SHIFLER

Mining and Reclamation Plan

Yolo County, California

Prepared For:

County of Yolo
Planning and Public Works Department
292 West Beamer Street
Woodland, CA 95695-2598

Prepared By:

Teichert Materials
Contact: Barry Baba
(916) 480-5505
bbaba@teichert.com

Date:

June 2018
Revised June 2021

TEICHERT

Shifler
Mining and Reclamation Plan
Yolo County, California

SUMMARY

Teichert Materials (Teichert) proposes to mine a portion of the Shifler Property for sand and gravel resources in order to continue supplying aggregate materials to the existing Teichert Woodland Plant processing facility ('Project'). The Shifler Property, located southwest of the Woodland Plant in Yolo County, is privately-owned and farmed for row and field crops, such as tomatoes, safflower, and wheat. In order to return the land to beneficial use, a reclamation plan has been prepared for the proposed mining project. This document presents Teichert's Reclamation Plan (Plan) for the Shifler Property, prepared pursuant to the State Surface Mining and Reclamation Act (SMARA) of 1975 and associated regulations (updated January 2012) and the Yolo County Cache Creek Area Plan (CCAP), which includes the Off-Channel Surface Mining Ordinance (OCSMO), Title 10 (Chapters 5 and 8) of the County Code Surface Mining Reclamation Ordinance (SMRO) and Agricultural Surface Mining and Reclamation Ordinance (ASMRO), and the Yolo County Off-Channel Mining Plan (OCMP). SMARA policies were prepared in accordance with the Administrative Procedures Act, (Government Code) and are found in California Code of Regulations (CCR), Title 14, Division 2, Chapter 8, Subchapter 1. This document consists of text and graphic descriptions of the mine plan and procedures necessary for the final reclamation of the Shifler Property, which is expected to be in operation for 30-50 years following the commencement of mining.

In preparation of this document, information was collected from onsite field surveys, visits to nearby reclamation areas, and from Teichert's previous reclamation projects. The Reclamation Plan embraces the Legislative intent that mined land is returned to a valid, quantifiable, and desirable post-mining use. Reclamation of the Shifler Property will include the restoration of approximately 113 acres of agriculture. The remainder of the site will be reclaimed to a combination of open space and wildlife habitat. The primary goal of the reclamation effort is to restore the agricultural use of the land, as well as provide quality wildlife habitat in proximity to the Cache Creek corridor.

This Reclamation Plan has been divided into nine general sections by discipline:

1) Mine Operation and Closure
2) End Land Use
3) Geotechnical Requirements
4) Hydrology and Water Quality
5) Environmental Setting and Protection of Fish and Wildlife Habitat

6) Revegetation, Resoiling and General Reclamation Requirements
7) Agricultural Soils Evaluation and Reclamation Plan
8) Open Space Habitat Revegetation and Establishment
9) Open Space Habitat Monitoring and Performance Standards
10) Administrative Requirements

CONTENTS

Shifler Mining and Reclamation Plan

Yolo County, California

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1 MINE OPERATION AND CLOSURE

Aggregate material (sand and gravel) mined at the Shifler Project Site ('Project Site') will be processed at Teichert's existing Woodland Plant, located adjacent to and north/northeast of the Project Site (Figure 1). The Woodland Plant is currently regulated by conditional use permit (CUP ZF #2011-0035) and development agreement (DA #12-152) for the nearby Schwarzgruber Property. These entitlements require that the Woodland Plant cease operation upon expiration of permits on 01 January 2028, unless additional mining sites, such as the Project Site, are permitted to continue supplying the Woodland Plant. The Project includes a request for a mining permit, reclamation plan, and development agreement for the Project Site. If the Project were approved, the Woodland Plant would then be regulated by the terms of the mining permit requested for the Project Site once mining on the Schwarzgruber site has been completed.

The mining process proposed for the Project will be the same as currently employed by Teichert at the Schwarzgruber mining site. Teichert proposes to mine/disturb approximately 264.1 acres of the 319.3-acre Project Site (Figure 2). Mining will begin at the northwestern portion of the site and proceed eastward, in two proposed phases. Mining requires overburden (i.e., materials overlying sand and gravel) to be removed using scrapers, motor graders and bull dozers. Salvaged soils will be progressively removed ahead of mining and stockpiled in setback areas, berms, and internal storage locations until retrieved for reclamation. Aggregate located above the groundwater level will be harvested by scrapers and dozers, while that mined below the water table will be extracted by a combination of equipment such as excavators and draglines. An electric-powered conveyor will be used to transport mined aggregate from the Project Site to the Woodland Plant. Mining and processing details of the Project are provided in the mine plan drawings prepared by Cunningham Engineering (2021). Additional details of the mine preparation, operation, and final reclamation are presented in subsequent sections of this document.

1.1 Name and Address of Operator – *SMARA 2772(c)(1)*

Operator Name:	A. Teichert & Son, Inc. (Teichert Materials)
Operator Physical Address:	Woodland Plant 35030 County Road 20 Woodland, CA 95695
Operator Mailing Address:	3500 American River Drive Sacramento, CA 95864

1.2 Type and Quantity of Materials to be Mined – *SMARA 2772(c)(2)*

Approximately 20 million cubic yards of Portland Cement Concrete (PCC) grade aggregate (sand and gravel) material will be removed from the site.

1.3 Initiation and Termination Dates – *SMARA 2772(c)(3)*

Mining is anticipated to commence as early as October 2021 and will continue for up to 30 years from the commencement of mining. The Shifler Mining Project will have an estimated termination date of 31 December 2051, depending on actual start date and market conditions.

1.4 Maximum Anticipated Depth of Mining – *SMARA 2772(c)(4)*

The maximum anticipated depth of mining is approximately 110 feet below existing grade, in the north-central section of the site. Final elevations are anticipated to range from approximately 5 feet below mean sea level (MSL) at the reclaimed pond bottom, to 80 feet above MSL in the northwestern portion of the reclaimed agricultural fields.

1.5 Project Site Description – *SMARA 2772(c)(5)*

The Project is located approximately 3 miles west of the City of Woodland, in unincorporated Yolo County and consists of seven parcels, four of which are owned by the Shifler Family Trust (Assessor Parcel Numbers [APNs] 025-120-032, 025-120-033, 025-430-001, and 025-430-002) and three that are owned by the Yolo County Flood Control and Water Conservation District (YCFCWCD) (APNs 025-430-009, 025-120-010, and 025-120-011) totaling approximately 319 acres (Figure 2). The Project is located within a portion of Sections 27 and 28, Township 10 North, and Range 1 East (MDBM) of the “Woodland, California” 7.5-minute quadrangle. Current surface elevations on the Project Site range from approximately 98 to 112 feet above mean sea level (MSL).

The vast majority of the site is in agricultural production and is classified as prime agricultural land. A concrete-lined canal (Moore Canal) traverses the Project Site from west to east, and an unlined canal (Magnolia Canal) conveys water northeast from the Moore Canal (Figure 2). Both canals are owned and operated by the Yolo County Flood Control and Water Conservation District (YCFCWCD).The Project Site is generally bounded by County Road 94B to the west, Cache Creek to the north, and County Road 22 to the south.

Surrounding land uses include Teichert’s Woodland Plant site to the northeast; agricultural land to the east; the Monument Hill Memorial Park cemetery and rural residential uses to the south; the Yolo Fliers Club golf course, Watts-Woodland Airport, and Monument Hills community to the southwest; and Teichert’s existing Storz mining site and the Cache Creek Nature Preserve to the northwest. Access to the site is available from paved County Road 94B.

1.6 Mine Plan and Phasing – *SMARA 2772(c)(6); SMRO §10-5.522; ASMRO §10-8.422*

A timetable of 30 years is proposed to complete mining in two phases (Figure 3). The phasing plan has been structured to minimize the area of disturbed agricultural lands during each mining phase, and to encourage the timely completion of the reclamation of agricultural land.

1.7 Public Health and Safety – CCR 3502(b)(2), CCR 3713(b); ASMRO §10-8.427

All equipment associated with mining of aggregate material at the Shifler Project Site will be stored in a designated area, and then removed from the Site upon completion of all mining and reclamation activities. During operations, the site shall be kept free of debris and maintained in a neat and orderly manner so as not to create any hazardous or unsightly conditions.

At the completion of operations, appropriate measures will be taken to return the Site to a safe condition that is free of all material and equipment associated with aggregate mining. Applicable portals, shafts, tunnels, or openings will be gated or protected from public entry, but in such a way as to preserve access for wildlife. Drill holes and water wells will be completed or abandoned in accordance with laws. Structures and equipment will be dismantled and removed, and any waste produced through mining activities will be disposed of off-site according to all state and local health and safety ordinances.

1.7.1 Fencing – *SMRO §10-5.510*

Fencing may enclose the property of which mining is a part, the mining site, or both. In addition, signs shall be installed along fence lines and access roads, indicating that the excavation area is restricted. Additional security (e.g. gates with protected locks and wing fences to prevent drive-arounds) shall be provided at all vehicular routes. All fencing and gates shall be maintained throughout the mining and reclamation period.

2 END LAND USE – SMARA 2772(C)(7), SMARA 2772(C)(8)

The proposed end use for the Shifler Project Site is agriculture (± 113.2 acres) and open space/wildlife habitat (± 148.4 acres) (Figure 4). The reclaimed habitat areas include grassland, pond, upper riparian woodland, and lower riparian woodland communities. Reclamation of the site will occur concurrently with and following the cessation of mining operations.

Reclamation has been separated into three primary phases (Figure 4). Final reclamation will be characterized by one large pond with associated shoreline habitat, bounded to the east and west by two agricultural fields and perimeter grassland slopes. Reclamation may also include permanent access roads as needed for agricultural use of the site. Table 1 below summarizes the quantity and types of reclamation features to be created.

TABLE 1. SHIFLER MINING PROJECT – PROPOSED RECLAMATION FEATURES

Reclamation Feature	Acres
Agriculture	± 113.2
Grassland Slopes	± 32.8
Pond	± 90.9
Lower Riparian Woodland	± 11.4
Upper Riparian Woodland	± 13.3
Access Road	± 2.5
Total Reclaimed	**264.1**

The particular timing for the completion of Project Site preparation and reclamation may vary depending on market conditions, quality of mineable materials and ultimate mining depth, acquisition and coordination with additional mineable areas, and availability of salvaged material and processed fines as backfill.

3 GEOTECHNICAL REQUIREMENTS

3.1 Bank Stabilization Maintenance – *SMRO §10-5.506*

The proposed mining falls within 700 feet of the active channel of Cache Creek.

The condition of flood protection structures and the integrity of the land within the approved setback zone separating the mining areas and the creek channel shall be inspected annually by a Registered Civil Engineer and reported to the Yolo County Community Development Agency (YCCDA). An annual report shall be prepared each year and include any recommendations for remedial action for identified erosion problems. All maintenance of bank stabilization features during the mining and reclamation period will be the responsibility of the mining operator.

3.2 Final Slopes - *CCR 3704(d); CCR 3704(e); SMRO §10-5.530 and §10-5.502; ASMRO §10-8.428*

A slope stability analysis was prepared for the Project in 2021 by Geocon Consultants (Geocon 2021). In order to provide for safety and to conform to surrounding topography, all final reclamation fill slopes will not exceed 2:1 (horizontal [H]: vertical [V]). Those slopes within 50 feet of the Moore Canal will be graded to no steeper than 3:1. Rounded edges and benches will be created in order to mimic natural landforms of the neighboring Cache Creek channel.

3.3 Disposition of Fill Materials - *CCR 3502(b)(4), CCR 3704(b)*

The Project Site contains soils at depths of 5 to 10+ feet, which will be stockpiled for future replacement on slopes and as salvaged soil for agricultural reclamation (Figure 3). Results of laboratory analysis indicate that there was generally no significant differentiation between 'topsoil' and 'subsoil' (upper and lower soil horizons) for the purposes of agricultural reclamation, and therefore may be mixed and stockpiled as one salvageable stockpile (Eco Synthesis 2017). As mining depth increases, some interbedded clays may be present as additional overburden material, which in these instances shall be stockpiled separately and used only in reclamation as a substrate material at least 5 feet below the final reclamation surface.

At the commencement of mining operations, reclamation soils will be first placed within the 50 foot-wide property setbacks surrounding the mine perimeter in the form of Mine Safety and Health Administration (MSHA) and noise buffer berms. These berms will be constructed in accordance with MSHA and County requirements and be seeded to prevent erosion, and will remain in place until all mining is complete. Remaining soils will be placed in one or more stockpile(s), each no greater than 40 feet in height and with side slopes of at least 2:1 (H:V) and seeded to prevent erosion, in accordance with OCSMO §10-4.433. Stockpiled soils will likely shift as mining and reclamation proceed from one area to the next. Thus, soil stockpiles may be placed within the Project boundary during the course of operations in previously-mined areas, the locations of which may change according to field conditions. A map illustrating the locations of all stockpiles to be used for final reclamation shall be prepared prior to mining and updated as soil stockpiles are relocated. Signs shall also be place at these locations indicating salvaged stockpile soils to be used for final reclamation.

In order to build back to at least 5 feet above the average high groundwater level in proposed agricultural reclamation areas, waste fines generated from the Woodland Plant may be pumped in slurry form onto the pit floor as substrate material. These waste fines may also be used to create peninsulas and other shoreline habitats surrounding the perimeter of the lake. Only suitable soils salvaged from stockpiles will be used as a final layer on top of any fines or overburden used for agricultural, slope, or habitat reclamation.

For a detailed description of soil removal, handling procedures, and placement refer to Sections 6 (Resoiling and General Reclamation Requirements) and 7 (Agricultural Soils Evaluation and Reclamation Plan) of this document.

4 SOILS, HYDROLOGY AND WATER QUALITY

The Natural Resources Conservation Service (NRCS) has mapped 5 soil units on the site (Figure 5). The most predominant soil component is mapped as Yolo Series, a fine silty series of Mollic Xerofluvents (NRCS 2015), which is distributed across approximately 94.5% of the Project Site, and classified as prime farmland by the NRCS if irrigated. After Yolo Silt Loam, Loamy Alluvial Land, which is classified as non-prime farmland, comprises 4.3% of the property. Other soil types, each comprising less than 1% of the property, include Brentwood Silty Clay Loam, 0 to 2 percent slopes; Sehorn-Balcom Complex, 2 to 15 percent slopes; and Sehorn-Balcom Complex, 30 to 50 percent slopes eroded.

Wetland features identified and mapped within the Project Site include two irrigation canals (Eco Synthesis 2019) (Figure 6). The hydrologic regime of the Project Site is dominated by summer (May through October) irrigation and seasonal precipitation (primarily between November and March). Annual average precipitation is 16-20 inches. Summer irrigation is supplied by the Moore Canal, which traverses the site. The amount of water applied to the site during the growing season depends upon the crop: tomatoes and cucumbers, which are planted in the two fields south of the canal and receive supplemental drip irrigation, are supplied approximately 2.0-2.5 acre feet of water; for sunflowers and canola, approximately 1.5 acre feet of water are applied; and for winter wheat, which is typically planted in the field north of the canal, no supplemental irrigation is applied. Much of the agricultural and stormwater surface runoff from the Shifler Property appears to drain into Cache Creek via roadside ditches situated throughout the site.

The northernmost portion of the Project Site is bordered by Cache Creek. All of the proposed mining area would be off-channel and located a minimum of 250 feet from the creek bank. Section 10-4.429(d) of the Yolo County OCSMO requires a minimum setback of 700 feet from the existing channel bank, but allows for that setback to be reduced to a minimum of 200 feet of unexcavated area with a demonstration that such a setback would not adversely affect channel stability. Consistent with this requirement, the project application includes a hydrological analysis that demonstrates that that the proposed 200-foot mining setback meets the required factors of safety and would not adversely affect the stability of the Cache Creek channel (Cunningham 2014).

Moore Canal currently traverses the Shifler property and will be retained and not impacted by the proposed mining area in coordination with the YCFCWCD. Reclaimed mining slopes within 50 feet of the relocated canal will include at least 3:1 (H:V) slopes, as requested by the YCFCWCD.

One groundwater monitoring well (known as the “Stephens” well) exists within the Project boundary, adjacent to County Road 94B near the northwest corner of the proposed mining area. This well exhibits annual groundwater elevation ranges that typically fluctuate between an average fall low of 49.5 feet AMSL to an average spring high of 57.5 AMSL (above mean sea level) (Luhdorff & Scalmanini 2014). During wetter hydrologic periods, spring groundwater levels may reach 67.5 feet AMSL, and during drier hydrologic periods, fall season levels may decline to as low as 42.5 feet AMSL.

4.1 Wet-Pit Mining - *SMRO §10-5.510, §10-5.524, and §10-5.528; ASMRO §10-8.409*

Wet-pit mining is proposed for part of the site where aggregate resources are deepest (Figure 3). Wet pits will not be used for the storage and treatment of sewage, nor for landfill purposes. Fueling and maintenance activities of heavy equipment are prohibited within one-hundred feet of open bodies of water during mining and reclamation.

Open wet pits will be fenced with a minimum 42-inch high, 4-strand barbed wire fence (bottom wire barbless and 18 inches above ground), prior to the commencement of excavation, during excavation, and during reclamation.

Groundwater monitoring will be ongoing throughout the mining and reclamation period. Following the completion of reclamation, groundwater monitoring of wet-pit mining areas will continue for 10 years.

4.2 Site Specific Sediment and Erosion Control - *CCR 3503(e); CCR 3706(c); CCR 3706(e); CCR 3710(a); OCSMO §10-4.413; SMRO §10-5.507 & §10-5.508; ASMRO §10-8.408*

A number of erosion and sedimentation controls will be implemented during the Project's life. A slope stability analysis has been conducted by a Registered Civil Engineer documenting that the proposed mining slopes will exhibit adequate static and seismic factors of safety (Geocon 2021). Inactive soil stockpiles will be vegetated to create an erosion-resistant outer layer. During operating hours, all disturbed soil and unpaved roads shall be adequately watered to keep soil moist. All disturbed but inactive portions of the site shall be either seeded or watered until vegetation is grown or shall be stabilized using jute netting or other soil binders.

Upon the completion of mining operations, grading and revegetation will minimize erosion and convey storm water runoff from reclaimed areas. During reclamation, the land surface will be graded so as to create broad gentle slopes that will allow sufficient drainage to prevent water pockets or undue erosion.

Various grading and revegetation activities associated with reclamation will be carried out to minimize erosion. All erosion and sedimentation will be controlled during all phases of reclamation to minimize siltation of nearby water courses per the Central Valley Regional Water Quality Control Board and the State Water Resources Control Board. To minimize erosion, the finish grading of pit slopes will be performed as soon as practical after the completion of mining activities. The grading of final slopes, the replacement of soil, and associated erosion control measures shall take place prior to November 1. Furthermore, all slopes shall be seeded prior to November 1.

Retention basins will be created to collect surface runoff and protect surrounding land and water resources. Surrounding topography graded gently such that runoff will flow naturally to retention basins and not rely solely on ditches and berms to direct runoff.

4.2.1 Site Specific Erosion Control Monitoring Plan – *SMARA 2773(a)*

Slopes will be observed regularly throughout the reclamation monitoring period. All observed erosion in excess of 6 square inches in cross-section and 6 feet in length will be backfilled with additional soils, reseeded, and mulch applied if necessary. Adjacent roads will also be re-graded as needed to minimize any focal areas of erosion. Long-term erosion control will be achieved through revegetation. Additional soil or supplemental materials (i.e., mulch, straw bales, or fiber blankets) will be applied around plantings if erosion continues in revegetated areas. All erosion control treatments will be monitored by Teichert and corrective measures will be employed throughout the reclamation monitoring period.

5 ENVIRONMENTAL SETTING & PROTECTION OF FISH AND WILDLIFE HABITAT

Details of the plant communities and potential wildlife that are present within the Project Site are described in the *Biological Resources Assessment – Teichert Woodland Shifler Project* (BRA) prepared by Teichert Materials (2018) and *Wetland Delineation for Shifler Property* prepared by Eco Synthesis (2019). The reports assess the potential for occurrence of special-status species and identify jurisdictional waters of the United States. .

5.1 Existing Vegetation Communities – *CCR 3502(b)(1)*

The majority of the Project study area consists of agriculture (row crops). Other habitats at the site include small sections of annual grassland/ruderal vegetation, oak woodland, canals, and other small wetlands.

5.1.1 Agriculture (Row and Field Crops)

The majority of the Project Site consists of agricultural land, totaling 285.6 acres (Figure 3). Crops planted at the site over the past decade have included wheat, alfalfa, tomatoes, cucumbers, canola, sunflower, and safflower. Selection of crop is made on the basis of various factors, but most notably the availability of irrigation water. Ruderal plants are common along agricultural borders and roads, including pigweed (*Amaranthus albus*, *A. blitoides*, and *A. retroflexus*), lamb's quarters (*Chenopodium album*), mallow (*Malva parviflora* and *M. leprosa*), bindweed (*Convolvulus arvensis*), devil's claw (*Proboscidea louisianica* and *P. lutea*), puncture vine (*Tribulus terrestris*), common knotweed (*Polygonum aviculare* subsp. *depressum*), bermuda grass (*Cynodon dactylon*), and Johnson grass (*Sorghum halepense*).

