



North Bay Watershed Association

in cooperation with

Sonoma County Water Agency

and the

City of Petaluma



Thompson Creek Revegetation Plan

November 2001

North Bay Watershed Association Thompson Creek Revegetation Plan

I. Background and Site Conditions

Site Description

The project site is located along Thompson Creek in the City of Petaluma. Thompson Creek drains an area west of the Petaluma River and Highway 101, and runs through the City of Petaluma before its confluence with Petaluma River.

The portion of creek under consideration includes 1,800 linear feet running through the Westridge subdivision between Westridge Drive and Sunnyslope Road. The property is approximately 5.7 acres and is owned by the City of Petaluma. Maintenance on this portion of the creek is conducted by the City of Petaluma (stream banks) and the Sonoma County Water Agency (hydraulic maintenance). The site is highly visible to adjacent residences and serves a linear park, complete with walking trails, community gardens, and a small playground.

Site Conditions

Thompson Creek is one of the few drainages in the Petaluma River watershed with perennial flow. The creek runs through the Westridge subdivisions, which are built on Pleasanton loam soils (City of Petaluma, 1996). Pleasanton loam soils consist of well-drained, gravelly loam that with a gravelly clay subsoil (City of Petaluma, 1996). Revegetation projects in the Thompson Creek watershed on these soils have been relatively successful, and tend to become established within two to three growing seasons so that they no longer require supplemental irrigation.

The creek bed and lower banks of the portion of Thompson Creek under consideration are usually choked with invasive vegetation such as cattail and wild blackberry. These dense stands of invasive vegetation reduce the hydraulic capacity of the channel, posing a potential flood hazard to nearby residences, and provide poor habitat value. The mid-bank and upper-bank are composed primarily of annual grasses with a few areas of open remnant wood cover, much of which has been planted by local residents during recent revegetation projects. The extreme northern and southern ends of the project site are composed of small areas of more established stands of riparian vegetation.

Previous Revegetation Efforts

Several revegetation efforts have previously taken place at Thompson Creek. The most recent efforts were conducted by local residents in 1992 (Waxman Landscaping and Environmental Consulting Services, 1992), 1994 (Waxman Landscaping and Environmental Consulting Services, 1994), and 1998. Species installed during these replanting projects are listed in Appendix A.

The previous revegetation efforts have had various levels of success. Much of the vegetation planted has been lost during mowing and other maintenance activities, or due to insufficient irrigation.

Site Maintenance

During August 2001, in preparation for revegetation activities, SCWA conducted vegetation removal in the stream bed and along the lower banks of the creek. Willows growing in the stream channel were thinned and cattail and wild black berry were cleared manually. Mowing of the channel banks also was conducted in June 2001 by the City of Petaluma. Figure 1 shows that the vegetation removal activities have increased the hydraulic capacity of the channel and have left the majority of the creek's mid- and lower-banks available for revegetation. In preparation for revegetation efforts scheduled for late November, additional blackberry removal is planned for October or November 2001.

Picture 1: Thompson Creek site after vegetation removal activities (July 2001)



II. Plant selection

Selecting a plant palette appropriate for the Thompson Creek site is a key step in designing its revegetation plan. The plant selection process for Thompson Creek Revegetation Plan involved the following steps:

1. Establishing plant selection criteria
2. Examining characteristics of a variety of plant species
3. Examining plants used at previous replantings on the site
4. Developing a recommended plant palate

Selection criteria

Depending on the goal of a revegetation project, plant selection criteria may differ. The main goal of the Thompson Creek restoration project is to provide canopy to shade out cattail and wild black berry growth. In doing so, revegetation of the site will restore native plant species and improve water quality and aquatic habitats. In order to fulfill the project goal and objectives, the following plant selection criteria was developed:

- Criteria #1:* Plants must be native to the Petaluma River watershed and, if possible found in the Thompson Creek watershed.
- Criteria #2:* Plants must provide adequate canopy to shade out the cattail growth in the channel bed and blackberry growth on the lower-banks.
- Criteria #3:* Plants should re-establish native biodiversity, and provide increased value, to the aquatic and riparian habitat.
- Criteria #4:* Plants must establish relatively quickly so that maintenance (irrigation) activities are limited to the first two or three growing seasons.
- Criteria #5:* Plants must be available from native plant sources in the area.

