Land Rehabilitation of Construction Damaged Parcel
at Santa Fe Road and Hoover Avenue in
San Luis Obispo, California

By

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Abstract

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Patience J. West
June 2009

A plan for the rehabilitation of a triangle of land near the San Luis Obispo County Airport was prepared to mitigate damage occurring during construction of surrounding roads and from heavy traffic. The site was analyzed visually and recommendations made based on site visits. The project contains recommendations for soil conditioning, a palette of California native plants and implementation of erosion and sediment control practices. It contains a landscape design and propagation techniques for acorn seedlings used in the project.

The project outlined a plan for the construction of a California native oak woodland for Fall of 2009. A construction schedule was determined as follows: grading completed in September 2009, erosion control completed by October 15, 2009, planting begun in December of 2009, with maintenance scheduled for three years.
Approval Page

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Author: Patience J. West

Date Submitted: June, 2009

Dr. Lynn Moody

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Senior Project Advisor

Dr. Lynn Moody

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Department Chair
Acknowledgements

I would like to thank the following people:

My mother, who led by example, showing me it is never too late to get a college education,

My three daughters, who have shown me the value of persistence and determination in college and in life,

My husband, for his calm unwavering support,

My boss, John Smith, for his infectious enthusiasm, Tartaglia Engineering for their commitment to the construction and maintenance of the parcel, and Don Sather, at County General Services, for his efforts to guide this project through the San Luis Obispo County governmental maze.

A resounding thank you goes to the Earth and Soils Department, the Geography Department and the Horticulture Department for the available, inspiring, and dedicated professors and instructors.

I thank Dr. William Preston for assigning the reading of The Man Who Planted Trees, providing the inspiration for my project. Thanks to Dr. Thomas Ruehr, a beacon of intellectual light, for insisting I persevere, to David Fross for his enthusiasm for California native landscapes, and Dr. Lynne Moody for her advice and guidance.
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Introduction

The idea for this project was suggested by John Smith, owner of Tartaglia Engineering in Atascadero, California. As a result of the runway extension at San Luis Obispo County Airport, two roads, Santa Fe Road and Hoover Avenue, were realigned leaving a triangle of land between their intersection and a new merge lane as shown in Figure 1. After construction of the new alignments truck traffic was observed using the lot as a turn around and for parking. This use compacted the soil, added contaminants, raised dust and sheared off emerging plants as shown in Figure 2. Figure 3 Shows a straight drainage swale lined with granite rip-rap connected two drain pipes, directing water to a tributary of San Luis Obispo Creek. The project’s focus was to rehabilitate this parcel of land.

The project began in October of 2008 with the gathering of native oak tree acorns from several sites in San Luis Obispo County. They were stored, propagated and planted in pots in March of 2009 in preparation of the construction phase of the project scheduled for August 2009.

The County of San Luis Obispo General Services Department was approached for permission to rehabilitate the site. Don Sather, project coordinator and architect, requested a formal proposal which was submitted and approved. The proposal is shown in its entirety in Appendix C. As of this writing an Indemnification Agreement is being drafted by County Counsel. Construction can begin once the agreement has been signed by all participating parties.
Figure 1. Santa Fe Road and Hoover Ave. were realigned around the runway leaving a triangle of land between the intersection and a new merge lane.
Figure 2. Evidence of heavy truck traffic shows on the compacted bare ground.
Figure 3. A rip-rap lined drainage swale connects two storm drain pipes bisecting the parcel.
A landscape plan was designed utilizing native plants exclusively. The grading of the project to realign an existing rip-rap lined swale and to create a back bay for ground water recharge was scheduled to begin August 2009. Soil compacted by traffic must be loosened by discing with a tractor and by adding compost by October 1, 2009. Erosion control best management practices, BMPs (CASQA, 2006) were scheduled for installation in early October. Planting was scheduled to begin after the first rains, November or December of 2009. Routine site inspections and maintenance for three years was required for County approval of the project.
Methods and Materials

