



Dune Restoration, sand fence and sign installation

USFWS F12PS00641

Wetland Sciences is providing a summary of efforts and services associated with the completion of the dune restoration project in Alabama as associated with the United States Fish and Wildlife (USFWS) solicitation F12PS00641. The following products and services were provided by Wetland Sciences (WSI) and the White Sands Planting Company (WSPC).

The dune restoration Project could be considered to consist of three components as follows:

1. Sand Fencing

WSI and WSPC were contracted to provide and install 31,100 linear feet of sand fencing following material, and installation guidelines established by the Alabama Department of Environmental Regulation (ADEM).

2. Educational Signage

WSI and WSPC provided input for design and provided installation for 230 educational signs. These consisted of 190 11"x14" Keep of The Dune signs of which 150 were installed along pedestrian dune crossings and other high traffic areas throughout the Project area. Additionally 40 11"x 14" keep of the dune signs were provided for future use or augmentation within high pedestrian traffic areas consisting of as described in Part 5 of the USFWS bid solicitation document. Forty larger 18" x 25" signs were provided which detail the Project and the importance of the dunes. Thirty were installed at public access points and an additional ten were provided for future use.

3. Vegetation Installation

WSI and WSPC were contracted to provide and install a minimum of 677,666 dune plants with appropriate soil amendments. The planting units were to meet project specifications prior to install as described in Part 5 of the USFWS bid solicitation document. Additionally WSI provided a guarantee of 80% survivorship for 180 days post installation. If the survivorship falls beneath this standard, plants must be replaced until success criteria is achieved.

The three dune restoration components are described further below.

Sand Fencing

Sand fence installation began in October 2012 and was completed during March 2013. Sand fence install location was verified in the field by USFWS representatives ,City representatives and coastal engineers to assure proper function and position in the landscape.

A total of 31,100 linear feet was established per contract specifications. There was some maintenance required and vandalism was identified in rare occurrences but overall the sand fencing was installed in proper locations and is accomplishing its intended function. In some cases the sand buildup was overwhelming the newly installed vegetation growth, but this was expected.



Typical sand fence configuration. Photo taken West of Our Rd. within BLM property. Faye Winters and Robby McKee inspecting



View East along an extensive sand fence run in Gulf shores Alabama

Project Signage

Project Information and dune protection signage was developed with the designated contract on-site representative (COR). Design proofs were provided to COR and approved prior to sign finalization and production. Signs were installed and delivered during August 2013 and consisted of the following:

SIGN Installation and Distribution

Agency	Installed 25"x18" Signs	Delivered** 25"x18" Signs	Installed 11"x14" Signs	Delivered** 11"x14" Signs	Total Delivered + Installed
City of Gulf Shores	8	0	60	10	8 – 25"x18" 70 – 11"x14"
City of Orange Beach	3	0	22	10	3 – 25"x18" 32 – 11"x14"
Alabama Gulf State Park	4	0	20	5	4 – 25"x18" 25 – 11"x14"
Bureau of Land Management	4	0	14	5	4 – 25"x18" 19 – 11"x14"
Bon Secour National Wildlife Refuge (USFWS)	2	9	34	10	2 – 25"x18" 54 – 11"x14"

**Delivered = signs, hardware and posts delivered to designated agency.



Example of the USFWS 11x14 signs that are installed within the Bon Secour National Wildlife portion of the Project

Alabama Dune Early Restoration Project



This project restores 55 acres of primary dune habitat along the Alabama Gulf coast. Restoration includes native vegetation plantings and sand fences. This project provides early restoration of natural resources injured by the Deepwater Horizon Oil Spill and clean-up activities.

Why is it Important?

Dune ecosystems provide and protect habitat for wildlife, such as shorebirds, nesting sea turtles, and the Alabama beach mouse. They also help protect homes and public infrastructure by absorbing the effects of storm surges.

How Can You Help?

Help restore Alabama's dunes by using only designated beach access points and by keeping out of the dunes. Reducing foot traffic allows fragile dune plants to grow and establish roots that help stabilize the dune.

Please do your part in protecting Alabama's coast and stay out of the dunes.

Thank You!