Plant Characteristics

In order to satisfy the plant selection criteria, the characteristics of potential plants were examined for a variety of factors such as native habitat, growing rates/invasiveness, establishment potential, bank location requirements, wildlife value, and availability. Table 1 summarizes the factors examined and the criteria they would satisfy.

Table 1: Factors examined when selecting candidate species.

| Factor | Purpose | Selection criteria |
|----------------------------|---|---------------------------|
| Native habitat | Plants must be native to California and/or the Petaluma River watershed. | Criteria #1 |
| Growing rate/invasiveness | Plants must be able to establish quickly and provide canopy to shade out exotic vegetation. Therefore, moderate to rapid growth rate and high invasiveness are desired. | Criteria #2, #3 |
| Establishment potential | Plants must be able to establish within two or three growing seasons to lessen required maintenance. Therefore, easy to establish plants are preferred. | Criteria #4 |
| Bank location requirements | Plants must cover a variety of bank locations for aesthetic, habitat and canopy establishment purposes. | Criteria #2, # 3 |
| Wildlife value | Plants should improve the aquatic and riparian habitat value of the site. Therefore, plants with high habitat value are desired. | Criteria #4 |
| Availability | Selected plants must be available from a local source. | Criteria #5 |

Previous replantings

Previous replanting efforts were considered during the development of the plant palate for the Thompson Creek Revegetation project. The analysis of previous plantings was based primarily on the 1992 and 1994 plantings, as there was no precise plan available from the 1998 replanting. When comparing the two previous revegetation plans, it was assumed that an adaptive management approach was taken and that trees and shrubs planted in 1992, but not planted in 1994, were considered not adapted/inadequate for the site. Therefore, these plants were not considered during the development of the plant palate for the NBWA Thompson Creek Revegetation Project. A table outlining plants used in previous replanting efforts is provided in Appendix A.

Recommended plant palate

Based on the development of plant selection criteria, and examination of species characteristics and previous revegetation projects, a recommended plant list for the Thompson Creek site was developed. The Restoration and Management Guidelines for the Petaluma Watershed (1996) also were examined when selecting plant species for the site. The recommended plant list includes eight tree species and four shrub species, as outlined below.

Tree species

| | |
|-------------------------|---------------------------------------|
| Coast live oak | <i>Quercus agrifolia</i> |
| Valley oak | <i>Quercus lobata</i> |
| Oregon ash | <i>Fraxinus latifolia</i> |
| California box elder | <i>Acer negundo ssp. californicum</i> |
| White alder | <i>Alnus rhombifolia</i> |
| Arroyo willow | <i>Salix lasiolepis</i> |
| Red tree willow | <i>Salix leavigata</i> |
| California black walnut | <i>Juglans californica hindsii</i> |

Shrub species

| | |
|----------------------|--------------------------------|
| Coyote brush | <i>Baccharis pilularis</i> |
| California wild rose | <i>Rosa californica</i> |
| Toyon | <i>Heteromeles arbutifloia</i> |
| Common rush | <i>Juncus patens</i> |

The recommended plants were examined to be sure that site conditions such as soils, moisture requirements and exposure requirements were suitable for the Thompson Creek site. Appendix B includes detailed plant data sheets for the selected plants from the Restoration Design and Management Guidelines for the Petaluma River Watershed.

III. Recommended site layout

Development of the Thompson Creek site layout includes delineating the replanting area boundaries, and selecting plant densities appropriate for the site.

