U.S. vs. MELVIN A. FISHER et al.

Report of

Brian E. Julius

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Damage Assessment Center
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1305 East-West Highway
Silver Spring, MD 20910

January 29, 1997

1. Introduction

The defendants are treasure hunters who have used various methods to recover gold and other artifacts from shipwrecks lying in what are now federal waters of the Florida Keys National Marine Sanctuary (hereafter "the Sanctuary"). During the first three months of 1992, the defendants operated three vessels in the Sanctuary, the M/V DAUNTLESS, the M/V TROPICAL MAGIC, and the M/V BOOKMAKER. These three vessels were equipped with prop wash deflectors, which are commonly known as "mailboxes," to assist in treasure hunting.

During this time period the defendants had made more than 500 excavations using mailboxes in "Coffins Patch," an area within the Sanctuary off Grassy Key. By their own calculation, defendants destroyed a total of approximately 1.63 acres of seagrass in Coffins Patch in 1992 as a result of their treasure-hunting activities. Experts retained by the United States in this case have confirmed that the defendants destroyed at least 1.63 acres of seagrass in Coffins Patch in 1992. Accordingly, my opinions are based on a total area of seagrass injury of 1.63 acres.

The purpose of my testimony in this case is to provide the appropriate measure of compensation for natural resource damages due the United States as a result of the injury to seagrass beds in Coffins Patch in 1992.

2. Statement of opinions.

According to experts consulted in this case, no active onsite restoration action is likely to be successful in restoring the injured seagrass beds. Thus, the appropriate measure of compensation for natural resource damages due NOAA, as the trustee for Sanctuary resources, is the sum of: the cost of implementing offsite restoration project(s) scaled to compensate for the interim lost resource services from the time of injury until full natural recovery; the costs of monitoring the compensatory restoration project(s); damage assessment and response costs; and accrued interest on these assessment and response costs.

For the purpose of this assessment, it was assumed that the offsite compensatory restoration project(s) would take the form of restoration of trench-like excavations (i.e. "scars") in

Thalassia seagrass beds within the Florida Keys National Marine Sanctuary caused by boating activities.

To determine the appropriate scale of the compensatory seagrass restoration projects, I employed an assessment methodology known as Habitat Equivalency Analysis (HEA). HEA determines the quantity of equivalent habitat necessary to be restored and/or created, beyond the restoration of the injured resources to baseline, such that the total services provided by the compensatory habitat over its lifespan equals the total services lost due to the natural resource injuries. Services refer to functions that a resource performs for other resources or for humans.

HEA is appropriate for scaling compensatory restoration projects when: the primary category of lost on-site services pertains to the ecological/biological function of the area; feasible restoration projects are available that provide services of the same type, quality and comparable value to those that were lost; and sufficient data on the required HEA input parameters exist and are cost effective to collect. Given that all of these criteria are met for this assessment, it is my opinion that HEA

represents the most technically appropriate and cost-effective methodology for quantifying the natural resource damages associated with this case.

Within the HEA framework, I used the values of the data inputs (parameters) described below to calculate the total services lost due to the injury, the total services provided by the compensatory restoration project, and the total acreage of compensatory habitat required such that the total resource services gained equals the total resource services lost. The specific inputs used in the HEA calculations were: the total acres of seagrass injured by defendants; the year of the injury; the current year; the percentage of resource services lost in the initial period following the injury; the duration and functional form (shape) of the recovery function associated with the injured seagrasses; the duration and functional form of the maturity function associated with the restored habitat; the relative productivity of the restored compensatory habitat to the injured habitat, prior to the injury; the lifespan of the restored habitat over which it is expected to provide services; the year in which recovery of the injured seagrasses is expected to begin;

the year in which the compensatory restoration project is expected to begin; and the real discount rate[1].

