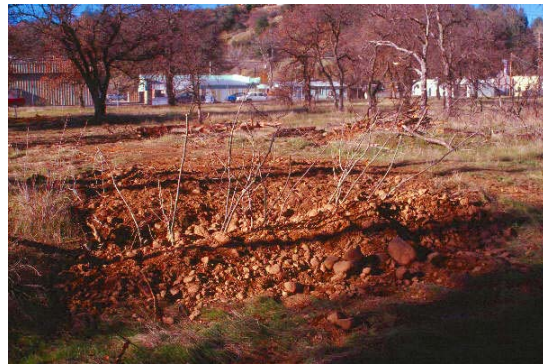


Pole Planting



Pole Plantings use large diameter cuttings (poles vs. stakes) which are relatively long, 5 to 10 feet in length. The cuttings are taken from willow (*Salix spp.*) or cottonwood (*Populus spp.*). The cuttings are intended to sprout and take root, stabilizing the streambank with a dense matrix of roots. Pole plantings are planted deep so they usually require heavy equipment assisted construction techniques. As defined by Schiechl and Stern (1997), poles are straight, poorly branched stems 1-2.5 m long.

Conditions Where Practice Applies



This mitigation project involved the use of pole plantings in order to reestablish a riparian corridor

**in an urban watershed.
(Pedestrian Bridge Mitigation Project, Redding, CA)**

Pole planting is suitable for floodplains, streambanks, and other riparian zones. Pole plantings are very useful for highly erodible areas and sites with fluctuating water tables. Pole planting is a useful "stand alone" revegetation technique for replacing and/or reestablishing riparian vegetation and cover. Pole planting is also particularly suitable for conjunctive uses with other streambank stabilization techniques such as [vegetated riprap](#), [vegetated gabions](#), [rootwad revetments with vegetated riprap](#), [vegetated deflectors](#), and [longitudinal peaked stone toe protection](#).

Pole planting areas may need to be accessible to heavy equipment as the poles should be planted into deep holes. The location of the water table (saturated zone) and vadose zone (moist soil zone including the capillary fringe, located above the saturated zone) should be approximately identified so the pole plantings can access sufficient moisture. Pole plantings are usually planted with a power auger or punch bar ("Stinger").



The following chart shows recorded shear stress and velocities withstood by brushlayering.

| Bank Material/Protection | Shear | | Velocity | | | Reference |
|---|--------------------|------------------|----------|---------|-------------|--------------------------------------|
| | lb/ft ² | N/m ² | ft/s | m/s | | |
| Sandy Loam | 0.0167 | | 1.75 | 0.53 | Design | Temple, 1980 |
| Silt Loam | 0.0218 | | 2 | 0.61 | Design | Temple, 1980 |
| Alluvial silts | 0.0218 | | 2 | 0.61 | Design | Temple, 1980 |
| Ordinary firm loam | 0.0341 | | 2.5 | 0.76 | Design | Temple, 1980 |
| Very light loose sand, no vegetation or protection | | | 1-1.5 | .3-.46 | Limit | Fortier & Scobey, 1926 |
| Average sandy soil | | | 2-2.5 | .61-.76 | Limit | Fortier & Scobey, 1926 |
| Stiff clay, ordinary gravel soil | | | 4-5 | 1.2-1.5 | Limit | Fortier & Scobey, 1926 |
| Deciduous tree plantings (immediately after construction) | 0.41 | 20 | | | Limit | Schiechtl & Stern, 1994 |
| Deciduous tree plantings (after 3-4 seasons) | 2.45 | 120 | | | Limit | Schiechtl & Stern, 1994 |
| Willow posts | | | 3.1 | 0.94 | Observation | USACE TR EL 97-8 (recommend 5-8 fps) |
| Herbaceous and woody vegetation | | | 8 | 1.5 | Observation | USACE TR EL 97-8 |

| | | | | | | |
|---------------------------------|-----|-----|-----|---|-------|--------------------|
| Willow cuttings / willow stakes | 2.1 | 103 | 9.8 | 3 | Limit | Gerstgrasser, 1999 |
|---------------------------------|-----|-----|-----|---|-------|--------------------|

Materials

Cottonwood or willow pole cuttings. A pond or storage area for soaking the cuttings will be necessary. Pole planting techniques may require the use of a power auger, "Stinger", or other method to excavate deep holes. The "Stinger" is a large metal punch bar mounted on a backhoe or hydraulic excavator. Instructions for building a "Stinger" can be obtained from:

USDA-NRCS Plant Materials Center
 Box 296
 Aberdeen, ID 83210
 (208) 397-4133

Or you can view the PDF file with instructions. [Waterjet Stinger](#). Another PDF article on the Waterjet Stinger can be found [here](#), and a Microsoft Word cost sheet for the Waterjet Stinger can be found [here](#).

Advantages



Larger diameter cuttings have greater supply of stored energy ("stored" photosynthesis). Works well with non-irrigated projects as the deep planting can ensure contact of the basal ends of the poles with the vadose zone during hot, dry summer months.

The poles have tremendous tensile strength which can enhance the strength and shear resistance of the soil, and when incorporated into structural practices, the poles can benefit the strength and longevity of the structures. When established, pole plantings can protect gabions (and the wire) from scour and the deep roots provide tremendous pull-out resistance which can greatly reduce future collapse of the structures. Pole plantings are an extremely useful way to provide habitat enhancement to standard structural engineering practices.

Disadvantages

Pole plantings often require conjunctive use of appropriate erosion control as large diameter poles can cause local turbulence and small-scale scour. Pole plantings usually require the excavation or construction of deep holes. Pole planting techniques implemented after construction is complete, for instance, after riprap placement, is very difficult. Pole plantings should be designed and scheduled to coincide with construction if possible.

