

HUMBOLDT STATE UNIVERSITY

# Luffenholtz County Park Enhancement Plan 2011

*Eradication of Invasive English Ivy (Hedera helix) to Encourage the Growth of Native Vegetation and Increase Habitat for Wolf's Evening Primrose (Oenothera wolfii)*



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ENVS 410  
Spring 2011

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## 1 Problem Statement

The purpose of the project is to enhance the native plant habitat within Luffenholtz County Park (LCP). The park is infested with English Ivy (*Hedera helix*), a non-native, invasive plant which degrades habitat for native plants.

## 2 Background

### 2.1 Causes of Problem

Wolf's Evening Primrose (*Oenothera wolfii*) is federally listed as a species of concern. Threats to this species include habitat degradation due to invasive plants, road maintenance and hybridization with other species of the genus *Oenothera*.

In Luffenholtz County Park invasive English Ivy (*Hedera helix*) has become the dominant understory cover effectively choking out all native vegetation. Without removal of this ivy the habitat will not be able to support native species such as *O. wolfii*.

### 2.2 Obstacles

Obstacles that could hinder the project's success could be: location in an unstable geologic area, highly erosive soils, location in a sensitive coastal area, *H. helix*'s vigorous growth habits and procuring funding. The site of this project is situated on a geologically unstable bluff. Soils found in LCP are highly erosive and once ivy is removed the soil will be at risk for increased rates of erosion. The California Coastal Commission has designated this site as a sensitive coastal area. Measures will be taken to ensure that there is coastal access, reduce erosion and maintain its scenic value. *H. helix* is able to re-sprout from roots and stems that are not removed during the primary treatment, requiring multiple years to effectively remove from the affected area. Funding for labor, erosion control materials, and materials for re-vegetation will need to be acquired to ensure that the project is completed successfully.

### 2.3 Why Problem is Important

The California Invasive Plant Council has listed English Ivy (*H. helix*) as an invasive species that can have a severely negative effect on an environment if left unchecked. This species is an aggressive woody vine native to Eurasia that rapidly colonizes (typically disturbed) ecosystems. *H. helix* is a fast growing evergreen perennial that is shade tolerant and has no known natural predators. The combination of these factors provides an explanation for this plant's ability to dominate most ecosystems it is introduced to. After becoming securely established, *H. helix* will often dramatically alter the landscape and disrupt the ecological functions of the environment it infests. This is the problem which is occurring within the LCP and why it is of importance that it be addressed.

Within LCP there is an infestation of *H. helix* which is hindering the further establishment of a species that is rare and endangered throughout its habitat, Wolf's evening primrose (*O. wolfii*). *H. helix* has also taken over the majority of the understory vegetation present at the project site. The red alder (*Alnus rubra.*) trees present on site are also threatened by *H. helix* and may in the future become hazard trees after they are killed by this plant.

### 3 Site Description

#### 3.1 Regional Setting

The project site is located in the LCP in Humboldt California, two miles south and fourteen miles north of the cities Trinidad and Arcata respectively. The park runs parallel on the westerly side of Scenic Drive. The entire park is comprised of 7.6 acres of estuarine, coastal bluff and beach environments, all of which are available for recreational use by the public (zoning PR/D, O, R). The park property is owned by the State of California and has been maintained by the County of Humboldt since 1988. Specifically, the enhancement plan will focus on a small section of the parcel in the southern most portion of the park. The project site is located within the Coastal Zone and the coordinates are Latitude 41.0400, Longitude 124.1188.

#### 3.2 Historical Conditions

The site is adjacent to previously established Native American settlements in and around the area now known as the City of Trinidad. The vegetation community was likely dominated by sitka spruce (*Picea sitchensis*). Summer and fall of 1850 saw a population boom in the City of Trinidad following the discovery of gold at the Gold Bluffs mine outside of Orick, CA (*Trinidad News and Views*, 1982). An undated photo taken by A. W. Ericson, a photographer known to be active in the Trinidad area between the mid 1880's and 1920's shows a horse-drawn buggy on Scenic Avenue, near Moonstone Beach (see Appendix, Figure 2). It was likely during the 1910's that the road was enhanced in order to accommodate axled vehicle access between Trinidad and Arcata, and later to and from San Francisco and Crescent City following the construction of the Redwood Highway in 1923. In the 1921 atlas of Humboldt County prepared by the Belcher Abstract and Title Company, Scenic Avenue is shown as the only "Main Road" in the area. Much of the existing mature Sitka spruce (*Picea sitchensis*) and nearby coastal redwood (*Sequoia sempervirens*) stands were likely logged during the first half of the 20<sup>th</sup> century.

In 1988, the County of Humboldt improved Luffenholtz County Park accessibility by paving two parking lots and constructing a restroom facility, in addition to providing stairway access to Luffenholtz Beach.

#### 3.3 Affected Environment

The project site within LCP is currently plagued with *H. helix*, a declared invasive species in the state of California. The plant is outcompeting native vegetation, including the rare and endangered species: *O. wolfii*. Restorative efforts began in 1989 to promote the survival of this plant and annual surveys have been conducted to monitor the success of those early efforts. The population has fluctuated dramatically throughout the years and it is inconclusive as to whether the population is becoming stable. The County of Humboldt is in the initial planning phases of reconstructing the current restroom facilities present at LCP. In conjunction with this project they would also like to implement an enhancement plan on site to address the *H. helix* infestation while creating habitat for *O. wolfii*.

### 3.4 Required Permits

The project site is located within the coastal zone, and therefore is subject to permitting authority by the California Coastal Commission, under the California Coastal Act. The project site is subject to the Trinidad Area Plan of the Humboldt County Local Coastal Program. Any required permits will be obtained from the Humboldt County Planning Commission. County general plan and zoning designations are for Public Recreation. Note that the 7.6 acre parcel within the project area (APN 515-102-004) is owned by California State Department of Fish & Game (DFG). The 25-year operation and maintenance agreement signed by the County of Humboldt in 1988 with DFG is expected to be renewed in 2013.

### 3.5 A Review of Previous *H. helix* Eradication Techniques Used Locally and their Effectiveness

Here in Humboldt County, Jacoby Creek Land Trust (JCLT) received just over \$9,000 of grant funding from the USFWS in order to conduct *H. helix* eradication. Manual removal is generally found to be the most effective method of eradication, especially in ecologically sensitive areas or highly erodible landscapes. JCLT hired a California Conservation Corps crew to conduct manual removal of *H. helix* from 2,500 ft<sup>2</sup> over a three day period. Thick root mats were removed from topsoil and the site was replanted with native woody species to occupy the soil surface and prevent subsequent colonization of ivy within the site. Although no formal post project assessment was conducted, JCLT emphasizes the importance of educational programs and public outreach in order to successfully reach the objective of regional English ivy eradication. Vertical runners were severed in trees becoming strangled, cutting off the supply of water and nutrients to ivy in the canopy. This ivy will eventually die back and fall to the ground.

### 3.6 Agencies/Interest Groups to be Contacted

The following government agencies and interest groups will be contacted, notified and/or consulted with regard to the one or more aspects of the proposed project:

- Humboldt County Planning Commission
- Humboldt County Board of Supervisors
- California Coastal Commission
- California Department of Fish and Game
- State/Regional Water Quality Control Board
- California Environmental Protection Agency
- California Native Plant Society
- California Invasive Plant Council
- Native American Heritage Commission
- North West Information Center – Sonoma State University
- US Army Corps of Engineers
- National Marine Fisheries Service
- Civilian Conservation Corps

## 4 Project Goals and Objectives

### 4.1 Project Goals

1. Enhance ecological integrity.
2. Increase habitat for Wolf's evening primrose (*Oenothera wolffi*).
3. Minimize long term maintenance of English ivy (*Hedera helix*).
4. Maintain slope stability.
5. Increase aesthetic value.

### 4.2 Project Objectives

➤ **Increase native vegetation**

Monitoring of native vegetation will be evaluated by measuring percent cover. A fifty percent increase after the first year and a seventy five percent increase after the second year is desirable.

➤ **Increase habitat available for colonization of *O. wolffi*.**

Increase in population numbers, especially in areas where enhancement activities will be focused.

➤ **Eradication of *H. helix***

No more than ten percent cover of *H. helix* after first year; no more than two percent cover after second year.

➤ **Maintain slope stability**

Reduce soil loss during and after vegetation removal by installing erosion control and slope stability measures.

➤ **Increase aesthetic value of the area**

Aesthetics will be improved by the removal of *H. helix*, which has created a monoculture type landscape within the vicinity of the project site.

## 5 Alternatives

### 5.1 Proposed Project

The proposed project entails removing the invasive *H. helix* with the use of light mechanical and manual methods. After removing *H. helix* erosion control and slope stability measures will be taken to reduce soil loss. Native vegetation, including *O. wolfii*, will be seeded and transplanted.

### 5.2 Proposed Project with Tree Remove

The proposed would proceed with invasive vegetation removal as discussed above. The removal of invasive vegetation would reduce competition allowing native vegetation to re-colonize the project area. The proposed project alternative would remove trees currently infested with ivy allowing light to reach the soil, improving conditions for *O. wolfii* as well as reducing hazards for the public. Erosion control measures must be taken to ensure that newly exposed soils remains on site.