5.1.2 Annual Grassland/Ruderal

The northern portion of the Project Site paralleling Cache Creek supports approximately 19.2 acres of annual grassland and ruderal vegetation (Figure 3). This area is separated from the agricultural area by a conveyor system and access/maintenance road. Common grassland species include filaree (*Erodium botrys*, *E. cicutarium*, and *E. moschatum*), common fiddleneck (*Amsinckia intermedia*), ripgut brome (*Bromus diandrus*), soft-chess (*Bromus hordeaceus*), wild oat (*Avena barbata* and *A. fatua*), hare wall barley (*Hordeum murinum*), and six-weeks fescue (*Festuca myuros*). Disturbed areas also support dense stands of ruderal vegetation, including milk thistle (*Silybum marianum*), Italian thistle (*Carduus pycnocephalus*), yellow star-thistle (*Centaurea solstitialis*), mallow, and perennial mustard (*Hirschfeldia incana*). Also scattered throughout the northern portion of the site are isolated trees and shrubs, including valley oak, Northern California black walnut (*Juglans hindsii*), tree of heaven (*Ailanthus altissima*), almond (*Prunus dulcis*), Fremont cottonwood (*Populus fremontii*), blue elderberry (*Sambucus nigra* subsp. *caerulea*), and poison oak (*Toxicodendron diversilobum*).

5.1.3 Oak Woodland

A small area (approximately 1.7 acres) projecting south from the northeastern portion of the Project Site supports a valley oak woodland stand. Most of these oaks are associated with a segment of the earthen-lined Magnolia Canal just north of the Moore Canal. Common understory vegetation include poison oak, horehound (*Marrubium vulgare*), Italian thistle, and ripgut brome.

5.1.4 Moore Canal and Magnolia Canal

Both the Moore Canal and Magnolia Canal (collectively totaling 1.738 acres) appear on the USGS 7.5-minute series "Woodland, California" quadrangle as a dashed blue line feature. The Moore Canal is an approximately 15-foot wide concrete-lined irrigation water conveyance system operated by the YCFCWCD. The Moore Canal enters the Project Site from underneath County Road 94B and flows in a west to east direction (Figure 3). A gate structure exists near the northeastern portion of the Project Site, which allows water from the Moore Canal to be diverted into the Magnolia Canal. The Magnolia Canal is an approximately 7-foot wide earthen-lined canal that starts at this gate structure and flows in a northeasterly direction (Figure 3). Both canals are continuously maintained, and vegetation is frequently absent. The earthen-lined Magnolia Canal supports some vegetation, which can vary between years depending on the availability of water allocations. When the canal is operating and flowing, predominant vegetation include nutsedge (*Cyperus esculentus* var. *leptostachyus* and *C. eragrostis*), bermuda grass, rye grass (*Festuca perennis*), bearded sprangletop (*Leptochloa fusca* subsp. *fascicularis*), common barnyard grass (*Echinochloa crus-galli*), and Johnson grass (*Sorghum halepense*). In drought years when the canal is not operating, vegetation generally consists of ruderal plants including milk thistle, perennial mustard, orach (*Atriplex* sp.), bermuda grass, and rye grass.

5.1.5 Other Areas

Other areas include an existing conveyor system and associated graveled maintenance road along the northern portion of the Project Site, which transports aggregate material from Teichert's adjacent Storz site to the west to the Woodland Processing Plant to the northeast (Figure 3). A maintenance road for the Moore Canal also parallels both sides of the canal throughout its entire length within the Project Site (Figure 3). Landscape plantings consisting of oleanders (*Nerium oleander*) are present along County Road 94B and the southeastern portion of the Project Site (Figure 3).

5.2 Sensitive Species and Wildlife Habitat – *CCR 3502(b)(1)*

Based upon a general review of the California Natural Diversity Database (CNDDB) (Rarefind Version 5), U.S. Fish and Wildlife Service (USFWS) (Sacramento Field Office website), California Native Plant Society's Online Inventory of Rare and Endangered Plants of California, and numerous field surveys, it was determined that several sensitive species have the potential to occur at the Project site. Teichert has prepared a BRA, which shall be used to facilitate the CEQA process for biological resources. This BRA provides a more detailed discussion of special-status species and sensitive habitats occurring or with the potential to occur on the Site, and associated mitigation measures where avoidance is not practicable (Teichert 2018).

5.3 Protection of Vegetation and Fish and Wildlife Habitat - *CCR 3503(c), CCR 3703(a), 3703(b), and 3703(c); ASMRO §10-8.433 & §10-8.435*

Disturbance to important wildlife habitat features (e.g., agricultural fields, grasslands, and trees) shall be avoided during the nesting season (e.g., between February and August). If disturbance activities are proposed during the nesting season, pre-construction surveys shall be performed to ensure no impacts to nesting birds will occur.

A minimum 250-foot mining setback has been established from the Cache Creek channel in order to protect fish and riparian habitat. All impacts to wetlands within the Project Site shall be mitigated through compliance with mitigation requirements established by the Corps.

A total of 32 elderberry shrubs were encountered outside of the project area within the Cache Creek riparian zone, proximal to the northern boundary of the project site (Teichert 2018). Elderberry shrubs are considered the sole host plant for the federally-threatened valley elderberry long horn beetle (*Desmocerus californicus dimorphus*) (VELB). No direct or indirect effects to these elderberry shrubs are anticipated as a result of the proposed action, as all shrubs exist at least 50 meters outside of the Project's limits of disturbance. According to United States Fish and Wildlife Service (Service) Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (May 2017), for elderberry shrubs that exist within a riparian area, no adverse effects may be assumed when a 50-meter (or wider) buffer is established and maintained around the elderberry shrubs. This buffer will be established and maintained for all mining and construction activities associated with the Shifler project.

5.4 Sensitive Natural Communities – *ASMRO §10-8.434*

Due to the highly disturbed nature of the Project Site, there is a virtual absence of sensitive natural communities within the Site's boundaries. In addition the Project will maintain a minimum 250-foot setback from Cache Creek and its associated riparian habitat.

6 RESOILING AND GENERAL RECLAMATION REQUIREMENTS

One of the important concepts underlying the development of a revegetation plan is the necessity to determine future use of the site subsequent to mining. Post-mining use at the Shifler property centers primarily on agricultural production, in conjunction with an open space component, including habitat for wildlife. This reclamation plan is based upon the nature of the surrounding areas and characteristics of the property, salvaged reclamation soils, available overburden, waste fines, and site topography and hydrology. The agriculture and habitat zones, together with their respective revegetation designs, are detailed in subsequent sections and shown on Figure 5.

The reclamation plan is intended to maximize agricultural use of the property while also enhancing the wildlife habitat quality of the open space component of the site. The agricultural component (Section 7) of the reclamation plan is based on existing and final expected soil quality and depth, historic and current crop rotations and production rates, and current and expected average groundwater levels. For the habitat component (Section 8), planting densities of native species were determined based on several factors, including expected success, ultimate plant size, natural recruitment potential, and desired level of habitat types.

6.1 Resoiling - *CCR 3503(f); SMRO §10-5.511, §10-5.512, §10-5.516, §10-5.530, §10-5.531, and §10-5.532; ASMRO §10-8.412, §10-8.413, §10-8.428 and §10-8.430*

Agricultural areas will follow soil handling and replacement methods recommended in the *Teichert Shifler Project – Agricultural Reclamation Feasibility Study* (Eco Synthesis 2017, Appendix A) and as described in the Agricultural Soils Evaluation and Reclamation Plan (Section 7). In order to minimize compaction of the reclaimed agricultural fields, each 2-foot layer of soil laid down will be ripped to a depth of at least 3 feet. Final reclaimed agricultural surfaces shall be of sufficient depth to prevent the formation of anaerobic conditions in the crop rooting zone, suggested as at least 5 feet above the average high groundwater level. Post-reclamation groundwater models indicate that the average high groundwater level (spring high) for the Shifler property will be 75-80 feet AMSL in the west, and 45-50 feet AMSL in the east (Luhdorff & Scalmanini 2015). Final reclaimed agricultural surfaces will be graded to provide suitable field gradients to allow surface/furrow irrigation of crops and allow for adequate storm water drainage.

A cover crop will be seeded on the reclaimed fields following soil replacement on the pit floor, and then disked to incorporate this green manure organic matter as a soil amendment. Agricultural fields will be revegetated in accordance with the recommendations outlined in Section 7. After the first two crop seasons have been completed on the reclaimed agricultural fields, Teichert shall retain a Licensed Land Surveyor or Registered Civil Engineer to resurvey the fields; any areas where settling has occurred shall be releveled to the field grade specified in the approved reclamation plan.

Slopes and other non-agricultural areas (open space habitat) will be ripped/disked to a minimum depth of 6 inches to de-compact surfaces compressed by various equipment operations. Slopes that are less than 5 feet below the average summer low groundwater level will be reclaimed to no steeper than 2:1

(H:V). These slopes will be dressed with a minimum one-foot layer of salvaged reclamation soils that will be track-walked and immediately seeded to prevent erosion and provide for grassland habitat. Reclaimed slopes within the wet-pit areas (pond) located 5 feet or more below the reclaimed average summer low groundwater level will not be steeper than 1:1 in order to minimize the effects of sedimentation and biological clogging on groundwater flow, to prevent stagnation, and to protect the public health. According to Luhdorff & Scalmanini (2015), the seasonal low (summer/fall) pond elevation is expected to be approximately 47 feet AMSL.

Overburden material and processing fines will be used whenever possible to build elevations for proposed agricultural areas and as a subsoil layer. Salvaged reclamation soils formerly in agricultural areas will be prioritized for the reclamation of agricultural fields. Farming shall commence in agricultural areas once an entire field is reclaimed. As constructed slopes and habitat areas are completed, revegetation as described in Section 8 will be initiated the following fall and winter.

6.2 Soils Handling and Stockpiling - *CCR 3704(c), CCR 3705(e), CCR 3707(b), CCR 3707(d), CCR 3711(a), CCR 3711(b), CCR 3711(c), CCR 3711(d), CCR 3711(e)*

Preserving soil productivity and minimizing soil compaction are key components during the removal (mining) and replacement (reclamation) process. This reclamation plan identifies the surface 10 feet of soil to be of sufficient texture and quality for separation as salvaged reclamation soil suitable for agricultural use. In order to minimize soil compaction, all handling of soils (soil stripping, stockpiling, and reconstruction) will occur when soil moisture is low.

Article 9 Reclamation Standards section 3711(a) requires all vegetation and salvageable soil not be removed more than one year preceding surface mining activities. Before soil removing operations are initiated in each phase, stockpile sites will be identified on plan maps and clearly marked in the field. Initial stockpile areas will be located along perimeter berms around the mine pit. Some stockpiles will remain longer than others, and some soil may be used immediately after stripping to reclaim portions of a preceding phase.

Salvaged reclamation soil stockpiles that are not used for reclamation within one mining season will be planted with an annual grassland seed mix similar to that identified in Table 2 below to minimize soil erosion, maintain microbial activity, and discourage noxious weed establishment. Specific species in the mix and seeding rates for soil revegetation are shown below. Seeding will occur prior to the end of October in each season soil stockpiling is completed. Seeding methods may include either hydro-seeding or broadcast seeding.

TABLE 2. SEEDING SPECIFICATIONS FOR SOIL STOCKPILE EROSION CONTROL – SHIFLER PROJECT

Common Name	Botanical Name	Seed Rate (lbs/acre)
Soft chess	*Bromus hordeaceus*	20.0
Six-weeks fescue	*Festuca myuros*	12.0
Ryegrass	*Festuca perennis*	6.0
Rose clover	*Trifolium hirtum*	7.0

Crimson clover	*Trifolium incarnatum*	3.0
Total		**48 lbs**

In addition, erosion control materials (e.g., wattles, coconut fabric rolls, etc.) or retarding basins/ditches shall be installed surrounding the base of all soil stockpiles to prevent soil runoff. Future management of soil stockpiles and MSHA berms will also include removing invasive or noxious species (e.g., yellow star-thistle, Italian thistle, etc.) and re-seeding as necessary.

All soil management (handling, stockpiling, maintaining, and reconstructing) objectives are intended to limit impact on the soils while maintaining the function and productivity of soils for future reclamation purposes.

7 AGRICULTURAL SOILS EVALUATION AND RECLAMATION PLAN

Per Article 4 (Agricultural Mining and Reclamation Standards) of the Yolo County ASMRO (§10-8.401), the general standard for agricultural reclamation is to ensure that the agricultural productivity of reclaimed lands either meets or exceeds farm production levels established prior to mining. An Agricultural Reclamation Feasibility Study (Eco Synthesis 2017) is attached as Appendix A of this document. Appendix A details existing agricultural conditions, including soil type as well as crop productivity, in addition to proposed reclamation procedures for the agricultural component of the site, including that for handling and redistribution of salvaged soils, planting specifications, and minimum reclamation success criteria.

As per §10-5.525 of the Yolo County SMRO, for each acre of prime farmland that would be converted to non-agricultural use, the reclamation plan shall present provisions to offset (at a 1:1 ratio) the conversion of these lands. Teichert proposes to offset the permanent loss of approximately 161 acres of prime farmland by placing permanent conservation easements on land meeting the Williamson Act definition of “prime farmland.”

7.1 Agricultural Reclamation Plan

7.1.1 Salvage – *ASMRO §10-8.429*

The results of the present soil analysis indicate that the material available for salvage, down to a depth of at least 10 feet, is all suitable for use as the uppermost layer of soil to support growth of agricultural crops common to the region (Appendix A). Accordingly, the recommended soil salvage procedure is for the entire 10 foot depth of the soil profile to be salvaged as one supply of agricultural reclamation soil.

After the initial recovery of a volume of soil sufficient to reclaim the final intended phase of operations, including construction of slopes and resoiling of areas to be future agricultural land, the remainder of the salvaged soil can be placed directly for reclamation. However, at any point where the active mining area exceeds the area that can be reclaimed with the stockpiled soil volume, then additional stockpiles shall be created to make up the potential future shortfall.

Soil shall be cut in maximum depths in order to minimize traffic and limit compaction. The handling and transport of soil shall be minimized, and all handling of salvaged reclamation soils should be accomplished when the soil is dry to avoid undue compaction.

7.1.2 Stockpiling - *ASMRO §10-8.431*

Soil stockpiles shall be constructed to a maximum height of 40 feet or less, with slopes of 2:1 (H:V) or gentler, to minimize erosion and discourage use by bank swallows. The top of the soil stockpile shall be graded to drain, at a slope of at least two percent, so as to minimize the infiltration of rain water into the interior of the stockpile. Soil stockpiles shall be seeded and vegetated to prevent wind and rain erosion. Salvaged soil may not be used for purposes other than reclamation without prior County approval.

7.1.3 Reclamation Soil Profile - *ASMRO §10-8.432*

Once mining operations have attained the lowest depth from which useful aggregate material can be removed, a slurry of fines that are separated from the commercial aggregate during processing will be discharged onto the bottom of the mined area where agricultural fields are proposed. The discharge/placement of fines is expected to create a desirable, uneven or sloping layer. This sloping subgrade surface will naturally create a gradient that enhances lateral flow of subsurface water, thus minimizing the mounding of percolating water on top of the low-permeability fines.

A minimum thickness of 4 feet of salvaged reclamation soil (that is, soil recovered from the uppermost 10-foot depth of the existing soil and overburden profile) shall be placed directly, or from a stockpile, to create the final agricultural soil profile on top of the subgrade layer (Appendix A). Soils classified as prime agricultural land shall be reserved for on-site crop reclamation.

In order to facilitate irrigation, the final surface of the areas intended to be used as agricultural land shall be leveled such that irrigation ditches may be created. In accordance with the Yolo County SMRO, broad gentle slopes that will allow sufficient drainage to prevent water pockets or undue erosion will be created to allow for site irrigation management. An approximately 1% grade is proposed for agricultural fields, sloping toward the reclaimed pond area.

7.1.4 Agricultural Reclamation Monitoring and Minimum Performance Standards

According to SMARA Performance Standards for Prime Agricultural Land Reclamation (§3707), reclamation shall be deemed complete when productive capability of the affected land is equivalent to or exceeds, for 2 consecutive crop years, that of the pre-mining condition or similar crop production in the area. Detailed information regarding current agricultural production and minimum reclamation standards is available in Appendix A.

8 OPEN SPACE HABITAT REVEGETATION AND MAINTENANCE

The Shifler Property will be reclaimed to a combination of agriculture and open space/habitat. A detailed soils analysis and agricultural reclamation feasibility study, in addition to agricultural reclamation plan, has been developed separately and has been included as Section 7 of this document. This section of the reclamation plan is specifically designed to provide for the development of the remainder of the Site, which will be reclaimed to open space wildlife habitat featuring open water, grassland slopes, and riparian shoreline/woodland vegetation communities. The habitat communities and their respective revegetation designs are detailed in the sections below and shown on Figure 4. Included in the plan are the habitat types to be created, methods of establishment, general planting locations relative to final elevations and groundwater levels, species types, and densities. The general plan is intended to improve the wildlife habitat quality of the open space component of the site. Planting densities were determined based on several factors, including expected success, ultimate plant size, and potential of natural recruitment.

8.1 Open Space/Habitat Revegetation Description - *SMRO §10-5.502; SMRO §10-5.523; ASMRO §10-8.423 and §10-8.426*

Teichert's reclamation plan for the open space component of the Project has been developed based on information from existing site conditions, available soils for reclamation, and extensive experience with the creation and monitoring of other reclamation sites throughout central and northern California. Final vegetative types and acres will depend upon conditions of the reclaimed land, including availability of overburden and processed fines, access to groundwater, and depth of silts in ponds.

The Shifler Property has been in agricultural production since the late 1800s; therefore, natural preexisting conditions of the Project Site are virtually unknown. However, the floodplain terrace geomorphology of the site indicates that, prior to agricultural production, the Shifler Property likely consisted of various stages of wetland, riparian, and oak woodland habitats that changed in accordance with creek flows and migration patterns. Table 3 summarizes the quantity of habitat types proposed to be created by the Project.

TABLE 3. OPEN SPACE RECLAMATION PHASES AND HABITAT TYPES (ACRES)

Reclamation Phase	Reclamation Feature	Acres
PHASE A	Agriculture	± 47.5
	Access Roads	± 0.1
	Grassland Slopes	± 14.2
PHASE B	Access Road	± 1.1
	Agriculture	34.6
	Grassland Slopes	± 10.5
	Upper Riparian Woodland	± 6.4
	Lower Riparian Woodland	± 5.0
	Pond	± 42.9
PHASE C	Agriculture	31.1

Reclamation Phase	Reclamation Feature	Acres
	Access Roads	1.3
	Grassland Slopes	8.1
	Upper Riparian Woodland	6.9
	Lower Riparian Woodland	6.4
	Pond	48
Total Reclaimed Acreage		**± 264.1**

8.2 Habitat Communities

In addition to agriculture and associated access roads, a total of four reclaimed habitat communities are proposed. These include grassland slopes, pond, upper riparian woodland, and lower riparian woodland. Some of these communities may overlap or transition into one another. Grassland and woodland communities shall be established surrounding a reclaimed pond in order to enhance habitat values and protect neighboring agricultural fields (SMRO §10-5.533). These vegetation communities and their associated microhabitats are typical of naturally-occurring ones in the area. Each habitat community is designed to have a diversity of plants and conditions that will complement each other and provide a diverse habitat for wildlife. As a general rule, depth to groundwater will be a primary determinant of which plant associations or communities are appropriate for a given area. Ultimate mining depth and availability of fines and other materials for resoiling of slopes will largely determine the riparian features and are expected to adjust over time in response to changing site conditions.

8.2.1 Grassland Slopes

A total of ± 32.8 acres of slopes are proposed to be created surrounding the perimeter of the mined areas (Figure 4). All slopes will be reclaimed to no steeper than 2:1 (H:V), and 3:1 (H:V) within 50 feet of the Moore Canal. Slopes will be revegetated by broadcast seeding with an appropriate grassland seed mix selected for its erosion control and habitat value. Typical species in the seed mix shall include drought-tolerant native species, such as blue wildrye (*Elymus glaucus*), California brome (*Bromus carinatus*), annual fescue (*Festuca microstachys*), California poppy (*Eschscholzia californica*), and arroyo lupine (*Lupinus succulentus*). Additional naturalized, annual plants will likely colonize these areas, including soft chess brome (*Bromus hordeaceus*), wild oat (*Avena fatua*), six-weeks fescue (*Festuca myuros*), and filaree (*Erodium botrys*, *E. cicutarium*, and *E. moschatum*). Table 4 below shows seed mixes and seeding rates for the slopes following construction. All seeding rates are specified in terms of pounds of pure live seed (PLS).

