Chapter 13 Minerals

13.1 Introduction

This chapter describes the environmental setting, methods of analysis, and impact analysis for mineral resources that would potentially be affected by the construction and operation of the Project. Mineral resources within the counties where the Project would be constructed include natural gas, aggregate (i.e., gravel and sand), and rock. The analysis focuses on potential obstruction of access to these mineral resources. The study area is the footprint where construction or operation of Project facilities would occur.

Federally defined "critical minerals" are not addressed further in this chapter because there are no known critical minerals in the vicinity of the study area. This is confirmed with reference to work performed by the U.S. Geological Survey as directed by executive orders of the President of the United States and the Secretary of the Interior (Critical Minerals Executive Order and Secretary Order; Appendix 4A, Regulatory Requirements). Those orders directed U.S. Geological Survey to develop a plan to improve the Nation's understanding of domestic critical mineral resources. That initiative identified 35 critical minerals (Secretary of the Interior 2018). The only identified critical mineral found near the study area is chromium. A chromium mine operated in Glenn County during World War I and World War II and closed in the late 1940s (Shumway 1997). A low-grade chrome prospect occurs approximately 3.5 miles west of the inundation area in the hills east of East Park Reservoir (ICF 2020), which is outside of the study area and would not be affected by the Project.

Tables 13-1a and 13-1b summarize the CEQA determinations and NEPA conclusions for construction and operation impacts to mineral resources.

Table 13-1a. Summary of Construction Impacts and Mitigation Measures for Mineral Resources

Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation
Impact MIN-1: Loss of availability of a known mineral resource that would be of value to the region and the residents of the state			
No Project	NI/NE	-	NI/NE
Alternative 1	NI/NE	-	NI/NE
Alternative 2	NI/NE	-	NI/NE
Alternative 3	NI/NE	-	NI/NE
Impact MIN-2: Loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan			
No Project	NI/NE	-	NI/NE
Alternative 1	NI/NE	-	NI/NE
Alternative 2	NI/NE	-	NI/NE

Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation
Alternative 3	NI/NE	-	NI/NE

Notes:
NI = CEQA no impact
NE = NEPA no effect or no adverse effect

Table 13-1b. Summary of Operations Impacts and Mitigation Measures for Mineral Resources

Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation
Impact MIN-1: Loss of availability of a known mineral resource that would be of value to the region and the residents of the state			
No Project	NI/NE	-	NI/NE
Alternative 1	NI/NE	-	NI/NE
Alternative 2	NI/NE	-	NI/NE
Alternative 3	NI/NE	-	NI/NE
Impact MIN-2: Loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan			
No Project	NI/NE	-	NI/NE
Alternative 1	NI/NE	-	NI/NE
Alternative 2	NI/NE	-	NI/NE
Alternative 3	NI/NE	-	NI/NE

Notes:
NI = CEQA no impact
NE = NEPA no effect or no adverse effect

13.2 Environmental Setting

There are two primary categories of mineral resources that could occur in the study area: aggregate resources and natural gas. Aggregate resources are valuable economic commodities, are necessary for most construction, cannot be replaced with other products, and are most economical when used close to the area where they are mined because of the high cost of transportation. These resources are locally important resources because it is most economical to use them near their sources, but they are also regionally important in areas where the demand is great.

The surface of the Sacramento Valley is predominantly composed of unconsolidated sedimentary materials (i.e., gravel, sand, silt, clay, or alluvium) deposited from rivers draining the Coast Range, Klamath Mountains, Modoc Plateau, and Sierra Nevada (Chapter 12, *Geology and Soils*). These surface deposits are associated with the Sacramento River and its tributaries that enter from the Coast Range and Sierra Nevada. The deposits in the Sacramento Valley are very deep and become older at depths where they have become consolidated into sedimentary rock. At the

surface, the river deposits are mined for aggregate. At great depths (i.e., thousands of feet) the much older sedimentary rocks contain natural gas.

The natural gas is found in units called *fields* that are three-dimensional zones where natural gas is contained in porous rock which is trapped by overlying nonporous rock. Wells are drilled from the surface down into these fields to locate and extract the natural gas. There are 10 natural gas wells in the Project inundation area, but these wells have gone dry, have been plugged, and are therefore not active (ICF 2020). Natural gas fields are also present in the southern portion of the study area near Dunnigan, but the fields have no active wells. Other scattered wells in the vicinity are also dry (Geologic Energy Management Division 2021).