### 5.3 Proposed Project with Herbicide Use

With the use of herbicide there would be a higher greater success in ivy removal. With herbicide the need for revisits would be reduced. Potentially lower costs due to less human intervention. Gaining public support for the use of herbicide would be difficult. There may be unforeseen ecological repercussions.

## 6 Implementation Strategies

- Submit our plan to the environmental service project manager, Hank Seemann, who will then deal with the all the appropriate permits and legal issues involved in implementing this plan. The plan will be turned into Hank Seemann by Friday May 6, 2011.
- Gather public support and volunteers for the removal day through advertisements in local journals and community bulletin boards. These efforts will be undertaken by the students at Humboldt State University in the Natural Resources Department and/or Hank Seemann.
- During late summer and early fall, ideally in the month of September 2011, removal of *H. helix* will occur. Immediately following removal of vegetation, BMP erosion control and slope stabilization measures will be installed no later than October 1, 2011.
- Six months after initial ivy eradication, removal of resprouts will occur.
- Six months after first monitoring, it will occur again. The project manager will decide whether a revisit to pull more resprouts and/or revegetation is necessary.
- For four years following the first year of monitoring, annual post project assessments will continue to occur and there will be a report developed at the end of the monitoring period to detail the success and short comings of the overall enhancement project.



## 7 Monitoring and Evaluation

Monitoring is to take place along two permanent transects installed prior to Phase I of the project. Transect locations will be marked with rebar or metal stake and arranged to capture possible differences between the 2 dominant aspects represented within the project site: SSW and W. Transects will run perpendicular to the hillslope, from the edge of Scenic Avenue/LCP parking lot to the shoulder of the natural bench. Pre-project (baseline) data will be collected prior to Phase I of the project.

Data collection will take place in 1 m<sup>2</sup> monitoring plots spaced at 10 m intervals along the 2 permanent monitoring transects. The first sampling plots will border the designated transect starting points. Sampling locations in this monitoring design are repeatable and care should be taken to accurately measure the 10 m intervals used to determine plot locations along each of the transects. Any effectiveness monitoring is to be conducted along the 2 transects using the same methodology (starting point and spacing). The installation of permanent transects with data collection taking place at the same exact plot location over the years will allow for a much more detailed account of how the vegetation community is responding to restoration efforts, guiding project evaluation and assessment of the need for the implementation of any adaptive management strategies.

Data to be collected at each 1m<sup>2</sup> monitoring plot (pre and post-project unless otherwise stated):

1. Photo at designated photo-points and specific compass azimuth.
2. Species Present (Vegetation Survey).
3. Percent Vegetative Cover (Native vs. Non-native).
4. Survivorship of nursery plantings (post-project only).

The results of the data analysis are to be presented to the project manager in the form of a completed monitoring assessment report, which is to include the following sections: introduction, methodology (as outlined above), results (data), management/maintenance recommendations and photographs from photo-points.

### 7.1 Adaptive Management

Adaptive management will be employed from the beginning of this project until the end of the five year monitoring period where it is deemed appropriate by the project manager. Implementing this management approach is a key component to this plan's success. Working in an environment that is in constant flux there is a need for the plan to have the ability to adapt and respond to unpredicted obstacles that could be encountered. As project phases occur, pre and post monitoring will take place. Based on the results of the monitoring, the project manager can decide whether actions should be adjusted to meet the plan's goals and objectives.

Table 1. Adaptive management table that displays the corrective adaptive management strategies to use when situation arises that necessitate it (trigger points).

Project Phase	Trigger Point	Adaptive Management Strategy Recommendation
Phase I	Excessive soil loss and bank destabilization	Increase erosion control measures; lengthen the amount of time between treatments to decrease disturbance.
Phase II	<i>H. helix</i> resprouts > 10 % cover after first year	Revisit site biannually to monitor and perform treatments vs. the suggested annual scheduling.
Phase III	<i>H. helix</i> resprouts > 2 % cover after second year	Suggested revisit at the earliest convenience to remove resprouts.
Phase III	Native vegetation survivorship < 40%	Hire a professional botanist to determine explanation for increased mortality and to provide recommendations for achieving original targets for species density.
Phase III	No significant increase in <i>O. wolfii</i> population numbers	Hire a professional botanist to determine explanation for decreased survivorship of <i>O. wolfii</i> . Reseed and/or revegetate with more <i>O. wolfii</i> per recommendation of botanist.

### 8 Conclusion

During the course of this project we learned that the process required to research, compose, proofread, edit and implement a restoration management plan is very intensive. Possibly most importantly, we learned firsthand that bureaucratic policies and regulatory framework at each of the three levels of government can make the process more difficult. In addition, the large number of agencies involved during the development, approval, and implementation of this and similar projects can impact timing and the ability for work to take place as scheduled. Furthermore, the current economic state results in significant financial limitations for project implementation; these include but are not limited to (employing hand crews, hauling waste, erosion control and bank stabilization measures, permitting costs, and others)

If we were to do this project differently, with the knowledge we have now at the end of the spring 2011 semester, we would have preferred to have our final draft completed at an earlier point in the semester to allow more time for project implementation at LCP.

## 9 Literature Cited

Belcher Abstract and Title Co. 1921. "*Atlas of Humboldt County California.*" Sheet 8. Eureka, CA.

"*Trinidad News and Views: Historical Happenings.*" April 1, 1982. Second Year, No. 7.

Trinidad CA. Humboldt State University Library, The Humboldt Room

## 10 Appendices

### Appendix A

#### Brainstorming List for Solutions

##### *Possible solutions for eradication of *H. helix**

- Mechanical-use of machinery
- Mechanical-use of human power
- Chemical
- Fire
- Shade-out/blackout tarp over all *H. helix*
- Biological-grazers (goats)
- Complete removal of *A. rubrus* (Non-commercial THP)/passive restoration

##### *Increase *O. wolfii* habitat*

- Seeding
- Transplanting *O. wolfii*
- Removal of invasive species (*H. helix*)

##### *Increase native vegetation*

- Removal of *H. helix*
- Seeding of natives
- Transplanting natives

## Appendix B

### Log of Group Hours

#### Hours for Cydney Szymanowski

Date	Number of hours
25-Jan	2
4-Feb	2
15-Feb	2
22-Feb	5
23-Feb	4
24-Feb	3
27-Feb	2
3-Mar	3
6-Mar	1
8-Mar	3
17-Mar	3
20-Mar	3
21-Mar	2
24-Mar	5
25-Mar	2
29-Mar	2
1-Apr	5
3-Apr	2
4-Apr	2
5-Apr	3
12-Apr	3
17-Apr	8
18-Apr	4
19-Apr	1
28-Apr	3
30-Apr	1
1-May	1
2-May	2
3-May	1.5
<b>Total</b>	<b>80.5</b>

## Appendix C Log of Group Hours Continued

### Hours for Benjamin Pedroni

Day - Date 2011	Hours	Task(s)
	2	Organize
	2	Meeting with Hank Seeman
	2	Distribute tasks
	3	Outline, preliminary research
	2	Timeline
TR - March 3	2:00-4:00	Research online - looked over various regional restoration documents
T - March 8	2:00-4:50	Research Online - MapTech, local restoration documents,
TR - March 10	2:00-5:00	Research In person @ Humboldt Room
F - March 11	10:00-11:30	Research online - Humboldt Room
T - March 14	2:00-4:30	Researching online - soils, climate, aerial photographs, maps, topo.
TR - March 17	2:00-4:50	Researching online - permitting authority, erosion control BMP's
F - March 18	11:00-12:00	Research online - Humboldt Room
T - March 22	2:00-4:30	Researching online - local erosion control examples and costs
TR - March 24	2:00-5:00	Group Discussion - brainstorming alternatives, Write up - erosion control
T - March 29	2:00-5:00	Write-up - permitting authority, soils and geology, erosion econ.
TR - March 31	2:00-4:00	Proof Read - edits and critique of other's sections
T - April 5	2:00-5:30	Researching online & Write-up - Adaptive Management
TR - April 7	2:00-4:00	Write-up - Discussion
T - April 12	2:00:5:45	GIS - Mapping; Edit - adaptive management
TR - April 14	2:00:4:00	Write-up - monitoring; peer edits
M- April 18	10:00-12:00	Researching online: permitting, zoning, local coastal plans, general plan
T - April 19	2:00-3:00	Group Discussion - LCPEP 2011 paper revisions
TR - April 21	1:00-2:00	Edit LCPEP 2011 sections, revisions
TR - April 28	1:00-6:00	Group Discussion - Compose ENVS 410 paper, PowerPoint sections
SU - May 1	12:30-2:30	Proofread/edit papers
M - May 2	2:30-4:20	Compose PowerPoint for corresponding sections
M - May 2	9:30-10:30	Compose record of hours

T- May 3	8:00-10:00	Finalize PowerPoint, group review
T - May 3	11:00- 12:00	PowerPoint notes
T - May 3	1:00-2:00	PowerPoint, individual review
T - May 3	2:00 - 2:30	PowerPoint presentation