Based on the values for the parameters pertaining to the level, severity and duration of the seagrass injury, I calculated that a total of 44.08 acre-years of seagrass services have been and will continue to be lost from the period of the injury until the point when full recovery is estimated to occur. An acre-year represents the total level of ecological services provided by one acre of seagrass over a single year. Based on the parameters used to characterize the compensatory restoration project, I calculated the total discounted acre-years of services that would be provided per unit of compensatory habitat, and then scaled the amount of compensatory seagrass habitat to be restored such that the total discounted level of resource services provided was equivalent to the total discounted level of services lost due to the injury. The results of these calculations indicate that restoring 1.55 acres of compensatory seagrass habitat will provide a total of 44.08 discounted acre-years of services over

[1] The real discount rate is used to transform flows of services or monetary payments occurring over time into a single economically equivalent amount specified in present value terms.

time, the exact amount lost due to the injury. The values for all of the HEA input parameters and the corresponding calculations are presented in Attachment A of this report.

In order to estimate the total monetary costs associated with the compensatory seagrass restoration project of 1.55 acres, I calculated the expected costs of the following four steps required to implement such a project in accordance with NOAA's preferred restoration approach: secure aerial photographs of proposed restoration site(s); perform on-site groundtruthing of the selected sites, including preparation of a site map; collect and install the seagrass planting units, including anticipated remedial planting necessary to meet restoration performance standards; and implement a multi-year seagrass monitoring program (including fertilization of the seagrass planting units). Monitoring is necessary to ensure that the project is meeting specified performance standards and restoration goals, and to determine if mid-course corrections to the restoration project are necessary. Added to the costs associated with these four steps were the anticipated costs of project permitting, NEPA compliance and trustee oversight.

The costs for each step of the restoration implementation were calculated by summing: expected labor costs, using loaded federal government labor rates as a conservative proxy for comparable contract labor costs; expected travel costs, based on current federal government rates for travel reimbursement; expected vessels costs, based on current market rental rates, plus fuel costs; and expected materials' costs, also based on current market rates. All labor cost estimates were adjusted for expected inflation by the Congressional Budget Office's Employment Cost Index over the relevant period, to account for the fact that restoration and monitoring costs will be incurred in future years. A similar adjustment was made to travel, vessel, and materials' costs using the Consumer Price Index.

Based on the above approach, the total estimated costs required to implement the compensatory restoration project, including monitoring costs, are $351,648. The calculations used to arrive at this figure are presented in Attachment B of this report.

The final component of the claim, interest on past assessment costs, was determined by first calculating the annual

damage assessment and response costs associated with each fiscal year, from the time of the injury through fiscal year 1996. Interest for each year was then calculated by compounding the total annual costs by the historic 1992 5-year nominal U.S. Treasury Bill rate (6.2 percent) for the number of years elapsed since the costs were incurred. Annual interest calculations were summed over all years to arrive at the total amount of interest due. Based on this approach, the total interest due on the $211,130 in assessment and response costs incurred to date is $26,553.

Summing compensatory restoration and monitoring costs, damage assessment and response costs, and interest on assessment costs results in a total claim to date for natural resource damages associated with this incident of $589,331.

3. Data or other information considered.

In forming my opinions, I have relied on the following data and sources: data on the total area of seagrass injury provided by Dr. Joseph C. Zieman and defendants' proffer of new evidence; estimates of HEA input parameters provided by Dr. Zieman; estimates of seagrass recovery functions provided by Dr. Zieman,

Dr. Judson Kenworthy and Mr. Arthur Schwarzschild; information on compensatory restoration alternatives provided by Dr. Zieman, Dr. Mark Fonseca, Dr. Kenworthy, Mr. Roy R. Lewis, and Mr. Curtis Kruer; data on restoration and monitoring costs (including permitting, NEPA compliance and trustee oversight) provided by Mr. Lewis, Mr. Kruer, Dr. Fonseca, Dr. Kenworthy, and Dr. Erik Zobrist; official government salary, overhead, travel cost and per diem information; historical U.S. Treasury Bill rates from the U.S. Federal Reserve; current market rates for vessel costs and other materials required to implement restoration and monitoring; inflation index information from the Congressional Budget Office; data on assessment and response costs incurred, provided by Ms. Michele McQuillan; and my experience, education, and best professional judgment in the fields of natural resource damage assessment and economics.