Replanting area boundaries

In order to fulfill the goal of establishing a canopy to shade out exotic species growth in the stream channel and at the lower banks, plantings should be concentrated on the mid-bank to toe-of-slope. Furthermore, to coordinate with bank mowing activities, it is recommended that the revegetation area be clearly delineated. Therefore, the replanting area for the Thompson Creek project extends the entire length of the site within 40 feet of the channel centerline.

Plant densities

Individual plant species should be planted in small groups. Generally, tree species are planted in groups of two to three, and shrubs should be planted in groups of three to five (City of Petaluma, 1996). Planting should alternate trees and shrubs with the ultimate goal of establishing a habitat that includes both tree and shrub layers.

In order to fulfill the primary project goal of shading out invasive species in the creek bed and on the lower banks, a canopy cover density along the lower creeks banks of 60 to 79 percent would be required. This correlates to a “Park-like” density, as described in the Restoration Design and Management Guidelines for the Petaluma River Watershed (City of Petaluma, 1996).

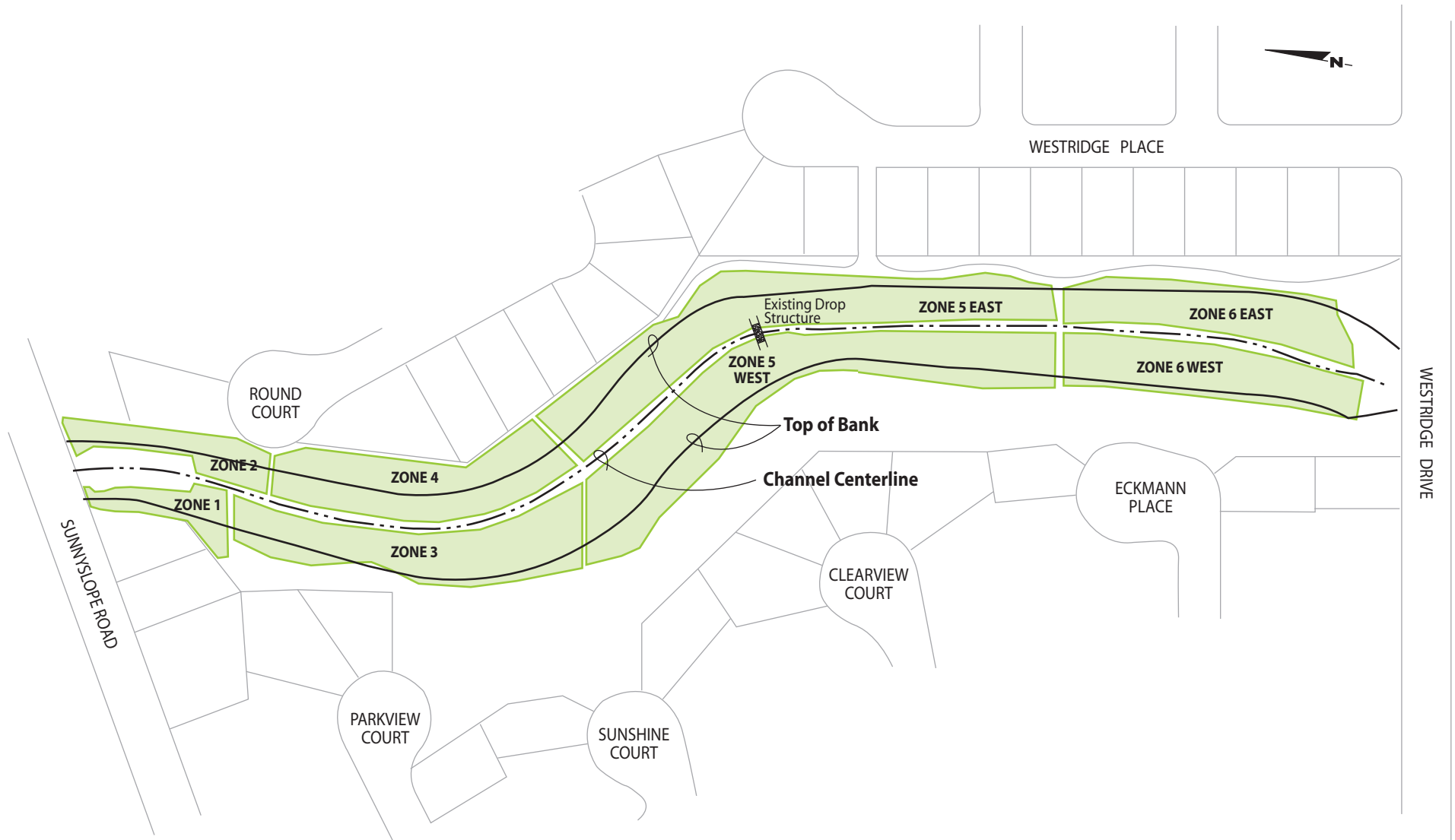
The Petaluma Watershed Restoration Design Guidelines describe the Park-like density as dense stands of mature willows and other riparian species with spacings of 12 to 15 feet, relating to a minimum density of 120 to 300 trees per acre (City of Petaluma, 1996). Park-like areas typically have nearly closed canopies, often with abundant undergrowth vegetation.

