DEPARTMENT OF THE ARMY
BASE REALIGNMENT AND CLOSURE
ATLANTA FIELD OFFICE
BRAC ENVIRONMENTAL COORDINATOR
HAMILTON ARMY AIRFIELD
1 BURMA ROAD
NOVATO, CALIFORNIA 94949

April 11, 2006

DAIM-BO-A-HA

SUBJECT: Submittal of the *2005 Annual Vegetation Survey Results for Coastal Salt Marsh Remediation Sites at Hamilton Army Airfield; Novato, California.*

Mr. Wayne White
Field Supervisor
Attention: Jim Browning
U.S. Fish and Wildlife Service
2800 Cottage Way, Suite W-2605
Sacramento, CA 95821-6340

Dear Mr. White:

The Army is pleased to provide the *2005 Annual Vegetation Survey Results for Coastal Salt Marsh Remediation Sites at Hamilton Army Airfield; Novato, California.*

This document is submitted in compliance with the *Biological Opinion for the Endangered Species Formal Consultation on the Hamilton Army Airfield Base Realignment and Closure Property, North Antenna Field, and Hamilton Wetland Restoration Project, Marin County, California* (BO) dated August 22, 2003, amended September 10, 2003. Terms and Conditions Item 2c required that a re-vegetation monitoring and adaptive management plan be prepared for any work sites in the Coastal Salt Marsh. The Army prepared a re-vegetation monitoring plan (USACE November 2004) which required yearly surveys for 5 years or until re-vegetation goals are achieved whichever is less.

The enclosed document provides results of the first post-remediation re-vegetation survey.

If you have any questions, please contact me at (415) 883-6386.

Sincerely,

Edward Keller, P.E.
BRAC Environmental Coordinator
Hamilton Army Airfield

Copies Furnished:

N. Feger (RWQCB)
D. Welsh (USFWS)
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BRAC Files

Distribution List
2005 Annual Vegetation Survey Results
Coastal Salt Marsh Remediation Sites
Hamilton Army Airfield, Novato, CA
April 2006

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Distribution List
2005 Annual Vegetation Survey Results
Coastal Salt Marsh Remediation Sites
Hamilton Army Airfield, Novato, CA
April 2006

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2005 ANNUAL VEGETATION SURVEY RESULTS

FOR COASTAL SALT MARSH REMEDIATION SITES

HAMILTON ARMY AIRFIELD
NOVATO, CALIFORNIA

March 28, 2006

Prepared by:
SACRAMENTO USACE
Environmental Resources Branch
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Prepared for:
US Army BRAC Office
Hamilton Army Airfield

U. S. Army Corps
of Engineers
Sacramento District

March 28, 2006

2005 ANNUAL VEGETATION SURVEY RESULTS FOR COASTAL SALT MARSH REMEDIATION SITES AT HAMILTON ARMY AIRFIELD, NOVATO, CALIFORNIA

Introduction

The Biological Opinion (BO) from the U.S. Fish and Wildlife Service (Ref. # 1-1-03-F-0207), dated August 22, 2003 and amended on September 10, 2003, which addressed the Hamilton Army Airfield Base Realignment and Closure Property, the North Antenna Field, and the Hamilton Wetland Restoration Project, Marin County, California, required the Army to prepare a monitoring and adaptive management plan for the project. In accordance with the BO, the Army prepared the "Revegetation Monitoring and Adaptive Management Plan, Coastal Salt Marsh Remediation Sites, Hamilton Army Airfield, Novato, California" (plan), dated February 2005. The plan describes pre-construction and post-construction vegetation surveys for areas within the coastal salt marsh that were disturbed during remedial activities. Results of pre-construction surveys were presented in the report, "Pre-construction Vegetation Survey Results for Coastal Salt Marsh Remediation Sites at Hamilton Army Airfield," dated April 29, 2005. The post-construction surveys are planned annually for five years or until the revegetation goal is achieved.