4. Exhibits.

The following exhibits are attached to this report: Attachment A, "Habitat Equivalency Analysis Calculations and Results for Salvors, Inc. Case"; and Attachment B, "Estimated

Costs for Salvors, Inc. Case Associated with Compensatory Restoration and Monitoring".

Executed on the 29th day of January 1997

Brian E. Julius

Brian E. Julius

ATTACHMENT A

HABITAT EQUIVALENCY ANALYSIS (HEA) CALCULATIONS AND RESULTS FOR SALVORS, INC. CASE

HEA Parameters:	
Total Acres of Seagrass Habitat Injured:	1.63
Year of Injury:	1992
Current Year:	1997
Percent of Resource Services Lost in Initial Period Following Mailboxing Incident:	100%
Recovery Function (Natural Recovery):	
Functional form of recovery function	Logistic
Years to full recovery following restoration activities	75
"Maturity" Function with Active Restoration:	
Functional form of recovery function	Based on Thalassia Prop Scar Model
Years to full maturity following restoration activities	17
Relative Productivity of Restored to Original Natural Habitat	100%
Time Horizon for Service Production of Restored Habitat	Perpetuity
Year in Which Primary Restoration Begins	1993
Year in Which Compensatory Habitat Restoration Project Begins	1998
Real Discount Rate	3.0%

Value to be Calculated:	
Acres of Seagrass Habitat to be Restored to Compensate for Lost Resource Services	**1.55**

ATTACHMENT A

HABITAT EQUIVALENCY ANALYSIS (HEA) CALCULATIONS AND RESULTS FOR SALVORS, INC. CASE

Total Acre-Years of Resource Services Lost:

Year (t)	Transformed Year f(x)=(0,1)	Percent Recovery (t) (Assymptotic)	Percent Recovery (t) (0,1 Endpoints)	Raw Acre-Years of Resource Services Lost	Discounted Acre-Years of Resource Services Lost
1992	-11.512915	0.0010%	0.0000%	1.63	1.89
1993	-11.512915	0.0010%	0.0010%	1.63	1.83
1994	-11.205904	0.0014%	0.0014%	1.63	1.78
1995	-10.898893	0.0018%	0.0018%	1.63	1.73
1996	-10.591882	0.0025%	0.0025%	1.63	1.68
1997	-10.284871	0.0034%	0.0034%	1.63	1.63
1998	-9.977860	0.0046%	0.0046%	1.63	1.58
1999	-9.670849	0.0063%	0.0063%	1.63	1.54
2000	-9.363838	0.0086%	0.0086%	1.63	1.49
2001	-9.056826	0.0117%	0.0117%	1.63	1.45
2002	-8.749815	0.0158%	0.0158%	1.63	1.41
2003	-8.442804	0.0215%	0.0215%	1.63	1.36
2004	-8.135793	0.0293%	0.0293%	1.63	1.32
2005	-7.828782	0.0398%	0.0398%	1.63	1.29
2006	-7.521771	0.0541%	0.0541%	1.63	1.25
2007	-7.214760	0.0735%	0.0735%	1.63	1.21
2008	-6.907749	0.0999%	0.0999%	1.63	1.18
2009	-6.600738	0.1358%	0.1358%	1.63	1.14
2010	-6.293727	0.1844%	0.1844%	1.63	1.11
2011	-5.986716	0.2506%	0.2506%	1.63	1.07
2012	-5.679705	0.3403%	0.3403%	1.62	1.04
2013	-5.372694	0.4620%	0.4620%	1.62	1.01
2014	-5.065683	0.6270%	0.6270%	1.62	0.98
2015	-4.758672	0.8504%	0.8504%	1.62	0.95
2016	-4.451660	1.1525%	1.1525%	1.61	0.92
2017	-4.144649	1.5602%	1.5602%	1.60	0.89
2018	-3.837638	2.1090%	2.1090%	1.60	0.86
2019	-3.530627	2.8453%	2.8453%	1.58	0.83
2020	-3.223616	3.8287%	3.8287%	1.57	0.79
2021	-2.916605	5.1339%	5.1339%	1.55	0.76
2022	-2.609594	6.8524%	6.8524%	1.52	0.73
2023	-2.302583	9.0909%	9.0909%	1.48	0.69
2024	-1.995572	11.9669%	11.9669%	1.43	0.65
2025	-1.688561	15.5965%	15.5965%	1.38	0.60
2026	-1.381550	20.0760%	20.0760%	1.30	0.55
2027	-1.074539	25.4541%	25.4541%	1.22	0.50
2028	-0.767528	31.7014%	31.7014%	1.11	0.45
2029	-0.460517	38.6863%	38.6863%	1.00	0.39
2030	-0.153506	46.1699%	46.1699%	0.88	0.33
2031	0.153506	53.8301%	53.8301%	0.75	0.28
2032	0.460517	61.3137%	61.3137%	0.63	0.22
2033	0.767528	68.2986%	68.2986%	0.52	0.18
2034	1.074539	74.5459%	74.5459%	0.41	0.14
2035	1.381550	79.9240%	79.9240%	0.33	0.11
2036	1.688561	84.4035%	84.4035%	0.25	0.08
2037	1.995572	88.0331%	88.0331%	0.20	0.06
2038	2.302583	90.9091%	90.9091%	0.15	0.04
2039	2.609594	93.1476%	93.1476%	0.11	0.03