Plant density recommendations for the site were developed for eight zones at the Thompson Creek site. The eight zones were based on zones delineated for the 1992 and 1994 replanting efforts and are shown in Figure 1.

The recommended number of species for each zone is summarized in Table 2. The total number of plants recommended for the site is 515. This correlates to a planting density of 242 plants per acre for the site. However, plant densities vary by zone, due to the varied conditions found in each of the zones at the project site.

Figure 1

Thompson Creek Zones



(Based on Waxman Landscaping & Environmental Services, 1992 and 1994.)

Table 2: Recommended number of plant species by zone.

| | Species Code | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5E | Zone 5W | Zone 6E | Zone 6W | Total |
|------------------------------|---------------------|---------------|---------------|---------------|---------------|----------------|----------------|----------------|----------------|--------------|
| <i>Size (acres)</i> | | 0.08 | 0.11 | 0.32 | 0.26 | 0.48 | 0.41 | 0.23 | 0.23 | 2.13 |
| Coast live oak | QuAg | | | | 4 | 3 | | | | 7 |
| Valley oak | QuLo | | 3 | 4 | 4 | 4 | | | | 15 |
| Oregon ash | FrLa | | | | 4 | | 5 | | | 9 |
| Box elders | AcNe | | 3 | 4 | 6 | 9 | 8 | 4 | 4 | 38 |
| White alder | AlRh | 4 | 5 | 15 | 14 | 28 | 24 | 12 | 12 | 114 |
| Arroyo willows | SaLa | 3 | 3 | 4 | 12 | 14 | 12 | 10 | 10 | 68 |
| California black walnut | JuCa | | 2 | 4 | 4 | | | | | 10 |
| Coyote brush | BaPi | | | 4 | 7 | 4 | | | | 15 |
| California wild rose | RoCa | 4 | 6 | 14 | 9 | 18 | 15 | 10 | 10 | 86 |
| Toyon | HeAr | 4 | | 7 | | 9 | | | | 20 |
| Rush | JuPa | 6 | 7 | 16 | 14 | 24 | 36 | 15 | 15 | 133 |
| Total by zone | | 21 | 29 | 72 | 78 | 113 | 100 | 51 | 51 | 515 |
| Density (plants/acre) | | 254 | 260 | 224 | 295 | 234 | 245 | 224 | 223 | 242 |

IV. Installation Guidelines

Plant installation considerations include planting timeline, spacing, weed control, and plant protection. Coordination of plant installation with the installation of an irrigation system is also an important consideration.

Timeline

To maximize plant survival, plants should be installed at the site between October 1 and January 1. For the Thompson Creek site, revegetation activities are planned for November 30 and December 1, 2001.

Plant channel locations

Each of the selected plant species should be planted in the appropriate channel location. Table 4 provides the appropriate channel locations for each of the selected plant species for the Thompson Creek site.