Separately from known natural gas fields, the U.S. Geological Survey has explored the possibility that there are undiscovered, technically recoverable natural gas resources in the Sacramento Valley (Schenk et al. 2020). These potential resources are in much deeper and older rocks than those that have historically provided natural gas (Sacramento Valley and easternmost Coast Range) (Schenk et al. 2020). The assessment by Schenk et al. (2020) used a variety of rock characteristics to quantify a range of possible natural gas volumes that might be recovered from the entirety of the Sacramento Basin. One of the areas providing insight to the Schenk et al. (2020) analysis is just north of the Project inundation area (Sterling 2018). A well was drilled approximately 1.6 miles northeast of the northernmost portion of the Project inundation area in late 2017 but is now idle (Tulainyo well 2-7). There are no reports of natural gas production from that well. To date these older and deeper rocks have not yet yielded natural gas (Schenk et al. 2020).

Aggregate availability and production in the study area counties and vicinity are described by Shumway (1997; Glenn County), Clinkenbeard and Gius (2018; statewide), and O'Neal and Gius (2018; Yolo County). Those reports designate the aggregate deposits along the river and stream systems as Mineral Resource Zones (MRZs): MRZ-2a, MRZ-2b, and MRZ-3a. The MRZ-2a designation indicates areas of prime importance for aggregate materials, MRZ-2b characterizes significant resources with inferred reserves, and MRZ-3a refers to areas with moderate potential for economic aggregate. These designations indicate that aggregate resources are physically available if there is enough demand to make extraction economically viable. There are no designated mineral resource zones in the study area (Shumway 1997; O'Neal and Gius 2018; California Geological Survey 2021).

13.3 Methods of Analysis

This section describes the qualitative and quantitative methods used to evaluate the Project's potential impacts to mineral resource availability. The analysis assumes the Project would be designed and constructed in accordance with the standards, criteria, and regulations described in Appendix 2C, *Construction Means, Methods, and Assumptions*.

13.3.1. Construction

Construction impacts are evaluated by identifying the locations of Project components that might temporarily obstruct access to known natural gas or aggregates. Known natural gas or aggregate resources were identified by reviewing the following maps (ICF 2020):

- California Geologic Energy Management Division (CalGEM) Well Finder online map
- California Geological Survey Information Warehouse: Mineral Land Classification online map (California Geological Survey 2021)
- California Department of Conservation Mines online map

The county general plans did not identify any additional mineral resources in the study area beyond those identified in the CalGEM database and the California Geological Survey mineral land classification maps (Colusa County 2012; County of Glenn 1993 and 2020; Tehama County 2009; County of Yolo 2009).

13.3.2. Operation

The impacts of operation on natural gas resources are evaluated by identifying the locations of existing wells and pipelines and assessing potential conflicts with permanent facilities. Operational impacts on aggregate resources are evaluated by identifying the locations of aggregate resources that would no longer be physically accessible following Project completion.

13.3.3. Thresholds of Significance

An impact on mineral resources would be considered significant if the Project would:

- Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state.
- Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

13.4 Impact Analysis and Mitigation Measures

Impact MIN-1: Loss of availability of a known mineral resource that would be of value to the region and the residents of the state

No Project

Under the No Project Alternative, the operations of the existing TC Canal, RBPP, and GCID Main Canal would continue and any obstruction of access to mineral resources would be unchanged.

Significance Determination

The No Project Alternative would not result in a loss of availability of a known mineral or natural gas resource that would be of value to the region and the residents of the state. There would be no impact/no effect.

Alternatives 1 and 3

Construction of Alternative 1 or 3 would potentially interfere with the availability of mineral resources of value to the region and residents of the state if construction activities would temporarily block access to underlying natural gas fields, natural gas wells, or identified mineral

resource zones. Operational effects would occur if the permanent Project footprint would block access to such resources.

Because their footprints are the same, Alternatives 1 and 3 are equivalent for the purpose of this analysis.