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**Total**     **67.95**



## Appendix D Log of Group Hours Continued

### Hours for Joseph Tona

Day - Date 2011	Hours	Task(s)
	2	Organize
	2	Meeting with Hank Seemann
	.5	Meeting with Hank
	2	Distribute tasks
	3	Outline, preliminary research
	2	Timeline
March 3	2	Research - looked over various regional restoration documents
March 7	2	Research
March 15	2.5	Research- Research wolf's evening primrose.
March 16	2	Research-
March 18	1	Research online - Humboldt Room
March 22	2	Researching online - local erosion control examples and costs
March 23	2	Success criteria
March 30	3	Writing
March 31	2	Proof Read
April 5	3	Researching online & Write-up
April 7	2	Write-up - Discussion
April 14	2	Write-up - monitoring; peer edits
April 18	2	Researching online: rare veg., replanting, project phases.
April 19	1	Group Discussion - LCPEP 2011 paper revisions
April 21	1	Edit sections, revisions
April 28	5	Group Discussion - Compose ENVS 410 paper, PowerPoint sections
May 1	2	Proofread/edit papers
May 2	1	Compose PowerPoint for corresponding sections
May 2	.5	Compose record of hours
May 3	2	Finalize PowerPoint, group review
May 3	1	PowerPoint notes
May 3	1	PowerPoint, individual review
May 3	.5	PowerPoint presentation
<b>Total</b>	<b>54</b>	

APPENDIX E  
WORK PLAN FOR LCPEP

## Luffenholtz County Park Enhancement Plan

Eradication of Invasive English Ivy (*Hedera helix*) to Encourage the Growth of  
Native Vegetation and Increase Habitat for Wolf's Evening Primrose  
(*Oenothera wolffi*)



**Prepared for:**  
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## 1 Introduction

In conjunction with replacing the current restroom facility at the Luffenholtz County Park (LCP), the County will also be undertaking enhancement activities within the general vicinity. Approximately 0.8 acres of the LCP is severely infested with English Ivy (*H. helix*). This invader has drastically altered the ecosystem within this segment of the park by outcompeting native vegetation and decreasing biological diversity. Present within the project's location are members of a species that is listed as rare and endangered throughout its habitat; Wolf's Evening Primrose (*Oenothera wolfii*). This plant also faces threats, such as habitat loss from, *H. helix*. Removing this nonnative invasive from the LCP is an action that must be taken to restore the ecological balance of this location and protect populations of an endangered species that is known to persist in the area. The following document is a work plan that is aimed at eradicating the *H. helix* within the LCP while promoting the survival of *O. wolfii* and other native vegetation primarily with manual removal and active revegetation methods.

## 2 Project background

### 2.1 Overview

The California Invasive Plant Council has listed English Ivy (*Hedera helix*) as an invasive species that can have a severely negative effect on an environment if left unchecked (Cal-IPC, 2006). Within the Luffenholtz County Park (LCP) there is an infestation of *H. helix* which is hindering the further establishment of Wolf's evening primrose (*Oenothera wolfii*), a species that is rare and endangered throughout its range, and seriously endangered in California. The North Coast Chapter of the California Native Plant Society (CNPS) (2011) has put *H. helix* on the "A-list" of Humboldt County's invasive weeds inventory, meaning that it is one of the seventeen most harmful plants in this area. This plant has overrun the majority of the native understory vegetation present on the top and south side of the bluff top in addition to the small stand of red alder trees (*Alnus rubra*) (Figure 1).

Restoration efforts began in 1989 to promote the survival of *O. wolfii* and annual surveys have been continuously conducted to monitor the success of those early efforts. The population has fluctuated dramatically throughout the years and it is inconclusive as to whether the population is becoming stable (Imper, 2009). The County of Humboldt is in the initial planning phases of replacing the restroom building and septic system present at LCP. With this project they would also like to implement an enhancement plan on site to address the *H. helix* infestation while creating habitat for *O. wolfii* (DPW, 2011).

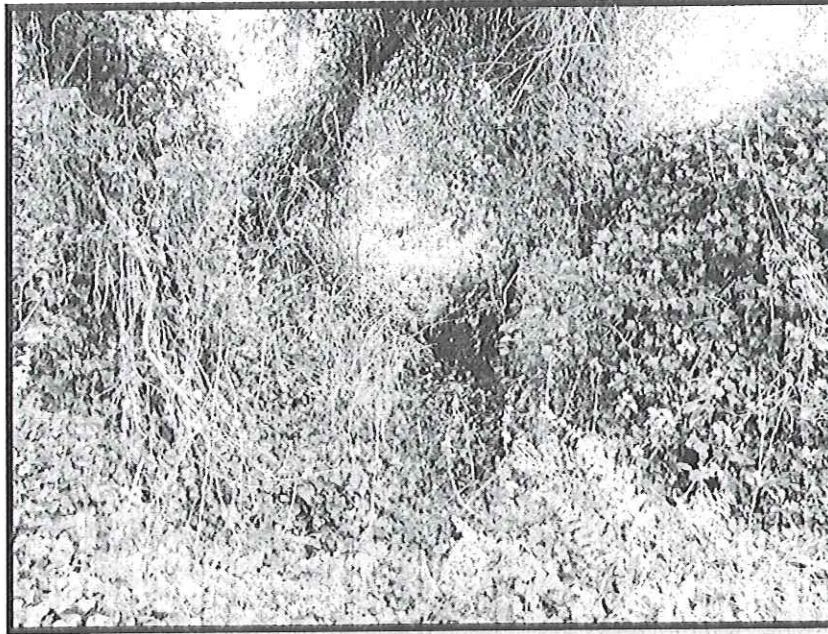


Figure 1. Facing north and looking up from topographic bench, ivy is seen here in this picture (taken 10/2010) over-taking trees and smothering understory vegetation.

## 2.2 Project Location

The project site is located in the LCP in Humboldt California, two miles south and fourteen miles north of the cities Trinidad and Arcata respectively. The park runs parallel on the westerly side of Scenic Drive (Appendix A). The entire park is comprised of 7.6 acres of estuarine, coastal bluff and beach environments, all of which are available for recreational use by the public (zoning PR/D, O, R). Luffenholtz Park is owned by the State of California and has been maintained by the County of Humboldt since 1988. Specifically, the enhancement plan will focus on a small section of the parcel in the southern most portion of the park. The project site is located within the Coastal Zone and the coordinates are Latitude 41.0400, Longitude -124.1188.

Approximately 25 feet below the park restroom, there is a natural topographic bench with steep slopes bordering the north and east side, and a rock wall that tapers down to the coast line to the west. The bench is approximated to be 80 feet in width. From the bathroom down to the bench area, is where the majority of the enhancement efforts will occur. On top of the bluffs where the parking lot is located *H. helix* is also found persisting primarily on the south facing slopes; work will be required to remove this plant from this area as well. There is approximately 1 acre of *H. helix* infestation to be eradicated (See Site Map, Appendix B).

### 2.3 Project Goals

In conjunction with replacing the restroom facilities within LCP, the infestation of the non-native *H. helix* will also be addressed. As noted in the LCP Enhancement Memorandum (2011) this species is threatening and degrading habitat for native vegetation. The rare and endangered *O. wolfii* is concurrently being negatively impacted by this invader. Overarching goals for this project are as follows:

1. Enhance ecological integrity.
2. Increase habitat for *O. wolfii*.
3. Minimize long term maintenance of *H. helix*.
4. Increase aesthetic value.
5. Maintain slope stability.

More specific objectives for the above listed goals are detailed in Section 5.1.

## 3 Project Setting

### 3.1 Historical Conditions

The site is adjacent to previously established Native American settlements in and around the area now known as the City of Trinidad. The vegetation community was likely dominated by mature Sitka spruce (*Picea sitchensis*) stands. Summer and fall of 1850 saw a population boom in the City of Trinidad following the discovery of gold at the Gold Bluffs mine outside of Orick, CA (*Trinidad News and Views*, 1982). The project area was likely subject to disturbance during grading and site preparation, as a number of road development projects have taken place over the years. It is assumed that during the 1910's the road (now Scenic Ave.) was enhanced in order to accommodate axled vehicle access between Trinidad and Arcata, and later to and from San Francisco and Crescent City following the construction of the Redwood Highway in 1923. In the 1921 atlas of Humboldt County prepared by the Belcher Abstract and Title Company, Scenic Avenue is shown as the only "Main Road" in the area. Much of the existing mature *P. sitchensis* and nearby coastal redwood (*Sequoia sempervirens*) stands were intensively harvested during the first half of the 20<sup>th</sup> century.

The LCP is managed by the County of Humboldt under a contract with the Department of Fish and Game (DFG) who owns the property. The 25-year operation and maintenance agreement signed by the County of Humboldt in 1988 with the DFG is expected to be renewed in 2013. In 1988, the County of Humboldt improved LCP accessibility by paving two parking lots, establishing stairway access to Luffenholtz Beach and constructing a restroom facility.

## 3.2 Existing Conditions

### 3.2.1 Climate

The climate for the general Westhaven area is characterized by wet, cool winters and dry, foggy summers. The average annual maximum and minimum temperatures for the region are 78.6°F (25.8°C) and 48.3°F (9°C). Mean annual temperature at the site ranges from 50-55 °F. The average annual precipitation is approximately 30 inches (760 mm) and arrives primarily as rainfall in the seven months from October through April. The growing season, or frost-free period, ranges from 275 to 330 days per year (WRCC, 2011).

