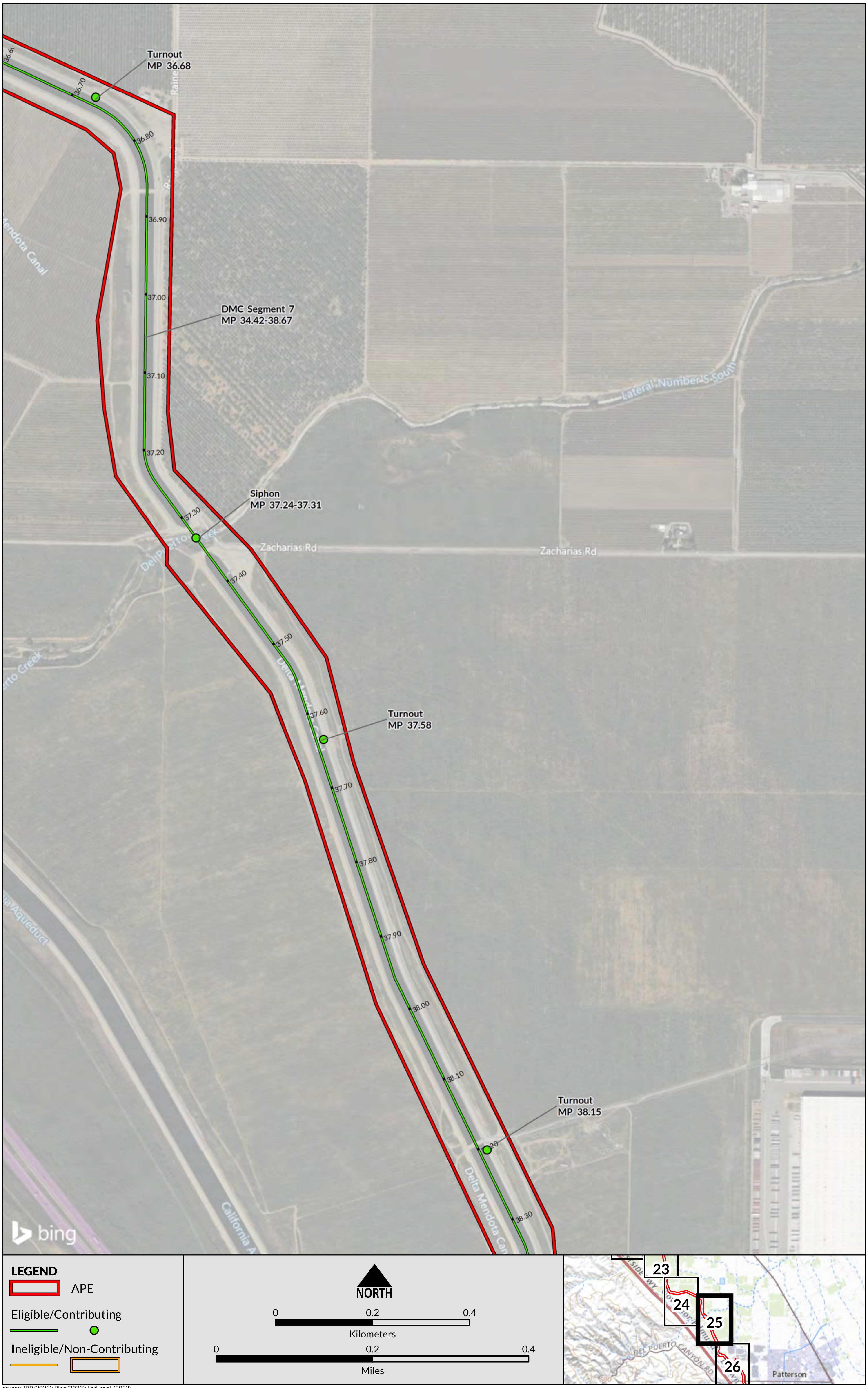

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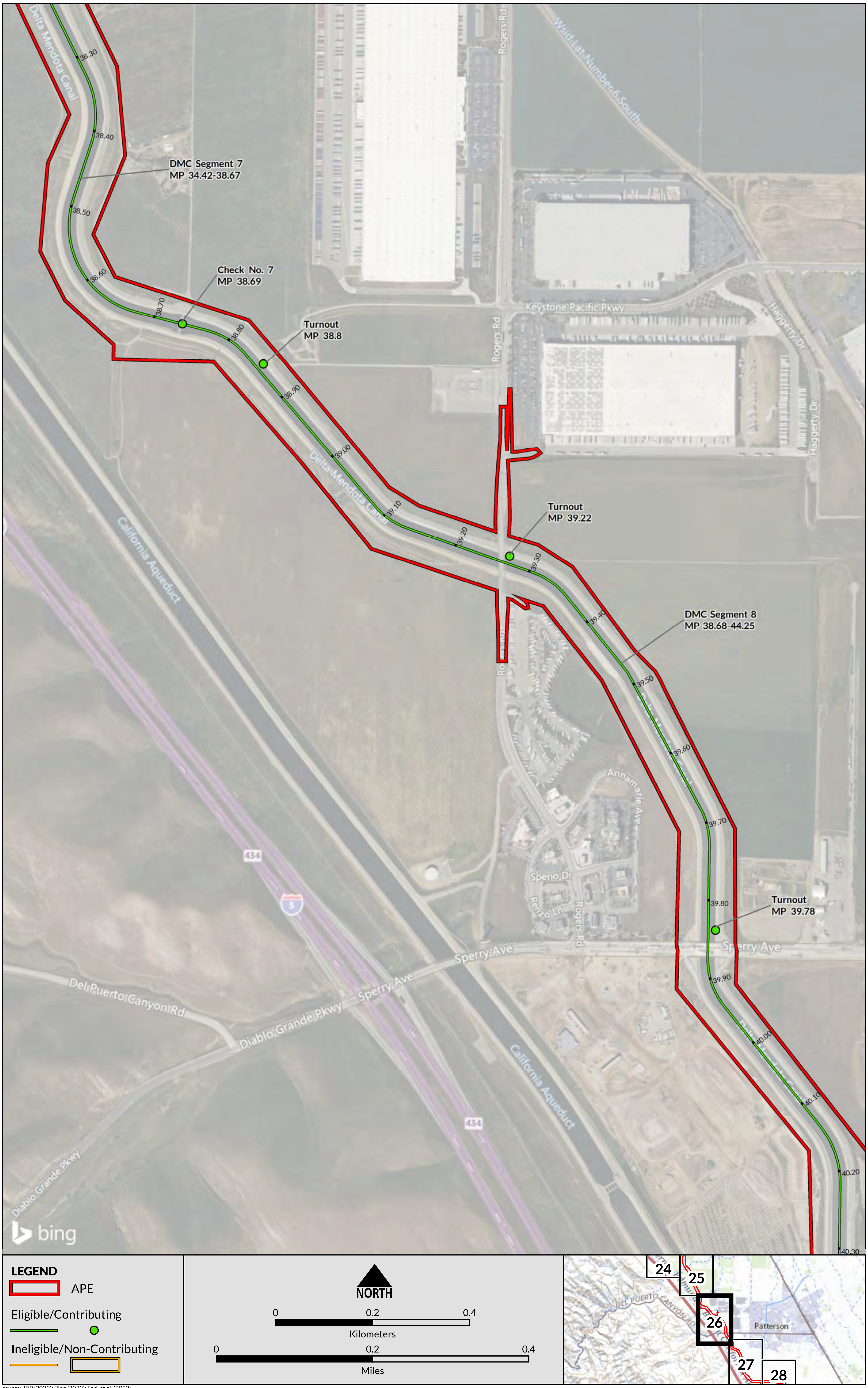

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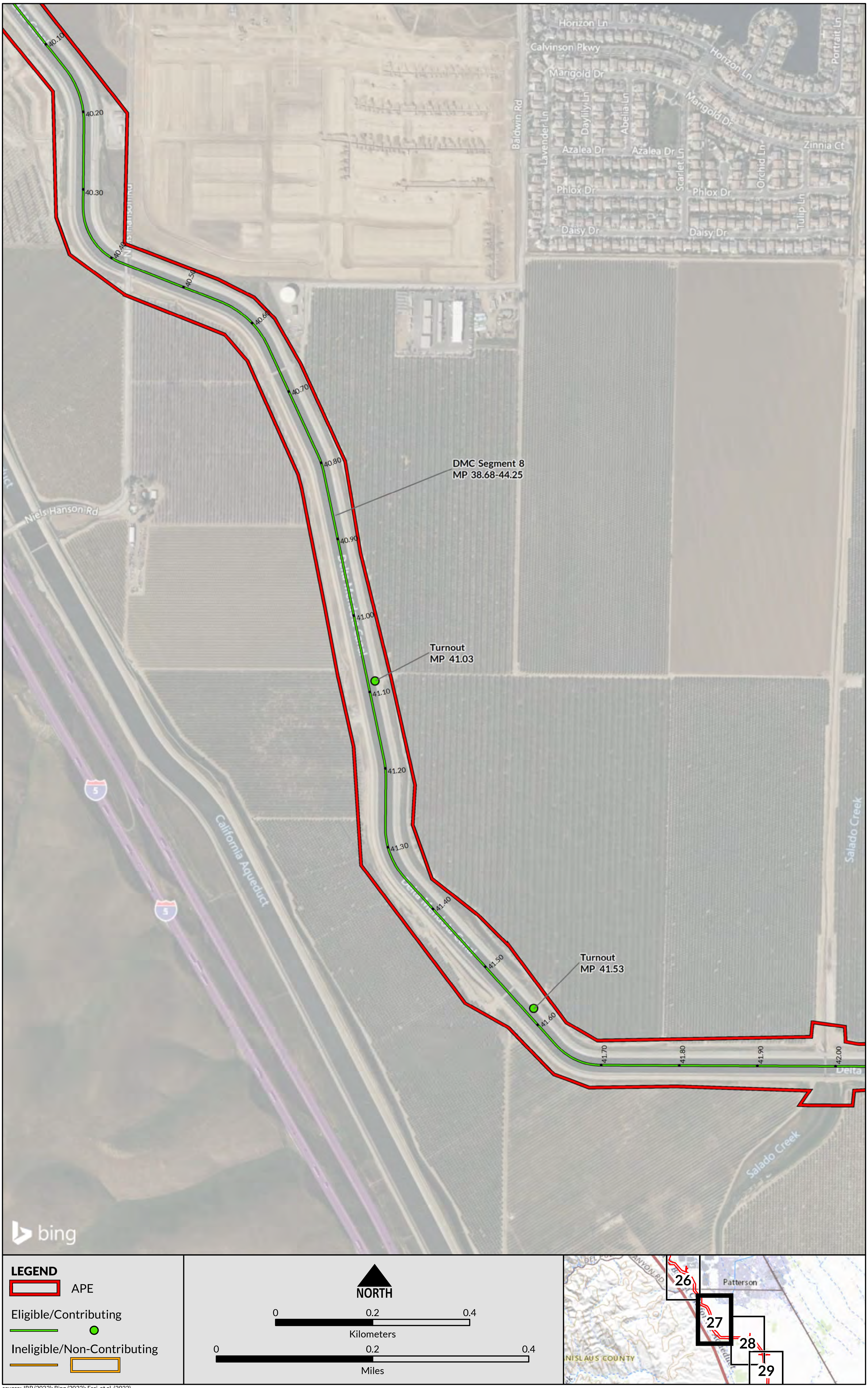