Construction

Natural Gas Fields

Construction and operation of the TRR East and conveyance complex, main dams, saddle dams, saddle dikes, and the I/O Works under Alternatives 1 and 3 would not affect any natural gas fields because there are no gas fields identified within the inundation area or construction footprint of the facilities. With respect to the potential for future natural gas recovery from very deep rocks (Schenk et al. 2020), should these resources be discovered, construction and operation of Alternatives 1 and 3 would not preclude their extraction because the associated facilities overlie such a small portion of the total potential natural gas field.

Modifications at the existing RBPP and GCID Main Canal, other GCID system upgrades, and the construction of the Dunnigan Pipeline at the terminus of the TC Canal would generally not affect natural gas fields. The modifications at the RBPP would occur within the existing footprint and no underlying natural gas fields are present. The GCID Main Canal would have a new head gate upstream of the existing structure, height additions to the canal, and 17 miles of road upgrade along the canal. These activities would occur within existing rights-of-way and facility footprints.

The Dunnigan Pipeline would be constructed from approximately the terminus of the TC Canal eastward to the CBD and would include an intake on the TC Canal and an outlet at the CBD. There is one natural gas field in the vicinity of the CBD. Linear pipeline construction and the footprint of the CBD outlet would not obstruct access to the underlying natural gas field because the footprint would be narrow (approximately 100 feet wide) and any well that would be drilled in its vicinity could be located to avoid the pipeline or outlet.

Natural Gas Wells

Construction of Alternatives 1 and 3 would entail several borrow areas, disposal sites, staging areas, stockpile sites, and quarry and rock processing areas in the inundation area (Figure 2-38). Several of these areas would be located near 10 existing plugged natural gas wells. The borrow area to the southeast of the Peninsula Hills Recreation Area (SD 3-Z1 Borrow) is close to one of these plugged wells (API 041100366). There are also five other plugged wells in the vicinity, but they are not near that borrow area. There would be several borrow areas, stockpile sites, staging areas, and quarry and rock processing areas in the northeastern portion of the inundation area. There are three dry and plugged natural gas wells nearby that would all underlie these components.

Because these wells were dry and previously plugged (i.e., decommissioned), there would be no effect on natural gas production from them. All the individual well heads would require on-the-ground identification, examination, and isolation to ensure that surface activities, excavation, or future inundation did not damage them so as to cause a hazard. BMPs and impacts related to

hazards and hazardous materials are discussed in Chapter 27, *Public Health and Environmental Hazards*.

There is one plugged, dry hole approximately 950 feet east of TRR East. That well would not be affected by the construction of this facility because of its location. No natural gas wells occur at the existing RBPP or GCID facilities. There are no natural gas wells in the vicinity of the 3-mile-long Dunnigan Pipeline alignment, TC Canal intake, or CBD outlet.

Aggregate and Rock Resources

Construction of Alternatives 1 and 3 would require a substantial amount of borrow (fine grained material such as sand and clay), gravel, and stone. These materials would be used to construct the two main dams, seven saddle dams, and two saddle dikes. Additionally, gravel aggregate would be used for all facilities requiring concrete for construction (concrete aggregate) such as the bridge, I/O tower, and I/O tunnel lining. Gravel aggregate would also be used for road base and parking lots. Large rocks (i.e., approximately 3 feet in longest dimension) would also be placed along the reservoir face of all the dams as riprap to protect them from shoreline erosion. In addition, the dams would have sand and gravel filter, drain, and transition zones that would require offsite borrow.

Much of the earth (material suitable for earth-rock mix dams) and rock materials, including riprap, that would be required to construct the facilities would come from onsite sources (within or immediately adjacent to the inundation area) (Figure 2-38). Approximately 20% of the material required for dam construction would be obtained from offsite commercial sources. Aggregate material for concrete and road base would also come from offsite commercial sources (Chapter 2 and Appendix 2C, Table 2C-10).

Construction would not obstruct access to economically viable aggregate or rock resources of value to the region and the residents of the state because any resources present at the site are far from construction centers and transportation routes (e.g., Interstate 5). Additionally, existing and developed aggregate resources are close to regional users.

Operation

Operation of Alternative 1 or 3 would be the same because the differences in water deliveries would not affect accessibility of mineral resources and because the constructed facilities would be identical. Operation of the constructed facilities could affect access to natural gas fields, natural gas wells, or aggregate resources if access to these resources was reduced such that they became unavailable.