Table 4. Seeding Specifications for Grassland Slopes

Common Name	Botanical Name	Seed Rate (lbs/acre)
Blue wild rye	*Elymus glaucus*	8.0
California brome	*Bromus carinatus*	12.0
Annual fescue	*Festuca microstachys*	6.0
California poppy	*Eschscholzia californica*	1.0
Arroyo Lupine	*Lupinus succulentus*	5.0
TOTAL		**32.0**

8.2.2 Pond

Approximately 90.9acres of the Project Site are proposed to be reclaimed to pond (open water), which is expected to experience seasonal and annual fluctuations in water level as dictated by changes in precipitation patterns, creek flows, and the groundwater table. The pond will be separated from the surrounding agricultural land by vegetated slopes and berms. The use of motorized watercraft will be prohibited on this reclamation feature.

The open water habitat occurs within the deepest mined areas of the site and will be entirely dependent upon groundwater elevations, making it a dynamic zone. Seasonal variations in groundwater levels, and variations in the maximum mining depth, will dictate which areas remain seasonally or permanently inundated. Regardless, it can be expected that during portions of the year (typically winter and spring) open water will be present. The depth, slope, and size of the pond will vary, and in some cases, undergo a seasonal succession ranging from open water to mudflats in winter and spring to vegetated or parched areas in summer and fall. The distribution of each of these specific communities may also vary spatially each year. Rainfall patterns and creek flows affecting groundwater levels will dictate the specific arrangement of wetland-related communities by season and year.

In general, deeper areas with longer hydroperiods will remain open water and lack vegetation, or consist of submerged and floating-leaved herbaceous plants. Other areas may eventually dry and become mudflats until re-submerged when groundwater elevations rise. Although no wetland habitats are proposed as part of this reclamation plan, other areas within the reclaimed wet pit may become intermittently established with various wetland species, such as cattail (*Typha* spp.), smartweed (*Polygonum* spp.), spikerush (*Eleocharis macrostachya*), rush (*Juncus* sp.), loosestrife (*Lythrum* spp.), Texas bergia (*Bergia texana*), beard grass (*Polypogon* spp.), and Mediterranean barley (*Hordeum marinum*). If successive drought years persist and groundwater levels remain low, some areas may also become vegetated with woody riparian vegetation, including willows (*Salix* spp.), mule fat (*Baccharis salicifolia*), and Fremont cottonwood (*Populus fremontii*).

8.2.3 Lower Riparian Woodland

The proposed lower riparian woodland community will consist of approximately 11.4 acres surrounding the reclaimed pond. In general, the lower riparian woodland community represents a transition area between the pond and upper riparian slopes. The ultimate acres of lower riparian woodland habitat to be created within the proposed mining area will be dependent upon final reclaimed slopes, availability of soil harvested from the settling ponds/berms, groundwater elevations, and seasonal hydrological conditions.

Plants tolerant of saturated soils and occasional inundation are characteristic of this community. Willows (*Salix gooddingii*, *S. laevigata*, and *S. exigua*), cottonwood (*Populus fremontii*), and mulefat (*Baccharis salicifolia*) are expected volunteers where hydrological conditions and soil moisture is favorable during establishment. Other species, including California box elder (*Acer negundo* var.

californicum), Oregon ash (*Fraxinus latifolia*), California sycamore (*Platanus racemosa*), and button willow (*Cephalanthus occidentalis*) will be planted to supplement natural colonization and increase species diversity and wildlife habitat value. Table 5 shows planting specifications and minimum planting densities for the riparian wetland community.

TABLE 5. PLANTING SPECIFICATIONS FOR THE LOWER RIPARIAN WOODLAND

Common Name	Botanical Name	Planting Density (seedlings/acre)
California Box Elder	*Acer negundo* var. *californicum*	30
Oregon Ash	*Fraxinus latifolia*	30
California Sycamore	*Platanus racemosa*	10
California Button Willow	*Cephalanthus occidentalis*	30
	TOTAL	**100**

Planting ratios of species may be modified due to existing site conditions, relative proximity to groundwater elevations, and availability at the time of planting. Should additional natural colonization of willows, cottonwoods, or mulefat not be evident, additional plantings of these species shall be included within this community. The total initial target density of woody riparian plants (combination of planted and volunteers) shall be at least 250 plants per acre. In general, seedlings will be planted from Deepot™ 40[1] size containers. Alternative container size seedlings or methods, including direct seeding or installation of pole cuttings, may be substituted if monitoring suggests adequate survival and success rate.

8.2.4 Upper Riparian Woodland

Approximately 13.3 acres of the slopes surrounding the pond, in areas above the lower riparian woodland that demonstrate adequate soil depths, are proposed to be reclaimed to upper riparian woodland habitat. This habitat will consist of several discontinuous stands separated by grassland slopes to provide for habitat diversity. Final locations and sizes of the upper riparian woodland areas will be determined by site conditions at the time of final reclamation. In order to facilitate the successful establishment of woody species, designated upper riparian woodland areas will require at least 3 feet of soil and good drainage. Initially, these areas will predominantly resemble an open grassland community, but eventually grow into a woodland habitat as the plantings develop. Vegetation in this community is typically represented by relatively drought-tolerant riparian species, including valley oak (*Quercus lobata*), elderberry (*Sambucus mexicana*), coyote brush (*Baccharis pilularis*), California wild rose (*Rosa californica*) and California blackberry (*Rubus ursinus*). Table 6 shows the planting specifications and minimum densities for the upper riparian woodland community.

TABLE 6. PLANTING SPECIFICATIONS FOR UPPER RIPARIAN WOODLAND

Common Name	Botanical Name	Planting Density (seedlings/acre)
Valley oak	*Quercus lobata*	50

[1] Seedlings grown in plant containers measuring 2.5” diameter x 10” deep, or 40 cubic inches.

Blue elderberry	*Sambucus mexicana*	55
Coyote brush	*Baccharis pilularis*	20
California wild rose	*Rosa californica*	35
California blackberry	*Rubus ursinus*	30
	TOTAL	**190**

Planting ratios of species may be modified due to existing site conditions and availability of plants at the time of planting. In general, seedlings will be planted from Deepot™- 40 size containers. Alternative container size seedlings or methods, including direct seeding (i.e., oak acorns), may be substituted if monitoring suggests adequate survival and success rates.

8.3 Revegetation Test Plot

Article 9 Reclamation Standards section 3705(b), requires revegetation test plots to be implemented concurrent with mining to determine the most appropriate revegetation procedures to be followed to ensure successful establishment of the proposed reclamation plan. The primary objective of a test plot is to document the success or failure in attaining designated objectives and performance standards. For Teichert's Shifler open space reclamation features, these objectives relate to success in slope, grassland, riparian upland, riparian wetland, and pond habitat.

Teichert's mining and reclamation plan for the Shifler Project was developed on information from existing site conditions, available soils for reclamation, and extensive experience with the creation and monitoring of other reclamation sites throughout central and northern California. Specific reclamation features described in this plan have already been successfully created at several sites in the Woodland area. Teichert's Muller Reclamation Site (Figure 7), located just northwest and across Cache Creek, demonstrates similar reclamation features as those described for the Shifler Project and, therefore, shall be referenced as the revegetation test plot for the Schwarzgruber Project.

Teichert's Muller Reclamation Site is an approximately 135-acre site located just northwest of Cache Creek and the Schwarzgruber Property. It is one of several properties comprising Teichert's Woodland aggregate mine operation. The Muller Property was mined for sand and gravel from the late-1990's to 2008. Reclamation of the Muller Property includes reestablishment of both agricultural and natural habitat lands in areas previously disturbed by mining (Figure 8). An approximately 32-acre portion of the site (also known as Muller 30-Acre) was reclaimed to agriculture in 2006. Seven acres of slopes also surround the northern, western, and southern portion of the reclaimed agricultural field. The remaining 86 acre portion of the site (also known as Muller 90-Acre) was completed from 2008 and 2009 and includes similar reclamation features as those proposed for the Shifler Project. These include slopes, grasslands, oak riparian woodland, riparian wetland, and pond habitats. The first monitoring report for the Muller 90-Acre Reclamation Project was prepared in October 2010, with the final report submitted in November 2014.

8.4 Plant Procurement and Installation

A variety of different plant materials may be used in the restoration planting of the various communities. These include seeds, container-grown plants, and cuttings. The specific planting methods will depend upon which habitats and what materials are available at the time of planting. Plants collected and grown locally will always be given priority in the selection process. All seeding for grassland cover and erosion control will occur before the end of October, prior to the first major rains. Planting of trees and shrub seedlings will generally occur between November and January, ideally after winter storms have moistened the ground. Plants will not be installed in linear rows or of equal spacing, but randomly placed as individuals or in clusters intermixed with other species. Clumping of some species will also emphasize the variety of plant associations. Natural colonization by additional plants is expected to further enrich the site along various zones.

8.4.1 Direct Planting

The following are various technical specifications regarding plant materials, seeding or planting densities, and their installation. Often site requirements, timing, species, and availability will dictate the method of planting. Contingent upon the results of monitoring, amendments to the soil prior to or during the time of planting may be required. All seeding for grassland cover and erosion control will occur before the end of October, prior to the first major rains. Planting of trees and shrub seedlings will generally occur between November and January, ideally after winter storms have moistened the ground. Plants will not be installed in linear rows or of equal spacing, but randomly placed as individuals or in clusters intermixed with other species. Clumping of some species will also emphasize the variety of plant associations. Natural colonization by additional plants is expected to further enrich the site along various zones.

8.4.1.1 *Seeding for Erosion Control/Grassland Cover*

Seeding areas and techniques to establish vegetative cover on slopes and grassland communities will depend on a number of factors, especially hydrology, soils, existing terrain, and size of the area. Annual grasses and broadleaf weeds are likely to invade much of the area. However, native grasses will be planted at the site to increase native plant diversity.

Prior to seeding, all slopes will be track-walked with imprints perpendicular to the direction of the slope. Slope will be broadcast seeded using a belly grinder, or spreader mounted on a tractor if slopes are gentle enough.

8.4.1.2 *Container/Seedling Installation*

Seedlings will be grown out in containers from locally collected seeds or purchased from a local nursery shortly before installation. Planting holes for seedlings will be dug at least twice as deep and twice as wide as the seedling root wad. A slow-release fertilizer (11-17-9) will be placed in each planting hole, with one teaspoon at the bottom of the hole and another teaspoon with the backfill material. Holes shall be backfilled such that when the seedling is in place, the top of the root wad is level with or slightly above the grade of the surrounding ground. A shallow trench will be created surrounding each seedling for a watering basin. All plantings will be carried out during the dormant season, following seasonal rains.

8.4.1.3 *Collection and Planting of Acorns*

Depending on oak acorn production years and timing of restoration planting, oaks may be directly planted in the field from acorns. Acorns will be collected in the fall, inspected for viability, and stored in refrigeration until the ground is moistened by rains. Viable acorns will be separated from damaged ones by placing acorns in a bucket of water and discarding those that float to the top. Acorns may be stored in refrigeration for up to 2 months, but may begin to lose viability soon after. Prior to planting acorns, the existing ground will be prepped by loosening the first 12 inches. This may be done by equipment (i.e., auger) or by hand (i.e., shovel). At each planting spot, two or three acorns will be placed about ½ inch below the surface. Plant protector tubes will be installed to identify planting locations and protect young shoots from animal damage.

8.4.2 Natural Colonization

Natural colonization, or regeneration, is the process where existing conditions (i.e., topography, soils, hydrology, weather, etc.) are favorable and plant species adapted to those specific conditions are able to grow and establish on their own. Although this process is difficult in some areas and may be extremely slow for some species, it is often the most appropriate and efficient form of restoring sites. Natural colonization of desired or target vegetation is expected to some degree, but will most likely be dependent upon hydrological conditions. Willows, cottonwood, and mule fat are expected to colonize along riparian wetland zones (i.e., pond shorelines) where fine sediment is available to initiate seed germination.

8.5 Maintenance and Follow-Up of Restoration Plantings

In design and development of a restoration site such as this, there are numerous conditions and elements that may interfere with the accomplishment of the original goals and objectives. Some of the most critical factors affecting restoration are water availability, invasive species and weed competition, herbivory, and human vandalism. Each of these issues is addressed separately and a maintenance plan is included below. Acts of God, such as fires and flood events, could alter reclamation deliverables if areas are burned, washed away or depositional areas are created.

8.5.1 Irrigation

A temporary drip irrigation system will be used for installed plants in the lower and upper riparian woodland communities during the first 2 to 3 years of establishment. The length of supplemental irrigation will depend on soils and seasonal rainfall patterns. Irrigation will be installed prior to the arrival of the dry season so that water can be provided to individual plantings before water stress becomes a problem. All irrigation systems will be installed to a portable water pump that will pump water from the created pond. A screen will be installed on the intake hose of the pump to minimize debris entering the irrigation system and clogging emitters.

Individual seedlings will be irrigated with two drip emitters, spaced to provide water to the entire root zone, each applying water at a rate of 2 to 4 gallons per hour. A minimum of 8 gallons of water will be applied to each planting once a week during the first year. Irrigation will be monitored and adjusted as necessary to ensure plants are properly watered. Future irrigation will be applied for the following one to two seasons, as necessary. The frequency of irrigation will be reduced gradually over the 2 to 3 year period (depending upon species), and the effects will be monitored to ensure successful weaning of the plants from artificial watering.

8.5.2 Weed Maintenance/Control of Invasive Plants

Another critical factor potentially affecting young plants and overall reclamation objectives is competing vegetation. The amount of competition will vary depending on the species present, the existing seed bank in the soil material used for reclamation, hydrological conditions, and a number of other factors.

For individual tree and shrub plantings, a 3 to 4 foot circular area around each seedling will be cleared of weeds. Herbicides (i.e., Roundup®) may be applied around individual plantings as needed for the first 3 years. The use of any chemical herbicide, however, must be coordinated with a qualified biologist to ensure that the most effective methods are applied and damage to non-target vegetation is minimized. If weeds are minimal, a weed maintenance program around individual plants may not be necessary, or weeds can simply be mechanically removed by hand.

The Shifler Site is potentially subject to a number of invasive or noxious plants, particularly during the reclamation process as new areas are disturbed. A number of invasive plants have been identified within the lower Cache Creek watershed and could potentially threaten reclamation success of a project. Table 7 below is a partial list of invasive or noxious weed species recorded from the site or from nearby areas. The list includes those species categorized as “noxious” by the California Department of Food and Agriculture (CDFA) and “invasive (High)” by the California Invasive Plant Council (Cal-IPC).

TABLE 7. PARTIAL LIST OF INVASIVE/NOXIOUS WEEDS ALONG THE LOWER CACHE CREEK WATERSHED

Common Name	Scientific Name	Cal-IPC Rating	CDFA Rating
Barbed goatgrass	*Aegilops triuncialis*	High	B
Giant reed	*Arundo donax*	High	B
Red brome	*Bromus madritensis ssp. rubens*	High	----
Italian thistle	*Carduus pycnocephalus*	Moderate	C
Purple star-thistle	*Centaurea calcitrapa*	Moderate	B
Yellow star-thistle	*Centaurea solstitialis*	High	C
Bull thistle	*Cirsium vulgare*	Moderate	C
Pampas grass	*Cortaderia selloana*	High	----
Medusahead	*Elymus caput-medusae*	High	C
Hydrilla	*Hydrilla verticillata*	High	A
Perennial pepperweed	*Lepidium latifolium*	High	C
Creeping water-primrose	*Ludwigia peploides ssp. montevidensis*	High	----

Purple loosestrife	*Lythrum salicaria*	High	B
Parrot's feather	*Myriophyllum aquaticum*	High	----
Eurasian watermilfoil	*Myriophyllum spicatum*	High	C
Himalyan blackberry	*Rubus armeniacus*	High	----
Smallflower tamarisk	*Tamarix parviflora*	High	B
Saltcedar	*Tamarix ramosissima*	High	B

Reclamation standards require that all Cal-IPC rated "invasive (High)" and CDFA rated "noxious" plants be managed such that they do not threaten the success of the proposed revegetation. While the list only includes those species listed by the CDFA or ranked "High" by the Cal-IPC, other species should also be considered for management in reclamation of the site, including milk thistle (*Silybum marianum*), field mustard (*Hirschfeldia incana*), tree tobacco (*Nicotiana glauca*), poison hemlock (*Conium maculatum*), stinkwort (*Dittrichia graveolens*), and Ravenna grass (*Saccharum ravennae*). Adjustments shall be made to ensure that all of the most invasive and undesirable species are included within the management plan for the site.

Invasive/noxious weeds shall be managed annually as necessary throughout each of the reclamation areas in which monitoring is required. A list of target species will be updated each year and those found at the site will be identified for removal. Management of invasive weeds will include both mechanical and approved chemical methods, carried out on an annual basis and any time the observed component of invasive species exceeds 5%. Methods based on the latest scientific research at the time of reclamation shall be applied to all management actions. Adjacent areas within the property boundaries will also be managed to minimize future spreading into reclaimed areas. The use of any chemical herbicide will be coordinated with a qualified biologist with an applicator license to ensure that the most effective methods are applied and damage to non-target vegetation is minimized. Monitoring and management of invasive weeds will continue to occur in the reclaimed areas throughout the end of the monitoring period.

8.5.3 Herbivory Control

To protect planted seedlings from deer, small rodents, rabbits, and beavers, it may be necessary to implement various measures that will reduce herbivory. If present, herbivory may be minimized through several approaches. First, plant protector tubes, or tree shelters, will be placed around seedlings if herbivory from voles or rabbits are evident. Tubes will be inserted approximately 4 inches into the ground to minimize voles from tunneling under them and left in place until they become of sufficient size to tolerate occasional browsing, usually after the first year or two. Tree shelters may be left around some tree seedlings indefinitely (or until they naturally degrade) if monitoring suggests.

Additionally, oaks and other tree seedlings may be protected from larger animals (i.e., deer or beaver) by installing wire cylinder cages around individual seedlings. Cages shall be large enough (i.e., 2' wide and 4' tall) to allow for some new plant growth before they can be browsed.

8.5.4 Vandalism

Visitors to the Project Site are required to register and receive safety orientation at the Woodland Plant. Any vandalism would most likely occur from trespassers along Cache Creek or adjacent County roads. Fencing, as required by SMRO § 10-5.510, will be the primary deterrent to trespassing/vandalism (Section 1.7.1). In addition, trespassing is expected to be discouraged by weekly visits by Teichert staff and/or contractors to the site during the reclamation establishment period. In addition, no trespassing signs will be placed along the entire perimeter of the Project Site.

9 OPEN SPACE HABITAT MONITORING AND PERFORMANCE STANDARDS

The primary objective of a monitoring program is to document the success or failure in attaining designated objectives and performance standards. For the open space habitat features, these objectives relate to plant establishment and the general conditions of revegetated areas. Monitoring is also designed to provide sufficient data to identify and evaluate the cause of problems in attaining success should they occur, and assist in devising appropriate corrective measures. A biologist or revegetation specialist with qualifications acceptable to the County of Yolo and State Mining and Geology Board will conduct all monitoring and reporting requirements for the habitat features.

9.1 Monitoring Time Period

Habitat reclamation will be monitored annually for a minimum of 5 years following implementation. Because reclamation will occur in phases, monitoring may represent various stages in vegetation and reclamation development. As reclamation areas are completed and all success criteria are met, monitoring and reporting for that particular area will end. If success criteria are not met, further monitoring and/or corrective measures will be required until such time that success criteria have been achieved.

9.1.1 Photo Monitoring

Photographs will be taken in late-spring or early summer while vegetative conditions are at their peak. A minimum of four permanent photo stations will be selected to qualitatively document changes in habitat development, types, and distribution over successive monitoring periods. Each photo station will be staked and mapped in the field with a GPS (global positioning system) unit with sub-meter accuracy and its direction of view recorded for future monitoring. Fixed features (i.e., mature trees, slope features, etc.) will be included in photos to provide a consistent reference and background against which yearly comparisons can be made. Representative photos during construction and revegetation will also be taken and included in monitoring reports.

9.1.2 Vegetation Monitoring

Vegetation monitoring will be conducted for each of the habitat types proposed. Vegetation data will be collected using randomly placed 10 meter (m) long transects and using a point-line intercept method. Each transect will be treated as a sampling unit to calculate total absolute plant cover[1] for each unit and each species. Starting points for each transect will be randomly generated using ArcGIS software (i.e., tool in Data Management Tools/Feature Class called Create Random Points) or any other scientifically justified method for generating random points. In addition, a random degree of direction between 0 and 360 degrees for each point will be produced.

Once random points are created and a degree of direction for each point assigned, the information will be saved and uploaded into a GPS unit. Each point will be identified in the field using the GPS unit, and a transect will be established by laying a 10-m tape in the direction randomly assigned for that particular point. At every 0.1-m interval along each transect, all vegetation intercepted by a vertical pointed will be recorded. Sample sizes for all monitoring efforts will be sufficient to produce at least an 80 percent confidence level with a confidence interval width within 20 percent of the mean. Total absolute cover of each transect will be calculated using the data collected at each transect.

$$\text{Total Cover of Transect X} = \frac{\text{Total \# of points where vegetation is recorded}}{\text{Total \# of points along each transect}}$$

Species richness data will be calculated by using 10-m^2 plots and the same transects as those established for collecting cover data. All species encountered within 0.5 meter of each transect will be recorded, and the data for the plots will be averaged to determine the number of species per 10-m^2 area. Noxious or invasive weeds will be recorded separately from total plant cover and species richness data.