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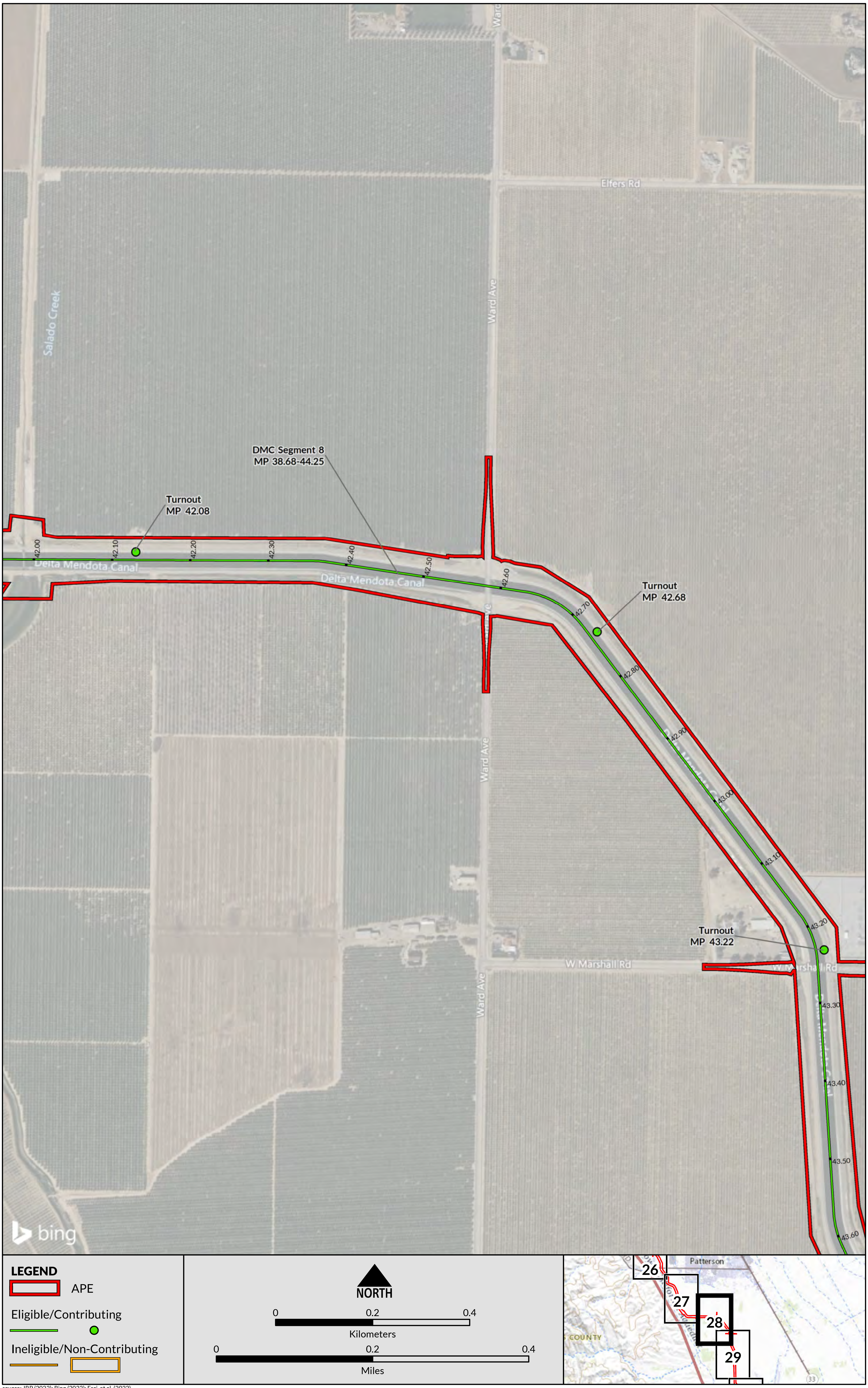

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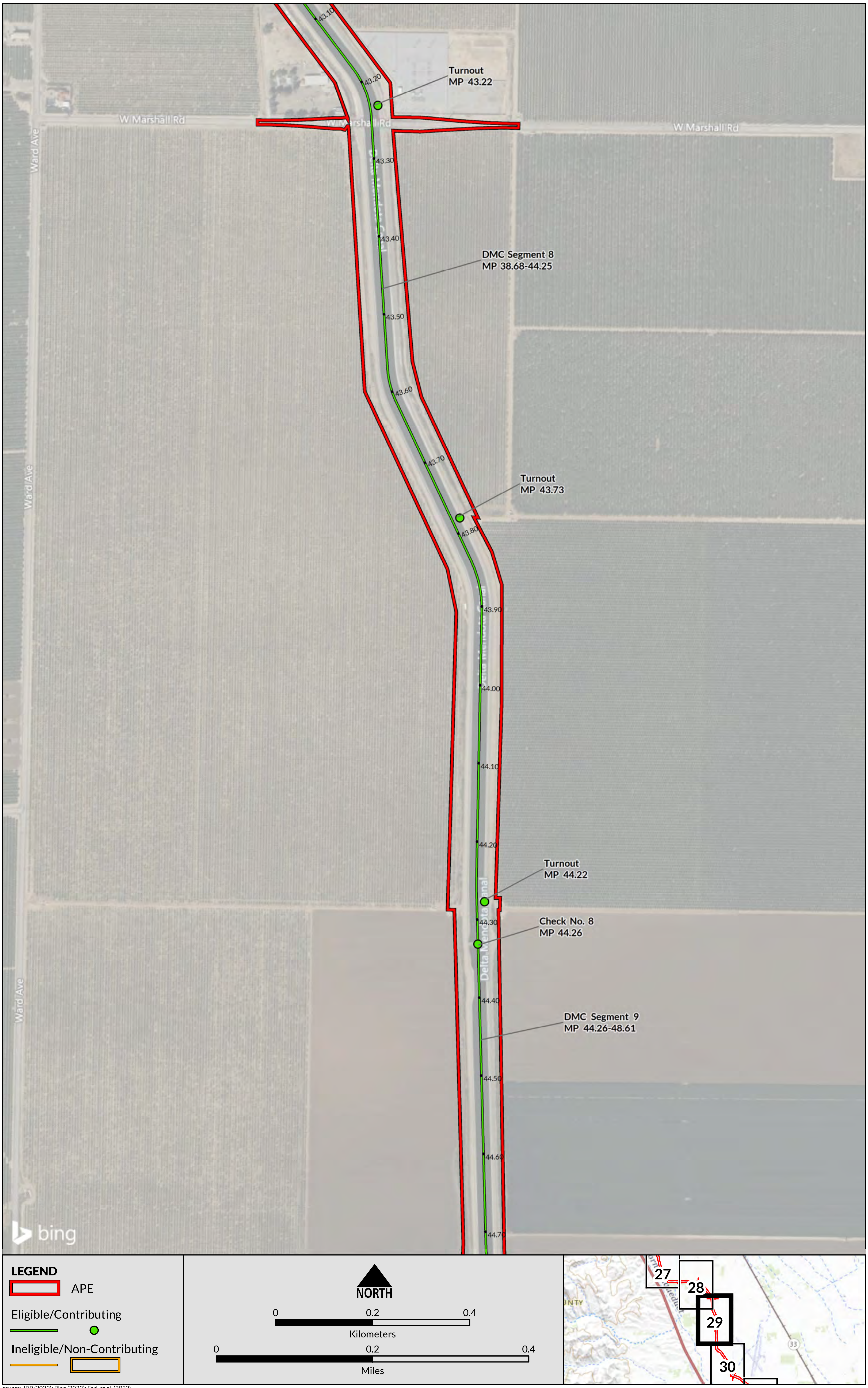

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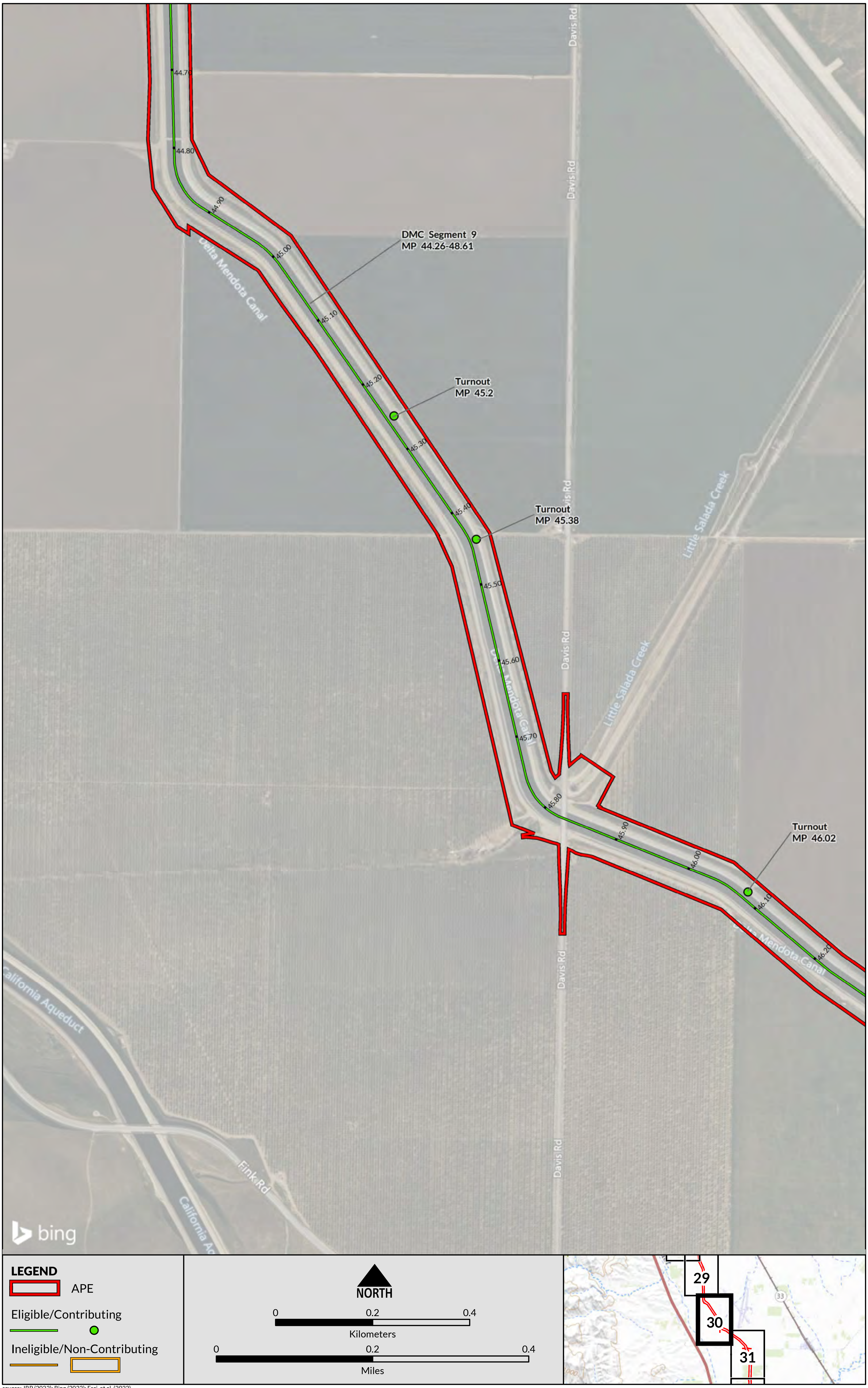