Representative of the 25" x 18" signs which were installed incrementally at public access points along the length of the entire project

Planting

The Project was considered to include five distinct municipal, State or Federal land holdings, including the Bureau of Land Management (BLM), Bon Secour National Wildlife Reserve (BSNWR), Gulf State Park (GSP), and properties associated with the City of Gulf Shores (GGS), and Orange Beach (COB). The planting areas included a continuous reach of the beaches fronting the Gulf of Mexico. Generally the dune enhancement efforts were directed southward but contiguous of the existing primary dune feature.

Vegetation was chosen that was common within the adjacent habitats and generally selected for the particular plants ability to tolerate the harsh conditions of the primary dune habits. Sea oats (*Uniola paniculata*) were the dominant plant installed. Panic grass (*Panicum amarum*), blue stem (*Schizachyrium*

scoparium), seashore paspalum (*Paspalum virgatum*) and marsh hay (*Spartina patens*) were installed as diversity plants. All the plants were inspected for minimum size requirements, root ball, and stem condition. Overall, the planting units met the minimum pre-planting conditions specified within the contract.

Planting began within the BLM properties and BSNWR during February and finished during May of 2013. These two segments of the Project accounted for 202,666 plants. Both of these parcels are maintained by federal trustees, but have slightly differing management styles and are located in different topographical positions within the barrier island landscape.

The BSNWR planting areas included some Mobile Bay frontage as well as the tip of the Island and adjacent beaches, BSNWR did not allow the installation of sand fencing. The BSNWR properties maintain some low elevation areas that are susceptible to high tide influences and this type of event did cause some mortality (wash outs) within the planted areas. The high tide events that washed out the newly planted specimens were considered an act of god and therefore no replanting was necessary. The BLM installation including sand fencing and considered beach access points from adjacent residences. The BLM representative attempted to concentrate access into four areas by installing orange string on the dune fencing, but this effort was futile and pedestrian access through the planting areas continued. BLM suffered some tidal loss and pedestrian disruption to the transplants, but the losses were considered minimal.

Gulf State Park (GSP) received 70,000 plants and installation and planting locations were coordinated with State representatives. The planting in GSP was in conjunction utilizing discarded Christmas trees that are commonly utilized in GSP for dune enhancement activities.

The GSP planting segment is within a relatively limited access environment and care was afforded to allow no planting corridors consistent with the dune walkovers /beach access points. This reduced and

mostly eliminated pedestrian impacts within the newly planted areas. Planting within this portion of the Project was finished by September 2013. The City's of Orange Beach (COB) and Gulf Shores (CGS) were included in the dune restoration project to receive 20,000 planting units, and 385,000 plants respectively. These sections of the dune restoration project were generally within high traffic multi-family residential and public beach access areas. Planting within these segments was completed during December 2013. Anticipated challenges were pedestrian access and subsequent trampling of the newly planted vegetation. This was almost inevitable in these high traffic areas. Impacts to plant survivorship were noted and considered a non warranty loss.

Survivorship reviews were accomplished within a 90 day and 180 day post planting as referenced in the contract, these plant condition review efforts consisted of the COR and planting contractor meeting during the time frames specified from the date of the initiation of planting. When the random planted area was chosen a subplot (10x10) was established and surviving plants were counted, condition noted, and deficiencies discussed.



Red flags represent the survivorship evaluation plots



Representative Condition of planting site 180 days after installation. These plants should continue to produce vegetatively and produce seed heads at the end of next growing season (2015).

Following is a total list of days planted and total numbers of plants installed. The City of Gulf Shores and the City of Orange Beach received additional plants that were not charged for.

Table 1. From the COR (USFWS) depicting the jurisdictions planted and the numbers and totals associated with the Contract.

	BSNWR	BLM	CGS	COB	GSP
	9716	9405	10000	8900	3999
	9317	6602	12000	4970	6999
	10648	4934	5432	600	500
	11997	1333	6100	600	4500
	15996	10530	5212	1440	4998
	11997	2442	11440	2200	1000
	13858	754	8481	3000	2327
	7998		11190	8500	4673
	9331		7540		13004
	3999		10000		15000
	10664		14888		13000
	9331		4000		
	6665		11000		
	9331		5137		
	7998		5499		
	6665		9100		
	7231		9700		
	1657		4000		
	2267		9100		
			15400		
			9100		
			6000		
			15000		
			9400		
			11400		
			13800		
			15000		
			12000		
			10600		
			13100		
			14000		
			10200		
			13600		
			4100		
			3000		
			14000		
			13000		
			12400		
Actual Plant Total	166,666	36,000	385,129	30,210	70,000
Contract Plant Total	166,666	36,000	385,000	20,000	70,000

Conclusions

Overall the dune restoration project is achieving the desired results and will continue to provide the service of coastal dune development and habitat enhancement. The Project is and will continue to enhance the overall physical configuration of the primary dune systems, and also enhance primary dune habitat conditions.