Natural Gas Fields

Operation would not affect underlying natural gas fields because there are none in this area. There would be no impact. The RBPP and GCID facilities already exist and would not affect underlying natural gas fields during operations. There is a natural gas field in the vicinity of the Dunnigan Pipeline alignment and the CBD outlet, but the pipeline and outlet would have a relatively small footprint and primarily be a narrow, linear feature which would not obstruct access to this gas field. There would be no impact.

Natural Gas Wells

There are 10 dry natural gas wells within the 13,200-acre inundation area of Alternatives 1 and 3. These all have been plugged (i.e., they are not active) and were never in production (ICF 2020). Alternatives 1 and 3 would not affect gas production from these wells. There is one idle well and one plugged dry well approximately 1.6 miles to the northeast of the inundation area. These wells would not be covered by the reservoir and there are no other facilities for Alternatives 1 and 3 near its location. Access to the idle well would continue from the southeast via Road 69 and from the north on Road 400. The wells in the vicinity of the Dunnigan Pipeline are not active. There are no natural gas wells in any other locations that would be affected by the operation of facilities for Alternatives 1 and 3.

Aggregate and Rock Resources

None of the facilities for Alternatives 1 and 3 would cover identified MRZs and make them unavailable for future use (Shumway 1997, O'Neal and Gius 2018). Although aggregate resources suitable for construction are present in the inundation area and would be used for construction of the facilities, these resources are not economically viable for use outside the immediate area. There is not sufficient demand for aggregate products in the vicinity; therefore, mineral resource zones have not been mapped in the area. In addition, aggregate resources in the Sacramento Valley are already permitted and close to points of use.

CEQA Significance Determination and Mitigation Measures

No impacts on natural gas fields or natural gas wells would occur as a result of construction or operation of Alternative 1 or 3 because either natural gas fields or wells do not exist in the study area or there would not be a loss of access to the natural gas fields and wells. No impact on aggregate availability would occur from construction or operation of Alternatives 1 and 3 because no designated aggregate resources exist in the footprint; the use of the aggregate in the area would not currently be economically viable outside the immediate vicinity; and should future demand increase, other aggregate resources are readily available in the Sacramento Valley.

NEPA Conclusion

Construction and operation effects would be the same as described above for CEQA. Construction and operation effects would not occur because of the lack of resources or access would be maintained as compared to the No Project Alternative. Alternative 1 or 3 would have no effect on natural gas fields or natural gas wells, and there would be no adverse effect from construction and no effect from operation of Alternative 1 or 3 on aggregate availability.

Alternative 2

Under Alternative 2, there would be slight differences in the locations and sizes of the main dams, saddle dams, and saddle dikes. The TRR West would be in a slightly different location, the bridge would not be constructed, South Road would be constructed around the southern end of the reservoir, and the Dunnigan Pipeline would continue past the CBD to the Sacramento River discharge. These components of Alternative 2 are in the same minerals setting as Alternatives 1 and 3.

Construction

Natural Gas Fields and Natural Gas Wells

There are no natural gas fields or natural gas wells along the Huffmaster Road realignment, the South Road alignment, or at TRR West. As with Alternatives 1 and 3, the natural gas wells in the vicinity of the longer Dunnigan Pipeline for Alternative 2 are dry. Therefore, the potential construction impacts on natural gas fields and natural gas wells for Alternative 2 would be the same as for Alternatives 1 and 3.

Aggregate and Rock Resources

There are minor differences between Alternative 1 or 3 and Alternative 2 relevant to potential impacts to aggregate because the footprints would be similar. Alternative 2 would involve a smaller inundation area, Huffmaster Road realignment, South Road alignment, fewer saddle dams, an additional saddle dike, and TRR West. There would be a longer Dunnigan Pipeline from the TC Canal to the Sacramento River discharge.

The Sites Lodoga Road realignment and the construction and operation of the South Road would be required under Alternative 2 because the bridge over the Sites Reservoir would not be built. Alternative 2 would also use a different, and longer, temporary access road to construct the Dunnigan Pipeline than Alternatives 1 and 3.

There are also differences between Alternative 1 or 3 and Alternative 2 with respect to the size of the main dams and the number of saddle dams. Alternative 2 would not have Saddle Dams 1, 2, or 6. Also, because of the smaller reservoir volume, the main dams, saddle dams, and saddle dikes would be slightly shorter in length. TRR West would not require any borrow material and excavated aggregate would be used on site for local road improvements or reservoir erosion protection.