Implementation

Collect and harvest cuttings (ideally during the dormant season) and then soak the poles for 5 to 7 days. See [harvesting and handling](#). Plant poles into an augered, "punched", or excavated hole. The holes should extend to approximately 1 foot above the water table and through the vadose zone. This depth can be difficult to determine in areas with reservoirs and streams with widely fluctuating seasonal water levels. In this case, ensure that the ends of the poles reach the low waterline at the time of planting if possible.



Pole plantings should ideally be installed during the construction of any structural appurtenances. For instance, plant the poles with the placement of riprap, especially into any trenches excavated for keyways or scour trenches. Another example is to plant the poles during riprap placement such that the poles extend through the riprap and backfill and into contact with the "native" bank. The backfill can be placed over and around the poles rather than having to "punch" holes through the riprap. Another method is to plant the poles during gabion construction. See [vegetated gabions](#).

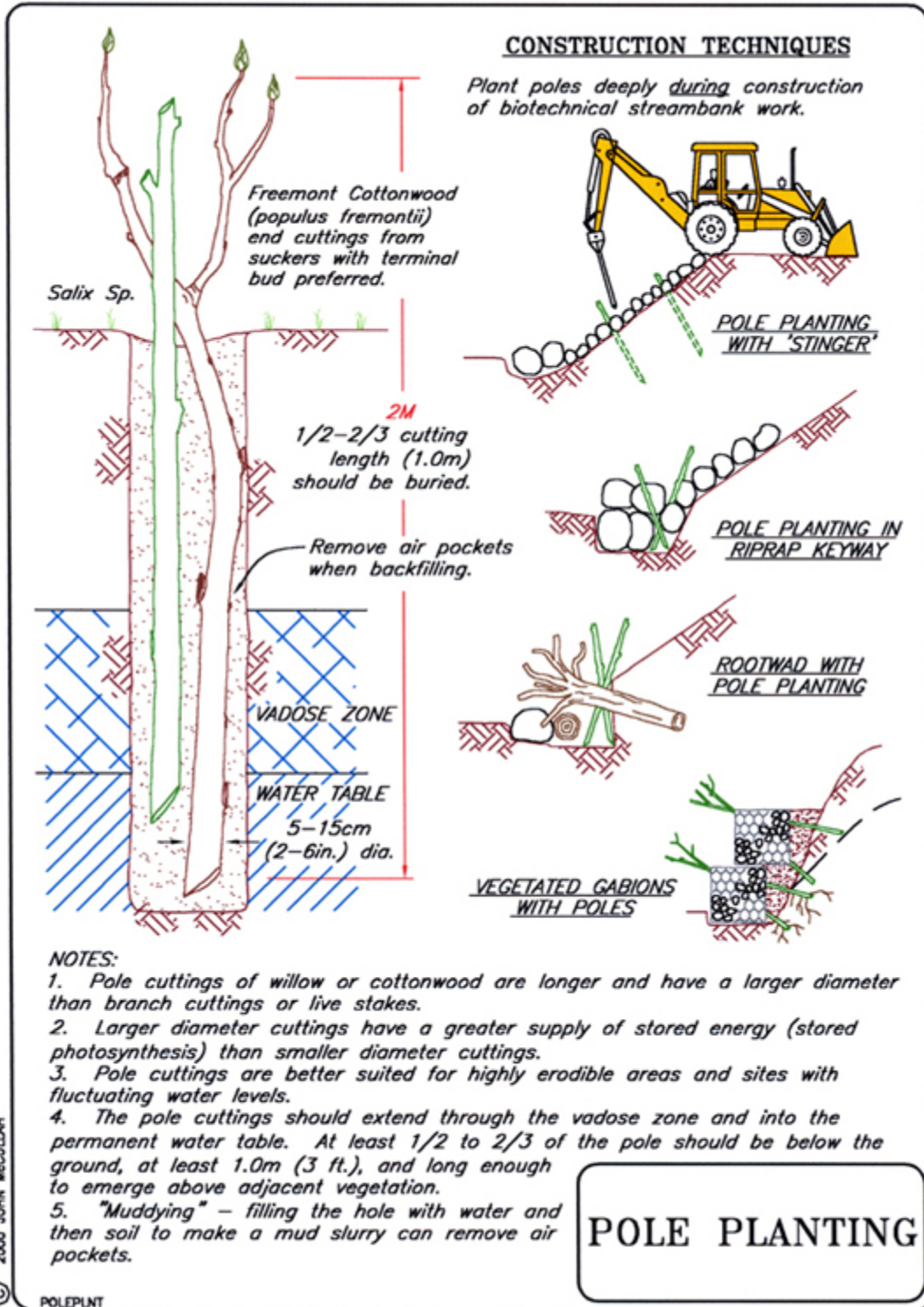
The pole plantings, especially the basal ends, must have good contact with the soil. "Mudding" (filling the hole with water and then adding soil to make a mud slurry) can remove air pockets.



An inventive Equipment Operator uses an oak log as a "Stinger" .



Workers place willow poles into the hole left by the oak "Stinger".



Typical drawing: Pole Planting

[.dwg](#)
[.dgn](#)



Installation in 1999



September 2002

Costs

Installed costs of pole plantings are typically estimated at \$2.50 per pole, although this can range up to \$5.00 per pole and beyond, depending on how far the harvesting area is from the site, labor costs, and other site variables.

A Microsoft Word cost sheet for the Waterjet Stinger can be found [here](#).

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