Oak Tree Propagation:

In October and November of 2008 acorns from California native oak trees were gathered at several locations in San Luis Obispo County. Coast live oak acorns, *Quercus agrifolia*, were picked off the trees in the hills within one mile south of the rehabilitation site. Blue oak acorns, *Quercus douglasii*, and coast live oaks were picked at Heilmann Park in Atascadero, California and valley oaks, *Quercus lobata*, and coast live oaks were picked within one half mile of the Atascadero Junior High School. As suggested by John Smith, a certified oak grower, the order of preference for picking is as follows: green on the tree, brown on the tree, green on the ground, brown on the ground. All of the acorns were bagged, dated, and tagged with species name.

The acorns were washed and floated. Acorns floating to the top were discarded as unviable. Viable acorns were dried for a day, re-bagged, tagged and placed in a refrigerator until they sprouted (Smith, 2008). The sprouted acorns were planted 1 to 2 inches deep in March of 2009 in 6 inch pots and emerged in late May. These seedlings will be planted beneath native shrubs for protection from the elements, enhancing their chances of survival.
Design:

The project design considered existing wind patterns, soils, exposure, slopes and water availability when selecting a plant palette. Because the soil is Cropley clay, 0-9% (U.S.D.A. 1997), all plants were chosen based on adaptability to multiple soil types (Fross, D. 2005). Native sedge, grasses, and reeds, *Juncus*, *Carex praegracelis*, *Carex spissa* and *Leymus condensatus*, being tolerant of wet conditions, were used in the drainage swale and back bay (Fross, 2009). The sycamore tree, *Platanus racemosa*, a riparian species, was placed in the center of the recharge basin, along with elderberry, *Sambucus mexicana*, and deer grass, *Muhlenbergia rigens*. Drought tolerant species, *Salvia leucophylla*, *Mimulus aurantiaca* and several varieties of *Ceanothus*, were used in upland positions (Fross, 2005).

The oak saplings will form the backbone of the re-creation of a California oak woodland. Over-planting of the oak seedlings allows for lower survival rates. Oaks will be planted as noted on the landscape plan (Appendix D).

Soil Preparation:

Soil preparation was scheduled as follows: two weeks prior to beginning grading, a utility locating service must be called to request identification of all utility lines within the site boundary. The soil at the project site must be disced by tractor to loosen soil compacted by large truck traffic. Soil amendment in the form of compost must be added at a rate of 1.5 tons/acre
to a depth of one foot. Large rocks will be used to stabilize the newly aligned waterway and the weir into the constructed back bay and all swale side slopes as shown on the Landscape Plan (Appendix D). Alternatively they will be placed to protect seedling oak trees from trampling.

**Planting of Native Plants:**

Specifications for planting were established as follows: each plant will be placed in a hole twice as deep and twice as wide as the original nursery container. Holes will be lined with chicken wire gopher baskets to reduce rodent damage and then backfilled with native soil. Sapling trees will be marked with t-posts and flagged for the first three years to ensure visibility during mowing and watering procedures. Plants will be planted in locations noted on the landscape plan and in the density and or pattern designated thereon.

Native grass and wildflower seed mix will be applied at the Caltrans recommended application rates by hydro-seeding after the trees and shrubs have been planted. Seeds will be applied to all cut and fill slopes at the purity, germination rates and application rates as shown in Table 1.
Table 1. Hydro-seeding grass species and application rates

<table>
<thead>
<tr>
<th>Botanical name (Common name)</th>
<th>% Purity</th>
<th>% Germination</th>
<th>Lbs/Ac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromus carinatus Cucamonga (Cucamonga Brome)</td>
<td>95</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>Vulpia microstachys (Small fescue)</td>
<td>90</td>
<td>60</td>
<td>8</td>
</tr>
<tr>
<td>Trifolium gracilentum (Pinpoint clover)</td>
<td>90</td>
<td>85</td>
<td>8</td>
</tr>
</tbody>
</table>

Erosion control materials will be mixed and applied in approximately the following proportions per acre: 2,000 lbs if hydro-seeded; 3,000 lbs if straw; 36 lbs of seed; 400 lbs of compost; water as needed for application and stabilizing emulsion as recommended by manufacturers (Caltrans, 2008. Care will be taken not to walk on hydro-seeded areas once applied.