9.1.2.1 *Grassland Slopes*

Revegetation efforts on slopes will be evaluated based on total plant cover, species richness, and minimization of invasive/noxious weeds. Floristic surveys of reclaimed slopes will be conducted each spring when the majority of species are easily identifiable.

9.1.2.2 *Lower and Upper Riparian Woodland*

Plantings within the lower and upper riparian woodland will be monitored for an evaluation of native woody (trees and shrubs) species, including plant survival, total absolute cover, density, and species richness. A census of all plantings installed and those naturally recruited will be conducted each summer in which monitoring is required. At the time of installation, all plantings will be recorded with a GPS unit with sub-meter accuracy. Field maps of planting locations will then be generated to confirm the presence or absence (death) of plantings in the field. In addition, individual plantings will be assigned a vigor (health) ranking between 0 and 4 where: 0 = dead or missing, 1 = severe decline to nearly dead, 2 = possible decline or moderate defects, 3 = stable to fairly healthy and 4 = healthy with good growth. The amount of new growth, growth patterns, and foliage color will be considered when visually rating the health of each planting. Factors affecting these measurements may include weed competition, water, herbivory, soil characteristics, or disease. Only plantings with a vigor rating of 2 or high will be considered surviving plants.

Cover data for the riparian woodland habitats will focus on evaluating native woody vegetation and invasive species. Understory vegetation (herbaceous layer) would not be appropriate early in the restoration process as certain maintenance measures (i.e., weed removal around seedlings) would affect cover values.

Density and species richness of native woody vegetation can be calculated using the GPS information of individual plantings, or in the case of extensive natural recruitment, using similar plots established for calculating species richness. Densities for riparian woody species will be calculated to represent numbers per acre.

9.1.3 Wildlife Monitoring

Observations of wildlife (birds, amphibians, reptiles, or mammals) or their signs (i.e., tracks or scats) will be recorded whenever encountered, and a species list will be created for the site.

9.2 Performance Standards

In order to determine whether the goals of the habitat reclamation objectives have been met, a set of final performance standards have been developed. These success criteria for the different types of habitats created are provided in Table 8. All established criteria must be met and present at the end of the 5-year monitoring period.

TABLE 8. MINIMUM SUCCESS CRITERIA FOR HABITAT RECLAMATION

Habitat Type	Minimum Performance Standards
Grassland Slope	• Total absolute vegetative cover must be at least 70%. • Total absolute cover of noxious or invasive weeds must be less than 5%.* • Species richness must average at least 4 species per 10-m^2, excluding noxious or invasive.
Upper Riparian Woodland	• Survivorship of installed plantings will be at least 80% (health/vigor rating of 2 or higher). Natural recruitment of native woody species may be counted toward replacement seedlings. • Total absolute cover of native woody species must be at least 10%. • Density of native woody species must be at least 150 trees/shrubs per acre. • Species richness must average at least 4 native woody species. • Total absolute cover of invasive/noxious weeds must be less than 5%. • The total amount of Upper Riparian Woodland habitat established must be equal to or greater than 10.9 acres.
Lower Riparian Woodland	• Survivorship of installed plantings will be at least 80% (health/vigor rating of 2 or higher). Natural recruitment of native woody species may be counted toward replacement seedlings. • • Total absolute cover of native woody species must be at least 10%. • Density of native woody species must be at least 250 plants per acre. • Species richness must average at least 4 native woody species per acre. Total absolute cover of invasive/noxious weeds must be less than 5%.* • Total amount of Lower Riparian Woodland established must be equal to or greater than 13.0 acres.

* Invasive/noxious weeds are those species listed by the CDFA or ranked 'High' by the Cal-IPC.

An aerial photo of the site and constructed reclamation features shall be taken within the first year following completion, or the boundaries of each feature shall be mapped using a GPS unit with sub-meter accuracy, to report "as-built" conditions. In addition, constructed slopes shall be surveyed to verify grade. All information shall be provided in the first monitoring report and updated once again in the final monitoring report.

If a reclaimed area has been adversely affected by a natural disaster (i.e. flood, earthquake, fire, or other natural occurrence beyond the operator's control), contingency measures will be implemented to the extent feasible. Teichert shall meet with regulatory personnel to evaluate and agree upon the feasibility of such corrective actions, taking into account the extent to what areas have been previously reclaimed and destroyed prior to the natural occurrence, the effect of the natural occurrence on public health and safety, the site characteristics and proposed end use, etc.

9.3 Annual Monitoring Reports

Monitoring reports will summarize the reclamation responsibilities, construction and revegetation completed, monitoring implemented, and results compared to established success criteria. Photo documentation and field data will also be provided in appendices to the monitoring reports. If it is apparent that some reclamation features may not achieve intended success criteria, potential remediation opportunities will be evaluated or suggested and provided in the report.

Monitoring reports will be prepared and submitted annually to the Yolo County Natural Resources Division and Department of Conservation, Division of Mine Reclamation. Monitoring reports shall be due on August 31st of each year. This allows time for remedial actions, if necessary, or enhancement opportunities to be discussed and implemented prior to the end of the construction season.

At the end of the 5-year monitoring period, monitoring will cease, provided all the reclamation features are determined by the agencies to be in substantial compliance with the established success criteria. Reclamation monitoring and annual reporting will be extended beyond the 5-year period only if success criteria have not been met.

Upon review of the final monitoring report, the County or State may require a site visit to confirm the completion of the reclamation requirements. Once it is deemed that all success criteria have been met for the site, the performance bond will be released and the site will be allowed to continue to develop under natural processes.

10 ADMINISTRATIVE REQUIREMENTS

10.1 Performance (Financial) Assurances – *SMARA 2773.1(a)*

A Performance Bond payable to the "County of Yolo or the Department of Conservation" shall be provided to the County of Yolo in the amount for the estimated cost of reclamation. The financial assurances shall remain in effect for the duration of the surface mining operation and any additional period until reclamation is completed. The amount of financial assurances required for any one year shall be adjusted annually to account for new lands disturbed, inflation, and reclamation of lands accomplished in accordance with the approved Reclamation Plan. As items of reclamation work are accomplished to the standards set forth in the approved Reclamation Plan and are acceptable to the County, the operator may retrieve the existing assurance and submit a new one with the face value reduced accordingly.

Upon review of the final monitoring report, the County or State may require a site visit to confirm the completion of the reclamation requirements. Once it is deemed that all success criteria have been met for the site, the performance bond shall be released and the site shall be allowed to continue to develop under natural processes. An amended reclamation plan shall be required prior to substantial deviation to approved plans (PRC 2777).

10.2 Reclamation Cost Estimate – *SMARA 2773.1; SMRO §10-5.601(g)*

Reclamation is phased to be concurrent with mining so that costs can be distributed over the life of the operation. Reclamation tasks are shown with the various costs and summarized in Appendix B, Financial Assurance Cost Estimate (FACE). Costs are based on work being performed by outside contractors. The FACE is intended to be adjusted annually as mining begins and reclamation areas are completed.

10.3 Reclamation Responsibility Designee – SMARA 2772(c)(10)

STATEMENT OF RESPONSIBILITIES

Submittal of this Shifler Mining and Reclamation Plan represents a commitment by Teichert Materials, a division of A. Teichert & Son, Inc., to reclaim the Shifler Property per the approved entitlement granted by Yolo County. Teichert accepts responsibility for reclaiming the mined lands in accordance with the attached reclamation plan. Assuring this obligation will be a surety bond to be held by the lead agency and the Department of Conservation, Office of Mine Reclamation.

Signed this _____ day of, _________________2021

By ____
Dana Davis, President of Teichert Materials

By ____
Paul Mercurio, Production Manager

11 REFERENCES

California Invasive Plant Council (Cal-IPC). 2017. California Invasive Plant Inventory. Cal-IPC Publication 2006-17, California Invasive Plant Council: Berkeley, CA.

Cunningham Engineering. 2016. Shifler Mine Plan Drawings and Cross Sections. Prepared for Teichert Aggregates 11 February 2016.

Cunningham Engineering. 2014. Hydrological Analysis. Prepared for Teichert Aggregates.

Eco Synthesis. 2017. Shifler Agricultural Feasibility Study, Soils Analysis and Reclamation Plan. Prepared for Teichert Aggregates September 2017.

ECORP Consulting (ECORP). 2012. Wetland Delineation for Shifler Property, Yolo County, California. 16pp.

Geocon Consultants, Inc. (Geocon). 2014. Slope Stability Evaluation – Teichert Shifler Mining and Reclamation Project. Prepared for Teichert Aggregates May 2014.

Luhdorff and Scalmanini Consulting Engineers. 2014. Technical Memorandum: Assessment of Shifler Property Wetpit Pond Levels. Prepared for Teichert Aggregates May 2014.

Luhdorff and Scalmanini Consulting Engineers. 2015. Groundwater Conditions in the Vicinity of Planned Wetpit Mining Operations – Shifler Property. Prepared for Teichert Aggregates December 2015.

Natural Resource Conservation Service (NRCS). 2015. Custom Soil Resource Report for Yolo County, California. Report and data downloaded from WebSoilSurvey from internet application on 25 March 2015 (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

Teichert Aggregates. 2007. Woodland-Haller Peninsula Reclamation Monitoring: 10th (Final) Annual Monitoring Report. Submitted to County of Yolo July 2007.

Teichert Aggregates. 2013. Schwarzgruber Reclamation Plan. Prepared for County of Yolo Planning and Public Works Department May 2011, final revised April 2013.

Teichert, Inc. 2013. Shifler Property Oak Tree and Elderberry Survey. Prepared October 2013.

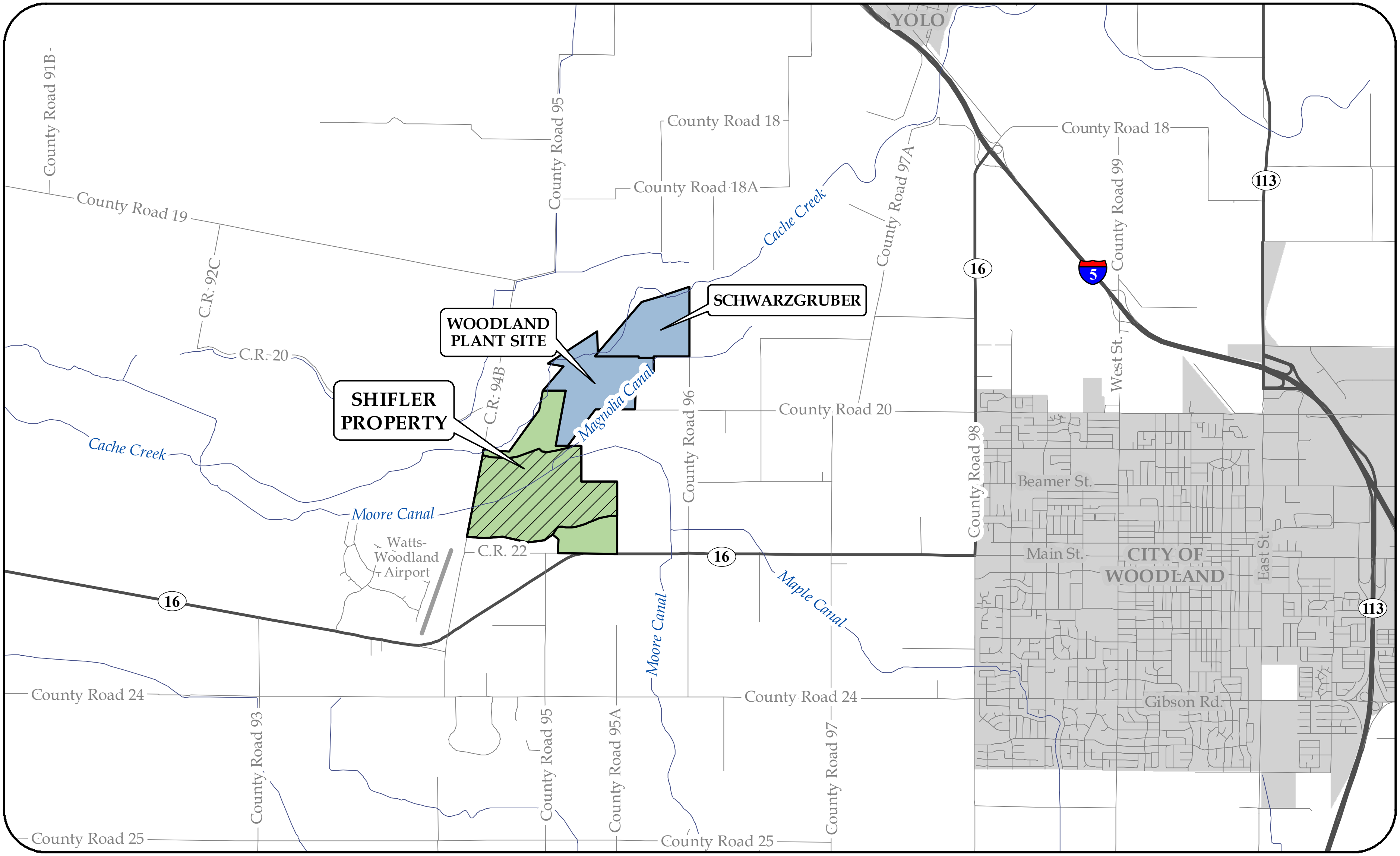
Teichert, Inc. 2013. Final Agricultural Reclamation Monitoring Report – Muller Site. Submitted to County of Yolo Planning and Public Works Department October 2013.

Teichert, Inc. 2014. Muller 90-Acre Habitat Reclamation – Final (Fifth) Year Monitoring Report. Submitted to County of Yolo Planning and Public Works Department November 2014.

Teichert Materials. 2018. Biological Resources Assessment – Teichert Woodland Shifler Project – Yolo County, California. Prepared for County of Yolo, May 2018.

U.S. Department of the Interior, Fish and Wildlife Service (USFWS). 1999. Conservation Guidelines for the Valley Elderberry Longhorn Beetle. Dated 9 July 1999.

LIST OF FIGURES



C. Cornejo 6/15/2018 SHF_RecPlan_Fig1_Vicinity_201806.mxd

TEICHERT MATERIALS

LEGEND:

- Project Site
- Shifler Property Boundary
- Teichert Woodland Plant Site & Schwarzgruber Property

DISCLAIMER:

The data was mapped for planning purposes only. No liability is assumed for the accuracy of the data shown.

N W E S

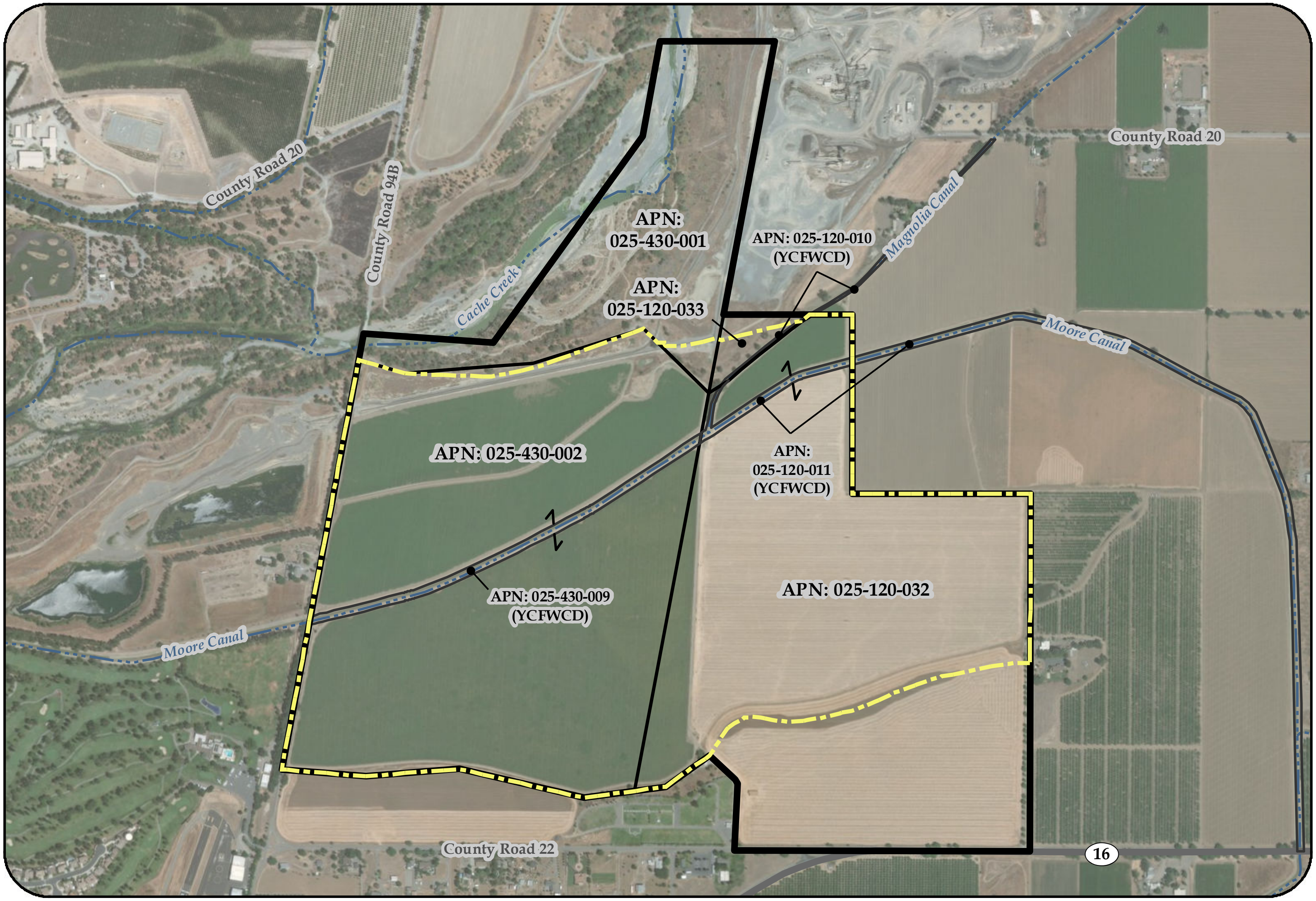
0 0.5 1 Miles

FIGURE 1

SITE VICINITY MAP

RECLAMATION PLAN
SHIFLER PROPERTY
TEICHERT MATERIALS

YOLO COUNTY, CALIFORNIA



C. Cornejo 6/15/2018 SHF_RecPlan_Fig2_Site_201806.mxd

TEICHERT MATERIALS

LEGEND:
- Project Site
- Yolo County Flood Control & Water Conservation District (YCFWCD) Parcel Boundaries (Approximate)
- Project Parcel Boundaries
- Shifler Property Boundary

SOURCE:
- Aerial Photography Provided by ESRI Basemaps & Affiliates (DigitalGlobe: July 08, 2016)

N E S W

0 550 1,100 Feet

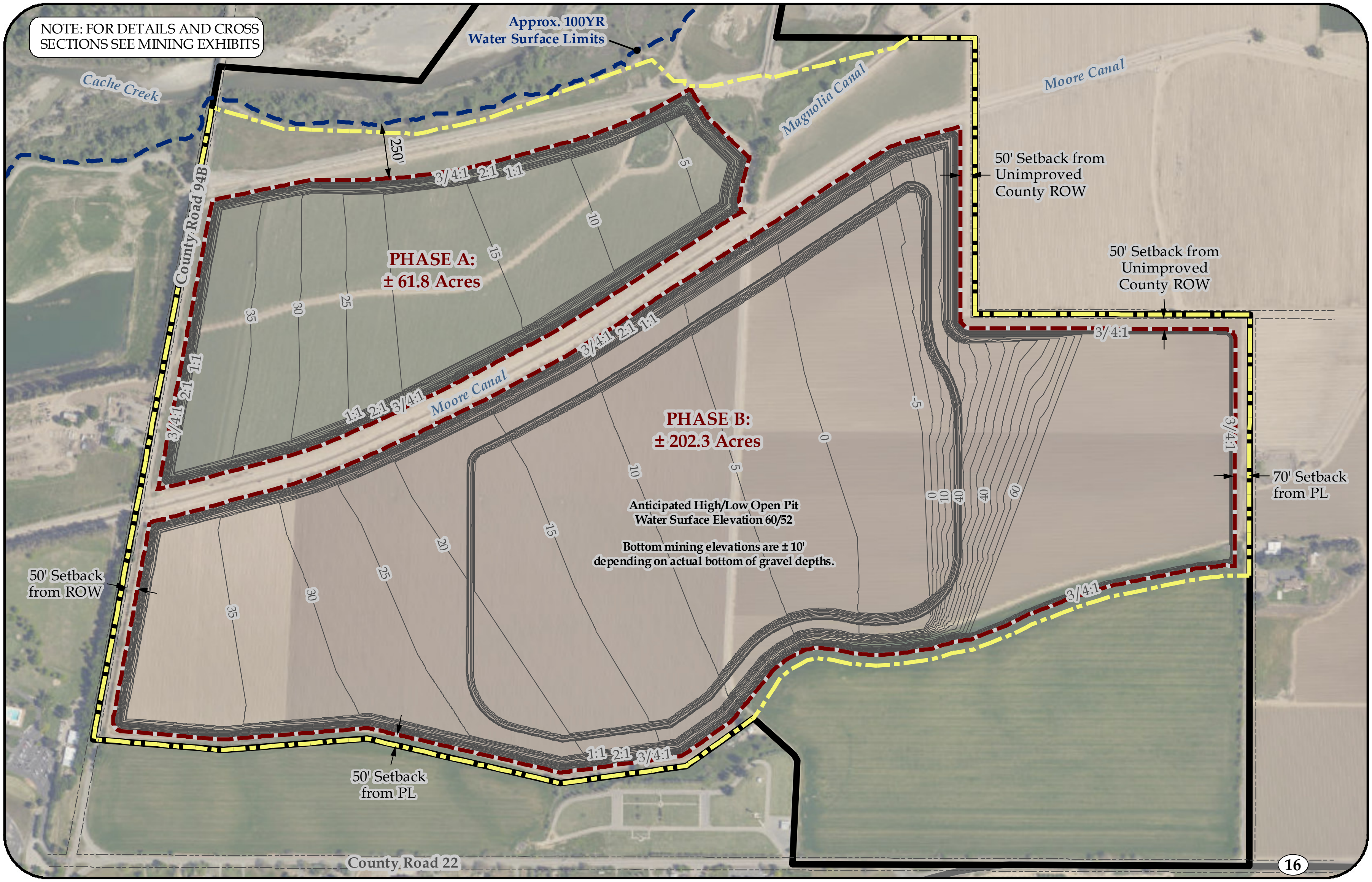
DISCLAIMER:

The data was mapped for planning purposes only. No liability is assumed for the accuracy of the data shown.