The goal for revegetation is that the average total percent cover of pickleweed at each disturbed site will be no less than 80% of the preexisting conditions. This report documents the results of the first annual vegetation survey after the completion of the remediation activities in the coastal salt marsh.

Methods for Annual Vegetation Surveys

Post-construction vegetation surveys were conducted in December 2005, approximately one year after the remediation activities in the coastal salt marsh. The methods used for the surveys followed the methods described in the plan, except as noted in the discussions for each site. The vegetation at most of the remediation sites was characterized by the use of a quadrat sampling method. The following 10 areas were revisited and surveyed, where appropriate, during the 2005 annual post-construction surveys:

- Boat dock
- Area 14
- Historic outfall drainage ditch (HODD)
- East levee construction debris disposal area (ELCDDA)
- Burn pit
- Outfall drainage ditch (ODD)
- Former sewage treatment plant (FSTP) outfall
- High marsh plain
- High marsh grid
- Access road to the FSTP outfall

Results

Table 1 is a summary of results of the pre-construction survey done in 2004 for each of the remediation sites. Total cover is the percentage of the soil surface that is covered by vegetation. Pickleweed relative cover is the percentage of the total cover that is comprised of pickleweed. A column labeled "Target for Average Pickleweed Total Cover" has been added to indicate the revegetation goal for each of the remediation sites. Results from the 2005 post-construction survey are provided in Tables 2 through 9. Table 2 is a summary of results of the 2005 survey for each of the remediation sites. These summary tables are included to allow comparisons of the results from pre-construction vegetation survey and the 2005 annual vegetation survey. The remaining tables provide a complete documentation of all quadrats included in the survey. Tables 3 through 9 include the results of the survey for each of the remediation sites that were surveyed by quadrats.

The following are the most common plants found during surveys in the area of coastal salt marsh at HAAF that was affected by contaminant removal activities:

Scientific Name	Common Name
Salicornia virginica	pickleweed
Frankenia salina	alkali heath
Atriplex patula	fat hen, salt bush
Grindelia humilis	gum-plant
Cotula coronopifolia	brass buttons
Distichlis spicata	salt grass
Scirpus robustus or *maritimus*	alkali bulrush/salt marsh bulrush
Lepidium latifolium	broadleaf peppergrass
Spartina foliosa	cordgrass

The following paragraphs address variations in the survey methods at each of the remedial sites and include a discussion of site conditions that will assist in interpreting the results from the survey:

Boat dock. The area that was previously pickleweed was excavated and not backfilled, per the remediation plan. These areas and most of the areas under the dock, which were also excavated, are now open water/mudflat. A small area of higher ground adjacent to the boat docks and previously vegetated with annual grasses was also part of the remediation site. The top two to three feet of soil was excavated and removed, leaving this site at approximately the elevation where pickleweed is found. At this time, recovery of vegetation is only just beginning. This site had some pickleweed, salt grass, and fat hen, but also included a lot of bare ground.

Area 14. The vegetation is fairly sparse but varied within this very small site. The species represented include pickleweed, fat hen, broadleaf peppergrass, and gum-plant. The site was small enough to estimate total vegetative cover for the entire area

rather than to survey representative quadrats. There was approximately 5 to 10 percent vegetative cover.

HODD. The expectation for vegetation recovery on this site was limited to the cleared buffer areas. Excavated areas were not backfilled and became part of the larger ditch. It is not clear how much of the buffer area remains in salt marsh since some sloughing of buffer area into the ditch has occurred. Along the bay side of the ditch, surveyors could not observe any noticeable transition from a buffer area along the edge of the ditch to surrounding undisturbed marsh. There was a very high total cover and a high percentage of pickleweed right up to the ditch. This would indicate that either recovery of the buffer area was complete or that the buffer area sloughed into the ditch.

Prior to construction, vegetation on the levee side of the ditch was dominated by broadleaf peppergrass, annual grasses, and other upland plants. Surveyors observed that vegetation on the landside of the ditch post-construction was similar to pre-construction. On the landside of the ditch, vegetation cover is 60 to 70 percent.

