# Appendix H

Eco Synthesis
SCIENTIFIC & REGULATORY SERVICES, INC.

# MEMORANDUM

**To:** Jason Smith

**From:** Adrian Juncosa

**Date:** April 2, 2021

**Subject:** Shifler Project Agricultural Reclamation

This memorandum provides summary and additional discussion of the feasibility of reclamation into agricultural uses within the Shifler project site, which is a subject that I understand has been raised in public comments on the project's Draft EIR.

These comments are informed by 27 years of professional experience with mine reclamation, ecological restoration, and revegetation feasibility studies and specifications. This includes extensive experience throughout this same time period studying hundreds of soil profiles and plant rooting behavior within them.

I prepared the Teichert Shifler Project Agricultural Reclamation Feasibility Study ("Feasibility Study") which is included as Appendix A in the Shifler Mining and Reclamation Plan ("Reclamation Plan"). The Reclamation Plan takes the principles described in the Feasibility Study further, by including specific soil management procedures that are consistent with, but more detailed than, the recommendations made in the Feasibility Study.

Reclamation standards and practices improve continually, and this memorandum is directed primarily at the technical and regulatory foundation and proposed reclamation actions for the present project, which may differ from approaches utilized elsewhere in the past.

A portion of the proposed project site is designated to remain below the water table, that is, it will be open water after reclamation. Areas around the periphery of the site will remain as slopes, to be stabilized against erosion, and in other areas, habitat restoration is proposed. Methods to be utilized in these sloping and habitat restoration areas are discussed in detail in the Reclamation Plan. The text that follows pertains to the remaining interior area, which will be reclaimed to topography similar to the surfaces within the site that are farmed at present (level to gently sloping).

## Prime Agricultural Land (Williamson Act)

The Feasibility Study discusses the definition of prime agricultural land (Williamson Act) and prime farmland (California Department of Conservation). Under Section 51201(c) of the Williamson Act, there are five alternative criteria, any one of which defines land as prime agricultural land. Two of these (NRCS land use capability class I or II, or Storie Index rating of 80 through 100) are based on soil characteristics, and others are based upon productivity. One of these is an annual carrying capacity of at least one animal unit per acre as defined by the USDA, the other two are based on annual crop production with a gross dollar value of at least two hundred dollars ($200) per acre either "normally" or in three of the previous five years.

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Considering the high cash value of some crops in several categories of economically useful plants, this latter standard is probably not difficult to meet even on rather poor soils, especially if irrigation water is available as is the case at the Shifler site. In addition, although the Storie Index was developed for application to in-situ soils, there is no intrinsic reason it could not be used to evaluate a reclamation soil profile. In this case, the somewhat generalized ratings it uses for physical profile, surface texture, slope, and other characteristics would result in the proposed post-reclamation circumstances at the Shifler site falling well within the required 80-100 rating range required to meet the Williamson Act definition. (In an interesting historical coincidence, Yolo loam is one of the soil series examples used in the original 1933 publication by Prof. Storie.)

## Prime Farmland (California Department of Conservation)

I believe that a more rigorous (higher productivity) reclamation standard is provided by the California Department of Conservation (DOC) definition of prime farmland, which is based on a much more stringent and detailed evaluation of specific soil characteristics than the Williamson Act definition of prime agricultural land. The DOC definition establishes ten thresholds that must be attained or exceeded (water regime, temperature range, acid-alkali balance, water table, sodium content, flooding, erodibility, permeability, rock fragment content, and rooting depth; see the Feasibility Study or DOC website for full details). The Feasibility Study addresses each one of these in turn, explaining how the proposed reclamation actions can reasonably be expected to ensure attainment and thereby showing that the post-reclamation conditions in the reclaimed area will meet the State DOC definition of prime farmland. For convenience of the reader, this discussion of the ten characteristics, found in Section 2.4 of the Feasibility Study, is repeated here in its entirety. For some parameters, the characteristics of the site's Yolo loam soils were derived from the NRCS soil survey data; for others, from the laboratory test results provided in the Feasibility Study.

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).

The Reclamation Plan (sections 6.1, 6.2, and 7.1) specifies the actions to be taken to implement the recommendations of the Feasibility Study throughout soil salvage, stockpiling, resoiling, and post-placement releveling of areas that are found to have settled so as to impair drainage or irrigation.

## Regional Agricultural Soil Context

The regional soils context was outside the scope of the Feasibility Study but may be relevant to the ease of reclaiming the Shifler site to agricultural use, relative to other soils in nearby agricultural areas. In brief, Yolo loam (which constitutes nearly 100 percent of the soil to be salvaged and used in agricultural reclamation at the Shifler site) is more amenable to such use than other agricultural soils that are mapped by NRCS nearby. For a few examples, other soil series that are mapped near the Shifler site (directly across Cache Creek) and support ongoing agricultural production include Brentwood silty clay loam, Corning gravelly loam, and Rincon silty clay loam.

The typical pedon of Brentwood soil has a clay loam or heavy clay loam layer extending from 18 inches depth down to the alkaline silty clay loam C horizon at 50 inches. That of Corning soil has a gravelly surface layer and gravelly clay and clay loam below 21 inches to the bottom of the described profile. Rincon soil is clay to clay loam throughout, and is moderately alkaline below 40 inches. Thus, all these soils have extensive amounts of clay, and in comparison with the soils observed at the Shifler site, much less volume of soil available that is suitable for use in agricultural reclamation.

While clay and clay loam soils can be salvaged and reused in reclamation, they may require special handling to preserve soil structure and nutrient characteristics. The Yolo loam found at the Shifler site, in contrast, is a silt loam with excellent internal drainage and is therefore more amenable to salvage, stockpiling, and reuse. As described in the Feasibility Study, the soils found throughout the site have no cemented layers, or high rock fragment content, or excessive clay content, or high content of undesirable minerals or pH imbalance, or any other characteristic that suggests that they would not be highly suitable for use in agricultural reclamation.

As stated in Section 7.1.3 of the Reclamation Plan, a minimum thickness of four feet of reclamation soil will be placed above the subgrade in the agricultural reclamation area. Once again referring to the regional context, that is a thicker layer of suitable agricultural soil than is generally found in the other highly productive agricultural soils nearby. The laboratory testing results provided in the Feasibility Study show that the salvaged material is expected to have suitable mineral nutrient characteristics to support crop production with the application of normal agricultural practices.

## Conclusions

To my knowledge, the approach taken by the Feasibility Study entailed a more thorough evaluation of existing conditions, soil restoration procedures, and farmland definitions than has hitherto been employed for any mining project proposed for prime agricultural land in California.

As documented in the Feasibility Study, extensive soil sampling and laboratory testing of textural and nutrient characteristics indicates that with feasible proposed soil salvage and replacement specifications, followed by agricultural practices that are normal for the project region (that is, potentially including normal soil amendments and irrigation practices), highly productive agricultural uses can be restored to the site after mining and reclamation are complete.

Therefore, it is reasonable to be confident that yields similar to those summarized and discussed in Section 5 of the Feasibility Study will be attained following reclamation of the agricultural portion of the Shifler site.