### 3.2.2 Geology, Soils and Topography

The project site is located on an uplifted marine terrace along highly unstable coastal bluffs. Substantial slumping events at locations adjacent to the project site require frequent maintenance of Scenic Avenue to ensure public safety and accessibility. The geologic substrate underling LCP is sandy and known to have significant instability issues due to the physical characteristics associated with coarse geologic material. Instability and soil destabilization during Phase 1 of the proposed project is a concern, especially between the parking lot and the lower bench due to moderate/steep slopes. The natural bench is relatively stable, as *A. rubra* has successfully colonized the site and reached maturity.

Soils at the sites are derived from mixed marine sediment deposits. According to the Luffenholtz Beach Area Draft Soil Survey Data (3/4/2011), the Luffenholtz County Park Enhancement Project (LCPEP) 2011 site is located in Map Unit 299. The well-drained Candymountain soil series is the dominant component of this Map Unit, with minor components making up the remaining 30%. USDA-NRCS Taxonomic Map Unit classification at the family level describes Candymountain soils as: coarse-loamy, mixed, superactive, isomesic, typic, humudepts (Wood, 2011). Taxonomic classification at the great group level (humudepts) indicates the soil shows little horizon development, formed under an udic moisture regime, and has a significant humic/organic component. Particle size class distribution coarsens with depth. Typical A and B horizon textural classes of fine sandy loam are subtended by C material with a textural class of loamy fine sand. Between the parking lot and lower terrace, the site is characterized by moderately steep liner/liner-concave slopes (30-45%).

### 3.2.3 Invasive Specie: English Ivy (*Hedera helix*)

The pervasive *H. helix* that is plaguing the southern portion of Luffenholtz County Park is an aggressive woody vine native to Eurasia that rapidly colonizes (typically disturbed) ecosystems. It can be found at elevations ranging from sea level to 3300 feet (Hickman,



1993). *H. helix* is a fast growing evergreen perennial that is shade tolerant, somewhat drought tolerant, has no known natural predators and is rhizomatous. The combination of these factors gives the plant the ability to dominate most ecosystems it is introduced to. Additionally this plant contains glycosides which are slightly toxic compounds that, when ingested can cause diarrhea, vomiting, dermatitis and nervous condition (Searingen, 2006). After becoming securely established, *H. helix* will often dramatically alter the landscape and disrupt the ecological functions of the environment it infests (Okerman, 2000).

*H. helix* is a member of the *Araliaceae* (ginseng family) and is found in all of the lower 48 states, Hawaii and Canada. In 18 states, as well as the District of Columbia, it has been reported as a problematic invasive (Figure 2). Its period of most active growth is during the spring and summer months. The life span of this plant is very long when compared against most species (USDA, 2011). It is propagated by stolons, cuttings, bare root and seed. The plant has a maximum rooting depth of 65 inches. Seeds are dispersed by birds that consume the fruit. Bird dissemination of the seeds is one a mechanism that serves to increase the spread of this invader. (Bossard et al, 2000).

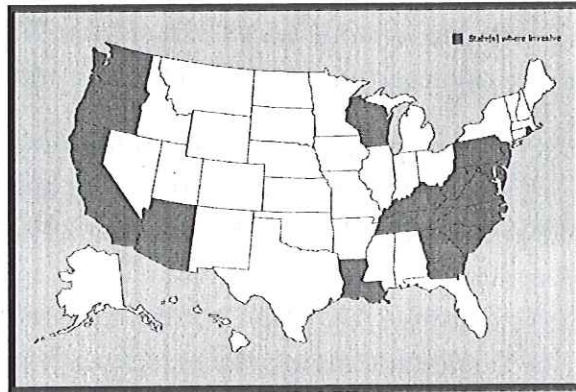


Figure 2. Map showing the states where *H. helix* has been reported as invasive: AZ , CA, DC, DE, GA, KY, LA, MD, NC, NJ, OR, PA, RI, SC, TN, VA, WA, WI, WV. (Searingen, 2006)

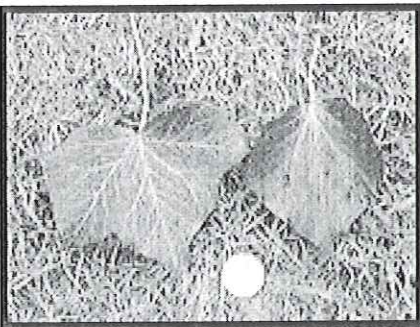


Figure 3. Juvenile and adult leaves of *H. helix*

Leaves vary between the juvenile and adult portions of the plant (Figure 3). The juvenile leaves can have 3-5 lobes that are approximately 4-10 cm width and length wise. The younger shoots, leaves and peduncles are covered with scales and are puberulent (having small hairs) whereas the older foliage is glabrous (lacking hair). The juvenile continuously produces adventitious roots at the nodes along the stem which are used to attach the

plant to the new surfaces it encounters as it creeps along the understory and up into the mid and upper stories of the environment in search of increased light. The adult flowering stems stand erect and do not creep or climb. The leaves on the mature portion of the plant are simple (no lobes), alternate and have an overall ovate to rhombic shape with a cordate leaf base. The mature leaves also tend to be a lighter shade of green than the older foliage (Cal-IPC, 2011).

The inflorescence produced by *H. helix* is a raceme (terminal cluster of flowers) that is umbellate in appearance (Figure 4). The flowers are usually 5-7 mm, radial in symmetry and bisexual. The flower will

contain 5 sepals that are fused at the base, 5 separate white to yellow green petals, 5 separate stamens that alternate with the petals, one style with a 5 lobed stigma and an inferior ovary. The fruit produced are drupes that appear berry-like (Figure 5). They are typically 6-9 mm in diameter and are dark blue to black in color. Each drupe contains 4-5 seeds (Cal-IPC, 2011).

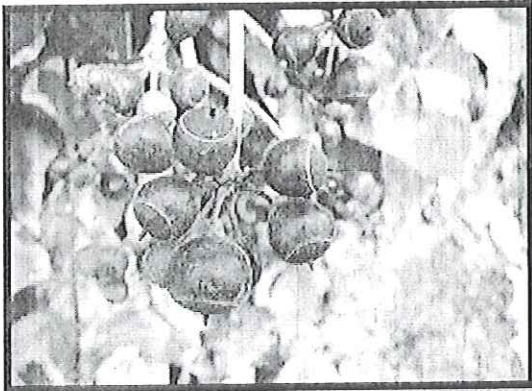


Figure 5. Fruit of *H. helix*.



Figure 4. Inflorescence of *H. helix*.

The flowers are pollinated by bees and flies while the seeds are dispersed by birds. Avian dispersers listed by Swearingen (2006) include the Cedar Waxwing (*Bombycilla cedrorum*), Northern Robin (*Turdus migratorius*), Stellar Jay (*Cyanocitta steller*), Mockingbird (*Mimus* spp.), European Starling (*Sturnus vulgaris*) and House Sparrow (*Passer domesticus*). Flowering occurs in the late spring to early fall and the fruits are produced the following spring (Hickman, 1993).

#### 3.2.4 Threatened and Native Species

*O. wolfii* (Figure 6) is a perennial herb found in Oregon and California in Coastal bluff scrub, Coastal Dunes, Coastal Prairie and lower montane coniferous forest; usually sandy and mesic. This herb is found at elevations ranging from 1 to 800 meters. *O. wolfii*'s distinguishing characteristics include: stem height of 5-15 decimeters, greens-red stems with stiff hairs, basal rosette (seen below in photo 2) with oval shaped leaves, yellow flowers about 4-5cm in diameter. *O. wolfii* is the only native species in the area different from an escaped ornamental by having smaller flowers with overlapping petals (ODA,

2011). The plant has been known to act as both a perennial and biannual. *O. wolfii* is listed as threatened in Oregon and CNPS has listed it as a 1B.1 in California; the plant is rare throughout its range and seriously endangered in California (CNPS, 2001).

The plant is also found with *Baccharis pilularis*, *Heracleum lanatum*, *Ribes sanguineum*, *Festuca arundinacea*, *Chrysanthemum*, *Lonicera involucrata*, *Rosa sp.*, *Holcus lanatus*, *Pteridium aquilinum*, *Rubus ursinus*, *Scrophularia californica*, *Anthoxanthum odoratum*, and *Ammophila arenaria* (Imper, 2009).

*O. wolfii* is found in disturbed habitats in coastal scrub, beach strand, coastal bluffs and road sides. Scenic Drive currently supports populations of *O. wolfii* about a half mile south of the project site. Successful efforts to re-establish *O. wolfii* has occurred at moonstone beach, Scenic Drive and Houda Point. Threats to this species include habitat loss, road maintenance and housing development. Successful efforts to re-establish *O. wolfii* has occurred at moonstone beach, Scenic Drive and Houda Point (Imper, 2009). Another threat to the long term sustainability of *O. wolfii* is

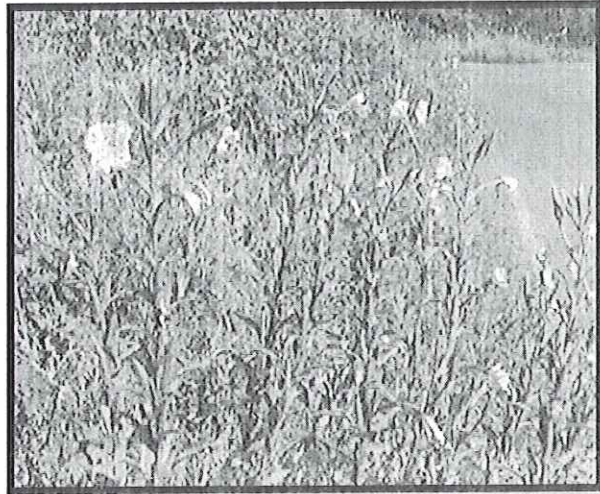


Figure 6. *O. wolfii* in bloom along Scenic Drive in Westhaven, California.

hybridization. The species *O. glazioviana* is a non-native naturalized species that readily reproduces with *O. wolfii*. Hybridization may result in the loss of pure *O. wolfii* genetic material, but may also increase genetic diversity.