ELCDDA. This site began at a higher elevation than was optimal for pickleweed. It was excavated and backfilled to an elevation below the pre-existing elevation but still slightly above the elevation in the surrounding salt marsh. Much of the area currently appears to be dry with little vegetative cover. The area along the south and southwestern edge is lower and has more vegetation, including pickleweed. Salt grass and alkali heath are also found at this site. There is some remnant vegetation within the site, which includes pickleweed, at similar elevations as surrounding bare areas. Therefore, the lack of vegetation may not be due to elevation but, rather, due to the distance from a source of propagules.

Five quadrats were surveyed within this remediation area. Four of the sites were taken along the outer edge at random locations and one site was randomly selected toward the middle of the remediation site. Only two of the 5 quadrats had any vegetative cover. The average vegetation cover for all quadrats was 11 percent (Table 3). The vegetation at this site includes alkali heath, gum-plant, pickleweed, and several willow species (*Salix* sp.). For the two quadrats with vegetation, pickleweed comprised 25 percent of the total cover.

Burn pit. On the south side of the access road, pickleweed is returning, but other species have not yet become established. On the north side of the pipeline, the site is wetter. Pickleweed is the predominant plant, but other species are present also, including bulrush, salt grass, fat hen, broadleaf peppergrass, gum plant, brass buttons, and alkali heath.

Vegetation was surveyed within only two quadrats at this site, one from the north and one from the south side of the road and pipeline. Quadrat number 1 in Table 4 was taken south of the pipeline. Quadrat number 2 was taken on the north side of the pipeline. The remediation site vegetation cover is approximately 43 percent. For the two quadrats surveyed, pickleweed comprised 95 percent of the vegetation cover.

ODD. The expectation for vegetation recovery on this site was limited to the cleared buffer areas. Excavated areas were not backfilled and became part of the larger ditch. Some sloughing of buffer area into the ditch has occurred. Along the bay side of the ditch, surveyors could not observe any noticeable transition from a buffer area along the edge of the ditch to surrounding undisturbed marsh. There was a very high total cover and a high percentage of pickleweed right up to the ditch. This would indicate that either recovery of the buffer area was complete or that the buffer area sloughed into the ditch.

Prior to construction, vegetation on the levee side of the ditch was dominated by broadleaf peppergrass, annual grasses, and other upland plants. The bank on the levee side of the drainage ditch was cut back to make a more gentle slope. This affected the buffer area on this bank. Vegetation on this bank is recovering. Cordgrass is found in some places along the water's edge, with pickleweed and bulrush on higher parts of the cut. At the north end of the ditch, on the levee-side bank, bulrush is dominant.

FSTP outfall. Vegetation recovery on this site would be limited to the cleared buffer areas. Excavated areas were not backfilled. The areas along the edge of the water are well vegetated. If there are some areas that were part of the cleared buffer area, it is not evident.

High-marsh plain. The original grading left the high-marsh plain a little too high. This area received additional grading to lower it, but this grading had to wait until the area dried out. Apparently, the additional excavation was completed after pickleweed propagules were dispersed since the high-marsh plain remains mostly bare after the first season of recovery. Seven quadrats spaced throughout this remedial site were surveyed along two transects running parallel to the levee. Based on these quadrats, this site has a total vegetation cover of approximately 4 percent (Table 5). The vegetation cover is 100 percent pickleweed.

High-marsh grid. The original grading of the northern portion of the high marsh grid left the area at the proper elevation. However, the southern part of this site was left higher than desired. This southern portion received additional grading to lower it, but this grading had to wait until the area dried out. While waiting for this area to dry out, the northern portion of the site was covered by a high tide. The critical nature of the timing of the excavation is evident by the much better recovery in the northern portion of this site. Twenty quadrats spaced throughout this remedial site were surveyed along three transects running parallel to the levee. Based on these quadrats, this site has a total vegetation cover of approximately 15 percent (Table 6). The vegetation cover is 86 percent pickleweed.