FIGURE 2

SITE MAP

RECLAMATION PLAN
SHIFLER PROPERTY
TEICHERT MATERIALS
YOLO COUNTY, CALIFORNIA



C. Cornejo 6/15/2021 SHF_RecPlan_Fig3_Mining_202106.mxd

TEICHERT MATERIALS

LEGEND:

- Approx. 100YR Water Surface Limits
- Proposed Mining Contours
- Proposed Mining Phases: Total ± 264.1 Ac.
- Project Site
- Shifler Property Boundary

SOURCE:

- Approx. 100YR Water Surface Limits Per Separate Hydraulic Report by Cunningham Engineering (Jan. 26, 2016)
- Mining Contours Provided by Cunningham Engineering (June 2021)
- Aerial Photography Provided by ESRI Basemaps (Yolo County: April 13, 2018)

0 350 700 Feet

DISCLAIMER:

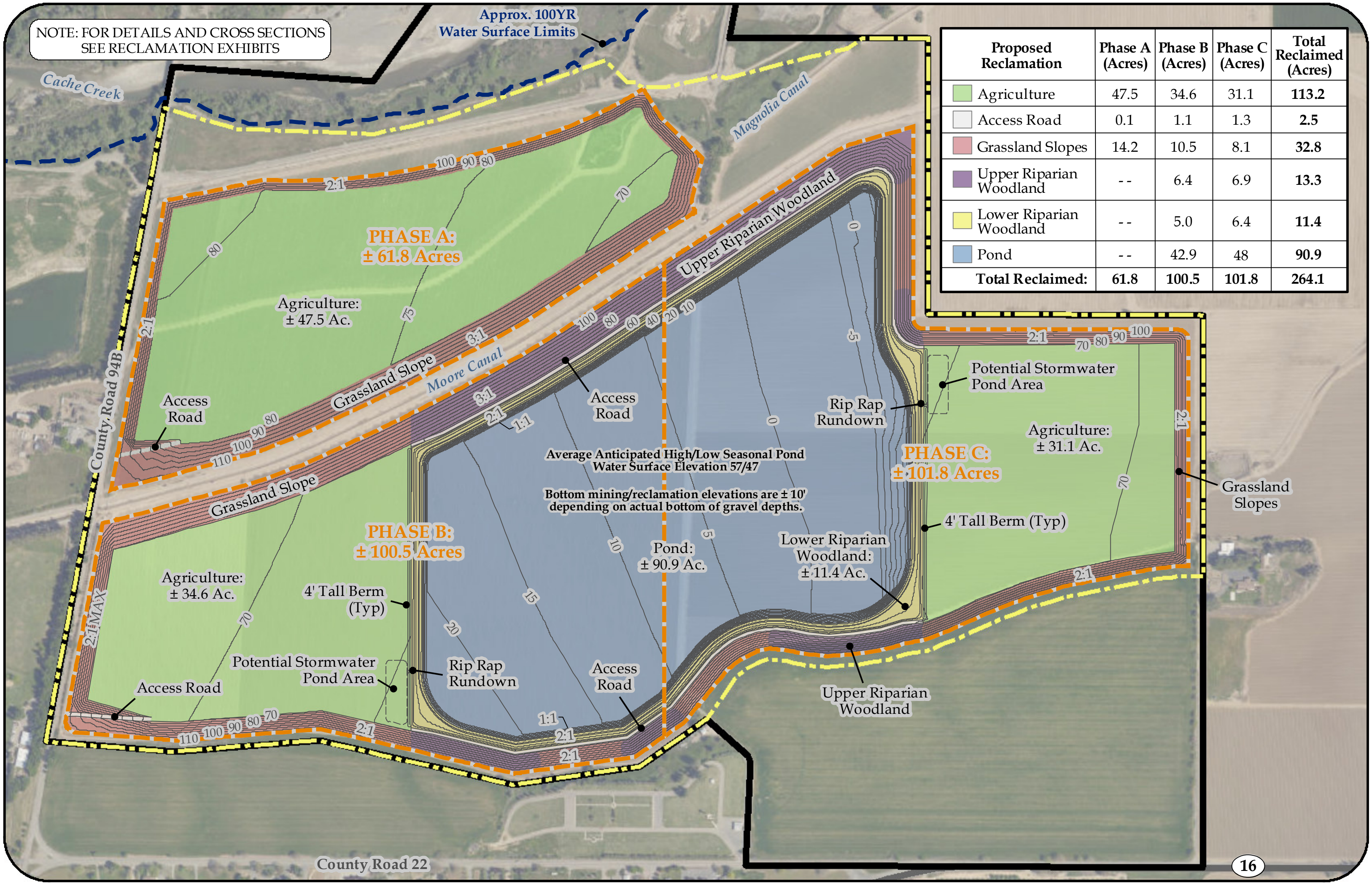
The data was mapped for planning purposes only. No liability is assumed for the accuracy of the data shown.

FIGURE 3

PROPOSED MINING AREA

RECLAMATION PLAN
SHIFLER PROPERTY
TEICHERT MATERIALS

YOLO COUNTY, CALIFORNIA



Proposed Reclamation	Phase A (Acres)	Phase B (Acres)	Phase C (Acres)	Total Reclaimed (Acres)
Agriculture	47.5	34.6	31.1	**113.2**
Access Road	0.1	1.1	1.3	**2.5**
Grassland Slopes	14.2	10.5	8.1	**32.8**
Upper Riparian Woodland	--	6.4	6.9	**13.3**
Lower Riparian Woodland	--	5.0	6.4	**11.4**
Pond	--	42.9	48	**90.9**
Total Reclaimed:	**61.8**	**100.5**	**101.8**	**264.1**

TEICHERT MATERIALS

LEGEND:
- Approx. 100YR Water Surface Limits
- Proposed Reclamation Contours
- Proposed Reclamation Phases: Total ± 264.1 Ac.
- Project Site
- Shifler Property Boundary

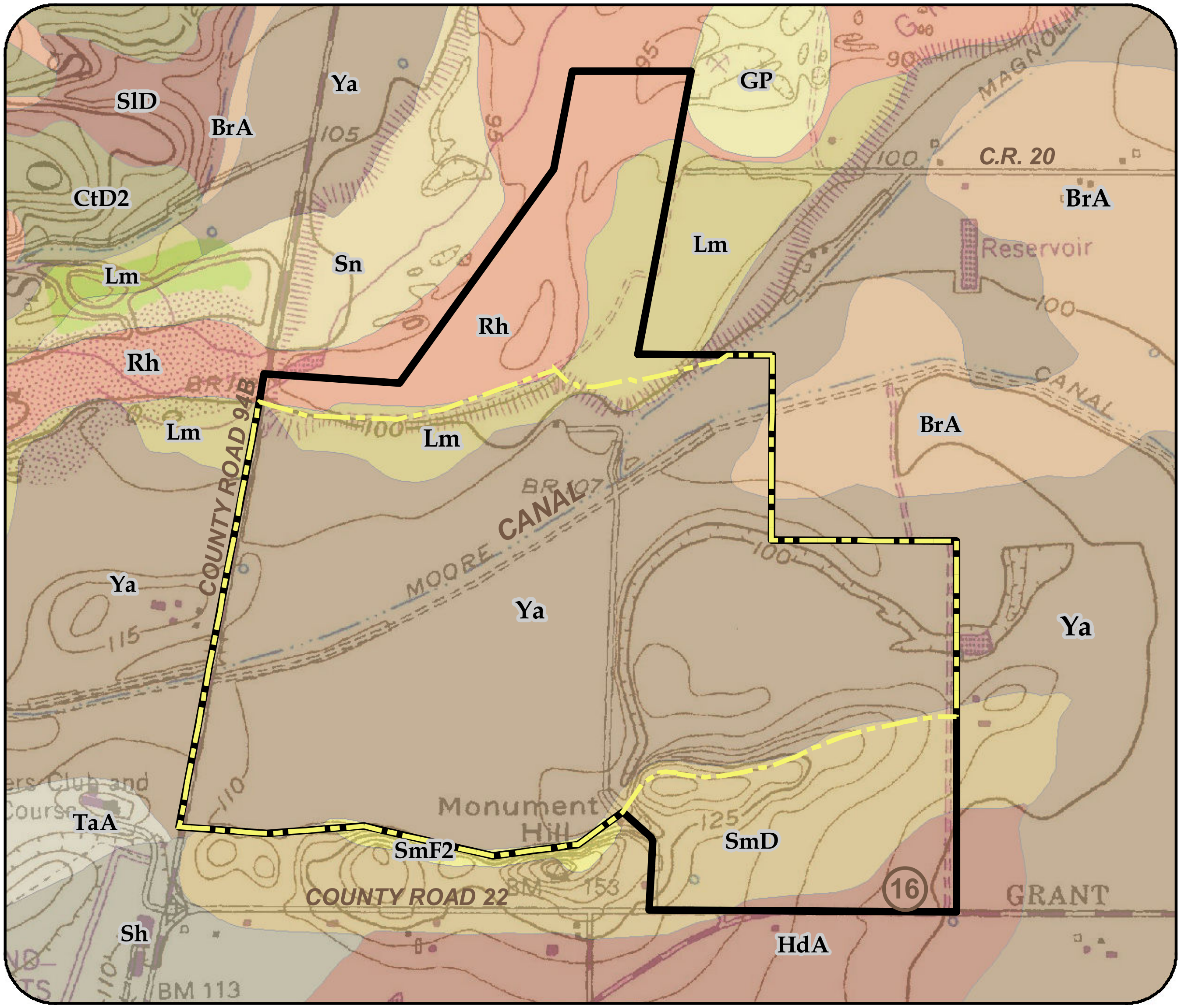
SOURCE:
- Approx. 100YR Water Surface Limits Per Separate Hydraulic Report by Cunningham Engineering (Jan. 26, 2016)
- Reclamations Contours Provided by Cunningham Engineering (June 2021)
- Aerial Photography Provided by ESRI Basemaps (Yolo County: April 13, 2018)

0 350 700 Feet

DISCLAIMER:
The data was mapped for planning purposes only. No liability is assumed for the accuracy of the data shown.

FIGURE 4
PROPOSED RECLAMATION-AGRICULTURE & HABITAT COMMUNITIES
RECLAMATION PLAN
SHIFLER PROPERTY
TEICHERT MATERIALS
YOLO COUNTY, CALIFORNIA

C. Cornejo 6/15/2021 SHF_RecPlan_Fig4_Rec_202106.mxd



NATURAL RESOURCES CONSERVATION SERVICE SOIL TYPES:

- BrA- Brentwood silty clay loam, 0 to 2 percent slopes
- CtD2- Corning gravelly loam, 0 to 12 percent slopes, MLRA 17
- GP- Gravel pits
- HdA- Hillgate loam, moderately deep, 0 to 2 percent slopes
- Lm- Loamy alluvial land
- Rh- Riverwash
- Sh- San Ysidro loam, 0 to 5 percent slopes, dry, MLRA 17
- SlD- Sehorn cobbly clay, 2 to 15 percent slopes
- SmD- Sehorn-Balcom complex, 2 to 15 percent slopes
- SmF2- Sehorn-Balcom complex, 30 to 50 percent slopes, eroded
- Sn- Soboba gravelly sandy loam
- TaA- Tehama loam, 0 to 2 percent slopes, loamy substratum, MLRA 17
- Ya- Yolo silt loam, 0 to 2 percent slopes, MLRA 17
- Project Site
- Shifler Property Boundary

C. Cornejo 6/15/2018 SHF_RecPlan_Fig5_Soils_201806.mxd

TEICHERT MATERIALS

SOURCE:

Soil Survey Provided by NRCS (Version 13, Sept. 13, 2017)

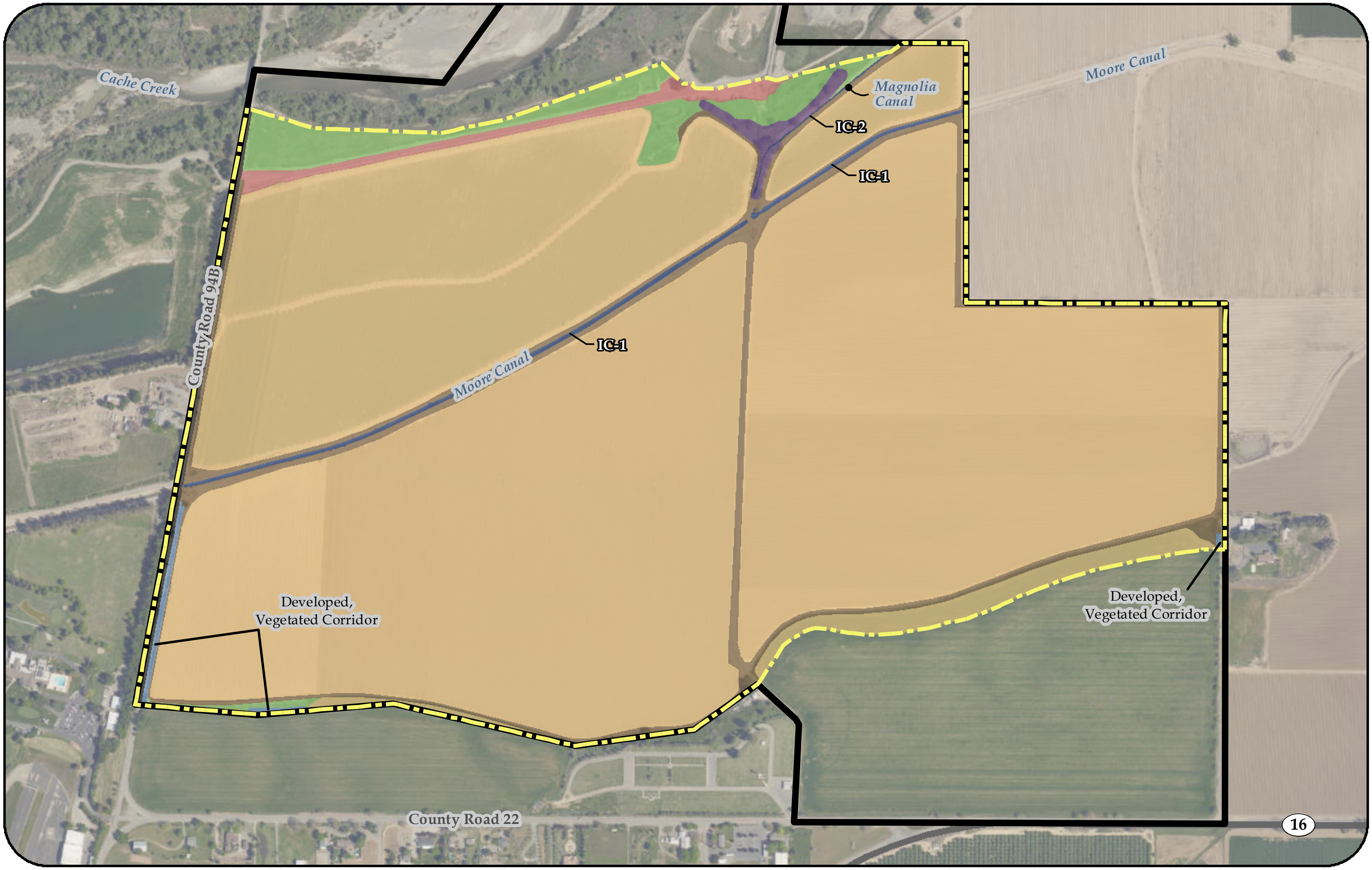
USGS 7.5' Quad: Woodland

0 600 1,200 Feet

DISCLAIMER:

The data was mapped for planning purposes only. No liability is assumed for the accuracy of the data shown.

FIGURE 5
NATURAL RESOURCES CONSERVATION SERVICE SOIL TYPES
RECLAMATION PLAN SHIFLER PROPERTY TEICHERT MATERIALS
YOLO COUNTY, CALIFORNIA



LEGEND:

WATERS OF THE U.S.

- Irrigation Canal (IC)
- Barren, Anthropogenic
- Cultivated Lands
- Developed, Vegetated Corridor
- Grassland
- Incidental to Agriculture
- Urban or Built Up, Paved Road
- Valley Oak Woodland
- Project Site
- Shifler Property Boundary

0 350 700 Feet

SOURCE:
- Existing Features Provided by Teichert (July 2020)
- Wetlands Provided by EcoSynthesis (Dec. 2019)
- Aerial Provided by ESRI Basemaps (Yolo Cnty: 04/13/18)

DISCLAIMER:
The data was mapped for planning purposes only.
No liability is assumed for the accuracy of the data shown.

TEICHERT MATERIALS

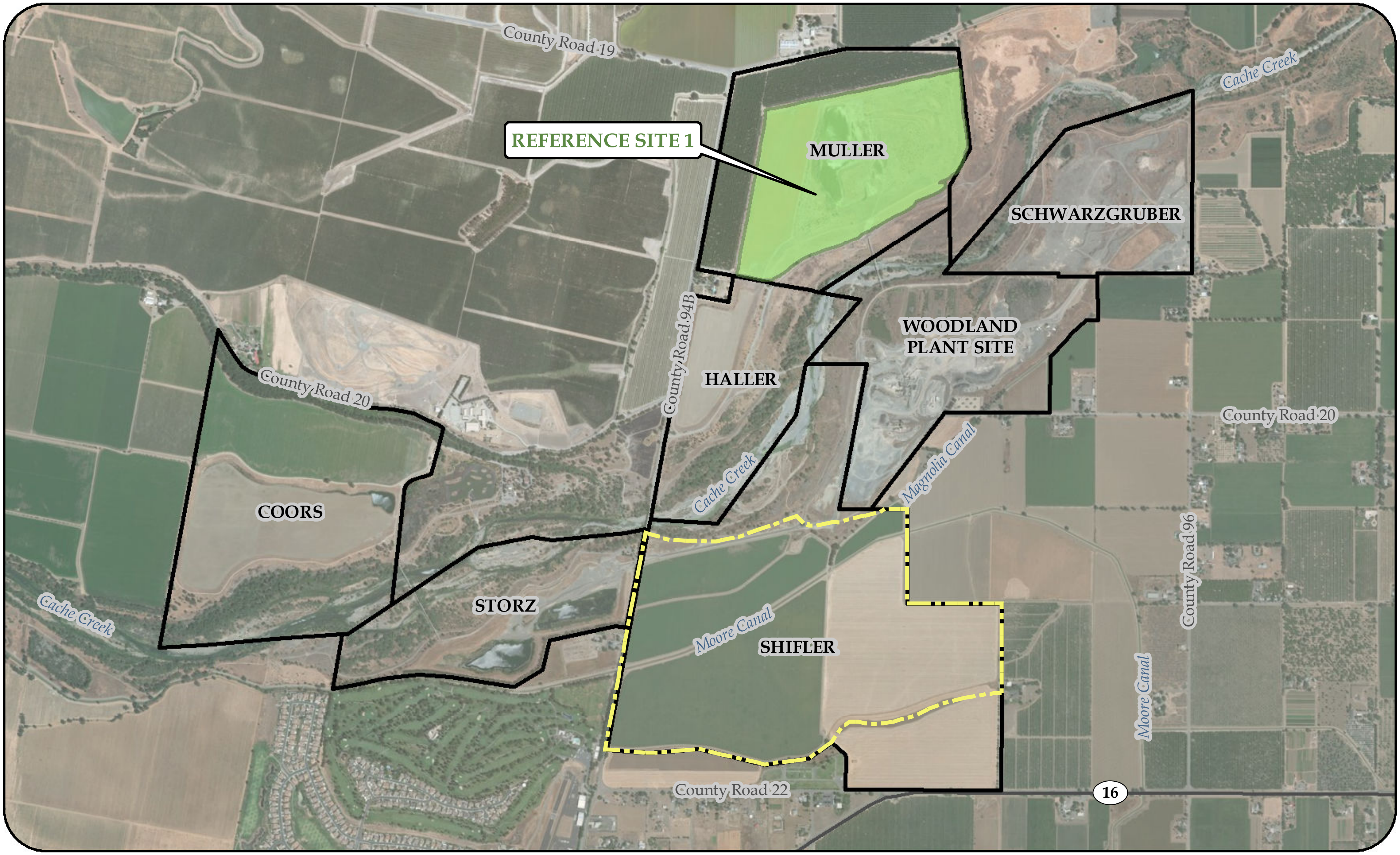
FIGURE 6

EXISTING HABITATS, WETLANDS AND FEATURES

RECLAMATION PLAN SHIFLER PROPERTY TEICHERT MATERIALS

YOLO COUNTY, CALIFORNIA

C. Cornejo 5/13/2021 SHF_RecPlan_Fig6_Bio_202105.mxd



LEGEND:

Reference Site 1: Muller

Project Site

Property Boundaries

SOURCE:

Aerial Photography Provided by
ESRI Basemaps & Affiliates
(Digital Globe: July 08, 2016)

0 1,000 2,000 Feet

DISCLAIMER:

The data was mapped for planning purposes only. No liability is assumed for the accuracy of the data shown.