Plantings of *O. wolfii* occurred from 1987-1990 and have shown wide fluctuations in population numbers. Luffenholtz showing the most promise as a suitable location (Mad River Biologists).

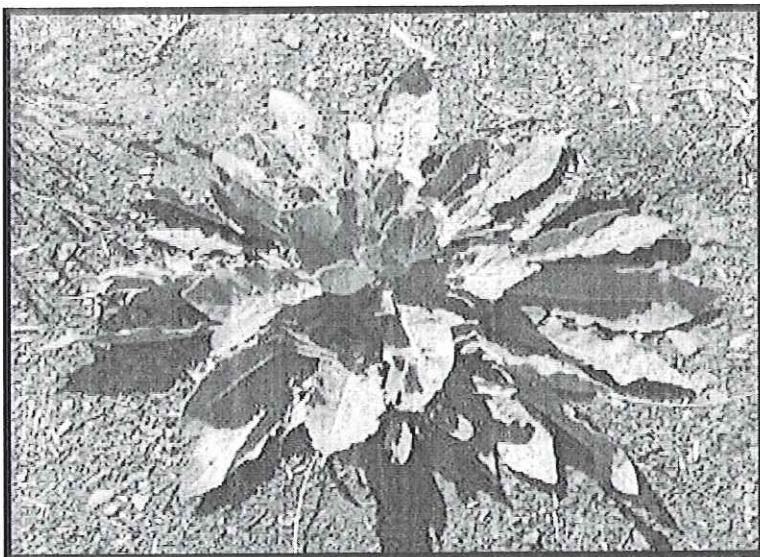


Figure 7. Basal rosette of *O. wolfii*.

## 3.2.5 Vegetation

The current vegetation within the project area includes, but is not limited to: (*In alphabetical order by scientific name*)

**Table 1. List of common vegetative members of the plant community at Luffenholtz County Park.**

Scientific Name	Common Name	Fed list	Cal list	CNPS list
<i>Achillea millefolium</i>	Yarrow	None	None	None
<i>Angelica spp</i> (possibly <i>Hendersonii</i> )	Wild celery	None	None	None
<i>Alnus rubra</i>	Red alder	None	None	None
<i>Baccharis pilularis</i>	Coyote bush	None	None	None
<i>Cortaderia selloana</i>	Pampas grass	Noxious weed	Noxious Weed	Cal IPC- High
<i>Garrya elliptica</i>	Silk Tassel	None	None	None
<i>Galium spp.</i>	N/A	None	None	None
<i>Hedera helix</i>	English Ivy	Noxious Weed	Noxious Weed	Cal IPC- High
<i>Marah oreganus</i>	Wild cucumber	None	None	No
<i>Oenothera wolfii</i>	Evening primrose	Species of Concern	None	1B.1
<i>Polystichum munitum</i>	Sword fern	None	None	None
<i>Raphanus raphanistrum</i>	Wild radish	Weed	Weed	Cal IPC- Limited
<i>Ribes sanguineum glutinosum</i>	Pink flowering current	None	None	None
<i>Rubus ursinus</i>	California black berry	None	None	None
<i>Rumex spp.</i>		?	?	?
<i>Urtica dioica</i>	Stinging nettle	None	None	None

*Other Vegetation on site is not able to be positively identified at this time.*

## 4 Restoration Plan

### 4.1 Restoration Objectives

The overarching goals of the LCPEP will meet the following specific restoration objectives if accomplished successfully.

- **Eradication of *H. helix***  
No more than ten percent cover of *H. helix* after first year; no more than two percent cover after second year.
- **Increase native vegetation**  
Monitoring of native vegetation will be evaluated by measuring percent cover. A fifty percent increase after the first year and a seventy five percent increase after the second year is desirable.
- **Increase habitat available for colonization of *O. wolfii*.**  
Increase in population numbers, especially in areas where enhancement activities will be focused.
- **Increase aesthetic value of the area**  
Aesthetics will be improved by the removal of *H. helix*, which has created a monoculture type landscape within the vicinity of the project site.

### 4.2 Ivy Eradication Plan

*H. helix* is an evergreen and as such, has the ability to photosynthesize during the winter months while a significant number of plants and trees are dormant (Oakerman, 2000). In order to minimize potential damage to native plants and wildlife, control efforts should be performed during the early fall months (approximately September to November) when there is a period of a week or more of fair weather with little to no precipitation (Swearingen and Diedrich, 2000; NIL, 2011). Though September is one of the driest months for Humboldt County, it is preferred that *H. helix* removal efforts occur during this month. This decision was made to avoid erosion control issues and to minimize the disturbance to the native vegetation.

Based on the comparatively small size of infestation (0.8 acre) and steep slopes in some sections of the site, manual/limited mechanical removal techniques are the recommended control methods. The steep section leading down to the topographic bench is roughly a 40% slope and contains soil that is moderately erodible. If heavy machinery were to be used at this site there would be a high potential for mass wasting to occur and significant disturbance to the area would result. Manual removal tends to be most widely utilized mechanical control approach used to suppress *H. helix* invasions (NIL, 2011) and has been

shown to be most successful with diligent monitoring and repeated treatments (Oakerman, 2000). The Nature Conservancy (2002) has concluded that manual options are generally the safest environmentally and also most effective, but tend to be more expensive than other control methods such as herbicide application which is roughly 10-20 times cheaper. The third and least common method of control is biological, specifically using goats to tame the invasion by consuming the foliage. This approach has had little to no success in eradicating *H. helix* and therefore does not merit further consideration.

Possible sources of labor to use for the manual removal of *H. helix* could be obtained from the California Conservation Corps (CCC) and/or volunteers. It is suggested that solicitations for volunteers be done through Humboldt State University's Natural Resource Club, the Humboldt Fish Action Council, Sunrise Rotary Club and the AmeriCorps Watershed Stewards Project. For the project a supervisor, possibly two, will be required to monitor the laborers to ensure that plans are implemented responsibly and correctly. Once the date for removal is determined notices can be placed in *the Humboldt County Journal*, *Humboldt State Now*, as well as community and campus bulletin boards.

Prior to enhancement activities a survey will be conducted by a certified botanist in all work areas to locate *O. wolfii* and other vegetation that should remain. Work areas are defined in this context as any location that will be utilized for the purposes of implementing this project such as where the removal will occur, where the resulting biomass will be stored temporarily and where vehicles and equipment will be staged. All locations found to contain members of the *O. wolfii* species will be clearly flagged with a radius of 5 feet from the individual(s). The plant itself will also be flagged for further insurance. Crews will be notified of their location and instructed to not disturb these areas. In order to minimize the adverse effects on the native flora workers should be properly informed of various species present (with detailed descriptions and pictures), and careful removal of *H. helix* should occur wherever the native vegetation is observed and salvageable (TNC, 2002). Flagging will be used to denote what is not to be taken.

The majority of the work will be performed by hand, however, there may be difficult sections that may require that use of tools such as a shovel or pick ax to remove the root mass, a forked garden tool to pry branches and vines away from the trunks of trees and loppers to remove larger stems (Morisawa, 1999). Chainsaws and/or handsaws should be utilized in circumstances where stems of *H. helix* have grown too large (>2 inches) to be removed with loppers. Chainsaws will also be employed where *H. helix* is surrounding tree trunks. All *H. helix* stems found engulfing trees should be cut approximately 2 feet above the ground and again at 4 feet thus creating a section where the plant is "girdled." All plant matter from the lower cut down shall be pulled away from the tree. Care should be taken not to damage the bark of the infested tree.

There should be a minimum of 20 shovels, 20 forked garden tools, 10 pruners, 10 loppers, 5 handsaws and 2 chainsaws available for use by the laborers. Prior to operations the equipment should be inspected and cleared of any residual or suspect plant material (Tu et al., 2001). To encourage the recruitment of a nonpaid workforce and maintain morale and

energy, a simple complimentary breakfast and lunch, is recommended for those who attend the enhancement event. It is recommended that the persons performing the removal be wearing gloves, a long sleeved shirt, pants and closed-toed footwear and should supply their own water.

As stated previously, the majority of *H. helix* eradication will be done manually. The best approach to this technique, as recommended by the No Ivy League (2011), the California Invasive Plant Council (2006) and Reichard (2000), is done by using pruners to cut and remove the vines and then pulling the plant up, trying to get as much of the root system as possible while also tearing it down from the trees. A recommended approach that has worked well for TNC (2002) is having their laborers or "ivy pullers" work from a kneeling position meticulously uprooting vines, as far as they can reach, rolling the masses into a crude ball so that it is easy to differentiate between what has and has not been pulled. This method minimizes repetitive bending over movements which can prevent back pain as well as the need to walk back and forth which will lessen the negative impacts from trampling.