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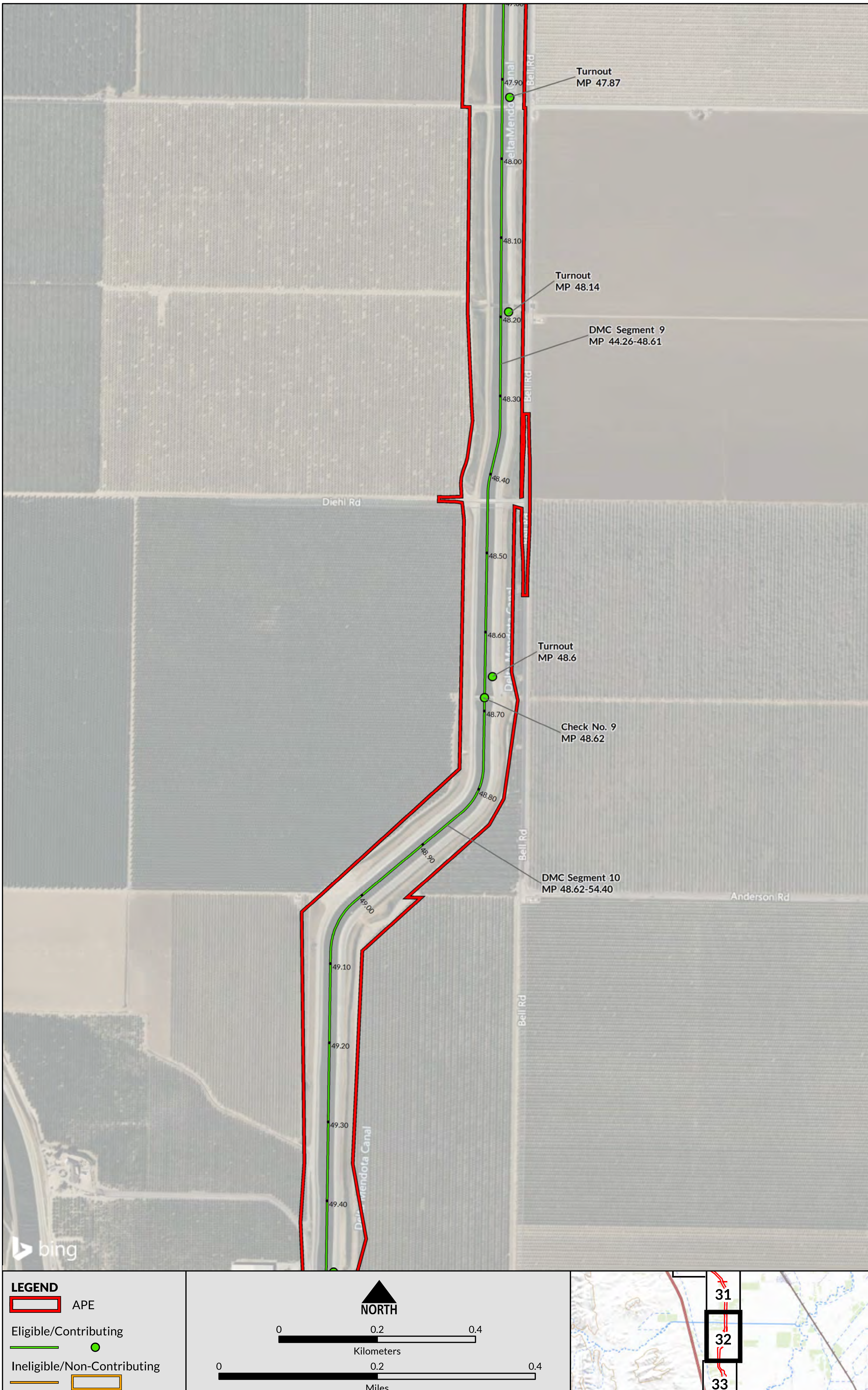

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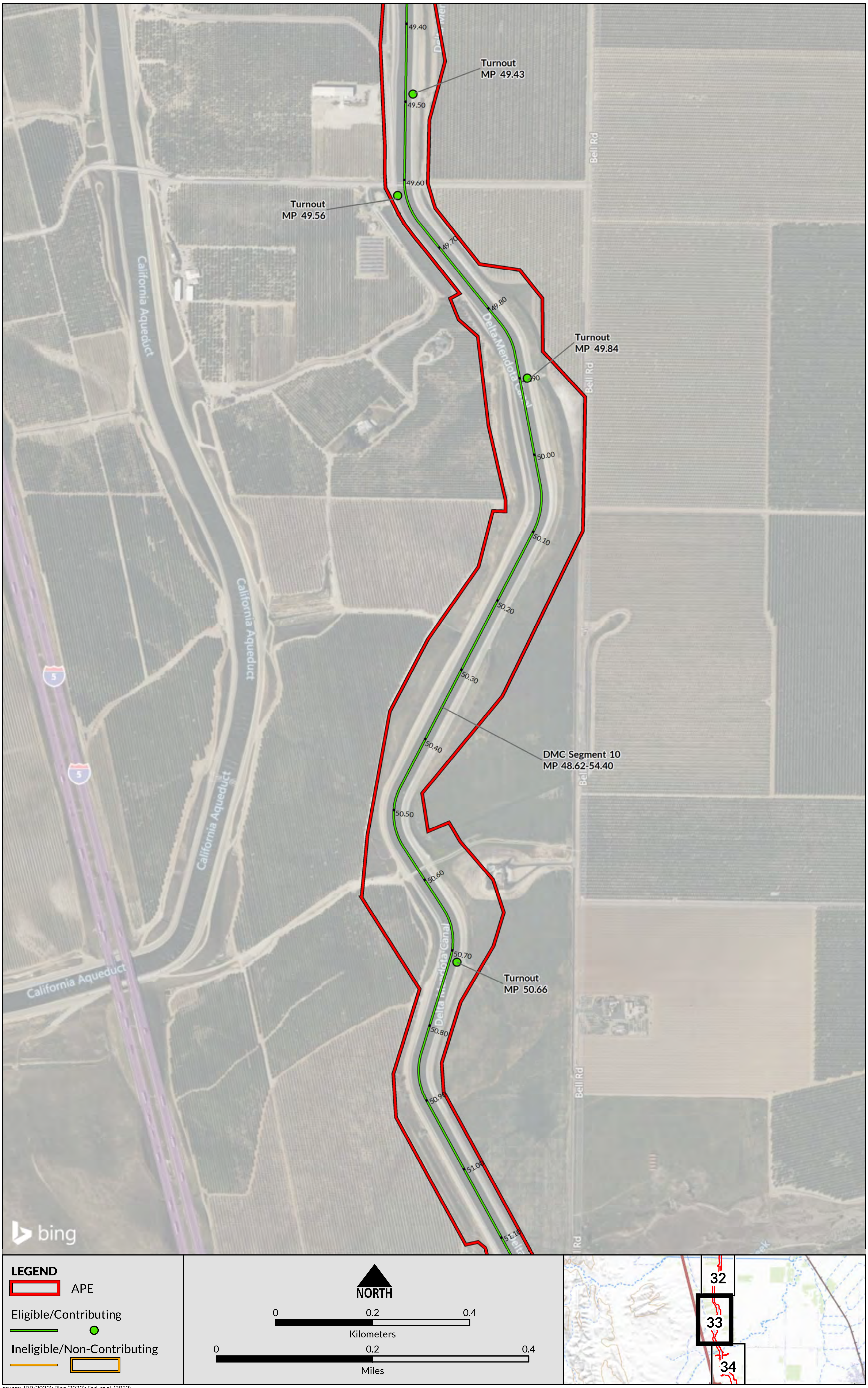

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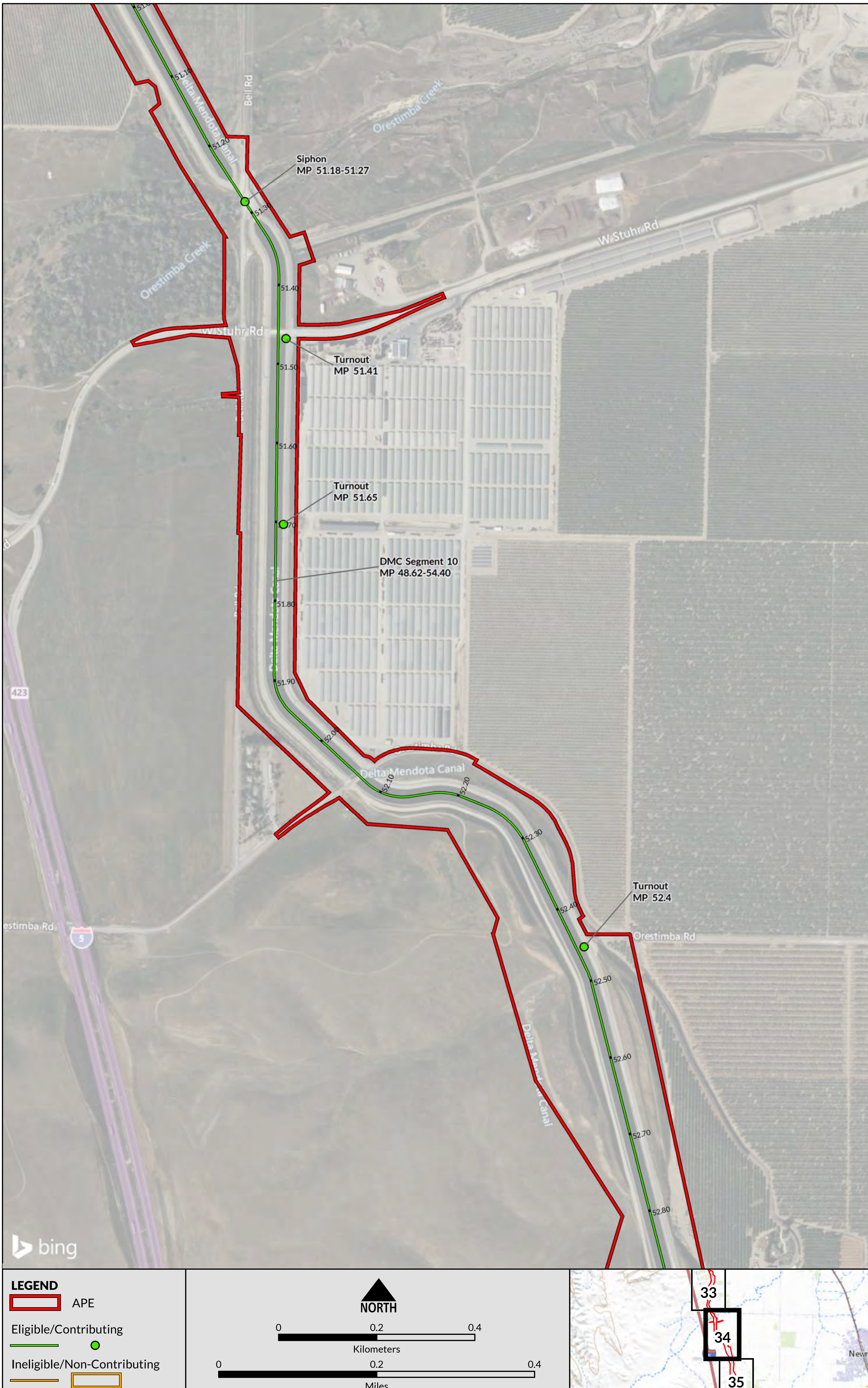