TEICHERT MATERIALS

FIGURE 7

REFERENCE SITE

RECLAMATION PLAN
SHIFLER PROPERTY
TEICHERT MATERIALS

YOLO COUNTY, CALIFORNIA

C. Cornejo 6/26/2018 SHF_RecPlan_Fig7_RefSites_201806.mxd

FIGURE 8

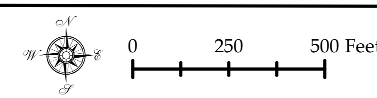
REFERENCE SITE 1: MULLER RECLAMATION PLAN AND HABITAT COMMUNITIES

RECLAMATION PLAN SHIFLER PROPERTY TEICHERT MATERIALS

YOLO COUNTY, CALIFORNIA

LEGEND

- Access Road
- Agriculture: ± 32 Acres
- Grassland Slopes: ± 18 Acres
- Low Density Oak Woodland/ Grassland: ± 11 Acres
- Native Hedgerow Planting: ± 1 Acre
- Open Water/ Seasonal Marsh: ± 27 Acres
- Riparian Upland: ± 40 Acres
- Riparian Wetland: ± 6 Acres
- Property Boundary



SOURCE:

- Updated Reclamation GPS (May 2012)
- Aerial Photography Provided by ESRI Basemaps & Affiliates (DigitalGlobe: July 08, 2016)

DISCLAIMER:

The data was mapped for assessment purposes only. No liability is assumed for the accuracy of the data shown.

TEICHERT MATERIALS

C. Cornejo 6/26/2018 SHF_RecPlan_Fig8_Muller_201806.mxd

APPENDIX A

Teichert Shifler Project – Agricultural Feasibility Study

EcoSynthesis
SCIENTIFIC & REGULATORY SERVICES, INC.

Teichert Shifler Project

Agricultural Reclamation Feasibility Study

Prepared by:
Adrian Juncosa, PhD

Prepared for:
Teichert Aggregates
3500 American River Drive
Sacramento, CA 95864

September 16, 2017

16173 Lancaster Place, Truckee, CA 96161 · Telephone: 530.412.1601 · E-mail: ajuncosa@ecosynthesis.com

SUMMARY

This report discusses the feasibility of reclamation of a portion of the Shifler project site into prime agricultural land, and provides recommendations for soil salvage and placement to achieve that goal.

Soils of the mining area are mapped by the USDA Natural Resources Conservation Service entirely as Yolo loam, which is a very deep silt loam classified as a Mollic Xerofluvent, having only a very slight horizonation between the A and C horizons. There is a subtle color change, but no consistent and substantial change in texture or nutrient content.

Soil test pits were studied at 19 locations, and samples obtained and analyzed for nutrient content and texture. Results of laboratory analysis indicate that there is generally no significant differentiation between "topsoil" and subsoil for the purposes of agricultural reclamation, and that almost all of the material studied, down to a depth of at least 10 feet in most pits, was suitable for placement as the agricultural soil surface layer. Based upon laboratory results, all soils that are salvaged from a depth of up to 10 feet and stockpiled for the purposes of resoiling of the agricultural field would be expected to have sufficiently similar nutrient content that they may be mixed and stockpiled as one salvage stockpile, without separation of material to be placed as subsoil and topsoil. With the application of irrigation and fertilization practices that are commonly utilized in the region, yields from the reclaimed agricultural land could reasonably be expected to meet mining ordinance performance criteria.

Wet mining areas will be backfilled with waste fines up to at least five feet higher than the level of average annual high groundwater; at a minimum, the uppermost four feet of the backfill will be salvaged Yolo loam and sloped to drain (similar surface topography to the present fields).

Analysis of temperature data from June 2015 to February 2016 indicates that the below-grade agricultural field will have a suitable temperature range for agricultural production. Temperature differences between a present day field at grade and a reclaimed field 40 feet below grade were slight, and if anything were more favorable for agriculture in the below-grade field than the control site: nighttime temperatures during cold periods of the year were not as low, and daytime temperatures during warm months were not quite as high as the control site. The presence of an even lower pond level next to the below-grade field (as will be the case at Shifler) explains this result.

Soil and temperature studies demonstrate that post-mining reclamation to prime agricultural land is feasible.

Table of Contents

Figures

Tables

Appendix

1 INTRODUCTION

1.1 Site Description and Project Summary

This report discusses the feasibility of, and procedures for, reclamation of the majority of the Teichert Shifler Project (Project) into prime agricultural land by the time of project closure.

The Project site is located a short distance to the south of Cache Creek in Yolo County, west of the City of Woodland. The majority, but not the entirety, of the site is proposed to be mined (the "Mining Area") and is currently used for agriculture and is classified as prime agricultural land; portions of the site outside the mining area are in ruderal native and non-native vegetation.

The Mining Area will be mined to levels below the groundwater elevation ("wet mining"), and commercial aggregate will be separated from waste fines. These waste fines will be used to bring a portion of the Mining Area up to the average annual groundwater elevation, or higher, then salvaged soil will be placed to achieve reclamation into prime agricultural land. A portion of the Mining Area will remain as a pond at closure.

Mining will create steep slopes near the Mining Area limits, which will be backfilled to establish slopes of 2:1 gradient or gentler in all areas above the average high groundwater level.

1.2 Agricultural Reclamation Overview and Objectives

The essence of all planned disturbed-land rehabilitation is to establish soil conditions that support the desired post-project vegetation. Ideally, this is achieved by salvaging and stockpiling appropriate soils, perhaps supplementing them with other growth media or amendments, and reestablishing the desired soil profile as disturbance is completed.

In order to determine what those supportive soil conditions are, one must understand how the desired post-project ecosystem functions. Agricultural systems may be highly managed, but they are fundamentally simply non-native vegetation types that produce plant parts that we find useful. The Yolo County Off Channel Surface Mining Ordinance and Yolo County Surface Mining Reclamation Ordinance (collectively, "Ordinance") specify that the applicable definition is that of the Williamson Act (sections 51200-51207 of the California Government Code). The present report discusses both the Williamson Act definition of prime agricultural land, and the definition of prime farmland provided by the California Department of Conservation (DOC), which are neither equivalent nor interchangeable. However, the latter definition includes details about soil characteristics that are relevant to the feasibility and methods of reclamation into prime agricultural land use as well. We are confident that the reclamation approach that is analyzed and recommended in the present feasibility report will achieve both the Williamson Act and DOC definitions and thus meet the Ordinance requirements with respect to reclamation of productive agricultural land.

1.2.1 DEFINITION AND DESCRIPTION OF AGRICULTURAL LANDS

Prime Agricultural Land (Williamson Act)

Section 10-4.220 of the Ordinance cites the Williamson Act, specifically California Government Code Section 51201, for the definition of prime agricultural land. This section reads as follows:

51201 (c). "Prime agricultural land" means any of the following:

1. All land that qualifies for rating as class I or class II in the Natural Resource Conservation Service land use capability classifications.
2. Land which qualifies for rating 80 through 100 in the Storie Index Rating.
3. Land which supports livestock used for the production of food and fiber and which has an annual carrying capacity equivalent to at least one animal unit per acre as defined by the United States Department of Agriculture.
4. Land planted with fruit- or nut-bearing trees, vines, bushes, or crops which have a nonbearing period of less than five years and which will normally return during the commercial bearing period on an annual basis from the production of unprocessed agricultural plant production not less than two hundred dollars ($200) per acre.
5. Land which has returned from the production of unprocessed agricultural plant products an annual gross value of not less than two hundred dollars ($200) per acre for three of the previous five years.

Prime Farmland (DOC)

Prime farmland is defined by the DOC primarily on the basis of soil profile characteristics, with the additional requirement of irrigation. The details of the soil profile provided in the DOC definition are discussed in Section 2.4, along with information from the soil survey data and from site observations that are pertinent to it.

Functional Overview of Agricultural Reclamation

Agriculture, and specifically prime agricultural land or prime farmland, is a distinctive ecosystem in two ways: 1) plant growth is largely dependent on irrigation (which is a key element in the DOC definition of the term); and 2) the species grown may change from time to time, and even from season to season. The present agricultural use of the Shifler site is for annual crops rather than trees, so the present discussion is directed primarily at that use, though reclamation to annual crop use, as described here, does not preclude future conversion to tree crops.

This latter characteristic (variable species composition) may result from variation in climate, availability and amount of water for irrigation, other inputs, market factors, desire to maintain long-term soil fertility, and/or avoidance of plant pests of one or another phylogenetic type. Since the "revegetation" is variable, soil studies and specifications are not tailored to the ecology of a specific desired community, but rather merely to be generally suitable for major crops that are commonly grown in the Woodland area (irrigated row crops and orchards).

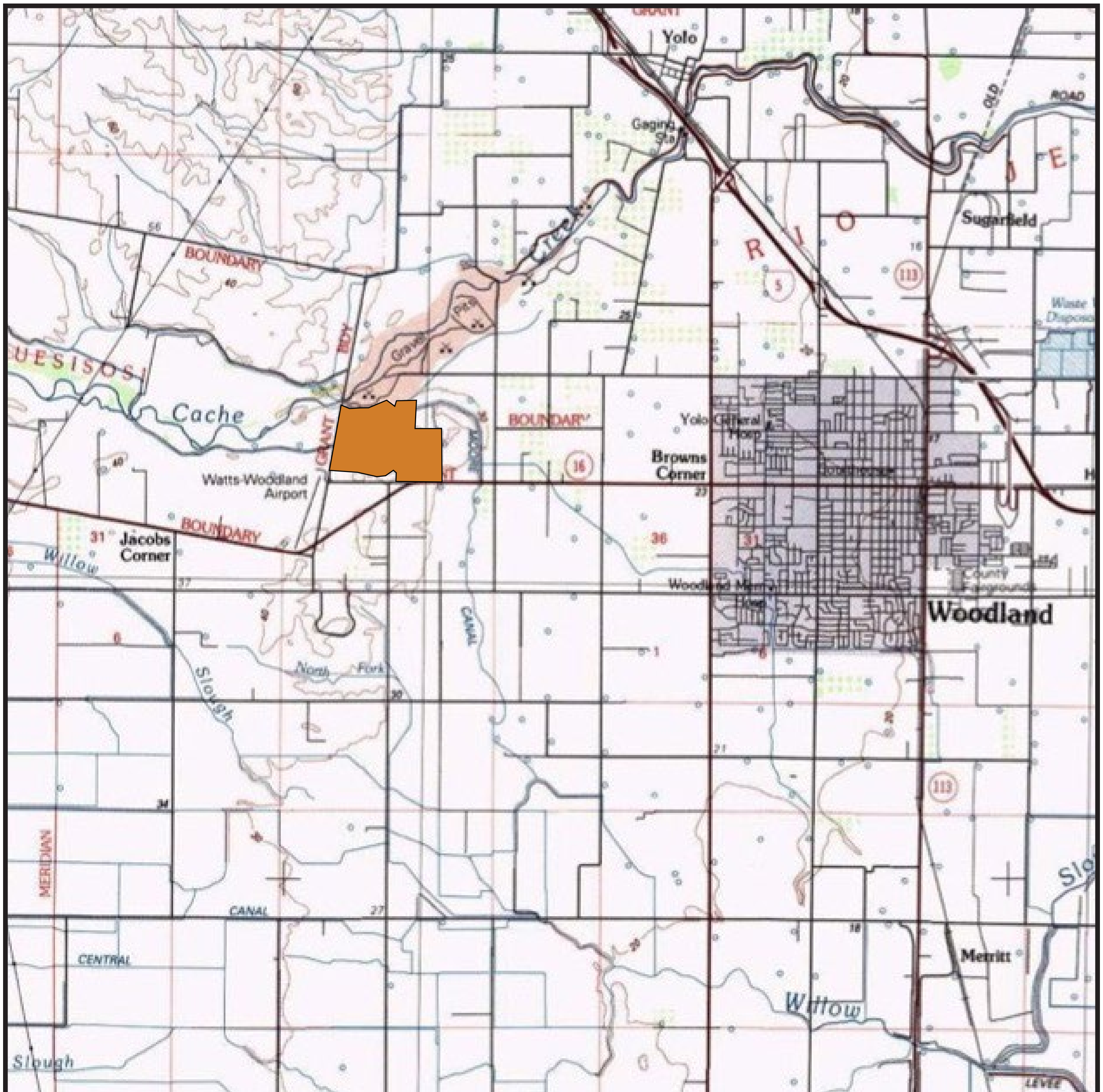
Agricultural Reclamation Objectives

Considering the additional requirements established by the Ordinance, the following objectives have been established for Project reclamation:

- Salvage and stockpiling of a sufficient amount of soil to provide the slope backfill and the prime agricultural land soil profile;
- Placement of a post-reclamation agricultural soil profile that will support production that meets the definition of prime agricultural land, relying in part upon the DOC description of prime farmland for guidance with respect to the characteristics of the soil profile;
- Establishment of a reclamation surface at least five feet higher than average annual high groundwater elevation at the Project site;

The present feasibility study also addresses several additional subjects:

- Determination of whether the soils of the upper pre-project soil profile differ sufficiently from the lower profile to merit segregation of "topsoil" and "subsoil" during salvage and stockpiling;
- Determination of the minimum thickness of salvaged soil that must be placed to achieve reclamation objectives; and
- Evaluation of possible concerns related to differences in temperature regime between the current elevation of agricultural fields and the post-reclamation topography.



EcoSynthesis
SCIENTIFIC & REGULATORY SERVICES INC

Scale: Approximately 1:100,000 (1″=8,333′)

North

Teichert Shifler Project

Agricultural Reclamation Feasibility Study

Figure 1. Location Map

Project site (approximate)

1.3 Current Prime Agricultural Land Use

Data in this section was provided by the farming operation that leases the land that includes the project site. Crops planted on the Shifler site in 2009-2014 have included wheat, canola, tomatoes, and cucumbers. Selection of crop is made on the basis of various factors, but most notably the availability of irrigation water. Not only the amount but the mode of application of irrigation affects yields. For example, two large fields that had previously been planted with tomatoes and irrigated with surface water was subsequently equipped with subterranean drip irrigation, increasing the commercial yield by almost 25 percent. In 2013-2014, however, it was known early in the season that irrigation water would be in short supply or entirely unavailable, consequently, the same field was planted with wheat.

The present and recent agricultural use of the Shifler site is for annual row crops rather than trees, so the present discussion is directed primarily at that use, though reclamation to annual crop use does not preclude future conversion to tree crops, which are also commonly grown in the region and provide higher commercial yields than do row crops.

1.3.1 RECENT PRODUCTION

A summary of minimum and average yields for the crops that have been grown in the Project site from 2009 to 2014 are provided in Table 1-1 (following page). Some subareas of the site are consistently more productive than others, irrespective of irrigation, but for the purposes of evaluating agricultural reclamation, which will entail salvage, mixing, and replacement of soils, it is reasonable to present averages. Minimum yields for the least productive fields, and average acreage-weighted yields for all fields where a particular crop was grown, are provided.

See Section 5 for additional discussion of crop production.

Table 1-1. Summary of recent yields from agricultural fields within the proposed mining area (in tons/acre [t/ac] unless otherwise noted). Wheat yields are tons of grain.

Year	Wheat Minimum	Wheat Average	Tomatoes	Sunflower Seed
2009	2.1	2.10		
2010	3.65	3.79	41.81	
2011	3.06	3.06		
2012			52.43*	
2013	2.64	2.64	52.93*	
2014	1.01	2.23		1414 lbs/acre
2015	1.53	1.53		1523 lbs/acre
2016	2.78	2.78	55*	
Other				
canola	Yield is $1,350/acre (sold by acre, not by weight of harvest).			
cucumbers	12.64 t/ac	Only grown once.		
safflower	1.66 t/ac	Only grown in 2015		

* With subterranean drip irrigation system in use. 2010 irrigation had been via ditches.

2 SOIL STUDIES

2.1 Soil Survey

Virtually the entirety of the proposed mining area is mapped as Yolo series, a fine-silty series of Mollic Xerofluvents (NRCS, 2015). Yolo loam is a very fine textured loam with almost no textural differentiation (most layers of the typical pedon are silt loam, to a depth of 65 inches; only the [buried] Ab is silty clay loam), and only minor color difference, between the A horizon (10YR 3/2 and 3/3 moist) and the C horizon (2.5Y 4/4 and darker). There is no B horizon in Entisols. Though these colors are on different hue pages in the Munsell color book, examination of the relevant chips shows that the color difference is subtle. The A horizon is neutral (pH 6.7 to 7.3 in the reference pedon) and the C horizon is mildly alkaline (pH 7.4).

Yolo silt loam is well drained and, despite the fine texture (silty rather than particularly clayey), has moderate permeability. However, tillage pans that reduce permeability have developed over large areas of the series' extensive geographic occurrence. Uses identified in the official series description include row, field, and orchard crops. No cemented or strongly compacted tillage pan was observed in the test pits (see below).

Notably, the pedon description cites the presence of many to common very fine roots to significant depth (33 inches; fewer such roots at greater depths), and the presence of many very fine tubular pores all the way to the maximum observed depth (65 inches). Although the plow layer (Ap horizon, normally no more than 8-12 inches thick) is the most important soil layer for agriculture, lower soil layers are also important to productivity, especially in a water-limited environment such as California.

2.2 Soil Test Pits

In addition to the original exploratory borings, 19 soil pits (at locations shown in Figure 2) were excavated by hand, backhoe, and excavator to examine the soil profile and obtain samples for laboratory analysis, determine the rooting behavior of the current year's crops (wheat), and to record details that could be of importance in determining the approach to soil management. Sites for the test pits were scattered across the proposed mining area, with representation of the whole range of depth to commercial aggregate as revealed by test drilling. Observations were logged by strata that were recognizable visually or by texture, but laboratory samples were collected by one foot increments (or thicker in the case of deep samples obtained with an excavator or backhoe bucket). This sampling approach would be unconventional in a standard pedological soil study, where soil samples are analyzed by observed horizons. However, it is more useful for assessment of soil salvage and application for mine reclamation, because it is typically infeasible to adjust soil recovery depth at a resolution of fractions of a foot (or inches). If soil lifts are to be recovered and stockpiled separately, the practical increment thickness is one foot or more.

Sampling of the shallower pits (up to seven feet deep) was in increments of one foot. Sampling of the deepest pits (up to 14 feet deep) was in increments of greater thickness and was approximate. A total of 91 separate soil samples were sent for laboratory analysis of nutrient content and other parameters.

Eco Synthesis
SCIENTIFIC & REGULATORY SERVICES, INC.

Legend

✳TWSx Test Pit Location (approx.)

Teichert Shifler Project

Figure 2. Soils Test Pit Locations

Scale approximately 1:7,800 (1″=650′)

2.3 Results

The 22 exploratory boreholes within the Mining Area had an average overburden/topsoil depth of 10.9 feet (median 10.5 feet). All 27 boreholes (including five outside the Mining Area footprint) had an average overburden/topsoil depth of 12.5 feet (median 12.0 feet). The nature of this layer was elucidated by the laboratory results from the 19 additional soils test pits, which are summarized in Table 2-1 by depth increments. The complete set of all soil data is provided in Appendix A.