Once *H. helix* is removed from the understory, the plant matter should be hauled off site to a green waste disposal facility where it will be composted. All green waste facilities in Humboldt County have been contacted to ensure that there are no limitations on accepting compostable waste from invasive species. If the material is left on site some of the plant will re-root and/or possible dead spots in the ground will be created (TNC, 2002). The County will haul the waste, using their own personnel and equipment, to dispose of it as they see fit.

#### 4.3 Erosion Control

Soil loss is one of the primary concerns with the proposed project. Due to the highly unstable nature of the geologic substrate in the area and the risk of slope destabilization associated with vegetation removal, erosion control measures implemented will be consistent with the CalTrans Construction Site BMP Manual 2003 recommendations for stabilization in active disturbed soil areas (DSAs) in California Region 1 (Humboldt, Del Norte, and coastal Mendocino Counties). *H. helix* root masses are known to be contributing to slope stabilization at the project site. Scheduling and erosion control measures are aimed at reducing impacts associated with their removal.

Scheduling of the *H. helix* eradication phase of the LCPEP 2011 is largely based on the geologic instability of the site. The project aims to maintain slope stability during vegetation removal. Although *H. helix* removal is easiest during the wet season, *Phase I* of the project will occur during September (one of the driest months in Humboldt County) due to known slope stability issues within and adjacent to the project site (e.g. Scenic Ave.). Soil stabilization and erosion control measures will be installed immediately following ivy removal/soil disturbance (no later than October 1). The prescribed timing also allows for

colonization of fall germinating grasses which will aid in the stabilization of the soil surface. DSA during *Phase I* of the project will be approximately 34,000 ft<sup>2</sup> or 0.8 acres.

Temporary soil stabilization measures to be used in the proposed project are: scheduling, hydroseeding, preservation of existing vegetation (*A. rubra*, and existing native understory species), revegetation and woven fiber erosion control mats. Temporary erosion control measures used in the proposed project are: woven fiber erosion control wattles and silt fencing. It was determined that construction of a de-silting basin is not feasible for this project site, due to limited area surface area and geologic instability.

On steeper slopes where *H. helix* root masses are directly contributing to soil stabilization, the use of erosion control wattles and woven fiber mats is especially important. The fully decomposable erosion control mats selected for use in this project have a field functionality of 4-6 years, allowing of adequate colonization of the site by native vegetation, which will provide slope stabilization over the years. If root mass removal is determined by the project manager to be contributing to excessive soil destabilization, project treatments and maintenance prescriptions will be adjusted accordingly.

#### 4.3.1 Erosion Control Wattles

Strips within the site will be cleared by hand of any loose rocks, roots, branches, or other undesirable debris in order to prepare for the installation of 9-in diameter x 15-ft length coconut fiber wattles such as BioD-Wat19 (Appendix C). Wattles will be secured along topographic contours and fastened into position using 12-in wooden Eco-Stakes (Appendix D). In addition to being placed on the toe slope position of the project site, wattles will be evenly spaced at 8-ft intervals on steep and/or disturbed slopes. Coconut fiber wattles were selected for use in this project because they effectively reduce sediment losses, economically efficient, easy to maintain, allow for root penetration, and are fully biodegradable.

#### 4.3.2 Woven Fiber Mats/Erosion Control Blankets

After installation of wattles, bare/exposed soil surfaces within the project area will be covered with 6.56-ft wide x 165-ft long (100 m<sup>2</sup>) woven bristle coconut fiber erosion control blankets such as BioD-Mat70 by GeoViero or Landlok C2 by ProPex (Appendix D). These strong durable mats were selected for use during the revegetation phase of this project because they are permeable biodegradable mats that serve to stabilize topsoil on steep/unstable terrain, hold moisture and promote enhanced seedling recruitment and vegetation establishment. The mats have a 4-6 years time period of field functionality. A biodegradable metal staple alternative such as NAG Bio-Stakes (Appendix D) will be used



to fasten coir mats to the soil surface. Following coir mat instillation, a hay/native seed mixture will be applied to discourage colonization by weedy species. The native seed mixture will include *O. wolfii* seeds purchased from a local nursery (See Section 4.4 for specifics pertaining to the revegetation plan).

#### 4.3.3 Silt Fencing

Silt fences are to be installed along the toe slope within the project area and along the western perimeter of the project area (just before the edge of the bench). Silt fencing will be removed following the first rainy season. Silt fence inspection will occur 4 times during the rainy season, and any required maintenance will be carried out in a timely fashion. Fencing will be anchored using 18" biodegradable stakes.

#### 4.4 Primrose and Native Vegetation Enhancement Plan

Immediately following the removal of *H. helix* in *Phase I*, the project site will be professionally hydroseeded with native grasses. Table 1 presents the list of the species of grasses that will be used for seeding. Costs of hydroseeding range from \$0.50 (Jet Stream) to \$0.81 per square yard (The Corporate Grounds, USA). This price varies based on hydroseeding mixture and the amount of seed used.

**Table 2. List of the species preferred for hydroseeding during *Phase I*.**

Species	Common Name
<i>Alopecurus geniculatus</i>	WATER FOXTAIL
<i>Calamagrostis nutkaensis</i>	PACIFIC REEDGRASS
<i>Deschampsia cespitosa</i>	TUFTED HAIRGRASS
<i>Elymus glaucus</i>	BLUE WILDRYE
<i>Festuca californica</i>	CALIFORNIA FESCUE
<i>Festuca idahoensis</i>	IDAHO FESCUE
<i>Festuca rubra (Molate)</i>	RED FESCUE
<i>Hordeum brachyantherum</i>	MEADOW BARLEY

During Phase II replanting will begin after it has been determined that *H. helix* would not threaten any new plantings. Table 2 displays the recommended native plants to use for revegetation. There are many nurseries in Humboldt County that supply native vegetation for restoration plantings. They can be purchased as either bare root stock or transplants in one gallon pots. Two potential nurseries that can supply materials needed for are Samara Restoration and Freshwater Farms (See Additional References Section 8 for contact information). Tools needed for planting activities should include knee pads, helmets and gardening spades/shovels.

Also during Phase II the site will be assessed by a local botanist to determine whether the habitat is suitable for *O. wolfii* and if the investment in planting the site with new specimens should be taken.

**Table 3. List of preferred native species to plant as either seedlings or transplants during Phase II**

Species	Common name	Location on Site	Cost
<i>Baccharis pilularis</i>	Coyote bush	Evenly on back slope and bench.	\$2.25-\$4.50 ea
<i>Ceanothus gloriosus var. exaltatus</i>	Blue blossom	On shoulder slope and bench.	\$2.75-\$5.00
<i>Garrya elliptica</i>	Silk tassel	Evenly on back slope and bench.	\$2.50-\$4.75 ea
<i>Oenothera wolfii</i>	Wolf's evening primrose	On shoulder slope on south side of parking lot.	N/A
<i>Ribes sanguineum glutinosum</i>	Red flowering currant	Evenly on back slope and bench.	\$2.00-\$4.00 ea

Assuming that the site is suitable, the plantings will occur on the southern side of the parking lot and on the south side of the road at the entrance to the park (Imper). Seeding of the site shall also occur on the slope and shelf.

Possible sources of labor to use for the manual removal of *H. helix* could be obtained from volunteers. Volunteers to perform monitoring can possibly be acquired from the Fall 2011 and Spring 2012 classes taught by Richard Hansis called ENVS 410 at Humboldt State University (HSU). Volunteers can also be found through HSU's Natural Resource Club, the Humboldt Fish Action Council, Sunrise Rotary Club and the AmeriCorps Watershed Stewards Project. For the project a supervisor, possibly two, will be required to monitor the laborers to ensure that plans are implemented responsibly and correctly. Once the date for removal is determined notices can be placed in the *Humboldt County Journal*, *Humboldt State Now*, as well as community and campus bulletin boards.

#### 4.5 Project Phases

The project will consist of three phases; Phase I will include the initial *H. helix* removal and two re-visits the first year; Phase II which will occur during the first year post project and consist of biannual monitoring and revegetation with shrubs and *O. wolfii*; Phase III of the plan entails post project monitoring that will occur annually four years post Phase II completion.

Phase I of the project will involve the eradication of *H. helix* during the first week of September. After removal all vegetative matter will be properly disposed of. Immediately after the elimination of *H. helix*, erosion control measures will be implemented. Coir matting will be used to cover the slopes which will then be hydro-seeded with a Humboldt county native seed mixture of grasses and forbes. Seeds of *O. wolfii* will be spread evenly throughout the site.

Phase II of the project will begin the following spring, or six months after eradication efforts have taken place. An initial assessment of re-sprouting *H. helix* will occur. All new growth will be immediately pulled and properly disposed of. This will occur again the following winter. After these evaluations a planting of *O. wolfii* will be considered, the main concern being that new plantings will face intense competition from resprouts of *H. helix*.

Phase III of the project will take place after the first winter post removal. Monitoring will occur on an annual basis for the four years following enhancement efforts. The site will be assessed for *H. helix* re-growth, erosion issues, habitat quality for *O. wolfii* and health of *O. wolfii* plantings with each monitoring visit. Based on the yearly observations and recommendations from the technician performing the monitoring, the project manager will decide if further eradication efforts are needed to control *H. helix* and if it is appropriate to reseed/plant the site with more *O. wolfii* or other vegetation.