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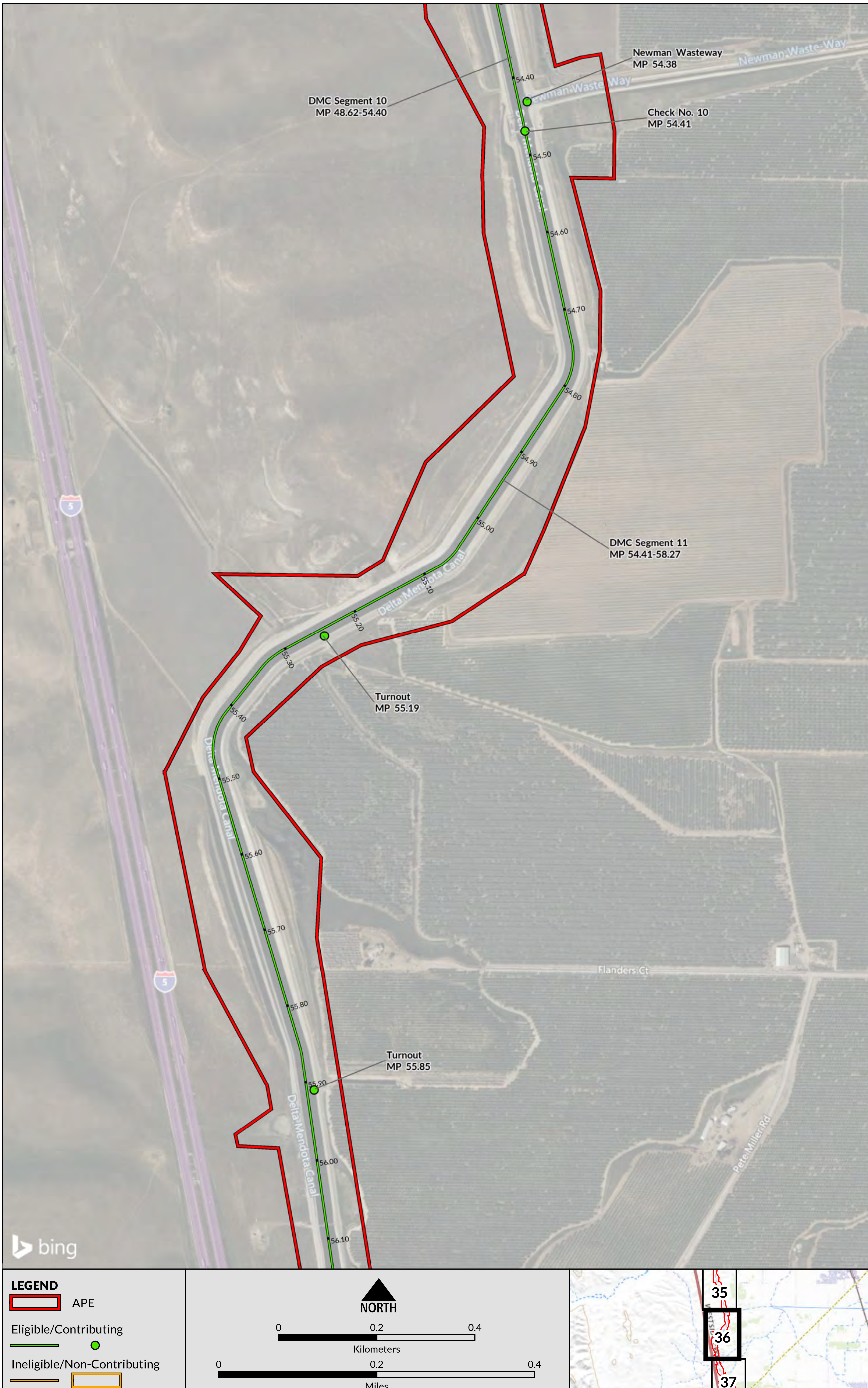

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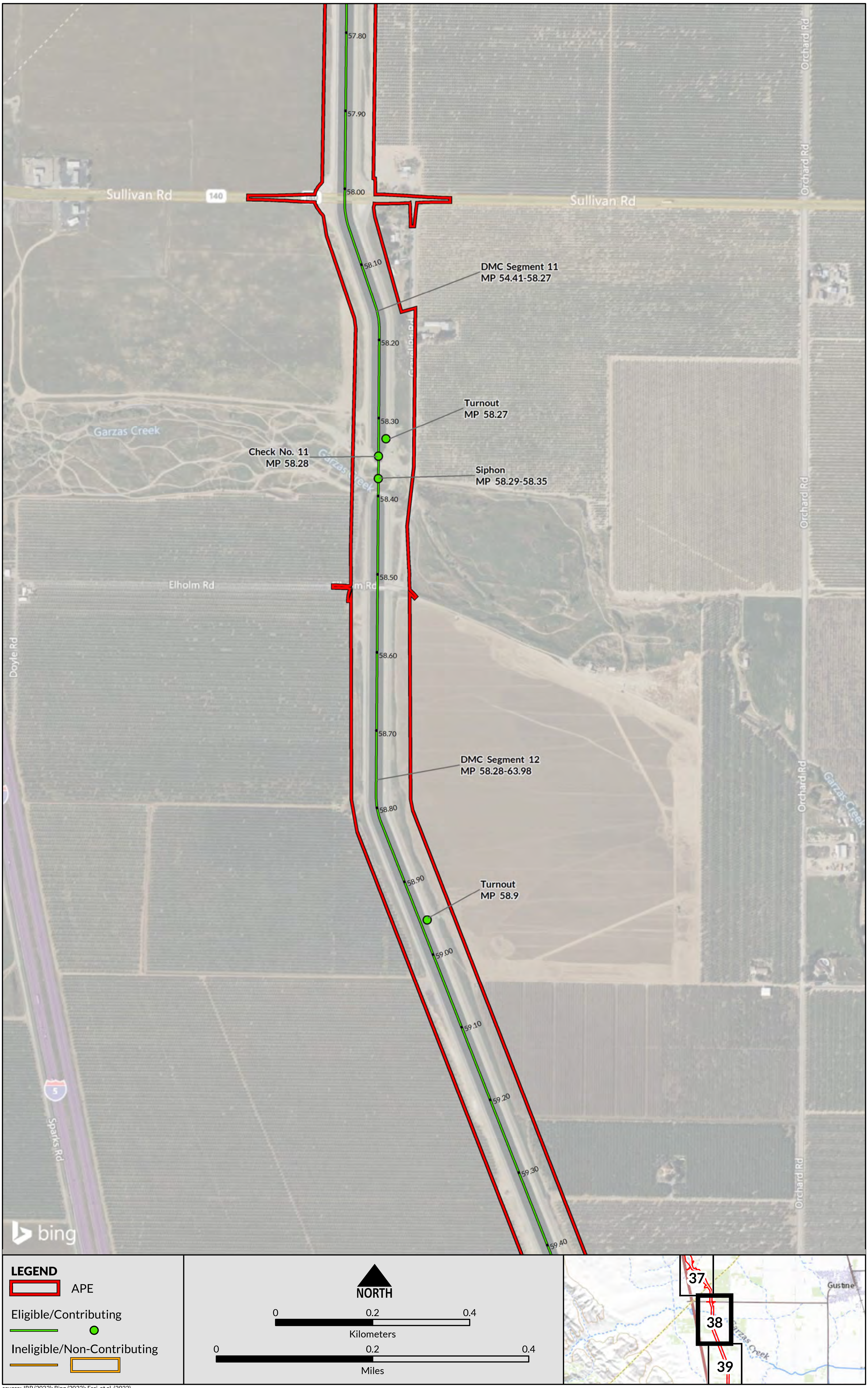

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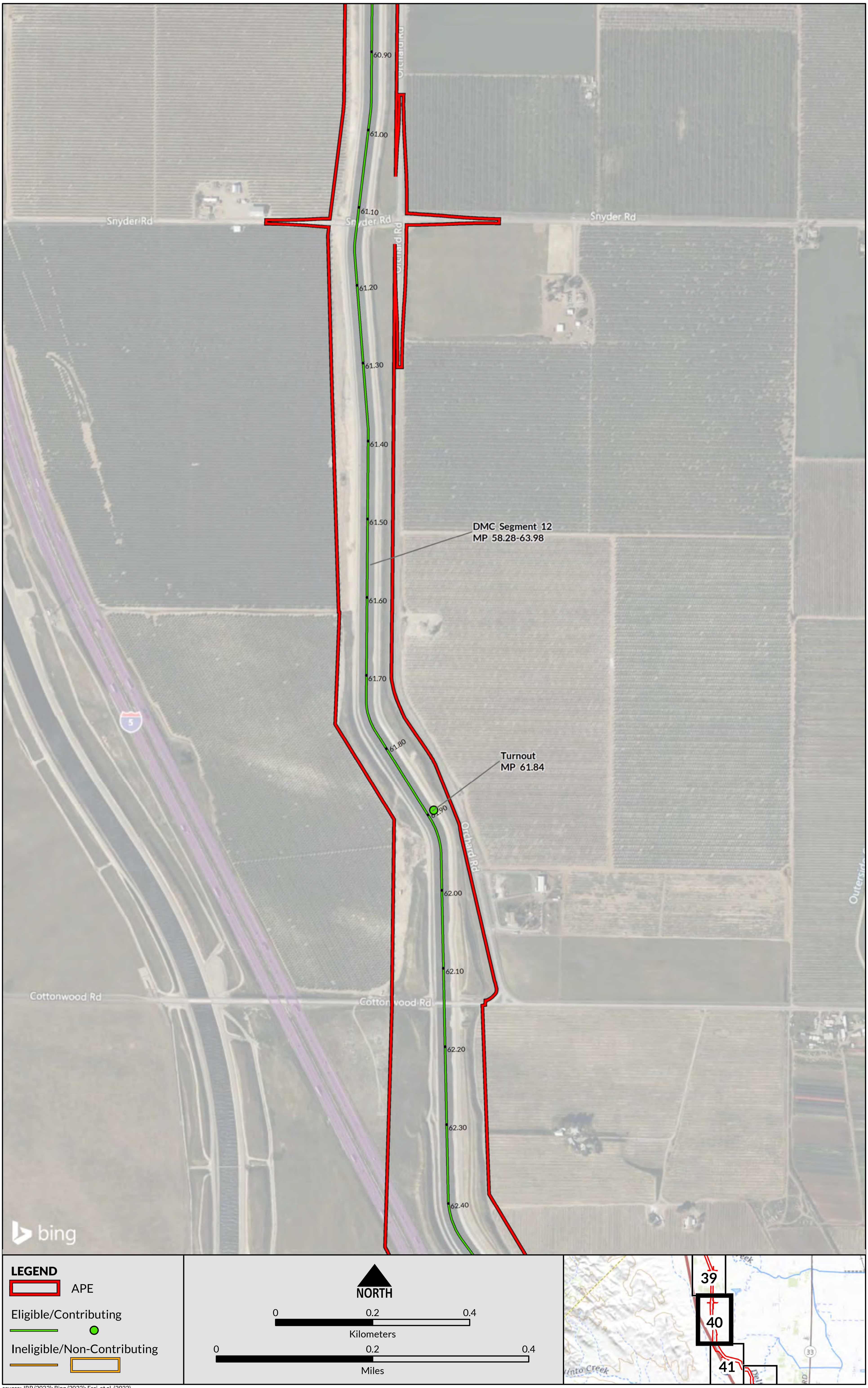