Access road to the FSTP outfall. Four transects were established perpendicular to the access road along its length. Each transect included a quadrat in the access road location, one quadrat five feet north, and another five feet south of the access road

location. It is clearly evident where the crane mat that was laid over the access road to the outfall was located.

The access road had an average vegetative cover of 43 percent, with 100 percent being pickleweed (Table 7). One quadrat had 100 percent standing water with no vegetation. The quadrats surveyed north of the access road had an average vegetative cover of 90 percent, with 100 percent being pickleweed (Table 8). The quadrats surveyed south of the access road had an average vegetative cover of 93 percent, with 100 percent pickleweed (Table 9).

Conclusions

The relative cover of pickleweed in the first year of post-construction surveys was 100 percent for most of the quadrats surveyed throughout the remedial action areas. However, pickleweed total cover is far short of the 80% revegetation goal for many sites, averaging between 3 and 43 percent for all but two of the sites at which it is reported. The height of pickleweed ranged from 2 to 20 inches, with only two quadrats higher than 14 inches. Based on a comparison of data in Tables 1 and 2, pickleweed height in recovering areas is well below the pre-existing conditions in most cases.

There are three categories of sites that require vegetation surveys to establish whether vegetation recovery is adequate: 1) sites excavated but not backfilled, 2) sites excavated and backfilled, and 3) access roads.

The first of these categories includes the boat dock, the HODD, the ODD, and the FSTP outfall. The only vegetation recovery of concern at these sites is for the buffer areas that were cleared of vegetation. Based on our observations, clearing pickleweed vegetation at or near ground level, while leaving the root system intact, had no observable effect on the vegetation after one season of recovery. We know that some of the buffer areas sloughed into adjacent excavated areas, but we were not able to determine how much sloughing occurred. There is no reason for continuing surveys at these sites.

The second of the three categories includes Area 14, the ELCDDA, burn pit, high-marsh plain, and the high-marsh grid. Based on a comparison of pickleweed total cover in Tables 1 and 2, all of these sites fall below the 80% revegetation goal. Therefore, these sites will need to be surveyed again next year.

The third category of sites includes the access road to the FSTP outfall. The vegetation within the road alignment was disturbed by the placement of the crane mat, by the truck traffic on the crane mat, and potentially by the deformation of the soils due to the weight of the trucks lowering the elevation of the marsh along the road alignment. Based on the survey results, vegetation within the road alignment has not recovered sufficiently to meet the revegetation goal. This site should be surveyed again next year.

Vegetation in the areas adjacent to the access road was also surveyed to determine whether deformation of the marsh due to the weight of the truck traffic would affect

marsh adjacent to the road. The concern was that deformation that lowered the elevation of the marsh within the road alignment might also cause a rise in the elevation of adjacent areas, which could adversely affect the marsh vegetation. Based on the survey results and direct observation, vegetation adjacent to the access road has not been adversely affected. The reason for there being no effect could be either that deformation of the soils did not occur, that deformation was only a transient phenomenon, or that the deformation was not of a magnitude to adversely affect the vegetation. The result is that the areas adjacent to the access road do not need to be surveyed next year.

At this time, there is no reason to believe that any management adjustments are necessary to facilitate vegetation recovery. It is reasonable to believe that due to the signs of some recovery, more recovery can be expected over the next year.

Table 1. Pre-Construction Vegetation Survey Summary for Remedial Sites in the Coastal Salt Marsh at Hamilton Army Airfield

Remediation Site	Average Pickleweed Relative Cover (%)	Average Total Cover (%)	Average Pickleweed Total Cover (%)	Target for Average Pickleweed Total Cover (%)	Average Pickleweed Height (inches)
Area 14	67	58	39	31	18
HODD	100	75	75	60*	17
ELCDDA - Pickleweed Sites	100	77	77	62**	15
Burn Pit	100	60	60	48	16
ODD	100	78	78	62*	15
High Marsh Plain	100	78	78	62	22
High Marsh Grid	100	81	81	64	24
FSTP Outfall Access Road	100	65	65	52	16

*These targets apply only to the buffer area on the bay side of the ditches.
**This target applies to 60% of the site; 40% of the site was other than pickleweed.