Fencing:

Temporary fencing will be installed once soil preparation and finish grading is completed. Permanent split rail fencing will be installed after all planting is completed in the locations shown on the plan (See Landscape Plan, Appendix D) to discourage traffic access to the parcel. Accommodations will be made for passage of a mower either between boulders or by installing removable split rails.

Maintenance:

A temporary source of irrigation water will be installed on the parcel for use during the first three years. It will be
designed and constructed by Tartaglia Engineering and be equipped with a solar-powered timer. Alternatively, watering will be supplemented in the summer by water trucks volunteered and manned by engineering contractors with construction yards in the immediate vicinity.

The site will be inspected monthly for the first year to note the condition of the plants. Plants lost during the first summer will be replaced during the following winter rainy season. Photographs of the project will be taken every season to record growth progress.

The site will be mowed or weed-wacked twice a year. The first time will be after the wildflowers and grasses have set seed. The second will be in the fall just prior to the onset of winter rains. The mower will leave mown materials scattered on-site, not bagged and removed.
Materials List

Construction Materials:

550 gallon plastic water tank
Drip irrigation piping and connections
Solar irrigation timer
2 tons of compost (approx. 1.5 tons/acre)
20 t-bars
1 roll of Flagging-visibility orange
Tractor
Shovels
Weed-wacker
Post-hole digger
Auger
24-5’ fence posts
360 l.f of 8’ rails
5 large boulders

Plant Materials:

20 Salix sticks
4 sapling Quercus agrifolia
2 sapling Quercus douglasii
1 sapling Platanus racemosa
4, 1-gallon Sambucus mexicana
2, 1-gallon Ceanothus, ‘Julia Phelps’
15, 1-gallon Mimulus aurantiacus
7, 1-gallon Ceanothus, ‘Anchor Bay’
13, 1-gallon Salvia leucophilia
9, 1-gallon Mimulus aurantica
1, 1-gallon Ceanothus, ‘Ray Hartman’
35 lbs of perennial grass seed
35 lbs of wildflower seed (dominantly California poppy and annual lupine)

Erosion and Sediment Control Materials:

1 roll, 4’ x 225’ Jute erosion control blanket
600 linear feet of straw wattle (biodegradable)
Wooden stakes or biodegradable pins to anchor blankets and wattles
Hydro-seeding materials to cover one acre
Rock rip-rap as exists on site
Discussion

This project presented several challenges. Among them were coordinating with San Luis Obispo County, finding volunteer labor, acquiring donated supplies, planning phasing of the project construction and maintenance.

The most daunting hurdle was approval by the County General Services Department for gaining legal access and making alterations to the site. While Don Sather, architect and project manager in General Services, was an cooperative and enthusiastically, the wheels of government grind slowly.

Labor for the construction of the project will be provided by the staff of Tartaglia Engineering, composed of ten people, on several volunteer workdays. This cooperative effort was viewed as a way of giving back to the community, the source of the company’s continued success.

Funding for the materials, or the materials themselves, will be donated by various contractors and businesses associated with Tartaglia Engineering over the years.