Table 4: Channel locations

| Species | Species Code | Planting location |
|-------------------------|---------------------|--------------------------|
| Coast live oak | QuAg | Upper bank, top of bank |
| Valley oak | QuLo | Upper bank, top of bank |
| Oregon ash | FrLa | Mid bank, upper bank |
| California box elder | AcNe | Mid bank, upper bank |
| White alder | AlRh | Lower bank, toe of slope |
| Arroyo willow | SaLa | Lower bank, toe of slope |
| California black walnut | JuCa | Mid bank, upper bank |
| Coyote brush | BaPi | Mid bank, upper bank |
| California wild rose | RoCa | Mid bank |
| Toyon | HeAr | Upper bank, top of bank |
| Common rush | JuPa | Lower bank, toe of slope |

Plant spacing

Plants spacing should consider the morphologies and growth structures of the individual plants. Recommended on-center spacing for the selected tree and shrub species is listed in Table 5. On-center spacing refer to the distance between plantings. Plants should also be installed using a triangular spacing methodology, not a square grid pattern. The triangular spacing results in a slightly denser planting region.

Table 5: Recommended on-center spacing

| Species | Species Code | Average On Center Spacing |
|-------------------------|--------------|---------------------------|
| Coast live oak | QuAg | 20 feet |
| Valley oak | QuLo | 20 feet |
| Oregon ash | FrLa | 15 feet |
| Box elder | AcNe | 15 feet |
| White alder | AIRh | 15 feet |
| Arroyo willow | SaLa | 10 feet |
| California black walnut | JuCa | 15 feet |
| Coyote brush | BaPi | 6 feet |
| California wild rose | RoCa | 6 feet |
| Toyon | HeAr | 6 feet |
| Common rush | JuPa | 3 feet |

Replanting events

For the Thompson Creek site, plant installation is scheduled for Friday, November 30th and Saturday, December 1st. In the days prior to the plant installation, SCWA will dig holes for the plants and a contractor hired by the City of Petaluma will install the irrigation system main lines.

Plant installation will be lead by SCWA staff. Plant installation is scheduled for the morning (between 10:00 am and 1:00 pm) of each planting day. School children (one high school class and one grade school class) will participate in planting activities on the morning of November 30th. Local residents and community groups will assist with planting on December 1st. During the afternoon of each replanting day, the drip irrigation system emitters and spaghetti lines will be installed on site by a contractor hired by City of Petaluma. This contractor will also install the plant protection as needed.

In addition to the plants, the following materials will be made available on planting days:

- Hand trowels and shovels
- Gloves
- Mulch
- Soil
- Pin flags
- Plant protection
- Mallets, ties, clips
- Trash bags

Container plant installation

Planting holes should generally be one to two feet wide and two feet deep. Plants should be installed so that their root crowns are at or slightly above the soil surface.

Weed control

After each plant is installed, weed mat will be installed around the plant to help prevent weeds from growing immediately around plants. The weed mat that will be used at the

site comes in pre-cut squares that are ready to be installed. A large or medium woodchip mulch can be placed over the weed mat and irrigation system once the plants and irrigation are installed. Mulch will provide additional weed protection as well as provide a protective layer over the irrigation system.

Plant protection

A large wooden stake should be placed next to all plants to help prevent incidental damage to the plantings during maintenance. The stake should extend three feet so that it is visible above the invasive grasses. Color-coding, either by painting on the stake or a colored ribbon, or marking can be used to help identify restoration plant species.

Plastic tree tubes should be installed over the newly planted species and connected to stakes with zip-ties. The tree tubes will provide protection from animals and humans during the plant establishment period. The tree tubes are about four feet high and will remain at the site for one to three growing seasons. Tubes will be removed from quicker growing species after the first growing season.