The test pits substantially confirmed the mapping of Yolo series loam throughout the proposed mining area, with some minor textural variations from the typical pedon that is described in the official series description. Most particularly, the observed soil texture based on actual particle size analysis (percent sand, silt, and clay per USDA definitions) was generally silty clay or silty clay loam rather than silt loam. Although some slight compaction below the plow depth was observed in some pits, there is no development of a pronounced tillage pan despite the clayey texture. This is a sign of good agricultural soil management.

With the exception of some slightly higher, but still quite moderate, results for nutrients that are best interpreted as being associated with normal agricultural applications of nitrogen, phosphorus, and potassium compounds in fertilizers, the laboratory results are remarkably consistent throughout the entire depth of soil and overburden that was studied for this soils analysis: essentially, it is all suitable for use as reclamation topsoil for the purpose of reclamation into prime agricultural land use. The five-to-six- foot depth increment for the first round of sampling shows notably lower nutrient values, however, this is the average of only two samples, one of which (TW12F) was 88 percent medium sand and therefore would be expected to have exceptionally low nutrient content. The other sample from this depth range (TWS4F) had similar values to samples from higher levels.

Laboratory results for pH consistently show a lower, but still nearly neutral, pH near the surface (mostly 6.5 to 7.0, with outliers as low as 5.9) and a slightly more alkaline pH lower in the soil profile. This is exactly as noted in the official soil description for Yolo soil.

Organic content of the soils is relatively low (average of less than 1.7 percent, even in the uppermost layer), but decreases only very slowly with increase in depth. Notwithstanding the low organic content, cation exchange capacity throughout the sampled depth is perfectly suitable for use as agricultural soil.

Finally, no redoximorphic features or other features (such as gley colors, depletion, and so on) suggestive of anaerobic conditions were encountered in soils at any depth in any of the soil test pits. This suggests that the present soil profile is not subject to prolonged seasonal saturation.

Table 2-1. Summary of laboratory analysis of soil samples from 19 test pits at the Shifler site (see Appendix A for complete results table). Mean values for cation saturation may not be strictly mathematically valid given the standard methodology used to compute these parameters, but provide a generally useful comparison of the likely results if samples from all test pits had been composited by depth increments. One sample from the entire soil study is not included below, but is present in the full data table in Appendix A. It was a single spuriously very sandy sample from the depth range of 5-6 feet at pit number 12 (88 percent sand). Unsurprisingly, levels of plant-available nutrients in that sample were much lower than in any other samples, including some from depths of up to about 14 or 15 feet.

Depth	Organic (% rating)	Est. N Release (lb/acre)	P (Weak Bray; ppm)[1]	P ($NaHCO_3$; ppm)[2]	K (ppm)	Mg (ppm)	Ca (ppm)	Na (ppm)	pH	CEC (meq/100 g)	Cation Saturation (%, computed)					Nitrate-N (ppm)	Sulfate-S (ppm)	Solube Salts (mmhos/cm)	Sand (%)	Silt (%)	Clay (%)	Texture
											K	Mg	Ca	H	Na							
Summary of samples from pits 1-12 (1-foot increments)																						
0-1′	1.1	52.5	32.6	25.9	218.6	959.3	1491.5	45.7	6.6	17.3	3.2	45.6	43.2	6.2	1.1	46.7	31.3	0.6	25	41	34	clay loam
1-2′	0.9	47.0	13.6	18.7	124.4	973.1	1519.3	54.4	7.1	16.2	1.9	49.3	46.8	0.5	1.4	28.3	15.8	0.4	26	40	34	clay loam
2-3′	0.8	45.2	7.4	11.4	95.1	989.3	1507.3	52.7	7.5	16.1	1.5	50.0	47.1	0.0	1.5	13.4	9.2	0.3	25	41	33	clay loam
3-4′	0.7	44.3	9.4	15.5	87.3	1000.1	1648.3	58.8	7.6	17.0	1.3	48.2	48.9	0.0	1.5	12.3	9.7	0.3	29	39	32	clay loam
4-5′	0.7	43.8	10.6	16.3	88.3	981.1	1778.3	64.5	7.7	17.5	1.3	46.5	50.6	0.0	1.6	16.1	11.8	0.3	33	40	27	(clay) loam
Summary of samples from pits 13 through 19 (2.5-foot increments). The first two rows below correspond approximately to the five rows of the section above.																						
0-2.5 ft	1.7	63	20	18	176	830	1497	30	6.8	13.9	3.0	43.9	47.6	4.7	0.8	20	6	0.3	25	38	37	clay loam
2.5-5 ft	1.6	61	8	14	80	949	1682	34	7.6	14.0	1.2	47.0	50.9	0.0	0.9	10	5	0.3	19	39	42	(silty) clay
5-7.5 ft	1.2	53	7	10	57	900	1548	33	7.9	13.1	1.0	47.9	50.2	0.0	0.9	10	3	0.3	32	34	33	clay loam
7.5-10 ft	1.3	56	6	11	62	986	1613	34	7.8	14.2	1.0	48.8	49.4	0.0	0.9	8	3	0.2	27	38	35	clay loam
>10 ft	1.1	52	7	9	64	939	1648	35	7.8	13.1	1.0	47.5	50.6	0.0	0.9	13	3	0.3	26	40	34	clay loam

[1] Weak Bray method is unreliable at pH >7.5; "n.a." is entered for these samples (values generally varied from 3 to 6: very low for agricultural soil).

[2] Olsen Method (sodium bicarbonate).

** Bicarbonate method is not reliable at pH <6.0, but value is provided anyway for this one sample.

The 2015 crop was winter wheat, which was selected to provide some commercial productivity in light of forecasts that irrigation water would be unavailable during the summer. A more commercially valuable crop such as tomatoes would have required irrigation water during the warmest part of the summer. The test pits confirmed the occurrence of living wheat roots and extensive very fine pores at depths throughout the soil profile, all the way down to five feet below the soil surface. In short, the test pits confirm that even a short-lived annual crop such as wheat utilizes a considerable depth of soil. Orchard crops, which are not currently grown on site, would be expected to utilize this depth of soil also.

Analyses for certain specific nutrients (e.g., nitrogen compounds) did not vary consistently with depth. To some extent, this is not surprising, because nutrient levels in crop fields, especially near the surface, are largely determined by the short-term and cumulative effects of application of fertilizer or other soil amendment (if any). Given that some of the individual fields within the proposed mining area are equipped with subterranean drip irrigation and others are not, and given that the cropping history of the various fields is not identical, variation in the nutrient analysis would be expected.

In general, organic matter content tends to be relatively low at all levels (less than 2.0 percent, often less than 1.0), magnesium content tends to be very high, and calcium and sodium content tends to be low. The levels of the three most important macronutrients (nitrogen, phosphorus, and potassium) are somewhat variable among the test pits and depths, but are customarily adjusted in agricultural practice by means of amendments.

At several of the test pits, a slight break in nutrient content was detected at about 24 inches, although others showed very little change in nutrient content from the surface to the bottom of the pit at a depth of four to six feet.

2.4 Prime Farmland Definition

The Ordinance definition of prime agricultural land is that of the Williamson Act, and is therefore based either upon very general soil characteristics or upon levels of commercial production (in terms of dollar value) or support of livestock. This definition consequently provides little guidance for the study of soil conditions on a particular site prior to mining or for the specification of the post-mining soil profile that would be expected to result in reclamation to prime agricultural land as defined by the Act and Ordinance. Accordingly, in making a reasonable inference as to the feasibility of agricultural reclamation, it is useful to consider a comparison of the characteristics of the soils that were observed in the Shifler test pits with the parameters noted in the DOC definition of Prime Farmland. For some parameters, the characteristics of the site's soils were derived from the NRCS soil survey data; for others, from the laboratory test results provided in Tables 1 and 2.

a. Water. *Definition:* Soils must have a xeric, ustic, or aridic moisture regime with available water capacity of at least 4.0 inches, and a developed irrigation water supply that is dependable and of adequate quality. *Shifler (NRCS):* Yolo series soil is a Xerorthent (xeric moisture regime) and has high available water capacity (about 11 inches). There is a developed irrigation system that is as dependable as the California climate permits, providing high quality irrigation water from the Moore Canal. Surface water allocations are provided by the Yolo County Flood Control and Water Conservation District (YCFCWCD).

b. Soil Temperature Range. *Definition*: Soils must have a frigid, thermic, or hyperthermic temperature regime (pergelic and cryic regimes are excluded). *Shifler* (NRCS): Yolo series has a thermic temperature regime.

c. Acid-Alkali Balance. *Definition*: Soils must have a pH between 4.5 and 8.4 in all horizons within a depth of 40 inches. *Shifler* (*laboratory*): Range of pH results for individual soil samples was 5.9 to 8.2.

d. Water Table. *Definition*: Soils have no water table or have a water table that is maintained at a sufficient depth during the cropping season to allow cultivated crops common to the area to be grown. *Shifler*: Yolo soils have a depth to water table of more than 200 cm (78.7 inches), which is sufficient to allow crops common to the area to be grown. In accordance with County ordinance, reclamation soil will be placed so as to maintain a minimum separation of five feet between the reclaimed soil surface and the average high groundwater level.

e. Soil Sodium Content. *Definition:* Soils can be managed so that, in all horizons within a depth of 40 inches, during part of each year the conductivity of the saturation extract is less than 4 mmhos/cm and the exchangeable sodium percentage is less than 15. *Shifler (laboratory):* Total conductivity from all soluble salts was 1.2 mmhos/cm or less in all samples. Exchangeable sodium was 3.2 percent or less in all samples.

f. Flooding. *Definition:* Flooding of the soil during the growing season occurs infrequently (less often than once every two years). *Shifler (NRCS):* Flooding rating for Yolo soil at the Shifler site is "none" meaning that the likelihood of flooding in any particular year is near zero.

g. Erodibility. *Definition:* The product of K (erodibility factor) multiplied by the percent of slope is less than 2.0. *Shifler (NRCS):* Yolo soil has a K factor of 0.43 (same value for whole soil or rock free), and reclaimed soil surface will be at a gradient of less than 4 percent (probably less than 1 percent), therefore the product will be less than 2.0.

h. Permeability. *Definition:* Soils must have a permeability rate of at least 0.15 cm/hour in the upper 20 inches if the mean annual soil temperature at 20 inches depth is less than 59 F. Permeability is not limiting if mean annual soil temperature is higher than 59 F. *Shifler (NRCS):* Yolo loam has a permeability of 3.24 cm/hour (may not be limiting anyway; mean annual temperature could not be ascertained).

i. Rock Fragment Content. *Definition:* In the upper six inches, soils must have less than 10 percent rock fragments coarser than three inches. *Shifler:* No rock fragments coarser than three inches were encountered in any soil test pits.

j. Rooting Depth. *Definition:* Soil has a minimum rooting depth of 40 inches. *Shifler (NRCS):* Soil survey data states that the depth to any type of restrictive layer is more than 200 cm (78.7 inches).

In summary, the soil survey data and laboratory results for general soil physical and hydrologic parameters, texture, organic and mineral nutrient content indicate that the entire sampled profile within the Mining Area, down to a depth of as much as 14 feet (maximum sampling depth), is suitable for use as the uppermost layer of a soil profile for reclamation of the site into prime farmland as defined by the DOC. Laboratory results indicate that it is not necessary to segregate a “topsoil” and “subsoil” layer for successful reclamation as prime agricultural land. The thickness of the layer of salvaged soil that is placed on the agricultural surfaces must be at least 40 inches to meet the specification in item (j), above. Recommendations are discussed in Section 4.

Sufficient soils are available to recreate a soil profile that meets the DOC definition of prime farmland. As discussed elsewhere in this report, it is reasonable to infer that lands that meet the DOC definition of prime farmland will support the levels of production that meet or exceed those stated in the Williamson Act definition of prime agricultural land. Therefore, it is reasonable to conclude from the soils analysis provided above that reclamation into land meeting the Williamson Act definition of prime agricultural land is feasible.

3 CLIMATIC CONSIDERATIONS

The County received preliminary comments expressing concern about the possibility that cool air might pool in agricultural fields that are located in closed depressions at lower elevation than the pre-mining grades, and that this could adversely affect the feasibility of agricultural reclamation. The general principle that cooler air flows downward and can pool in topographic basins is well known, however, the climatologic literature on the subject generally pertains to large basins of many square miles in area (e.g., Salt Lake City basin). This section discusses results from monitoring of temperature in two experimental control locations and two locations that are topographically analogous to situations that will be created by the proposed Project. The proposed agricultural reclamation would not be located at the bottom of a simple large depression; instead, the agricultural field will be some tens of feet below grade, and a pond will be created at an even lower elevation (average grade separation of about 20 feet).

Temperature loggers were installed in the Shifler site and in three other locations in a parcel about one-half mile north of the Shifler site, where there is an agricultural field at unmodified grade (control), another agricultural field 40 feet below grade, and at an even lower level adjacent to that, where mining has left an area that is subject to ponding during a normal rainy season. This site is referred to as the "below-grade pond" even though it was not actually ponded throughout most of the temperature study; it was merely a basin at an elevation that was even lower than that of the below-grade field. Thus, the temperature study provides a comparison of two at-grade fields, to show what the regional range of variation is without alteration of topography, and temperature data from situations similar to the post-mining condition of the Shifler agricultural reclamation (that is, a below-grade field with an even lower depression adjacent to it).

Temperatures were recorded every 10 minutes from June 16, 2015, through February 3, 2016. This date range includes both the warmest and coldest months of the year, thus also of the growing season which is potentially year-round depending on the crops that are planted. Table 2 summarizes data for the whole period and for specific two-month periods. The full set of 33,383 lines of data is available digitally upon request.

Several relevant data comparisons were made between the temperatures at the at-grade control nearby to the below-grade sites and each other site (Shifler control, below-grade field, below-grade pond). Comparisons were made by subtracting each 10-minute temperature reading from the corresponding reading from the desired comparison site, then by averaging these results over the desired time ranges as shown in the table.

The below-grade field represents the future condition of the reclaimed Shifler prime agricultural land. Extracts from the whole data set were analyzed for daytime and nighttime for the two historically warmest months of the year (July-August) and the two coldest months (December-January). For simplicity of data processing, "daytime" was defined as the period from 6:00 AM to 5:50 PM, and "nighttime" was defined as 6:00 PM to 5:50 AM. We are confident that the results from using these definitions are sufficiently representative of the actual conditions during the sun-up and sun-down periods to support reasonable inferences about agricultural use.

Table 3-1. Summary of pairwise temperature comparisons (degrees Fahrenheit [° F] difference) between the control site and the Shifler present field and two nearby locations representative of proposed future mining topography. A positive number indicates that the site was warmer than the control; negative numbers, colder. Standard deviations are provided in parentheses.

Data range	Shifler	Below-grade field	Below-grade pond
All data (June 2015-February 2016)	1.00 (2.47)	-0.20 (2.15)	-0.67 (2.37)
July-August daytime	0.02 (2.09)	0.01 (2.32)	-0.60 (1.59)
July-August nighttime	1.03 (2.94)	0.25 (1.32)	0.45 (2.33)
December-January daytime	0.55 (1.57)	-1.78 (1.24)	-0.67 (1.87)
December-January nighttime	0.58 (1.17)	-2.14 (1.07)	-1.63 (2.13)

For the entire data set, the present Shifler field is one degree warmer than the control, but this difference is much smaller than the standard deviation, that is, the vast majority of values fall within the same ranges. The below-grade field (representative of the future condition of the reclaimed field) is only 0.2° F cooler than the control site, which is unlikely to be agriculturally important overall.

During the summer months, when the most temperature sensitive crops such as tomatoes or cucumbers are grown, the daytime temperatures of the below-grade field are insignificantly different from the control; likewise, the nighttime temperatures average 0.25° F warmer. Temperatures during the two coldest winter months would be expected to be 1.78° F cooler on average during the day and 2.14° F cooler during the night. While these differences are not statistically insignificant, from an actual agricultural perspective, they are unlikely to be important.

The winter row crop that has been grown in the past on the site is winter wheat, which is resistant to temperatures substantially colder than those observed, and indeed is most resistant to cold temperatures during the coldest part of the winter. Further, there is some reasonable concern that yield of woody crops such as vines and orchard fruits or nuts in California will be impaired due to increasing temperatures and consequent insufficiency of chilling hours. For these plants, the slightly lower winter temperatures of the reclaimed field that are expected on the basis of the current data set would actually be a benefit.

With respect to temperature, the DOC definition of prime farmland requires a frigid, thermic, or hyperthermic soil temperature regime. Though soil temperatures were not monitored, it is nearly certain that the soil temperature regime would remain thermic (and absolutely certain it would not become colder than frigid) even with the air temperature differences discussed here.

4 RECOMMENDATIONS

4.1 Overview

As noted above in Section 2, the nutrient analyses do not provide consistent guidance on the separation of different lifts of soil during pre-mining soil salvage. The test pit visual observations of the boundary between the A and C horizons revealed it to be found at an approximate depth of (18-) 24 inches (there is no B horizon in Entisols, including Xerofluvents). This is consistent with some laboratory analyses that showed a very slight shift in content of some nutrients at about 24 inches; however, others did not.

The test pits and observations of roots at considerable depths support a specification of replacing salvaged soil to a total depth of five feet on top of any other materials that might be applied to attain desired topographic grades. Given that pure sand was encountered in some test pits in highly productive fields at a depth of about five feet, that depth of salvaged soil would appear to be adequate for maintenance of long-term agricultural productivity.

The soils presently occurring on site have significant clay content, although the observations of structure and fine porosity show that there is a desirable degree of secondary aggregation to allow for adequate hydraulic conductivity and avoidance of saturation. Accordingly, to avoid excessive destruction of soil structure, soils should ideally be handled when they are as dry as possible, subject to air quality considerations pertaining to the possible generation of fugitive dust.

4.2 Salvage

The results of the present soil analysis indicate that the material available for salvage, down to a depth of at least ten feet, is all suitable for use as the uppermost layer of soil to support growth of agricultural crops common to the region. In terms of the observed characteristics of the soils and the parameters that were tested in the laboratory, there is no pronounced differentiation between an upper horizon and a lower one (or multiple horizons) for suitability as a prime farmland soil. In short, the laboratory results do not indicate that salvaged material should be segregated and stockpiled by lifts.

Accordingly, the recommended soil salvage procedure is for the entire ten foot depth of the soil profile and overburden to be salvaged as one supply of agricultural reclamation soil. In some portions of the site, the exploratory drilling showed the presence of commercial aggregate at depths of less than ten feet, so equipment operators should be attentive to the appearance and texture of the material as it is being salvaged, in order to avoid mixing any significant quantities of sand or gravel into the soil stockpile.

Yolo series soil has a high clay content, and although the in situ texture is friable, some portions of the Ap and upper C horizons, and the buried A horizon if one were to be present, are massive (not secondarily aggregated) in structure. Therefore, soil handling should take place when the soil is as dry as possible within the constraints of dust control considerations, so as to minimize the loss of soil structure.

After the initial recovery of a volume of soil sufficient to reclaim the final intended phase of operations, including construction of slopes and resoiling of areas to be future agricultural land, the remainder of the soil salvage can be placed directly for reclamation. However, at any point where the active mining area exceeds the area that can be reclaimed with the stockpiled soil volume, then additional stockpiles shall be created to make up the potential future shortfall.

4.3 Stockpiling

A location where an ample stockpile of soil for reclamation of the final phase of reclamation can be left in place for the duration of the project operations should be selected on the basis of the pre-project exploratory drilling for commercial aggregate. Soil salvaged from the first phase of project operations should be stockpiled in this location and preferably moved a minimum number of times until the final phase of reclamation. Salvaged soil may not be used for purposes other than reclamation without prior County approval.

The soil stockpile should be constructed to meet the specifications provided by the Ordinance (Section 10-4.433): a maximum height of 40 feet or less, with slopes of 2h:1v or gentler, to minimize erosion and discourage use by bank swallows. During the bank swallow breeding season, slopes shall not exceed 1:1 even on a temporary basis: even when stockpiles are being disturbed for any other reason (soil removed or added), slopes shall be graded to a slope of 1:1 or less steep at the end of each work day. The top of the soil stockpile shall be graded to drain, at a slope of at least two percent (preferably three to five percent), so as to minimize the infiltration of rain water into the interior of the stockpile.

Soil stockpiles shall be seeded with cover vegetation to prevent wind and rain erosion. Since the laboratory results for the site showed that the available soils have relatively low organic content (many samples had less than one percent organic content rating), the more cover vegetation that is established, the better for future agricultural production.

4.4 Reclamation Soil Profile

The final depth of mining is currently expected to range from 40 to 110 feet below present grade.

Some mining will extend into groundwater; from this wet mining, fines will be separated from commercial aggregate and concentrated from slurry by settlement and evaporation. These waste fines will be used to backfill a portion of the mining area.

Once mining operations have attained the lowest depth from which useful aggregate material can be removed, a slurry of fines that are separated from the commercial aggregate during processing will be discharged onto the bottom of the mined area, so that the dried fines create a subgrade layer up to a the level where salvaged soil is placed to provide the agricultural soil profile. Although the waste fines are materials of a clayey to loamy texture and would be expected to be suitable for plant root growth, The discharge/placement of fines is expected to create an uneven or sloping upper surface, which should remain sloped but with a generally even surface so that the thickness of salvaged soil is more or less consistent. A sloping subgrade surface is preferable to a level one, because it creates a gradient that enhances lateral flow of subsurface water, thus minimizing the mounding of percolating water on top of the low-permeability fines.