Proper phasing of the project is critical. The first step is to loosen compacted soil and disc in the compost at the recommended rate. Rip-rap will be removed from the swale and stockpiled on site for later use. The swale will be widened and realigned from a straight v-channel to an eight foot wide,
erosion control fabric lined swale configured in the shape of an “S”. Rip-rap will be placed at the slopes to anchor the fabric. Willow sticks are to be inserted in the banks between the rocks. Carex spissa, Carex praegracilis, and Juncus patens will be planted in cut ‘+’s in the erosion fabric in the bottoms and sides of the swale. Water tolerant grass seed such as Carex praegracelis will be planted under the jute erosion fabric blankets. Grading must be done prior to the rainy season and all erosion control best management practices in place prior to October 15, 2009. Planting will be done in the fall after the rains start for ease of digging planting holes and to give the plants time to establish a healthy root system prior to the onset of summer heat. Permanent fencing should be erected as soon as the grading is completed to prevent further compaction by traffic. The drip irrigation system can be laid out later in the winter but should be in place and functional by April 1, 2010. Irrigation will be directed only to those plants grown in nursery containers, not the grass and wildflowers emerging from seed scattered on-site.

Other than the initial discing of the parcel, weed removal will not be the focus of the project. Should a particularly invasive weed such as star thistle or teasel be observed colonizing, then measures will be taken to remove them prior to their setting seed. The hope is dense seeding and planting of native plants will eventually out-compete the exotic species.
Weeding efforts will primarily focus on appearances, not the elimination of exotic species.
Conclusion

The goal of this project was to create and manage a sustainable California oak woodland over a three year period until it was established well enough to survive without imported water. The soil was to be restored to a pre-compacted state making it more conducive to seed germination, emergence, and root growth. Fencing will be erected to prevent any traffic damage to the plants and soil.

The wider, flatter swale would slow the drainage water, giving it time to come into contact with various grass, sedge and rush plants for capture and storage of contaminants from upstream paved surfaces, improving water quality prior to release into a local creek (Phytoremediation, 2006).

In time, the vertical elements of the trees will provide roosting spots for birds. The grasses, forbs, and shrubs will provide food, habitat, and shelter for small animals, birds, reptiles and insects. The incorporation of nitrogen-fixing plants will provide nutrients for the plants around them.

By changing the compaction of construction-damaged soils through tilling and planting, restoring soil health by encouraging soil dwelling invertebrates and microbes through the addition of organic matter, we can restore damaged, barren land to an historic state of oak woodland; sequestering carbon, encouraging bio-diversity, improving water and air quality while enhancing the beauty of our community.
References


Appendices
Appendix A
Aerial Photo of Project Site With Straight Swale Through Parcel
Appendix B
Looking North

Photograph of Project Parcel
Appendix C
March 20, 2009

Don Sather
County General Services
San Luis Obispo County,
San Luis Obispo, California

Subject: Rehabilitation and adoption of the property bordered by Santa Fe Rd., Hoover Ave., and the Santa Fe/Hoover Ave. merge lane to the northwest of San Luis Obispo County Airport.

Don Sather,

Thank you for your expressed enthusiasm for my senior project. I am excited to submit this proposal for the rehabilitation of the aforementioned property which has been scarified and compacted during the construction phase of the realignment of Santa Fe Road. Currently large trucks are using it for parking. I have enclosed a preliminary landscape plan for your use and consideration. Upon approval of this proposal I shall submit the grading and erosion control plans.

Proposal for a Land Rehabilitation Project

Scope of Project:

For my senior project I am prepared to design a grading, erosion control and landscape plan for the triangle of land lying between Santa Fe Rd., Hoover Ave. and the merge lane. I want to have all plans and design work done during Spring Quarter 2009, so it can be constructed this summer prior to the onset of rain. With the help and support of Tartaglia Engineering we will construct and then maintain the project for three years until the plants are well established. The design, construction and maintenance will be completed with no cost or obligation incurred by the County of San Luis Obispo. Earthwork volume will be kept under 50 cubic yards to avoid grading permit status.