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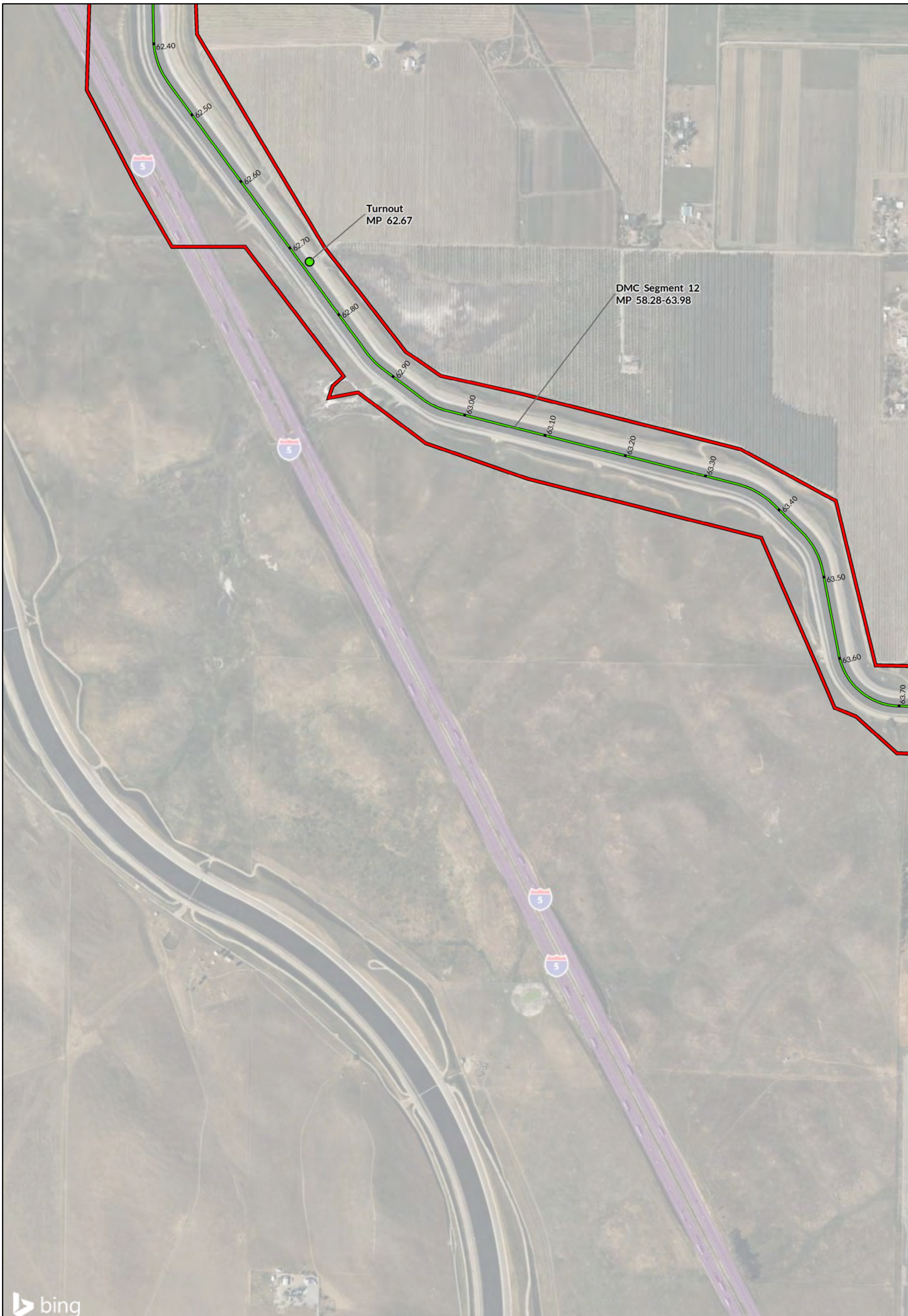


LEGEND

APE

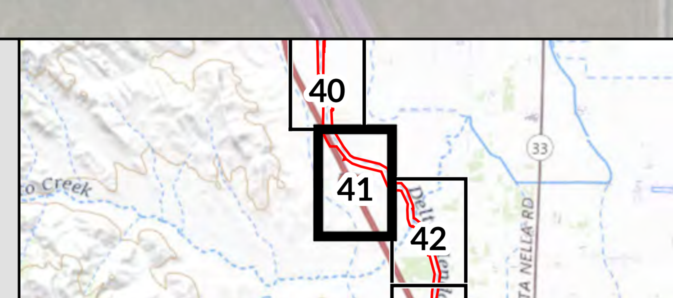
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4
Kilometers

0 0.2 0.4
Miles



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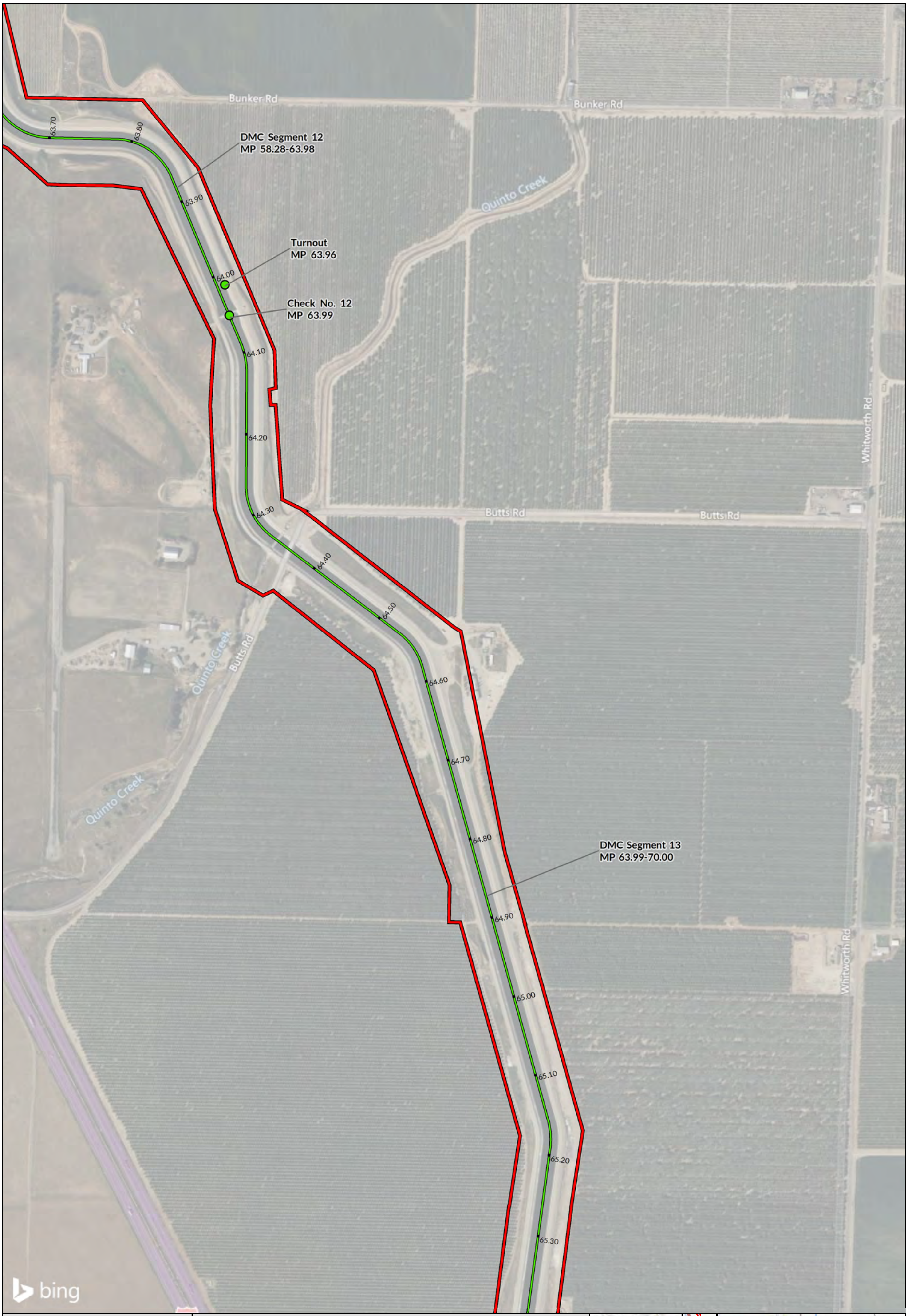


LEGEND

APE

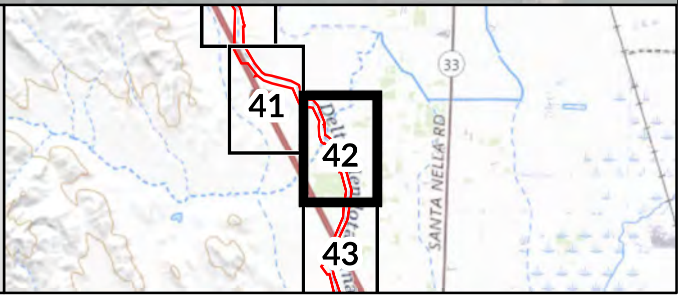
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4
Kilometers