To meet the DOC definition of the rooting zone of prime farmland, a minimum thickness of 40 of salvaged soil material (that is, soil recovered from the uppermost ten foot depth of the existing soil and overburden profile) must be placed directly, or from a stockpile, to create the final agricultural soil profile. This report recommends that this thickness be a minimum of four feet at all points, which means a somewhat thicker layer of salvaged soil in places where the subgrade level (waste fines) slopes downward more steeply than does the agricultural surface. As always in reclamation, the thicker the placement of the uppermost growth medium, the better.

In order to facilitate irrigation, which is a key element in the DOC definition of prime farmland, the final surface of the areas intended to be used as agricultural land shall be graded to be nearly level, but to drain sufficiently as to prevent local ponding or saturation (for example, at a slope of one percent).

It is reasonable to expect that a reclamation soil profile meeting these recommendations would meet the definition of prime agricultural land (see Section 1.2.1).

4.5 Side Slopes

Mining will proceed to as close to the Mining Area boundary as is feasible, thus creating steep temporary pit side slopes. In all areas above average high groundwater level, these will be backfilled to a 2:1 or gentler slope to result in a permanent side slopes that can be revegetated to resist erosion. These side slope backfills consume considerable quantities of salvaged soil. When soil budgets and stockpile management tracking spreadsheets are established for the salvaged soil, this need should be continually accounted for, and, if necessary, as much non-agricultural fill material should be used to build the interior of the slopes as is feasible. A minimum thickness of one foot of salvaged soil should be placed to support erosion control revegetation.

price/ton in different counties [no price provided for Yolo Co.] but would produce $2,528 to $28,961/acre based on prices provided for other counties).

These figures suggest that it is feasible to reclaim prime agricultural land as defined by the Williamson Act and Ordinance at the Shifler site, by merely growing about one ton/acre of wheat, and that the projected production of 2.1 tons (equal or exceeding average for the lowest production year, 2009) easily meets that standard.

5 PRODUCTION

A summary of minimum and average yields for the crops that have been grown in the Project site from 2009 to 2014 are provided in Table 1-1 (Section 1.3), repeated here for convenience.

Table 1-1. Summary of recent yields from agricultural fields within the proposed mining area (in tons/acre [t/ac] unless otherwise noted).

Year	Wheat Minimum	Wheat Average	Tomatoes	Sunflower Seed
2009	2.1	2.10		
2010	3.65	3.79	41.81	
2011	3.06	3.06		
2012			52.43*	
2013	2.64	2.64	52.93*	
2014	1.01	2.23		
2015	1.53 (grain)	1.53 (grain)		1523 lbs/acre
2016	2.78 (grain)	2.78 (grain)	55*	
Other				
canola	Yield is $1,350/acre (sold by acre, not by weight of harvest).			
cucumbers	12.64 t/ac	Only grown once.		
safflower	1.66 t/ac	Only grown in 2015		

* With subterranean drip irrigation system in use. 2010 irrigation had been via ditches.

Section 10-5.601(c)(2) of the Ordinance requires an estimate of projected production of reclaimed agricultural lands. With the implementation of the reclamation recommendations in Section 4 of this report, along with application of irrigation (if water allocation is available) and fertilizer as is common agricultural practice in the Woodland area, it is reasonable to project that production would equal or exceed the lowest production level, averaged across the present cultivated Shifler land area on an acreage-weighted basis, for any of the five years for which records were available for the present study, namely, 2.1 tons/acre of wheat.

According to the California Department of Food and Agriculture (California County Agricultural Commissioners' Reports, Crop Year 2013-2014; CDFA, 2015), the average dollar value of one ton of wheat harvested in Yolo County in 2013-14 was $216.27, thus, the minimum projected yield would be worth about $432.54/acre, that is, more than twice the threshold to meet the Ordinance definition of prime agricultural land ($200/acre). All other row crops that have been grown on the Shifler site from 2009 to 2014 have much higher commercial yields (e.g., canola, $1,350/acre; tomatoes, minimum production of 41.81 t/ac x $83.59/t = $3,495/acre; cucumbers vary greatly in

6 CONCLUSIONS

This report provides information from the following sources:

- NRCS soil survey and data base;
- studies and laboratory analysis of soils in 19 test pits within the mining area;
- monitoring of temperatures at control sites and at sites that are analogous to the post-mining reclamation topography for the proposed project;
- crop production for five recent years; and
- crop values from the California Department of Agriculture summaries for 2013-2014.

This information supports the following conclusions:

- Ample quantities of soils that have suitable nutrient and textural qualities for use in agricultural reclamation are present and may be salvaged down to a depth of 10 feet without the need to segregate topsoil and subsoil. Average and median overburden depths both exceed 10 feet.
- The amount of available soil is sufficient to recreate a soil profile that meets the DOC definition of prime farmland; and such a soil profile can reasonably be expected to support levels of production that would equal or exceed the levels required to satisfy the Williamson Act definition of prime agricultural land.
- Projected crop production, based upon the average yield for the worst production year during the period 2009-2014, would be 2.1 tons/acre of wheat. This would have a commercial value of more than twice the threshold to meet the Wiliamson Act definition of prime agricultural land.
- The temperature regime of the proposed reclaimed agricultural field will be very similar to that of the present at-grade agricultural fields during the summer and will be slightly cooler during the winter. The latter difference is not expected to be agriculturally important for the common winter row crop (wheat) and may have a slight benefit in terms of chilling hours for wheat and for orchard crops if those are grown in the future.

Accordingly, this report concludes that it is feasible to reclaim prime agricultural land as proposed by the project's reclamation plan.

7 REFERENCES

California Department of Food and Agriculture (CDFA). 2015. California County Agricultural Commissioners' Reports Crop Year 2013-2014. Report dated December 31, 2015, prepared by CDFA, cooperating with the USDA National Agricultural Statistics Service, Pacific Region.

Natural Resources Conservation Service (NRCS). 2015. Custom Soil Resource Report for Yolo County, California. Report and data downloaded from WebSoilSurvey internet application on March 26, 2015 (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

Appendix A:

Soils Test Pit Laboratory Results

Appendix A. Laboratory results for soil samples collected within the Mining Area of the Teichert Shifler Project site.

Sample	Organic (% rating)	Est. N Release (lb/acre)	P (Weak Bray; ppm)1	P (NaHCO3; ppm)2	K (ppm)	Mg (ppm)	Ca (ppm)	Na (ppm)	pH	CEC (meq/100g)	Cation saturation computed (%) K	Mg	Ca	H	Na	Nitrate-N (ppm)	Sulfate-S (ppm)	Solube Salts (mmhos/cm)	Sand (%)	Silt (%)	Clay (%)
TWS1A	2.6	82	16	17	198	1120	1869	31	7.1	19.2	2.6	48	48.6	0	0.7	67	34	1	16	42	42
TWS1B	2	71	7	13	98	1095	1697	30	7.1	17.9	1.4	50.4	47.4	0	0.7	21	6	0.3	10	44	46
TWS1C	1.8	67	4	8	43	1063	1522	36	7.5	16.6	0.7	52.6	45.7	0	1	4	2	0.2	10	48	42
TWS1D	1.3	56	4	6	57	1110	1526	41	7.6	17.1	0.9	53.5	44.6	0	1	2	2	0.2	8	46	46
TWS2A	1.7	65	17	22	91	871	1370	30	6.7	15	1.5	47.6	45.5	4.5	0.9	58	45	1.2	38	34	28
TWS2B	0.9	48	4	4	39	661	1032	26	7.4	10.8	0.9	50.3	47.7	0	1	21	10	0.4	56	22	22
TWS2C	0.7	43	6	5	39	503	1047	31	8	9.6	1	43.1	54.5	0	1.4	3	6	0.3	74	14	12
TWS2D	0.4	39	5	9	41	521	1910	32	8.2	14.1	0.7	30.5	67.8	0	1	3	8	0.3	82	8	10
TWS3A	1.6	61	17	12	119	885	1350	30	6.4	15.9	1.9	45.8	42.4	0.9	0.8	32	55	0.7	22	46	32
TWS3B	1.3	56	9	8	69	881	1586	31	7.3	15.5	1.1	46.8	51.2	0	0.9	34	26	0.6	38	36	26
TWS3C	1.6	61	3	3	75	1054	1445	43	7.6	16.3	1.2	53.3	44.4	0	1.1	2	8	0.2	18	48	34
TWS3D	1.2	53	4	61	78	1087	1724	49	8	18	1.1	49.8	47.9	0	1.2	2	6	0.3	18	48	34
TWS4A	0.8	46	36	47	156	696	1454	33	6.6	14.4	2.8	39.8	50.5	6	1	7	13	0.3	26	42	32
TWS4B	0.2	33	7	18	82	1144	1759	54	7.2	18.6	1.1	50.5	47.1	0	1.3	17	17	0.4	14	46	40
TWS4C	0.2	33	5	11	57	1157	1593	58	7.7	17.9	0.8	53.1	44.4	0	1.6	24	15	0.5	8	46	46
TWS4D	1.3	57	6	28	49	1117	2134	73	7.7	20.3	0.6	45.3	52.5	0	1.6	27	13	0.6	24	42	34
TWS4E	1.2	54	6	8	45	964	1994	81	8.1	18.3	0.6	43.2	54.2	0	1.9	25	16	0.3	38	38	24
TWS4F	0.2	33	6	11	31	790	1613	97	8.2	15	0.5	43.2	53.5	0	2.8	14	15	0.4	46	30	24
TWS5A	0.7	44	80	37	143	864	1435	38	6.7	15.5	2.4	45.9	46.2	4.5	1.1	41	43				
TWS5B	0.7	43	9	7	63	804	1219	36	7.1	13	1.2	50.8	46.7	0	1.2	51	21				
TWS5C	0.5	40	8	25	56	739	1194	37	7.3	12.3	1.2	49.2	48.3	0	1.3	27	9				
TWS5D	0.5	40	11	7	64	758	1179	35	7.4	12.4	1.3	50.1	47.3	0	1.2	21	9				
TWS5E	0.2	33	14	17	73	775	1186	42	7.7	12.7	1.5	50.3	46.7	0	1.4	10	8				
TWS6A	0.7	45	19	12	283	1099	1688	29	6.7	19.2	3.8	47.1	43.9	4.5	0.7	54	9				
TWS6B	0.3	36	7	21	136	1164	1773	34	7.1	18.9	1.8	50.6	46.8	0	0.8	22	5				
TWS6C	0.6	41	5	6	145	1318	1974	38	7.3	21.2	1.7	51.1	46.4	0	0.8	27	5				
TWS6D	0.4	39	5	8	77	1234	1750	40	7.4	19.3	1	52.7	45.4	0	0.9	18	6				
TWS6E	0.4	38	4	18	67	1210	2001	39	7.5	20.3	0.8	49.1	49.2	0	0.8	16	4				
TWS7A	0.8	45	37	32	360	893	1297	41	6.2	16.9	5.4	43.3	38.2	12	1	71	37	0.5	18	48	34
TWS7B	0.8	46	19	11	169	873	1415	38	7	14.8	2.9	48.4	47.6	0	1.1	40	12	0.4	16	48	36
TWS7C	0.8	46	14	20	144	982	1588	51	7.4	16.6	2.2	48.7	47.8	0	1.3	18	9	0.3	14	46	40
TWS7D	0.5	40	12	10	130	995	1541	63	7.4	16.5	2	49.7	46.7	0	1.7	23	11	0.5	14	46	40
TWS7E	0.5	40	9	19	116	1051	1458	81	7.5	16.6	1.8	52.2	43.9	0	2.1	28	12	0.6	20	48	32
TWS8A	1	50	53	35	275	924	1388	38	5.9	18.5	3.8	41	37.4	17	0.9	67	41				
TWS8B	1.2	53	30	69	169	902	1422	42	6.7	15.8	2.7	46.8	44.8	4.5	1.1	40	17				
TWS8C	0.6	41	14	13	134	1103	1610	61	7.3	17.7	1.9	51.2	45.4	0	1.5	16	9				
TWS8D	0.8	47	40	10	162	1248	1765	84	7.2	19.9	2.1	51.7	44.4	0	1.8	17	11				
TWS8E	0.5	40	11	14	65	1056	1409	74	7.5	16.2	1	53.6	43.4	0	2	13	8				
TWS9A	0.7	44	38	27	273	1083	1558	76	6.6	18.8	3.7	47.3	41.3	6	1.8	35	36				
TWS9B	0.8	47	11	11	202	1123	1718	110	7.2	18.8	2.7	49.1	45.6	0	2.5	26	13				
TWS9C	0.7	44	4	7	128	1171	1736	85	7.5	19	1.7	50.7	45.6	0	2	9	11				
TWS9D	0.7	43	1	11	77	1119	1510	77	7.6	17.3	1.1	53.3	43.6	0	1.9	4	9				
TW10A	0.6	43	58	42	363	1054	1574	110	6.3	20	4.6	43.3	39.2	10.5	2.4	87	48				
TW10B	0.6	42	49	43	308	979	1613	131	6.9	17.7	4.4	45.4	45.4	1.5	3.2	39	39				
TW10C	0.8	46	18	12	172	659	1272	87	7.4	12.6	3.5	43.1	50.5	0	3	18	19				
TW10D	0.6	42	15	19	195	710	1691	91	7.5	15.2	3.3	38.5	55.6	0	2.6	22	24				
TW10E	1.9	68	29	32	233	827	1882	84	7.2	17.2	3.5	39.6	54.8	0	2.1	28	27				
TW11A	1.2	54	11	13	178	1023	1471	46	6.8	16.9	2.7	49.7	43.4	3	1.2	19	9	0.3	18	44	38
TW11B	0.7	43	5	8	65	1016	1505	52	7.3	16.3	1	51.4	46.2	0	1.4	12	17	0.2	20	42	38
TW11C	0.5	39	4	7	68	1056	1564	60	7.4	16.9	1	51.3	46.1	0	1.5	4	10	0.2	18	50	32
TW11D	0.4	37	4	8	53	1161	1656	73	7.8	18.3	0.7	52.3	45.2	0	1.7	5	12	0.3	18	46	36
TW11E	0.3	36	7	15	58	1133	2085	68	8	20.2	0.7	46.2	51.6	0	1.5	6	11	0.2	18	46	36
TW12A	1	51	9	15	184	999	1444	46	6.6	17.1	2.8	48	42.1	6	1.2	22	5	0.3	36	30	34
TW12B	0.8	46	6	11	93	1035	1493	69	7.1	16.5	1.4	51.6	45.2	0	1.8	17	7	0.4	28	40	32
TW12C	0.5	41	4	20	80	1066	1542	45	7.3	16.9	1.2	52	45.6	0	1.2	9	7	0.2	36	36	28
TW12D	0.4	39	6	9	64	941	1394	48	7.6	15.1	1.1	51.4	46.2	0	1.4	4	5	0.2	42	36	22
TW12E	0.5	41	5	7	49	833	2211	47	8	18.2	0.7	37.6	60.6	0	1.1	3	8	0.2	56	28	16
TW12F	0.1	33	6	8	27	390	824	24	8	7.5	0.9	42.8	54.9	0	1.4	3	3	0.2	88	6	6

Test pits S13 through S19: sample A-D is 0 to 10 ft depth in ranges of 2.5 ft. Sample S13E is >10 ft; S14E is about 12-14 ft; S15E is 12-15 ft; S16E is >10 ft; S19E is >10 ft.

S13A	1.7	63	17	15	271	764	1146	23	6.4	14.1	4.9	44.7	40.7	9	0.7	7	3	0.3	24	44	32	clay loam
S13B	1.8	66	10	22	86	1179	1552	19	7.3	17.7	1.2	54.6	43.6	0	0.5	4	3	0.2	12	36	52	clay
S13C	1.4	58	5	9	58	1078	1666	20	7.8	17.4	0.9	50.9	47.7	0	0.5	3	2	0.2	28	38	34	clay loam
S13D	1.4	59	5	8	75	1222	1573	23	7.9	18.2	1.1	55.3	43.2	0	0.5	3	2	0.2	18	44	38	silty clay loam
S13E	1.5	59	5	8	74	1100	1865	29	7.9	18.7	1	48.5	49.9	0	0.7	3	2	0.3	16	42	42	silty clay
S14A	1.6	62	5	11	131	1249	1664	42	6.7	20	1.7	51.4	41.5	4.5	0.9	7	2	0.2	14	34	52	clay
S14B	1.3	55	9	11	103	1071	1324	19	7.7	15.8	1.7	55.9	41.9	0	0.5	6	2	0.2	28	30	42	clay
S14C	0.9	47	9	15	50	808	1238	18	7.9	13	1	51	47.4	0	0.6	2	1	0.1	42	26	32	clay loam
S14D	0.7	44	7	18	38	752	1287	19	7.8	12.8	0.8	48.4	50.2	0	0.6	2	1	0.2	46	26	28	sandy clay loam
S14E	0.5	40	6	8	26	685	1185	17	7.7	11.7	0.6	48.2	50.6	0	0.6	3	2	0.2	48	34	18	loam
S15A	1.6	63	22	20	171	705	1130	14	6	2.1	3.1	41.3	40.2	15	0.4	13	2	0.3	28	40	32	clay loam
S15B	1.9	68	8	12	135	1014	1760	56	7.1	0	1.9	47.1	49.6	0	1.4	31	5	0.3	16	38	46	clay
S15C	1.5	59	8	15	132	1075	1399	57	7.3	0	2.1	53.9	42.6	0	1.5	21	4	0.3	26	32	42	clay
S15D	1.2	55	8	12	125	1036	1389	48	7.3	0	2	53.3	43.4	0	1.3	21	4	0.3	26	38	36	clay loam
S15E	1.2	53	8	11	105	1021	1352	50	7.5	0	1.7	53.7	43.2	0	1.4	23	5	0.2	28	34	38	clay loam
S16A	1.3	55	32	27	170	747	1303	34	6.9	13.4	3.2	45.8	48.4	1.5	1.1	40	14	0.5	38	30	32	clay loam
S16B	1.9	67	9	10	91	770	1609	35	7.4	14.7	1.6	42.9	54.5	0	1	12	8	0.4	22	40	38	clay loam
S16C	1.3	55	5	11	52	776	1941	33	7.9	16.3	0.8	39	59.3	0	0.9	8	4	0.3	22	48	30	clay loam
S15D	1.7	63	5	10	57	811	1960	34	7.8	16.7	0.9	39.8	58.4	0	0.9	12	5	0.3	22	44	34	clay loam
S16E	1.4	58	5	8	54	763	2026	34	7.9	16.7	0.8	37.6	60.6	0	0.9	10	4	0.3	22	50	28	silt loam
S17A	1.4	58	26	21	153	785	1324	29	6.9	13.8	2.8	46.8	47.9	1.5	0.9	11	6	0.3	38	32	30	clay loam
S17B	1	50	7	22	39	832	1822	35	8	16.2	0.6	42.3	56.2	0	0.9	3	8	0.1	24	42	34	clay loam
S17C	0.7	43	6	6	39	628	1272	26	8.1	11.7	0.8	44.1	54.1	0	1	3	3	0.2	64	14	22	sandy clay loam
S17D	0.7	45	6	9	31	663	1643	27	8	13.8	0.6	39.4	59.2	0	0.8	7	4	0.2	44	30	26	loam
S18A	1.9	68	26	21	198	852	1492	35	6.9	15.3	3.3	45.7	48.5	1.5	1	6	5	0.2	18	44	38	silty clay loam
S18B	1.5	61	7	9	61	1070	1768	42	7.8	18	0.9	49	49.1	0	1	2	3	0.2	12	46	42	silty clay
S18C	1.6	62	7	8	39	1058	1543	35	8.1	16.7	0.6	52.2	46.2	0	0.9	2	2	0.2	16	42	42	silty clay
S18D	1.6	62	7	9	34	1160	1622	38	8.2	17.9	0.5	53.3	45.3	0	0.9	2	3	0.2	18	40	42	silty clay
S19A	2.2	73	10	14	135	705	2419	32	7.6	18.4	1.9	31.6	65.8	0	0.8	55	9	0.3	18	40	42	silty clay
S19B	1.5	59	8	9	45	707	1942	33	7.7	15.8	0.7	36.9	61.5	0	0.9	13	7	0.4	16	42	42	silty clay
S19C	1	50	6	9	30	879	1778	40	7.9	16.4	0.5	44.2	54.2	0	1.1	29	6	0.5	28	40	32	clay loam
S19D	1.7	64	7	10	77	1257	1820	52	7.9	19.8	1	52.1	45.8	0	1.1	12	3	0.2	14	42	44	silty clay
S19E	1	51	9	10	63	1124	1814	44	8	18.6	0.9	49.6	48.5	0	1	25	3	0.3	18	40	42	silty clay

APPENDIX B

Teichert Shifler Project – Financial Assurance Cost Estimae