The design phase will include:

1. Provide a detailed topographic map as the base map, using the same datum and basis of bearing as the Santa Fe Realignment project, supplied by Tartaglia Engineering.
2. Provide a landscape design to scale, incorporating native species of trees, shrubs, perennials, wildflowers and grasses to mimic oak woodland for the elevated portion of the parcel. Traffic safety will be primary when considering tree placement. The design for the swale will include sedges, rushes, and grasses known to phyto-remediate hydro-carbon contaminants from the surrounding streets and parking lots.
3. Provide a grading plan to scale, with changes in elevation, strategically placed boulders, and sections of split rail fence to discourage parking. Add visual interest by realigning the existing straight rip-rapped swale to an ‘S’ curve, mimicking a natural configuration. Widen the drainage swale to about 10’ to slow the storm water, reducing erosion and giving plants more time to take up contaminants. Add a depressed area at the outside of the swale bank for storm water overflows and to capture local drainage to recharge groundwater. The grading plan will take into consideration all existing utilities and protect them from damage. The grading plan will include an erosion control plan.

The construction phase will include:

1. Implementation of an erosion control plan.
2. Tilling the compacted soil and the addition of soil amendments as needed. Labor to be provided by Tartaglia Engineering staff or donated by a local contractor. Soil amendments to be donated.
3. Installation of barriers, i.e. fences and boulders.
4. Installation of a temporary water tank (2 year maximum) for drip irrigation.
5. Acquisition of the plant materials from donations and/or funds from Cal Poly set aside for senior projects. Propagation of the oak trees from a regional genetic pool.
6. All earthwork and planting will be done by Tartaglia-Engineering staff during a “work day”.
7. All installation of erosion control materials to be done by TE staff as well.

The maintenance phase will include:

1. Checking on erosion control during storm events. Repair as needed.
2. Importing water for drip-irrigation purposes as needed.
3. Scheduled work days, as needed, up to four per year to weed, mow, prune, replace, etc.
4. Building and monitoring of solar powered drip system, for imported water. The tank can be held in a scaled down water tower (temporary) or disguised.

Statement of Qualifications:

1. 35 years employment in Civil Engineering field, twenty of which spent in design, construction and topographic surveying.
2. B.S. in Earth Science at Cal Poly upon completion of senior project.
3. Land Rehabilitation Minor at Cal Poly upon completion of senior project.
4. Membership in Pi Alpha Xi— a professional horticulture fraternity (Cal Poly chapter)
   -Responsibilities included growing potted chrysanthemums for club fund raisers (5 crops/year).
5. Numerous horticultural science and soils classes at Cal Poly, including:
   General Botany
   Taxonomy of Vascular Plants
   California Native Plants for Landscaping
   Environmental Horticulture
   Potted Plant Production
   Enterprise Project (Propagation and sale of hanging floral baskets- 1 year duration)
   Plant Propagation
   Principals of Horticulture & Crop Science
   Organic Agriculture
   World Food Systems
   Holistic Management
   Plant Pathology
   Advanced Plant Pathology
   Plant Ecology
   Introduction to Soil Science
   Fertilizers & Plant Nutrition
   Soil Fertility
   Rocks and Minerals
   Soil Morphology
   Soil Interpretation and Management
   Soil Erosion/Water Conservation (in progress)
   Wetlands ( in progress)
6. Grading and Erosion Control Short Course Certificate from NRCS.
8. Land Desktop University

I appreciate this opportunity to put to practical use knowledge gained in school. I can beautify and rehabilitate this piece of land while simultaneously completing my degree in Earth Science and the Land Rehabilitation minor requirements. Tartaglia Engineering, in supporting my efforts, views this as their way of giving back to the community and promoting good will. Hopefully a successful project such as this will serve as an example of what other students and/or companies can accomplish in similar partnership with the County. Please let me know what I can do to expedite approval of my senior project. I hope to graduate this June and complete my project this spring and summer.

I thank you sincerely for your consideration of this matter.

Patience J. West
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Appendix D