0 0.2 0.4
Miles



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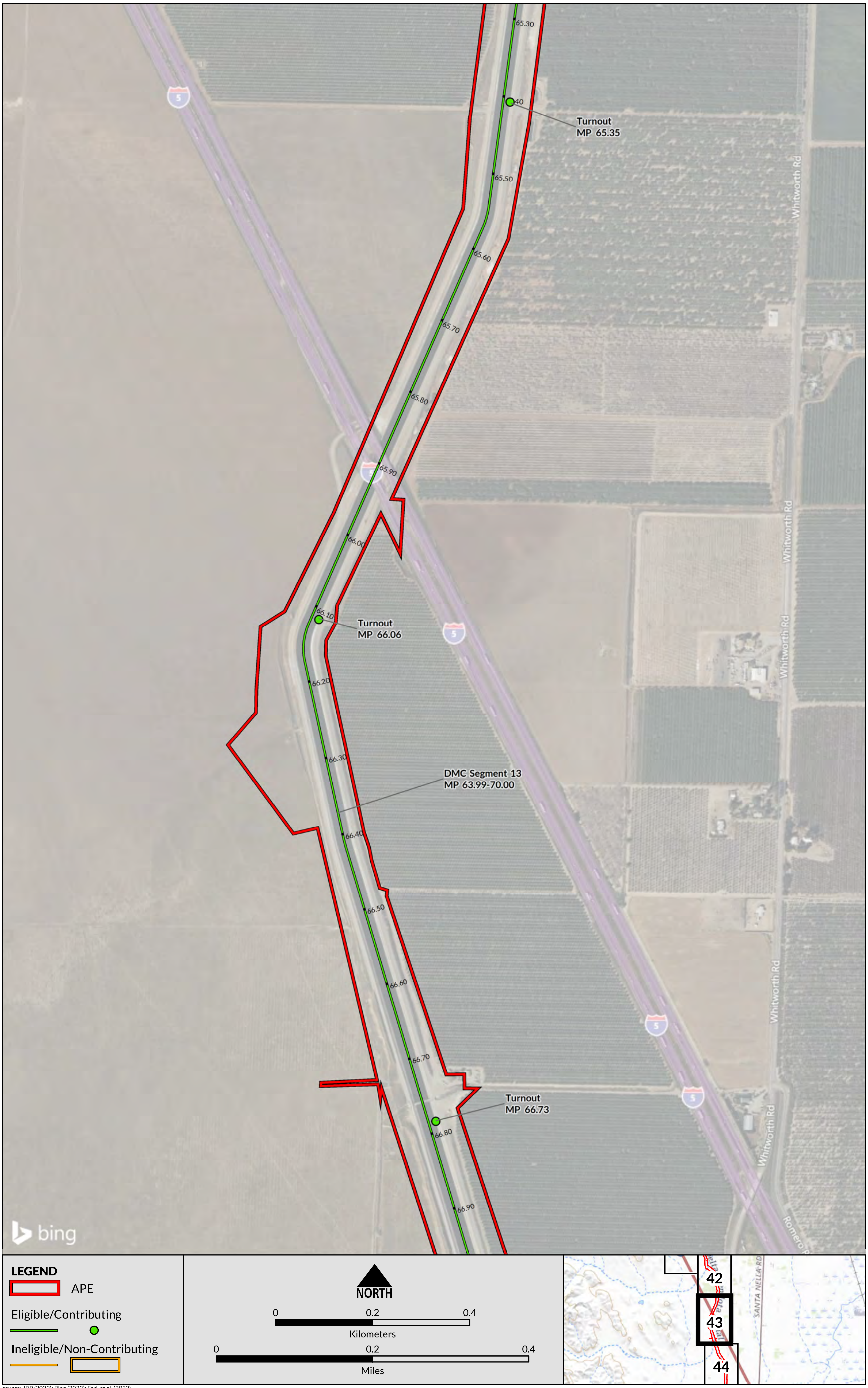

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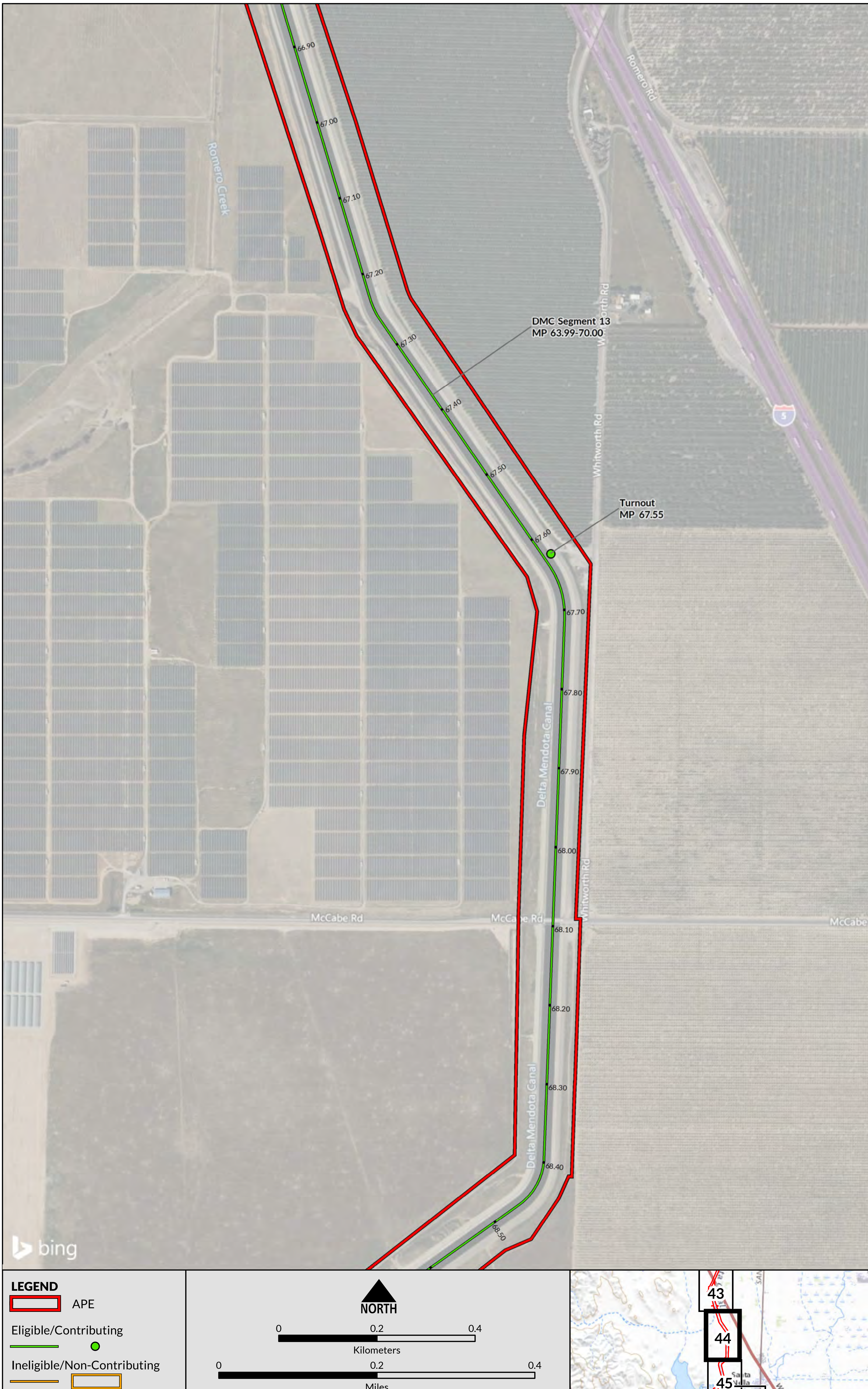

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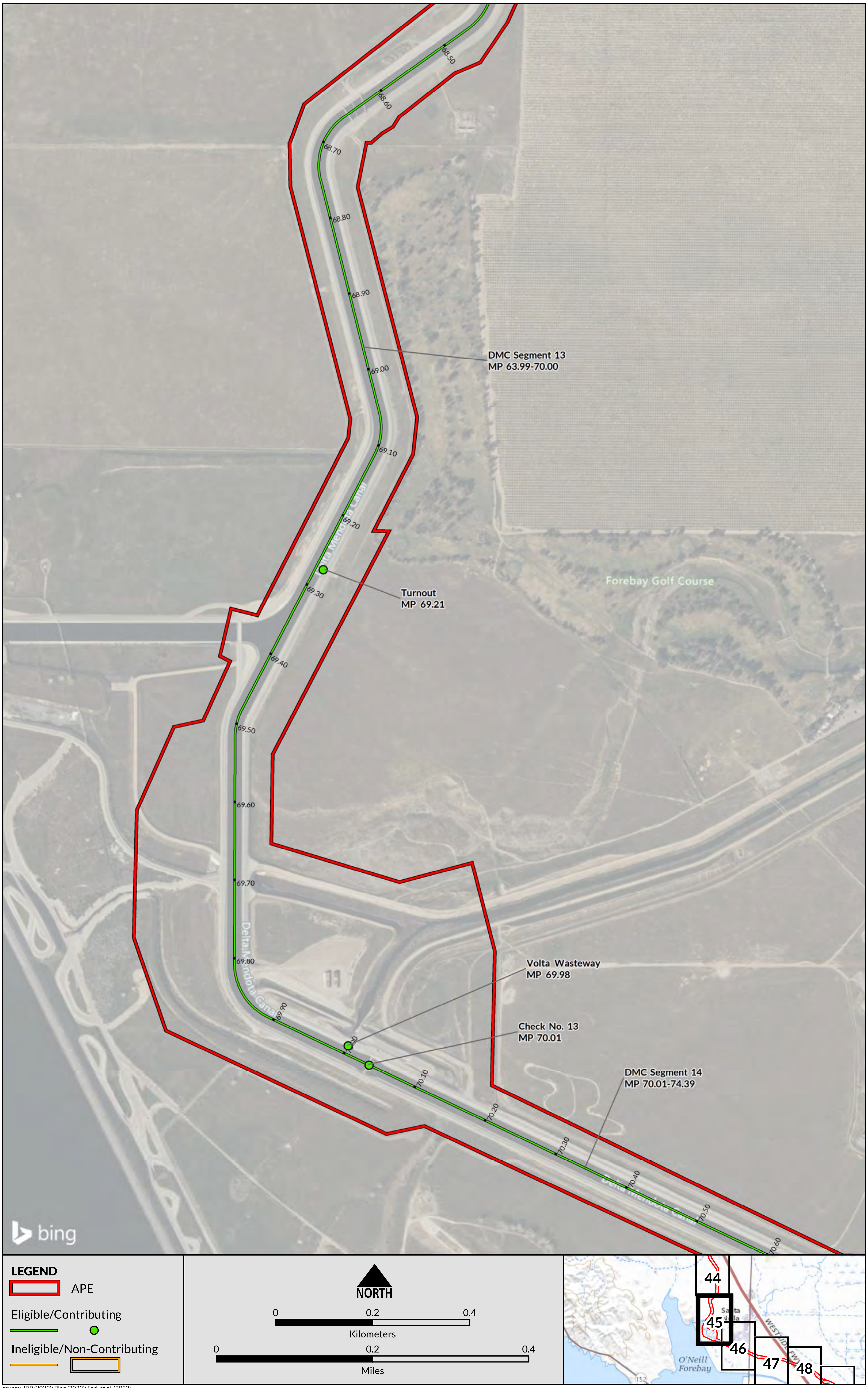