Plant loss was primarily associated with coastal scour within low areas on the west side of the Project (BSNWR and BLM) where the planting areas were inundated by storm tides, and pedestrian trampling and disruption at access points. Both of these types of disruptions were anticipated and almost an expected component of dune restoration within dynamic and populated environments.

Plant mortality overall achieved project guidelines as evidenced during the 90 day, 180 day, and final plant condition review which occurred during June of 2014. Currently, dune vegetation is reproducing naturally and becoming firmly established.

The only consideration associated with future primary dune restoration projects would be not to focus on the species diversity component during the initial phases of dune development. Many of the diversity species transplants are not adapted to the rapidly changing conditions that the newly transplants are subject to. Mortality rates are high for the forbs and vine species. The grasses such as the panicum, bluestem, and sea oats would be the preferred species for these pioneer dune development projects. The diversity plants such as the railroad vine, portulaca, sea rockets and sea shore elder will be recruited from local/adjacent sources when the dune becomes better established. It's our experience that the nursery grown stock for railroad vine and seashore elder are typically too frail to adapt to the changing topography and harsh conditions encountered along the open beach.

EXHIBIT 1
Survivorship Evaluations



March 19, 2014 Survivorship review

GSP 2

WP(5) 0437807, 3341047

photo 100-0022

plants - 100

oats, patches

March 19th 2014

City of Gulf Shores

CGS 1

WP(5) 423575 3344714

sea oats, panic, Paspalum

photo 100-0023

25 plants

CGS 2

WP(6) 424459 3344854

photo 100-0024

34 plants

sea oat

C6S 3

WP (7) 425245, 3344993
photo 100-0025
Sea oat, Patens
37 plants

C6S 4

WP (8) 426163 3345178
photo 100-0026
52 plants
sea oats, panic, patens

C6S 5

WP (9) 0426814 3345324
photo 100-0027
45 plants
Sea oats, panic, ~~patens~~ Blue stem

C6S 6

WP (10) 0427576 3345458
photo 100-0028
36 plants
Sea oat, Blue stem, Patens

C6S (7)

WP (11) 0428440 3345604
photo 100-0029
29 plants
Sea oats

C6S (8)

WP (12) 429344 3345726
photo 100-0030
41 plants
Sea oats, Patens

C6S (9)

WP (13) 429987 3345815
photo 100-0031
28 plants
Sea oats and Patens
Spring break area plants trampled

C6S (10)

WP (14) 0430800 3345917
photo 100-0032
25 plants
Sea oats
fences down, Spring Break area

CBS(11)

WP(15) 431606 3346095

photo 100-0033

39 plants

Sea oats patens Blue stem

CBS(12)

WP(16) 0432295 3346106

photo 100-0034

36 plants

Sea oats

Fence down

CBS(13)

WP(17) 433205 3346289

photo 100-0035

35 plants

Sea oats

CBS(14)

WP(18) 0434028 3346446

photo 100-0036

26 plants

Sea oats, patens

Fence down

CBS(15)

WP(19) 435158 3346371

photo 100-0037

33 plants

Sea oats panic

GSP(1)

WP

photo 100-0038

62 plants

Sea oats

GSP(2)

WP

Photo 100-0039

62 plants

Sea oats

CDB(1)

WP(26) 438922 3347277

photo 100-0040

47 plants

Sea oats

COB (2)
WP (21) 448555 339658
photo 100-0041
30 plants
Sea oats Blue stem

COB (3)
WP (22) 449333 3349807
photo 100-0042
53 plants
Sea oats patens
* near this 12-16 fence
(plants w/in burn out)



August 21, 2014 Review

8/21/13 62 plants /
square for 100%
survival

BLM DUR RD

photo #2

30.23177, -87.93637

pt. 806 on GPS

55 plants in 10x10

~80%

mostly Sea oat

panic (few)

paspalum (few)