#### 4.6 Maintenance

Biannual inspection of the site will take place during the year following Phase I of the enhancement project. Following a field survey, any maintenance deemed necessary by the project manager and biologist will be conducted in a timely manner. Special attention will be given *H. helix* re-sprouts following site preparation. Expected maintenance activities for the project area include, but are not limited to: weeding, re-seeding, erosion control maintenance/improvements (e.g. reinstalling coir wattles, securing silt fencing), and others. Section 6.3 addresses circumstances in which the implementation of adaptive management strategies may be required. Maintenance activities will be conducted by community volunteers and Humboldt State Department of Natural Resource Sciences students, and are to be overseen by the project supervisor or a knowledgeable individual.

## 5 Required Permits

The project site lies within the coastal zone, and hence is subject to permitting authority by the California Coastal Commission, under the California Coastal Act (1972). The project site is subject to the Trinidad Area Plan of the Humboldt County Local Coastal Program. Vegetation removal permits will be required for this plan in pursuant to section 39.13.2.1; chapter 3 of the Humboldt County Code Zoning Regulations (2009). These permits will be obtained from the Humboldt County Planning Commission prior to implementation.

## 6 Monitoring and Evaluation

### 6.1 Success Criteria

- At the end of the anticipated monitoring period, approximately five years, the project site will:
  - a) Have reduced *H. helix* cover to at a maximum of 2% of its previous cover.
  - b) Successfully establish native vegetation.
  - c) Have at least 75% of planted species present as five or more individuals
  - d) Successful establishment of at least five *O. wolfii*'s on southern edge of parking area.
- Following the five year monitoring period a determination will be made as to whether the project goals have been met, and/or whether additional planting efforts/maintenance are required. If additional efforts are required monitoring will continue until project goals are met.
- Monitoring will continue for a minimum of five years and until all success criteria are met.

### 6.2 Monitoring

Monitoring is to take place along two permanent transects installed prior to *Phase II* of the project. Transect locations will be marked with rebar or metal stake (see Site Map) and arranged to capture possible differences between the 2 dominant aspects represented within the project site: SSW and W. Transects will run perpendicular to the hillslope, from the edge of Scenic Avenue/LCP parking lot to the shoulder of the natural bench. Pre-project (baseline) data will be collected prior to *Phase I* of the project.

**NOTE:** The map that is referenced in the second sentence is in the works.

Data collection will take place in 1 m<sup>2</sup> monitoring plots spaced at 10 m intervals along the 2 permanent monitoring transects. The first sampling plots will border the designated transect starting points. Sampling locations in this monitoring design are repeatable and care should be taken to accurately measure the 10 m intervals used to determine plot locations along each of the transects. Any effectiveness monitoring is to be conducted along the 2 transects using the same methodology (starting point and spacing). The

installation of permanent transects with data collection taking place at the same exact plot location over the years will allow for a much more detailed account of how the vegetation community is responding to restoration efforts, guiding project evaluation and assessment of the need for the implementation of any adaptive management strategies.

Data to be collected at each 1m<sup>2</sup> monitoring plot (pre and post-project unless otherwise stated):

1. Photo at designated photo-points and specific compass azimuth.
2. Species Present (Vegetation Survey).
3. Percent Vegetative Cover (Native vs. Non-native).
4. Survivorship of nursery plantings (post-project only).

The results of the data analysis are to be presented to the project manager in the form of a completed monitoring assessment report, which is to include the following sections: introduction, methodology (as outlined above), results (data), management/maintenance recommendations and photographs from photo-points.

### 6.3 Adaptive Management

Adaptive management will be employed from the beginning of this project until the end of the five year monitoring period where it is deemed appropriate by the project manager. Implementing this management approach is a key component to this plan's success. Working in an environment that is in constant flux there is a need for the plan to have the ability to adapt and respond to unpredicted obstacles that could be encountered. As project phases occur, pre and post monitoring will take place. Based on the results of the monitoring, the project manager can decide whether actions should be adjusted to meet the plan's goals and objectives.

Table 4. Adaptive management table that displays the corrective adaptive management strategies to use when situation arises that necessitate it, i.e trigger points.

Project Phase	Trigger Point	Adaptive Management Strategy Recommendation
Phase I	Excessive soil loss and bank destabilization	Increase erosion control measures; lengthen the amount of time between treatments to decrease disturbance.
Phase II	<i>H. helix</i> resprouts > 10 % cover after first year	Revisit site biannually to monitor and perform treatments vs. the suggested annual scheduling.
Phase III	<i>H. helix</i> resprouts > 2 % cover after second year	Suggested revisit at the earliest convenience to remove resprouts.
Phase III	Native vegetation survivorship < 40%	Hire a professional botanist to determine explanation for increased mortality and to provide recommendations for achieving original targets for species density.
Phase III	No significant increase in <i>O. wolfii</i> population numbers	Hire a professional botanist to determine explanation for decreased survivorship of <i>O. wolfii</i> . Reseed and/or revegetate with more <i>O. wolfii</i> per recommendation of botanist.

## 7 Estimated Project Costs

The fees associated with the manual removal of *H. helix* with no volunteers and solely the CCC's the amount for one day of work would cost roughly \$1,200 per day. If there was a "free day" available from the state parks, and an all volunteer work force was used, the cost would be zero for labor. It has been estimated that 25 hours of labor (5 hours for 5 days) with a minimum crew of 10 individuals and 1 supervisor (minimum) is necessary to remove all plant matter from the project site. Hauling of the material to an appropriate green waste facility will necessitate additional work hours. Specific estimates cannot be made at this time due to unfamiliarity of what size load the County's vehicles will be able to haul for one dump trip.

To attract volunteers there should be an advertisement in *The North Coast Journal* as well as *Humboldt Now*. To place a black and white ad in *The Journal* for one week the cost is \$66. There is no cost to place an advertisement in *Humboldt State Now* for students, or student run organizations. It is likely that organizations such as Los Bagels and Brio bakery will sponsor the restoration events and provide food for the workers. If these organizations are unwilling to do so then solicitation will be required to find a company that will. If no businesses are able to assist in this endeavor then one should plan on spending approximately 3 dollars per person, per meal per day. With a minimum of 10 volunteers this will amount to roughly \$300-\$400 for the approximated 5 day effort.

The installation of erosion control materials and slope stabilization measures will be conducted by a local environmental contracting firm. Costs associated with this phase of the project will be: labor, erosion control/slope stabilization materials, hydroseeding, and maintenance. A number of environmental contractors should be contacted prior to Phase 1 or the project, in order to determine which is most economic feasible. A list of engendering contractors located near the project area can be found in the Additional Resource Section.

For revegetation, approximately 175-200 individual plants will need to be purchased. Depending on the size of the plant purchased, the total costs will range from \$350 - \$2,500. Hydroseeding costs vary from \$0.50 to \$0.81 per square yard. The costs given for hydroseeding was obtained from companies from out of the area, therefore local costs may vary. Cost will also vary depending on what is needed post *H. helix* removal, as total area disturbed that will require seeding is uncertain until project is underway.

## 8 Additional References

Table 5. List of local organizations and companies to be contact for various aspects of this plan.

Organization	Contact Information
AmeriCorps Watershed Stewards Project	(707) 839-5130
ATLAS Engineering	(707) 442-2032
Fortuna CCC	(707) 822-2822
Freshwater Farms	(707) 822-8035
Humboldt Fish Action Council	(707) 725-9453
Humboldt State University's Natural Resource Club	(707) 826-3776
Mad River Compost	(707) 822-3834.
North coast Environmental Construction	(707) 478-0565
Pacific Watershed Associates	(707) 725-8601
Samara Restoration	(707) 442-1400
Sunrise Rotary Club	(707) 834-4379
The Humboldt County Journal	(707) 444-8261