Operation

Alternative 2, like Alternatives 1 and 3, would not affect any natural gas fields or active natural gas wells during operation because either natural gas fields or wells do not exist in the footprint, or they could still be accessed under operating conditions of Alternative 2. Alternative 2, like Alternatives 1 and 3, would not render any aggregate resources of value regionally or to residents of the state unavailable because none exist in the footprint.

CEQA Significance Determination and Mitigation Measures

Construction and operation impacts would be the same on natural gas fields, natural gas wells, and aggregate resources for Alternative 2 as described for Alternatives 1 and 3. There would be no impacts.

NEPA Conclusion

Construction and operation effects would be the same as described above for CEQA. Construction and operation effects would not occur because of the lack of resources or access would be maintained as compared to the No Project Alternative. Alternative 2 would have no effect on natural gas fields or natural gas wells, and there would be no adverse effect from construction and no effect from operation of Alternative 2 on aggregate availability.

Impact MIN-2: Loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan

No Project

Under the No Project Alternative, operations of the existing TC Canal, RBPP, and GCID Main Canal would continue. None of these actions would affect underlying natural gas fields, natural gas wells, or aggregate resources.

Significance Determination

The No Project Alternative would not result in the loss of availability of a locally important mineral resource recovery site delineated in a local general plan, specific plan, or other land use plan. The No Project Alternative would not result in effects on natural gas fields, natural gas wells, or aggregate availability. There would be no impacts/no effect.

Alternatives 1 and 3

Construction and Operation

County general plans address natural gas and aggregate mineral resources and access to them, as well as their management and use (Appendix 4A, *Regulatory Requirements*). The goals and policies generally preserve access to and use of these known natural gas and mineral resources to the extent possible while balancing other environmental, economic, and development needs. No additional mineral resources of local importance were identified in county general plans beyond those identified in the CalGEM (2021) database and the California Geological Survey (2021) mineral land classification maps. Therefore, the construction and operation impacts on important mineral sites identified in these general plans are the same as those discussed for Alternatives 1 and 3 under Impact MIN-1.

CEQA Significance Determination and Mitigation Measures

As under Impact MIN-1, there would be no impact on natural gas fields and natural gas wells as a result of construction and operation of Alternative 1 or 3, due to either the lack of these resources or because they could continue to be used under construction or operating conditions. There would be no impact with respect to important mineral recovery sites delineated on a local general plan, specific plan, or other land use plan because none are identified.

NEPA Conclusion

Construction and operation effects would be the same as described above for CEQA. Construction and operation effects would not occur because of the lack of resources or they could continue to be used, and because there are no identified important mineral recovery sites, as compared to the No Project Alternative. Alternative 1 or 3 would have no effect on natural gas fields, natural gas wells, or aggregate resources and there would be no adverse effect with respect to important mineral recovery sites delineated on a local general plan, specific plan, or other land use plan.

Alternative 2

Construction and Operation

County general plans address natural gas and aggregate mineral resources and access to them, as well as their management and use (Appendix 4A, *Regulatory Requirements*). The goals and policies generally preserve access to and use of these known natural gas and mineral resources to the extent possible while balancing other environmental, economic, and development needs. No additional mineral resources of local importance were identified in county general plans beyond those identified in the CalGEM (2021) database and the California Geological Survey's (2021) mineral land classification maps. Therefore, the construction and operation impacts on important mineral sites identified in these plans are the same as those discussed for Alternative 2 under Impact MIN-1.

CEQA Significance Determination and Mitigation Measures

Construction and operation impacts would be the same on natural gas fields, natural gas wells, and aggregate resources under Alternative 2 as described for MIN-1. There would be no impacts.

NEPA Conclusion

Construction and operation effects would be the same as described above for CEQA. Construction and operation effects would not occur because of the lack of resources or they could continue to be used, and because there are no identified important mineral recovery sites, as compared to the No Project Alternative. Alternative 2 would have no effect on natural gas fields, natural gas wells, or aggregate resources and there would be no adverse effect with respect to important mineral recovery sites delineated on a local general plan, specific plan, or other land use plan.

13.5 References

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