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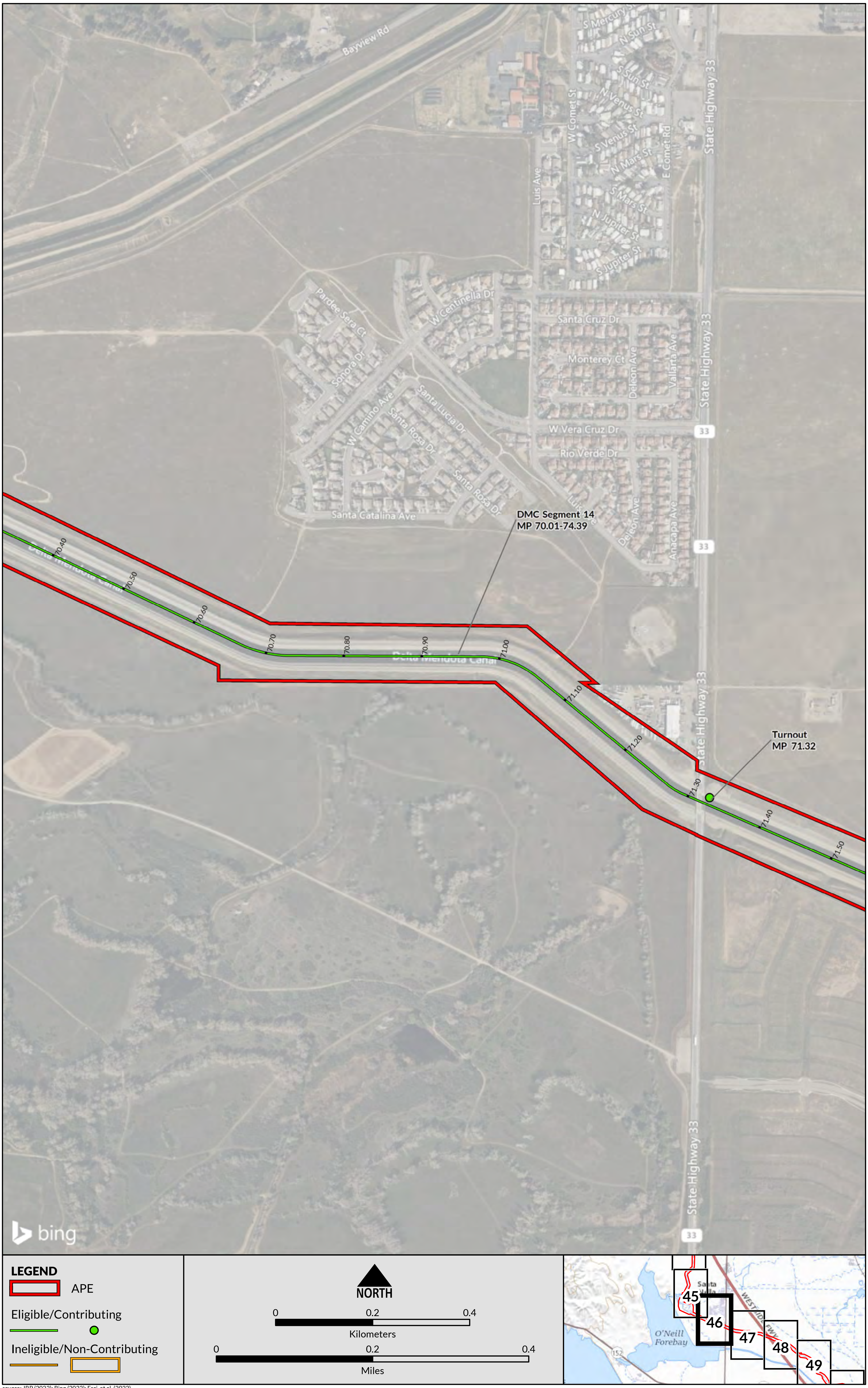

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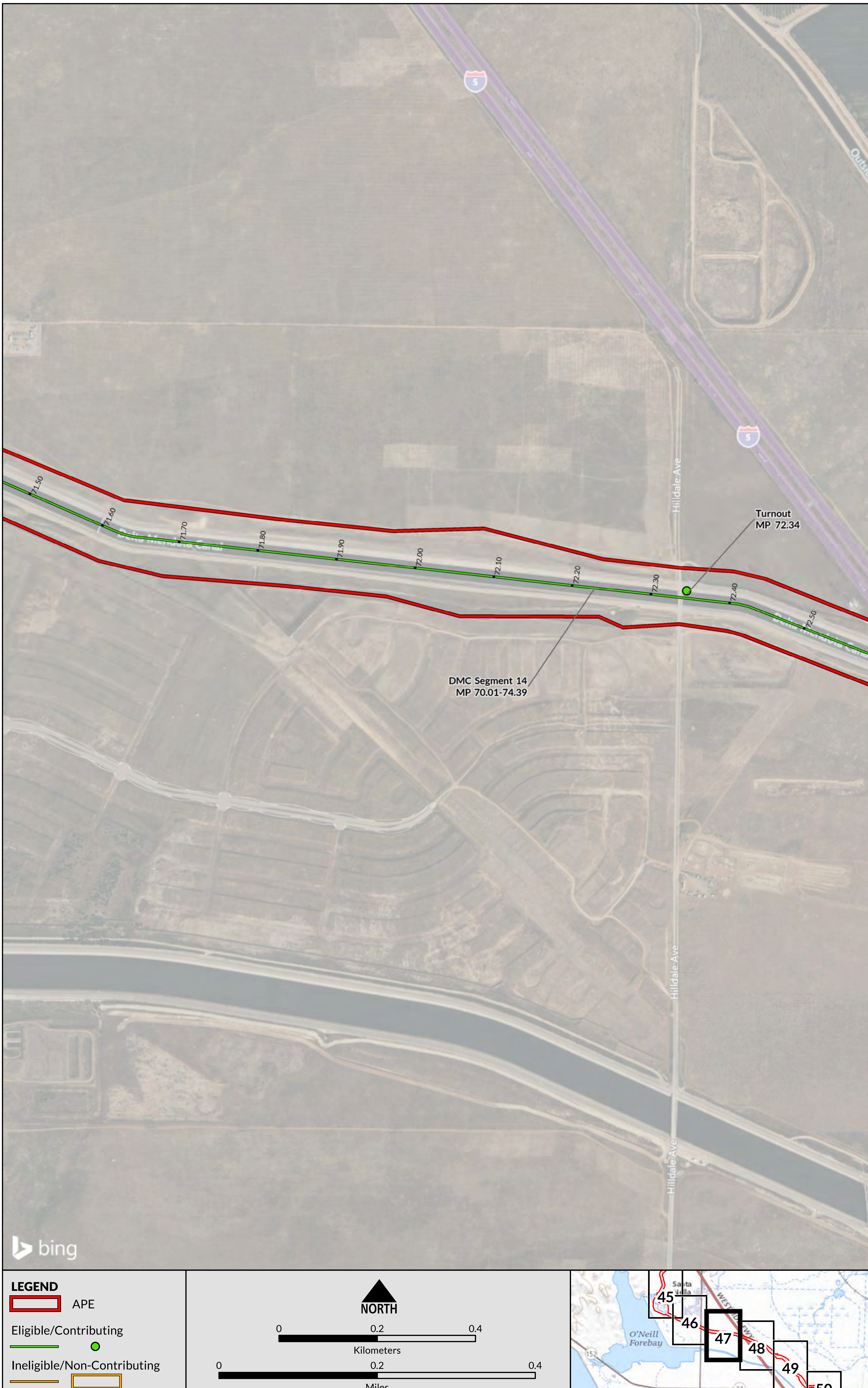

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LEGEND

APE

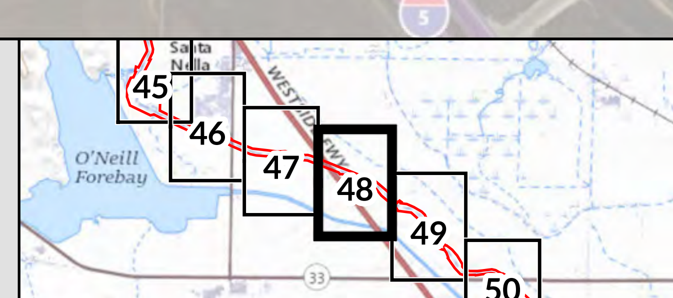
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4
Kilometers

0 0.2 0.4
Miles



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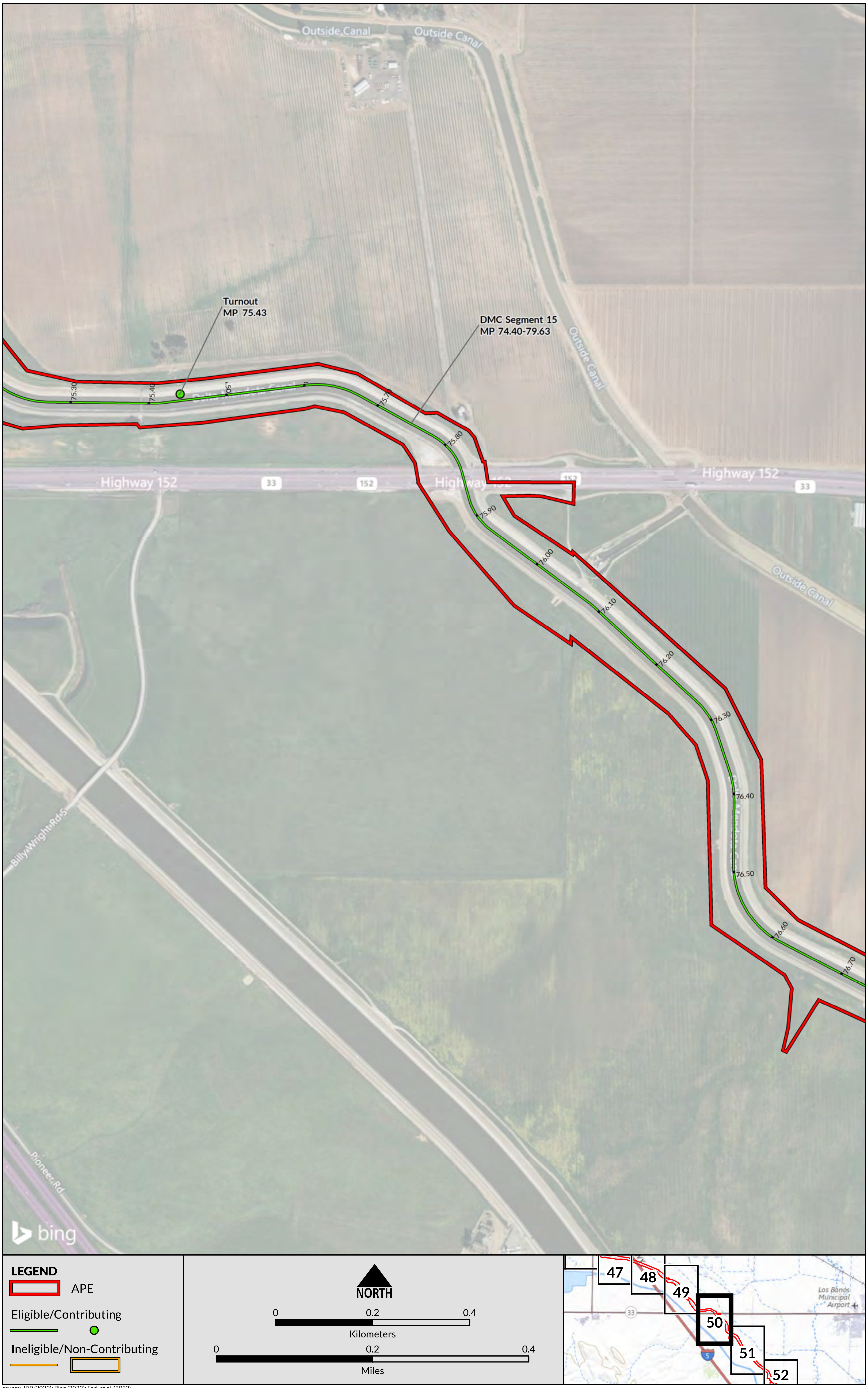