Lotsa Sand 1

photo 3

30.23172, -87.93637

pt. 807 on GPS

~61 plants

mostly Sea oat

panic

paspalum

patens

BLM Our Rd

BLM Lotsa Sand } 180 day
BSNWR Perdue } E-W check

Ft Morgan BSNWR W-E

BLM Veterans

Wolf St. Park } 90 day

12/19/13

FM BSNWR Mile 1 - 1

photo - 100-0005

plants - 0 (washed out)

did ~~survey~~ survey just

north - photo 100-0006

plants - [cold top fill only] - 42

oat, bivestem (still washout death)

FM BSNWR Mile 1 - 2

photo 100-007

plants (washed out)

New survey pt (WP3)

040198a 33441e1

photo 100-009

still washout death

38-40 plants

panic, patch, oat

Pat in the Rain

BSNWR Mile 2-2

Photo 100-0017

Plants - 57

Oats, panic, patens

BSNWR Mile 3-1

Photo 100-0016

Plants - 50

Oats, panic

BSNWR Mile 3-2

Photo 100-0015

Plants - 49

Oats, panic, patens

GSP 1

W-E

WP (4) 0436241, 3346634

Photo 100-0021

Plants 53

Oats

GSP 2

WP (5) 0437867, 3341047

Photo 100-0022

Plants - 60

Oats, patens

FM BSNWR Mile 2-1
photo 100-0010
plants - 42
still some without
oats, panic, patens

BLM Our Rd
photo 100-0011
plants - 45
oats, patens + panic

dunes growing because of
sand fence - ~~oats~~ covering plants
faster than they can grow

BLM Lotsa 1
photo 100-0012
plants - 60
oats, panic, patens

BLM Lotsa 2
photo 100-0013
plants - 62
oats, panic, patens, paspalum

BLM Veterans
photo 100-0014
plants - 50
oats

BSNWR PU Mile 1-1
photo 100-0020
plants - 52
oats, panic

BSNWR PU Mile 1-2
photo 100-0019
plants - 52
oats, panic

BSNWR PU Mile 2-1
photo 100-0018
plants - 42
oats, panic, patens

Slight
erosion
in
the
area

Patens in the area



December 19, 2014 Survivorship Representative Photographs

BLM Our Rd

BLM Lotsa Sand } 180 day
BSNWR Perdue } E-W check

Ft Morgan BSNWR W-E

BLM Veterans

wulf St. Park } 90 day

12/19/13

FM BSNWR Mile 1 - 1

photo - 100-0005

plants - 0 (washed out)

did ~~survey~~ survey just

north - photo 100-0006

plants - [cold top fill only] - 42

oat, bivestem (still without death)

FM BSNWR Mile 1 - 2

photo 100-007

plants (washed out)

New survey pt (WP3)

photo 100-009

still without death

38-40 plants

panic, pater, oat

Pat in the Rain

FM BSNWR Mile 2-1
photo 100-0010
plants - 42
still some washout
oats, panic, patens

BLM Our Rd
photo 100-0011
plants - 45
oats, patens + panic

dunes growing because of
sand fence - ~~oats~~ covering plants
faster than they can grow

BLM Lotsa 1
photo 100-0012
plants - 60
oats, panic, paten

BLM Lotsa 2
photo 100-0013
plants - 62
oats, panic, patens, paspalum

BLM Veterans
photo 100-0014
plants - 50
oats

BSNWR PU Mile 1-1
photo 100-0020
plants - 52
oats, panic

BSNWR PU Mile 1-2
photo 100-0019
plants - 52
oats, panic

BSNWR PU Mile 2-1
photo 100-0018
plants - 42
oats, panic, patens

photo
plants
oats
patens
paspalum

photo

BNNR Mile 2-2

photo 106-0017

plants - 57

oats, panic, pokers

BNNR Mile 3-1

photo 100-0016

plants - 50

oats, panic

BNNR Mile 3-2

photo 100-0015

plants - 79

oats, panic, pokers

GSP 1

WP (4) 043624, 334634

photo 100-0021

plants 53

oats

GSP 2

WP (5) 0437807, 3341047

photo 100-0022

plants - 60

oats, pokers