## 9 Literature Cited

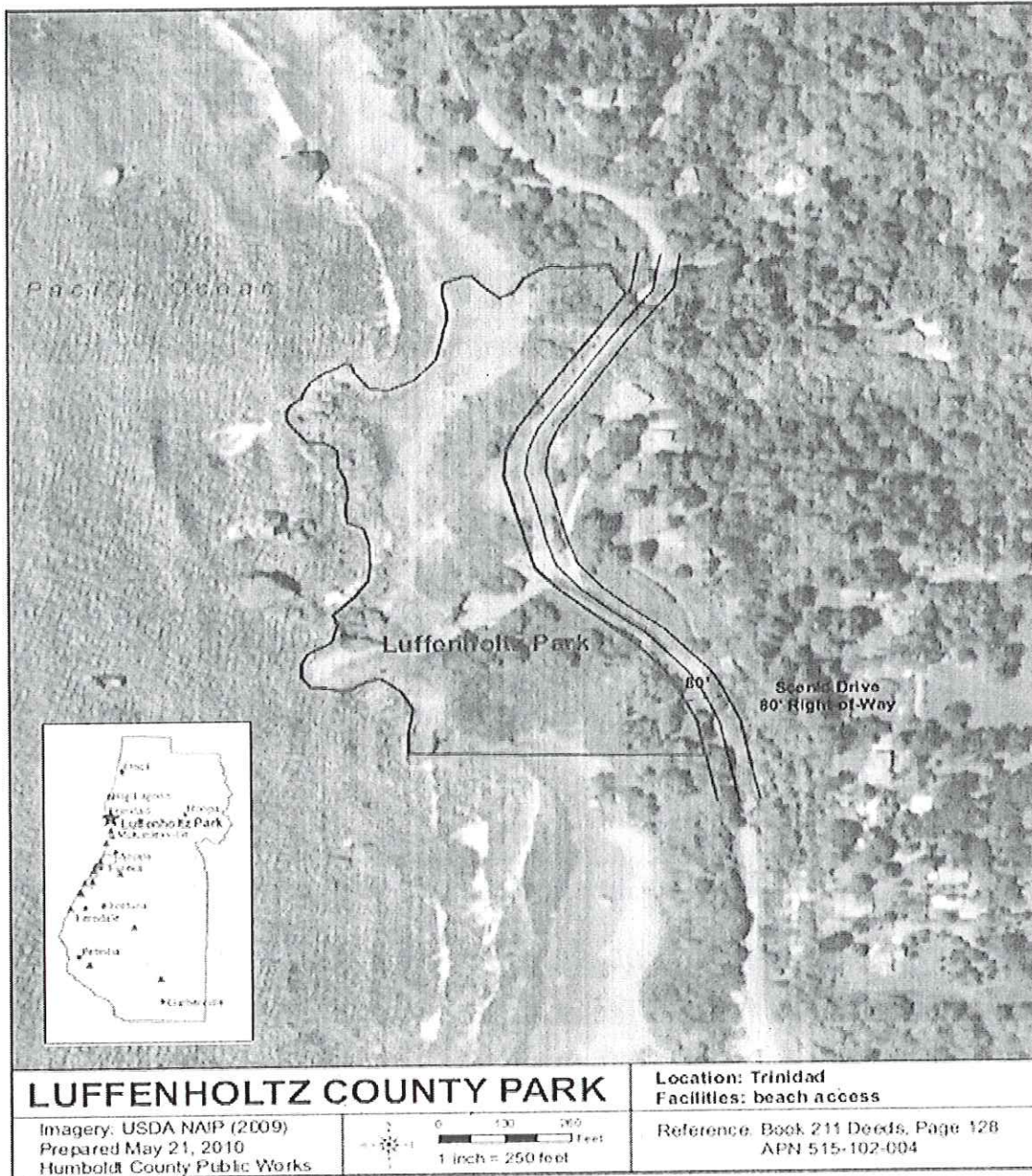
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# 10 Appendices

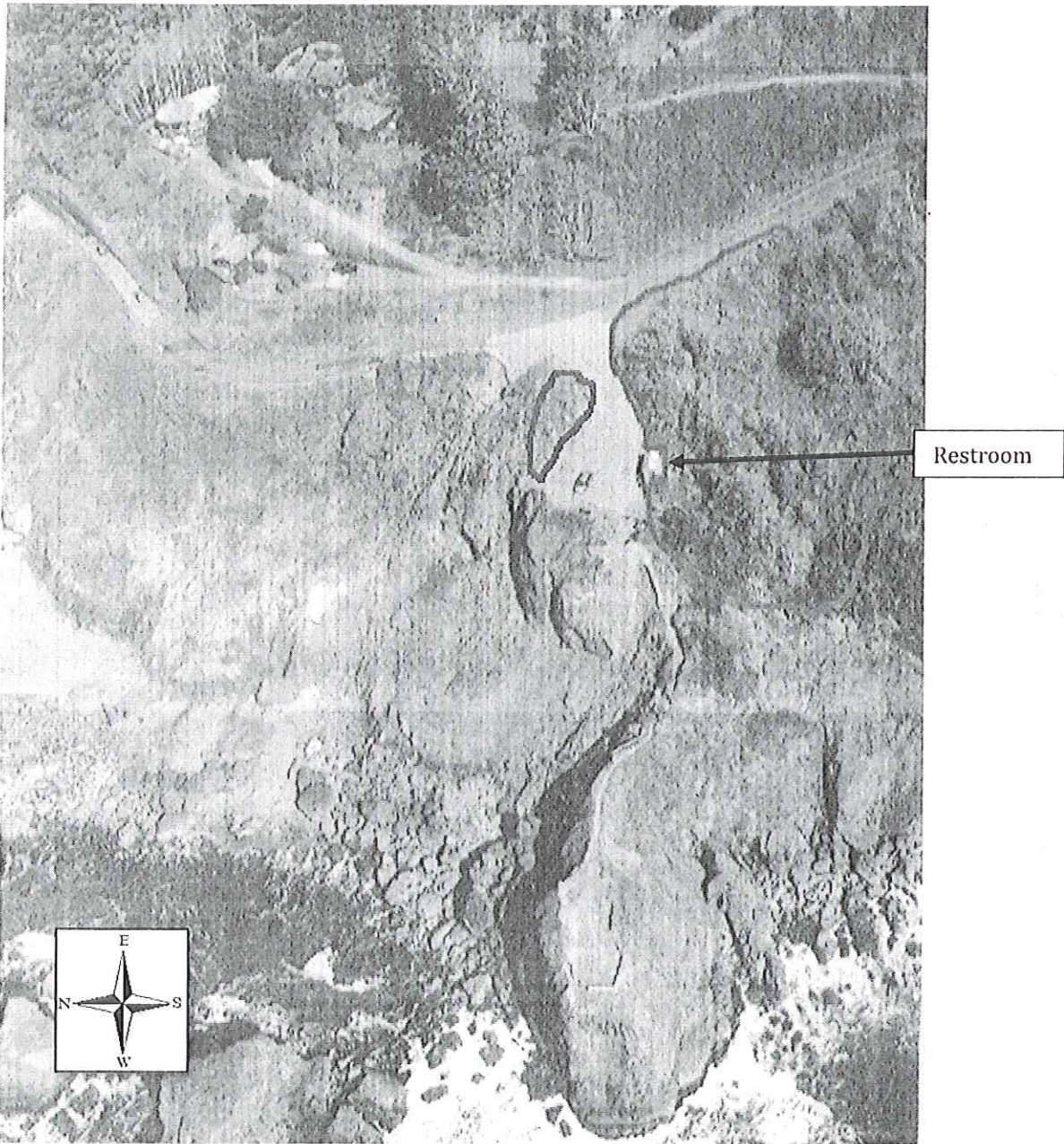
## Appendix A

Map showing the boundary of the Luffenholtz County Park.



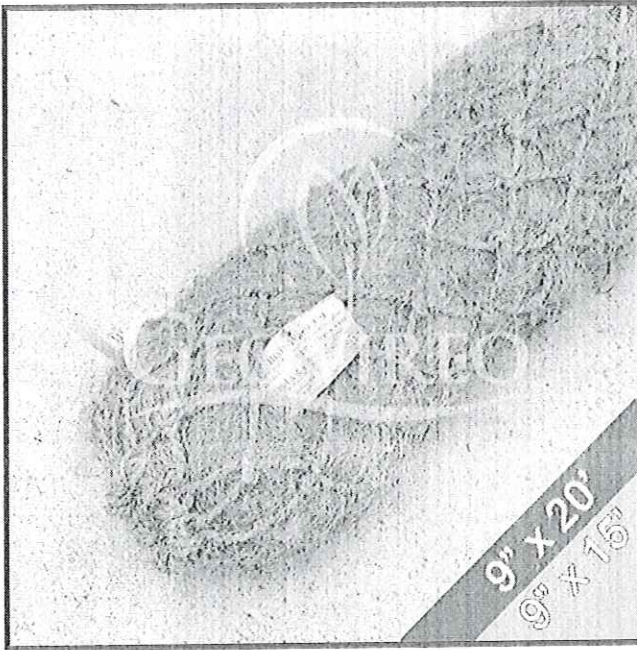
### Appendix B

Aerial photo of Luffenholtz County Park with the boundary of the enhancement project outlined in red.

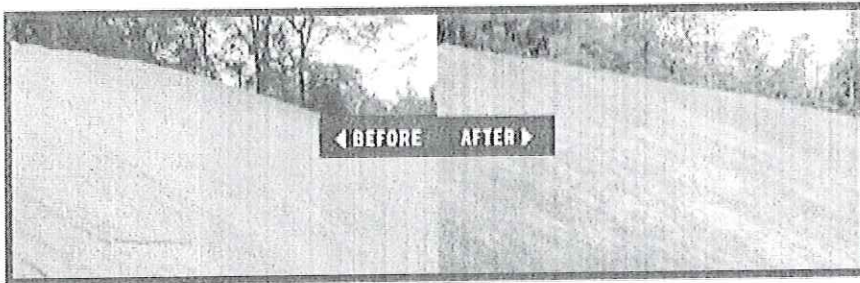


### Appendix C

Erosion control material



A woven coir fiber erosion control wattle for sale on [geovireo.com](http://geovireo.com)



A before and after picture showing the effectiveness of the Landlok C2 woven coconut fiber erosion control mat ([geotextile.com](http://geotextile.com)).

# Appendix D

Erosion control material continued.



**Appendix E**Erosion control – *Technical Specifications*

Item	Dimensions	Notes
Fiber Wattles	9-in x 15-ft	100% biodegradable fiber,
Erosion Control Mats	6.56 ft x 165 ft (100m <sup>2</sup> )	100% biodegradable fiber, ~60 lbs/roll
NAG Eco-Stakes	12-in	Metal stake alternative
NAG Bio-Stakes	6-in	Metal staple alternative
Nursery Mix	Hydro-seed mix	Local contractor