HABITAT EQUIVALENCY ANALYSIS (HEA) CALCULATIONS AND RESULTS FOR SALVORS, INC. CASE

2040	2.916605	94.8661%	94.8661%	0.08	0.02
2041	3.223616	96.1713%	96.1713%	0.06	0.02
2042	3.530627	97.1547%	97.1547%	0.05	0.01
2043	3.837638	97.8910%	97.8910%	0.03	0.01
2044	4.144649	98.4398%	98.4398%	0.03	0.01
2045	4.451660	98.8475%	98.8475%	0.02	0.00
2046	4.758672	99.1496%	99.1496%	0.01	0.00
2047	5.065683	99.3730%	99.3730%	0.01	0.00
2048	5.372694	99.5380%	99.5380%	0.01	0.00
2049	5.679705	99.6597%	99.6597%	0.01	0.00
2050	5.986716	99.7494%	99.7494%	0.00	0.00
2051	6.293727	99.8156%	99.8156%	0.00	0.00
2052	6.600738	99.8642%	99.8642%	0.00	0.00
2053	6.907749	99.9001%	99.9001%	0.00	0.00
2054	7.214760	99.9265%	99.9265%	0.00	0.00
2055	7.521771	99.9459%	99.9459%	0.00	0.00
2056	7.828782	99.9602%	99.9602%	0.00	0.00
2057	8.135793	99.9707%	99.9707%	0.00	0.00
2058	8.442804	99.9785%	99.9785%	0.00	0.00
2059	8.749815	99.9842%	99.9842%	0.00	0.00
2060	9.056826	99.9883%	99.9883%	0.00	0.00
2061	9.363838	99.9914%	99.9914%	0.00	0.00
2062	9.670849	99.9937%	99.9937%	0.00	0.00
2063	9.977860	99.9954%	99.9954%	0.00	0.00
2064	10.284871	99.9966%	99.9966%	0.00	0.00
2065	10.591882	99.9975%	99.9975%	0.00	0.00
2066	10.898893	99.9982%	99.9982%	0.00	0.00
2067	11.205904	99.9986%	100.0000%	0.00	0.00
2068	11.512915	99.9990%	100.0000%	0.00	0.00
2069	11.512915	99.9990%	100.0000%	0.00	0.00
2070	11.512915	99.9990%	100.0000%	0.00	0.00
2071	11.512915	99.9990%	100.0000%	0.00	0.00
2072	11.512915	99.9990%	100.0000%	0.00	0.00
2073	11.512915	99.9990%	100.0000%	0.00	0.00
2074	11.512915	99.9990%	100.0000%	0.00	0.00
2075	11.512915	99.9990%	100.0000%	0.00	0.00
2076	11.512915	99.9990%	100.0000%	0.00	0.00
2077	11.512915	99.9990%	100.0000%	0.00	0.00
2078	11.512915	99.9990%	100.0000%	0.00	0.00
2079	11.512915	99.9990%	100.0000%	0.00	0.00
2080	11.512915	99.9990%	100.0000%	0.00	0.00
2081	11.512915	99.9990%	100.0000%	0.00	0.00
2082	11.512915	99.9990%	100.0000%	0.00	0.00
2083	11.512915	99.9990%	100.0000%	0.00	0.00
2084	11.512915	99.9990%	100.0000%	0.00	0.00
2085	11.512915	99.9990%	100.0000%	0.00	0.00
2086	11.512915	99.9990%	100.0000%	0.00	0.00
2087	11.512915	99.9990%	100.0000%	0.00	0.00
2088	11.512915	99.9990%	100.0000%	0.00	0.00
2089	11.512915	99.9990%	100.0000%	0.00	0.00
2090	11.512915	99.9990%	100.0000%	0.00	0.00
2091	11.512915	99.9990%	100.0000%	0.00	0.00
2092	11.512915	99.9990%	100.0000%	0.00	0.00
2093	11.512915	99.9990%	100.0000%	0.00	0.00
2094	11.512915	99.9990%	100.0000%	0.00	0.00
2095	11.512915	99.9990%	100.0000%	0.00	0.00
2096	11.512915	99.9990%	100.0000%	0.00	0.00

