Arkansas River Corridor Projects Vegetation and Soils Assessment Summary

PREPARED FOR: Tulsa County

PREPARED BY: CH2M HILL

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Introduction

Tulsa County, as part of the Arkansas River Corridor Master Plan (Carter & Burgess, 2004; C. H. Guernsey and Company et al., 2005), is undertaking an improvement project on the Arkansas River. The primary goals of the overall project are to improve least tern habitat, improve fish habitat and fish passage, improve the function of the river system itself, enhance economic development, increase recreational opportunities, and increase connectivity between the river and surrounding communities. The conceptual project components are described in detail in the Technical Memorandum (TM) entitled Baseline Project Summary for the Arkansas River Corridor Project (CH2M HILL, 2009a). Key components include:

- Design of habitat improvements along the corridor
- Design of bank stabilization in select areas
- Design of a new Sand Springs low-head dam, pedestrian bridge, and amenities
- Design of modifications to Zink Dam and lake with whitewater features
- Design of a new South Tulsa/Jenks low-head dam, pedestrian bridge, and amenities

The purpose of this TM is to summarize the existing vegetation and soils conditions, as they pertain to constructing bank stabilization treatments along the Arkansas River from Keystone Lake to just below Jenks in south Tulsa County.

The study area includes a corridor extending approximately 42 miles long and 2,200 feet on each side of the centerline of the river. The study area along the Arkansas River corridor includes many different habitat types: upland forests (including cross timbers), forested wetlands, open grasslands and managed pasture, agriculture fields, and habitats associated with residential and commercial use. A detailed evaluation of the existing habitat and land use types is provided in the TM entitled Riparian Habitat Summary (CH2M HILL, 2009b).

This TM provides additional detail on soils characteristics and textures as these elements may be related to future requirements for bank stabilization. Vegetation types are presented that would provide suitable function in bioengineering bank stabilization measures for the project.

Vegetation

Many types of vegetation exist along the study corridor, within the various habitat communities (forest, wetlands, grasslands, etc.). Within these habitat types are species that are useful for bioengineering applications to enhance bank stability. The Riparian Habitat Summary TM suggested three native species suitable for bank stabilization/bioengineering techniques. These species are shown in Table 1 (CH2M HILL, 2009b).

TABLE 1
Native Species with Potential for Bank Stabilization Recommended in the Riparian Habitat Technical Memorandum

Common Name	Scientific Name
Trees	
Black willow	*Salix Nigra*
Cottonwood	*Populus Deltoides*
Shrubs	
Sandbar willow	*Salix Exigua*

Due to their ability to sprout from dormant cuttings, willow and cottonwood species are suitable for the following bioengineering applications, which may be utilized to stabilize banks on the project:

- Live Staking
- Live Fascine (cut and fill slopes)
- Brushlayering
- Fabric-Encapsulated Soil Lifts (FESL)
- Branch-Packing
- Live Slope Grating
- Vegetated Geogrid
- Joint Planting
- Vegetated Riprap (U.S. Army Corps of Engineers [USACE], 2009)
- Riprap with Soil, Grass, or Ground Cover (USACE, 2009)
- Longitudinal Peaked Stone Toe Protection (LPSTP) (USACE, 2009)

A separate riverbank stabilization concept TM will be prepared to prioritize slopes along the project study area, and provide concepts for treatment alternatives appropriate for these slopes.

Additional species or plant communities may be appropriate for certain bank stabilization treatments, such as other willow species, dogwood, sedges, and other tree species (Table 2). For example, an herbaceous mix of sedges, rushes, and bulrushes may be appropriate for stabilization at the normal water elevation. Another option would be a dense shrub community near the normal water elevation with a more xeric woody community higher on the banks.

Bermudagrass sod is another species for consideration. It provides significant erosion control immediately after installation. It can be used above the normal water elevation as a ground cover, providing immediate protection to riverbank soils against wind and raindrop erosion. It can be staked or stapled onto relatively steep riverbanks where loss of seed and soil is a concern. With some initial irrigation, bermudagrass sod can root deeply, rapidly, and densely. It also helps retain soil moisture, and provides a thick ground cover conducive to entrapping native plant seed. Therefore, in time, a more diverse riverbank vegetation community becomes established through the sod.

TABLE 2
Additional Native Species with Potential for Bank Stabilization

Common Name	Scientific Name
Lower Slopes	
River birch	*Betula nigra*
Swamp privet	*Forestiera acuminata*
Sedges	*Carex* spp.
Rushes	*Juncus* spp.
Smartweed	*Polygonum* spp.
Soft rush	*Juncus effuses*
Cattails	*Typha* spp.
Mid Slopes	
Box elder	*Acer negundo*
River birch	*Betula nigra*
Water oak	*Quercus nigra*
Big bluestem	*Andropogon gerardii*
Higher Slopes	
Sycamore	*Platanus occidentalis*
Green ash	*Fraxinus pennsylvanica*
Pecan	*Carya illinoensis*
Silver maple	*Acer saccharinum*
Black walnut	*Julgans nigra*
Sugarberry	*Celtis laevigata*
Overcup oak	*Quercus lyrata*
Willow oak	*Quercus phellos*

Soils

The near-surface soils within the study area were identified using the Natural Resources Conservation Service (NRCS) Soil Survey of Tulsa County, Oklahoma (Cole, 1977). The NRCS soil survey data are representative of soil conditions in the upper 3 to 5 feet of the site. Soil classifications were obtained by NRCS via discrete sampling methods and, therefore, are intended to represent average conditions in the vicinity.

The majority of the study area is dominated by the Choska-Severn soil series. These soils are primarily characterized as deep, well-drained sandy to silty loam overlying loamy and sandy floodplain alluvium. Along the Arkansas River banks, there are seven primary soil types, based on percentage of land area along the Arkansas River:

1. The Choska-Severn Complex
2. The Eram Coweta Unit
3. The Kiomatia Loamy Fine Sand Unit
4. The Latanier Clay Unit
5. The Niotaze-Darnell Complex
6. The Radley Silt Loam Complex
7. The Severn Very Fine Sandy Loam Unit

Of this group, there are three soil types that dominate the riverbanks: the Choska-Severn very fine sandy loam, the Kiomatia loamy fine sand, and the Severn very fine sandy loam. Stratification includes layers of very fine sandy loam to silty clay loam (Unified Soil Classification System [USCS] classification is typically CL, CL-ML, ML, and SM).

Soils are typically well-drained with moderate to moderately rapid permeability, with an available water capacity of approximately 10 inches. Mean annual precipitation in areas where these soils are common in this region is around 40 to 50 inches. These soils mainly exist on flat, 0 and 3 percent slopes.

Summary

The key soil issue determining the degree to which bank stabilization bioengineering techniques will be needed is soil texture. In general, water can dislodge finer soil particles more easily than larger particles. Therefore, soils dominated by clay and silts erode faster than soils dominated by gravels and stones. Slope steepness, river velocity, and shear stress also interact with the soil type to increase or decrease erosion potential. Soils along the river in the project area are composed of loams, fine sands, very fine sands, clays, and silts, all erosive soil types. Location–specific investigations based on the final river configuration and water surface elevations will be needed to assess soil physical properties at locations where hydraulic analyses indicate shear stress may initiate erosion. Site-specific bioengineering solutions will be designed for each location based on soil properties, slope steepness, and river hydraulics.

References

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