Irrigation system installation

Plantings should be coordinated with the installation of the site's irrigation system. If a drip irrigation system is to be used at the site, the systems should be live and the main system laterals should be in place before planting. This will allow for the installation of emitters and required "spaghetti" tubing as the plants are installed. This way, water can be delivered to the plants immediately after they are installed.

IV. Maintenance

Once plants are installed at the site, the site will require regular maintenance for at least three years. Maintenance activities will include:

- Irrigation system maintenance and operation
- Continued clearing of exotic species (cattail and blackberry) at the lower banks and in the stream channel and removal of non-native weeds/grasses around plantings
- Maintenance of plant stakes/markings and plant protection
- Plant replacement
- Annual “spring clean-up” activities

Irrigation

The newly installed plants will require irrigation for the first three years during the plant establishment period. Irrigation systems should be used as a supplement to seasonal precipitation to establish plants. After the typical three-year plant establishment period, the irrigation system should be removed to allow plants to adapt to the site. Irrigation requirements vary over the plant establishment period and are general guidelines provided in Table 6.

Table 6: Irrigation requirements

| Year | Frequency | Amount | Duration |
|-------------|------------------|--------------------------|-----------------|
| Year 1 | 4x per month | 2 inches/ watering event | March – October |
| Year 2 | 3x per month | 2 inches/ watering event | March – October |
| Year 3 | 1- 2x per month | 2 inches/ watering event | March – October |

A drip irrigation system will be installed at the Thompson Creek site by the City of Petaluma. Drip irrigation systems distribute water at low pressures and volumes more directly to the root zone, and have proven effective at other revegetation sites.

The drip irrigation system that will be installed at the site will be subject to damage from humans, machinery, and dogs. To ensure plant survival, it is important the irrigation system is inspected regularly. Broken drip lines should be replaced or repaired. The system should be inspected before the onset of the summer irrigation season in April, and approximately once per month during the irrigation season. Inspection and coordination of system repair of the system will be conducted during site walks by the City of Petaluma during the first three growing seasons while the irrigation system is in place.

Clearing of exotics

During the plant establishment period, it is important that exotic species on the site continue to be cleared. This continual upkeep will be most successful if SCWA, the City of Petaluma, and local neighbors each participate on different levels.

SCWA will continue clearing of cattails and blackberry that grow at the lower channel slopes in the stream channel. Grasses that grow on the site should be cleared around the native vegetation. Manual clearing of exotics and grasses should be used as much as possible to minimize damage to plants. SCWA may use mulch to help control exotic vegetation.

The City of Petaluma will coordinate bank mowing activities so that native plants are not mowed. Because all revegetation activities will be conducted within 40 feet of the stream channel center, the revegetation area will be clearly delineated and easy for City staff to identify and avoid when mowing the upper banks.

Clearing of grasses and exotic species around newly planted vegetation provides an opportunity for volunteers and local residents to participate in stream stewardship activities at the site. These efforts can be done on an annual basis or as volunteers are available through such events as scouting events or school events. However, any work done at the site by volunteers must be coordinated through, and approved by, the City of Petaluma.

Maintenance of plant markings and plant protection

It is important that plant markings and plant protection are maintained during the plant establishment period. Once plants are sufficiently established, plant protection can be removed from the site. For some of the faster growing species, plant protection can be removed after the first growing season. For other species, plant protection will be required for the first two to three seasons. After the first season, the site should be walked and plants assessed to determine which are sufficiently established and no longer need protection. SCWA staff will conduct this assessment. Local residents also may participate in maintenance of the plant protection and markings through activities approved by the City of Petaluma.

Plant replacement

Plant density numbers are high enough for the site to allow for some plant mortality. However, in order to achieve the goal of establishing native vegetation and developing a riparian canopy, it may be necessary to replace dead plants. SCWA will coordinate plant replacement activities during the first growing season. Plants installed during plant replacement should only include plants listed in this revegetation plan or other plants native to California and the Petaluma watershed. Local residents and community groups also may participate in plant replacement activities. However, any plant replacement activities conducted by local residents and community groups must be coordinated through, and approved by, the City of Petaluma.