HABITAT EQUIVALENCY ANALYSIS (HEA) CALCULATIONS AND RESULTS FOR SALVORS, INC. CASE

2097	11.512915	99.9990%	100.0000%	0.00	0.00
2098	11.512915	99.9990%	100.0000%	0.00	0.00
2099	11.512915	99.9990%	100.0000%	0.00	0.00
			TOTAL DISCOUNTED ACRE-YEARS OF SERVICES LOST		**44.08**

Total Resource Services Provided By Compensatory Seagrass Habitat:

Year (t)	Percent of Full Service Flows Provided (End of Period)	Raw Acre-Years of Services Provided	Discounted Acre-Years of Services Provided
1992	0.00%	0.00	0.00
1993	0.00%	0.00	0.00
1994	0.00%	0.00	0.00
1995	0.00%	0.00	0.00
1996	0.00%	0.00	0.00
1997	0.00%	0.00	0.00
1998	2.21%	0.03	0.03
1999	10.59%	0.16	0.16
2000	21.49%	0.33	0.31
2001	33.75%	0.52	0.47
2002	47.16%	0.73	0.63
2003	59.53%	0.93	0.77
2004	66.95%	1.04	0.85
2005	72.84%	1.13	0.89
2006	78.08%	1.21	0.93
2007	82.74%	1.29	0.96
2008	86.71%	1.35	0.97
2009	89.89%	1.40	0.98
2010	92.44%	1.44	0.98
2011	94.57%	1.47	0.97
2012	96.36%	1.50	0.96
2013	97.87%	1.52	0.95
2014	99.11%	1.54	0.93
2015	100.00%	1.55	0.91
2016	100.00%	1.55	0.89
2017	100.00%	1.55	0.86
2018	100.00%	1.55	0.84
2019	100.00%	1.55	0.81
2020	100.00%	1.55	0.79
2021	100.00%	1.55	0.76
2022	100.00%	1.55	0.74
2023	100.00%	1.55	0.72
2024	100.00%	1.55	0.70
2025	100.00%	1.55	0.68
2026	100.00%	1.55	0.66
2027	100.00%	1.55	0.64
2028	100.00%	1.55	0.62
2029	100.00%	1.55	0.60
2030	100.00%	1.55	0.59
2031	100.00%	1.55	0.57
2032	100.00%	1.55	0.55
2033	100.00%	1.55	0.54