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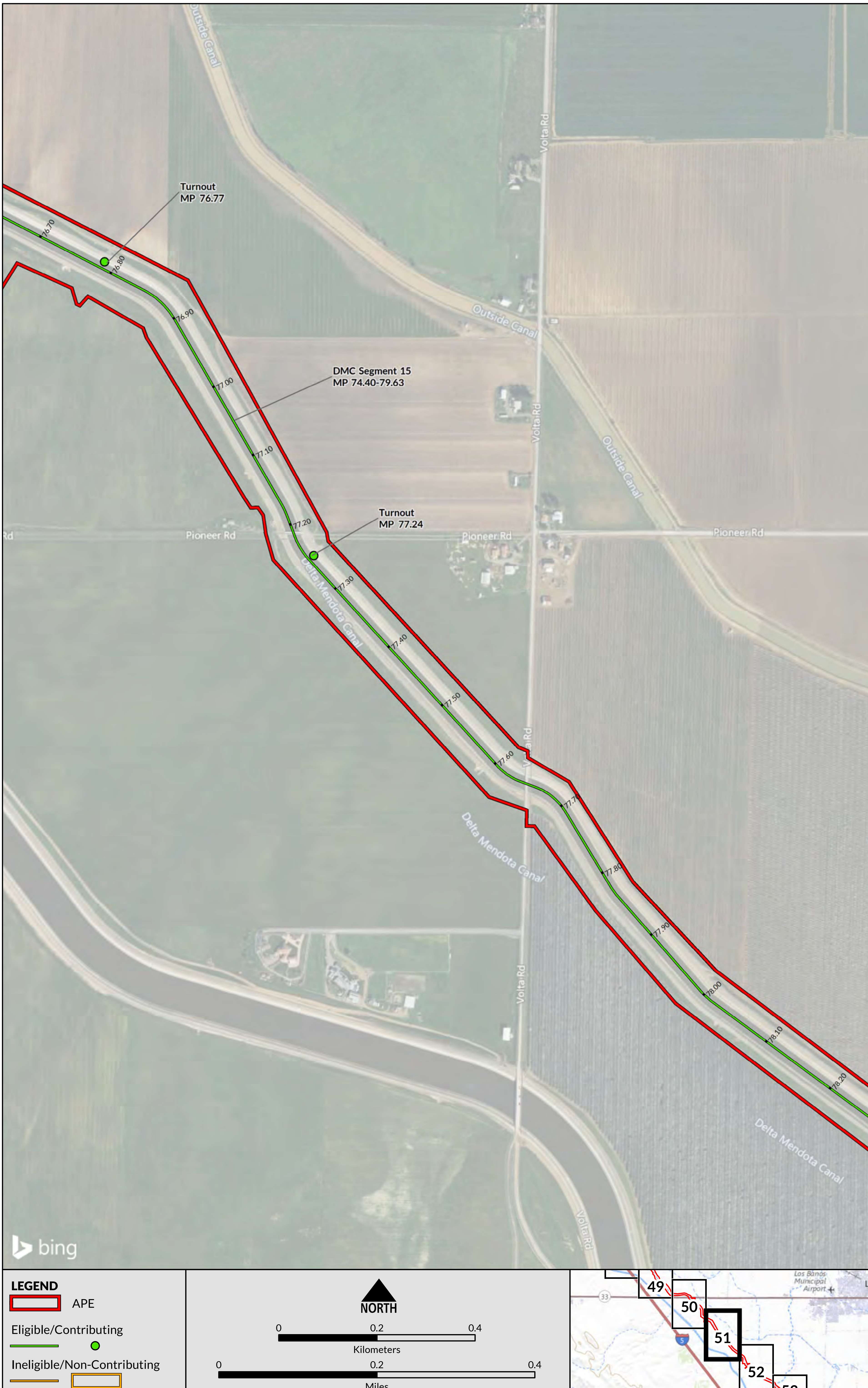


source: JRP (2022); Bing (2022); Esri, et al. (2022).

LEGEND

APE

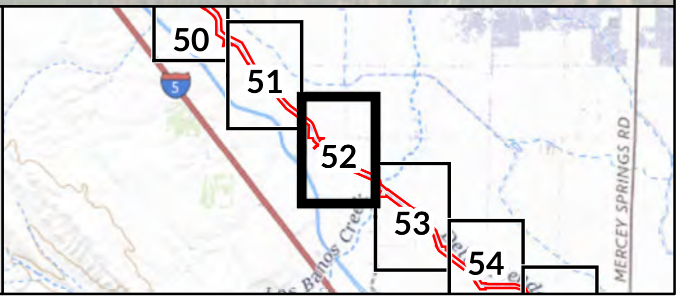
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4 Kilometers

0 0.2 0.4 Miles



source: JRP (2022); Bing (2022); Esri, et al. (2022).

LEGEND

APE

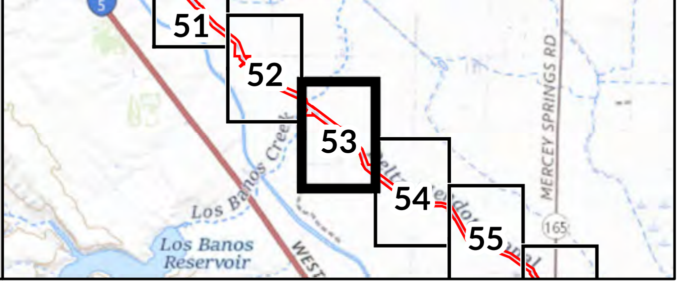
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4 Kilometers

0 0.2 0.4 Miles



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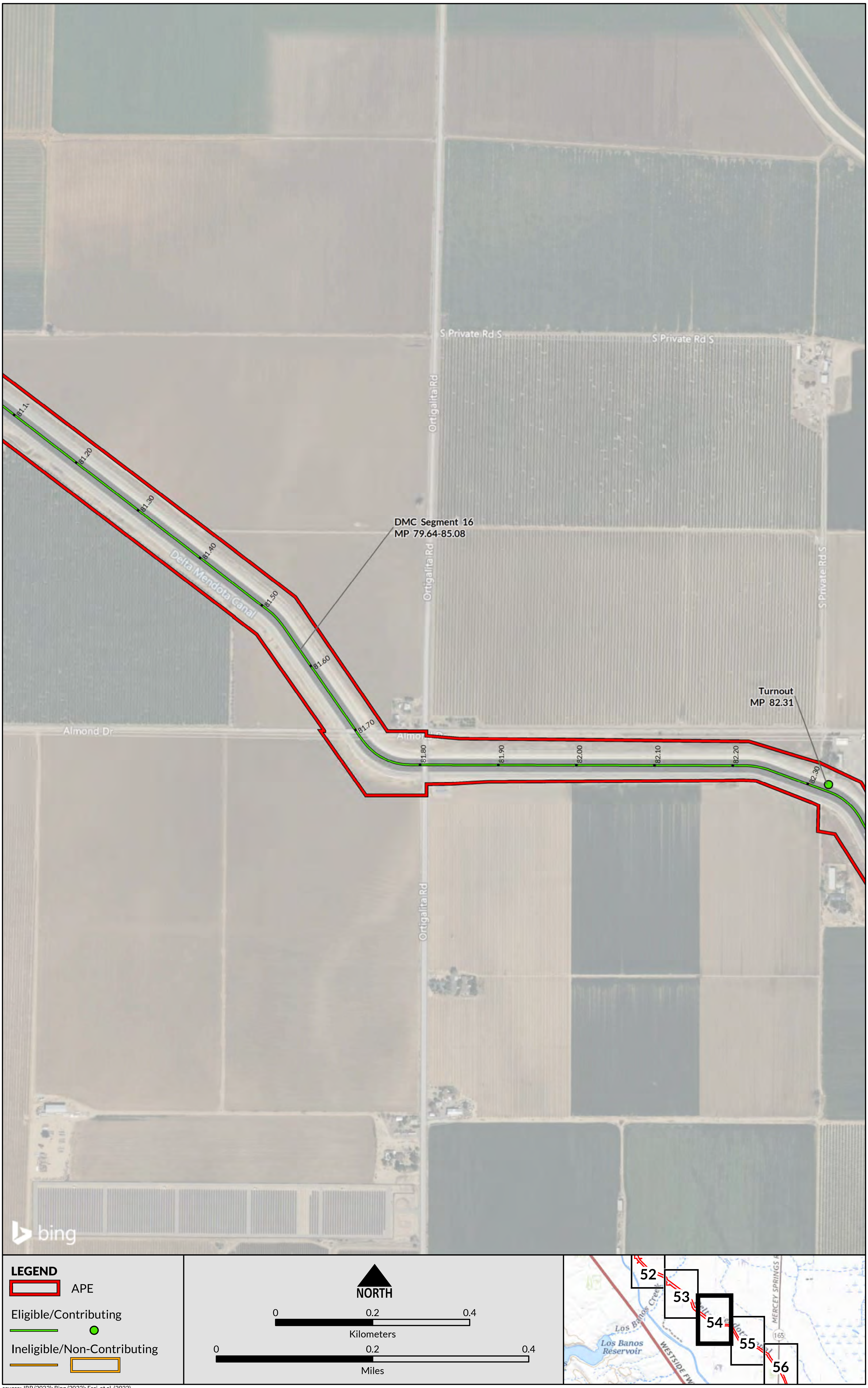

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LEGEND

APE

Eligible/Contributing

Ineligible/Non-Contributing

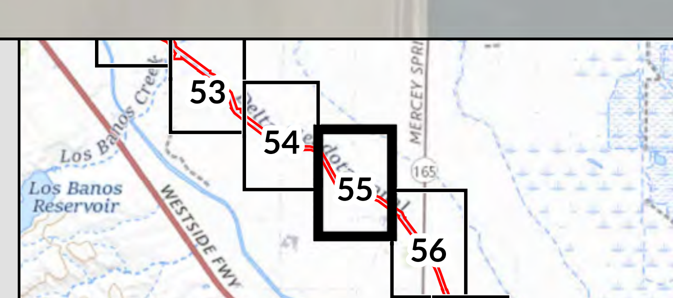
NORTH

0	0.2	0.4

Kilometers

0	0.2	0.4

Miles



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source: JRP (2022); Bing (2022); Esri, et al. (2022).

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LEGEND

APE

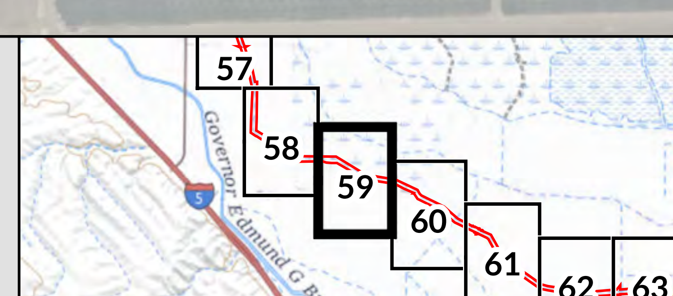
Eligible/Contributing

Ineligible/Non-Contributing

NORTH

0 0.2 0.4
Kilometers

0 0.2 0.4
Miles



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