“Spring Clean Up”

In April of each year a “spring clean up” program should be conducted. The program will include walking of the site and careful inspection of the plantings, plant protection, and irrigation system. SCWA will conduct spring clean up activities associated with inspection of plant markings and protection, and, during the first growing season, plant replacement. The City of Petaluma will conduct spring clean-up activities associated

with irrigation system inspection and maintenance. During the fourth year, plant protection (stakes and markings) can be removed from the site. The “spring clean up” activity may also be an opportunity for local neighbors to be involved with stream stewardship activities along the creek, provided activities are coordinated through, and approved by, the City of Petaluma.

V. Contact Information

City of Petaluma
Department of Parks and Recreation
(707) 778-4380

Sonoma County Water Agency
Flood Control Operations
(707) 526-5370

North Bay Watershed Association
www.nbwatershed.org

VI. References

City of Petaluma, 1996. *Restoration Design and Management Guidelines for the Petaluma River Watershed*. Prepared for the City of Petaluma and Sonoma County Water Agency. July 1996.

Waxman Landscaping and Environmental Consulting Services. 1992. *Thompson Creek Restoration Project*. 1992

Waxman Landscaping and Environmental Consulting Services. 1992. *Thompson Creek Restoration Project*. 1994

Appendix A: Previous replantings

Table A: Plant species used in previous replantings at Thompson Creek

| | | Zone1 | | Zone2 | | Zone3 | | Zone4 | | Zone5W | | Zone5E | | Zone6W | | Zone6E | | Total | |
|---|------------------------|-------|----|-------|----|-------|----|-------|----|--------|----|--------|----|--------|----|--------|----|-------|-----|
| | | 92 | 94 | 92 | 94 | 92 | 94 | 92 | 94 | 92 | 94 | 92 | 94 | 92 | 94 | 92 | 94 | 92 | 94 |
| X | Oregon Ash | 0 | 0 | 2 | 0 | 0 | 3 | 1 | 0 | 2 | 3 | 3 | 0 | 0 | 0 | 0 | 1 | 8 | 7 |
| | California Buckeye | 3 | 0 | 4 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| X | Coast Live Oak | 3 | 0 | 0 | 2 | 14 | 10 | 13 | 0 | 6 | 7 | 13 | 2 | 0 | 0 | 0 | 3 | 46 | 24 |
| X | Valley Oak | 4 | 0 | 10 | 0 | 0 | 13 | 5 | 5 | 3 | 25 | 0 | 5 | 0 | 5 | 0 | 10 | 18 | 63 |
| X | Red Alder | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 0 | 0 | 0 | 1 | 6 | 0 | 3 | 0 | 2 | 6 | 14 |
| X | Bigleaf Maple | 1 | 0 | 2 | 0 | 0 | 3 | 3 | 0 | 1 | 0 | 3 | 5 | 0 | 2 | 0 | 3 | 9 | 13 |
| X | Eldeberry | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 0 | 2 | 3 | 4 |
| X | Coyote Brush | 0 | 0 | 0 | 0 | 8 | 15 | 9 | 18 | 0 | 15 | 9 | 15 | 0 | 12 | 0 | 17 | 26 | 92 |
| | Snowberry | 0 | 0 | 9 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 21 | 0 |
| X | California Wild Rose | 27 | 25 | 18 | 10 | 18 | 27 | 0 | 25 | 0 | 40 | 11 | 40 | 0 | 43 | 0 | 40 | 47 | 225 |
| | Pink Flowering Currant | 4 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 12 | 0 |
| | Brush Monkeyflower | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| | California Fushia | 2 | 0 | 4 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| X | Toyon | 3 | 0 | 5 | 0 | 1 | 7 | 0 | 3 | 1 | 0 | 6 | 5 | 0 | 7 | 0 | 4 | 13 | 26 |

X = Plant species used in *both* 1992 and 1994 plantings.

Appendix B: Plant data sheets