Table 2. 2005 Annual Vegetation Survey Summary for Remedial Sites in the Coastal Salt Marsh at Hamilton Army Airfield

Remediation Site	Average Pickleweed Relative Cover (%)	Average Total Cover (%)	Average Pickleweed Total Cover (%)	Average Pickleweed Height (inches)
Area 14	25	10	3	8
ELCDDA	25	11	3	4
Burn Pit	95	43	41	7
High Marsh Plain	100	4	4	6
High Marsh Grid	86	15	13	8
FSTP Outfall Access Road (in Road)	100	43	43	8
FSTP Outfall Access Road (North of Road)	100	90	90	12
FSTP Outfall Access Road (South of Road)	100	93	93	16

Table 3. 2005 Annual Vegetation Survey Data for the ELCDDA Site at Hamilton Army Airfield

Quadrat Number	Pickleweed Relative Cover (%)	Total Cover (%)	Pickleweed Height (inches)
1	-*	0	-
2	-	0	-
3	50	10	4
4	0	45	-
5	-	0	-
AVG	25	11	4

*Since it is based on a ratio, relative cover is meaningless for a quadrat that has no vegetative cover.

Table 4. 2005 Annual Vegetation Survey Data for Burn Pit Site at Hamilton Army Airfield

Quadrat Number	Pickleweed Relative Cover (%)	Total Cover (%)	Pickleweed Height (inches)
1	90	45	10
2	100	40	4
AVG	95	43	7

Table 5. 2005 Annual Vegetation Survey Data for High Marsh Plain Site at Hamilton Army Airfield

Quadrat Number	Pickleweed Relative Cover (%)	Total Cover (%)	Pickleweed Height (inches)
1	-	0	-
2	100	5	4
3	100	15	11
4	100	5	3
5	-	0	-
6	-	0	-
7	-	0	-
AVG	100	4	6

Table 6. 2005 Annual Vegetation Survey Data for High Marsh Grid Site at Hamilton Army Airfield

Quadrat Number	Pickleweed Relative Cover (%)	Total Cover (%)	Pickleweed Height (inches)
1	100	5	8
2	50	10	10
3	50	10	8
4	100	15	8
5	100	15	10
6	100	15	10
7	75	20	8
8	60	25	5
9	100	40	10
10	100	5	2
11	100	5	4
12	-	0	-
13	100	5	4
14	100	15	8
15	100	15	8
16	50	10	8
17	80	45	10
18	100	5	11
19	60	25	11
20	100	15	6
AVG	86	15	8

Table 7. 2005 Annual Vegetation Survey Data for Access Road to FSTP Outfall at Hamilton Army Airfield

Quadrat Number	Pickleweed Relative Cover (%)	Total Cover (%)	Pickleweed Height (inches)
1	100	65	11
2	-	0	-
3	100	40	8
4	100	65	12
AVG	100	43	10

Table 8. 2005 Annual Vegetation Survey Data for Quadrats North of Access Road to FSTP Outfall at Hamilton Army Airfield

Quadrat Number	Pickleweed Relative Cover (%)	Total Cover (%)	Pickleweed Height (inches)
1	100	85	12
2	100	95	12
3	100	85	12
4	100	95	14
AVG	100	90	12

Table 9. 2005 Annual Vegetation Survey Data for Quadrats South of Access Road to FSTP Outfall at Hamilton Army Airfield

Quadrat Number	Pickleweed Relative Cover (%)	Total Cover (%)	Pickleweed Height (inches)
1	100	95	18
2	100	95	13
3	100	85	14
4	100	95	20
AVG	100	93	16