HABITAT EQUIVALENCY ANALYSIS (HEA) CALCULATIONS AND RESULTS FOR SALVORS, INC. CASE

2034	100.00%	1.55	0.52
2035	100.00%	1.55	0.51
2036	100.00%	1.55	0.49
2037	100.00%	1.55	0.48
2038	100.00%	1.55	0.46
2039	100.00%	1.55	0.45
2040	100.00%	1.55	0.44
2041	100.00%	1.55	0.42
2042	100.00%	1.55	0.41
2043	100.00%	1.55	0.40
2044	100.00%	1.55	0.39
2045	100.00%	1.55	0.38
2046	100.00%	1.55	0.37
2047	100.00%	1.55	0.35
2048	100.00%	1.55	0.34
2049	100.00%	1.55	0.33
2050	100.00%	1.55	0.32
2051	100.00%	1.55	0.31
2052	100.00%	1.55	0.31
2053	100.00%	1.55	0.30
2054	100.00%	1.55	0.29
2055	100.00%	1.55	0.28
2056	100.00%	1.55	0.27
2057	100.00%	1.55	0.26
2058	100.00%	1.55	0.26
2059	100.00%	1.55	0.25
2060	100.00%	1.55	0.24
2061	100.00%	1.55	0.23
2062	100.00%	1.55	0.23
2063	100.00%	1.55	0.22
2064	100.00%	1.55	0.21
2065	100.00%	1.55	0.21
2066	100.00%	1.55	0.20
2067	100.00%	1.55	0.20
2068	100.00%	1.55	0.19
2069	100.00%	1.55	0.19
2070	100.00%	1.55	0.18
2071	100.00%	1.55	0.17
2072	100.00%	1.55	0.17
2073	100.00%	1.55	0.16
2074	100.00%	1.55	0.16
2075	100.00%	1.55	0.15
2076	100.00%	1.55	0.15
2077	100.00%	1.55	0.15
2078	100.00%	1.55	0.14
2079	100.00%	1.55	0.14
2080	100.00%	1.55	0.13
2081	100.00%	1.55	0.13
2082	100.00%	1.55	0.13
2083	100.00%	1.55	0.12
2084	100.00%	1.55	0.12
2085	100.00%	1.55	0.12
2086	100.00%	1.55	0.11
2087	100.00%	1.55	0.11
2088	100.00%	1.55	0.11
2089	100.00%	1.55	0.10
2090	100.00%	1.55	0.10

HABITAT EQUIVALENCY ANALYSIS (HEA) CALCULATIONS AND RESULTS FOR SALVORS, INC. CASE

2091	100.00%	1.55	0.10
2092	100.00%	1.55	0.09
2093	100.00%	1.55	0.09
2094	100.00%	1.55	0.09
2095	100.00%	1.55	0.09
2096	100.00%	1.55	0.08
2097	100.00%	1.55	0.08
2098	100.00%	1.55	0.08
2099	100.00%	1.55	0.08
2100	100.00%	1.55	0.07
2101	100.00%	1.55	0.07
2102	100.00%	1.55	0.07
2103	100.00%	1.55	0.07
2104	100.00%	1.55	0.07
2105	100.00%	1.55	0.06
2106	100.00%	1.55	0.06
2107	100.00%	1.55	0.06
2108	100.00%	1.55	0.06
2109	100.00%	1.55	0.06
2110	100.00%	1.55	0.06
2111	100.00%	1.55	0.05
2112	100.00%	1.55	0.05
2113	100.00%	1.55	0.05
2114	100.00%	1.55	0.05
2115	100.00%	1.55	0.05
2116	100.00%	1.55	0.05
2117	100.00%	1.55	0.04
2118	100.00%	1.55	0.04
2119	100.00%	1.55	0.04
2120	100.00%	1.55	0.04
2121	100.00%	1.55	0.04
2122	100.00%	1.55	0.04
2123	100.00%	1.55	0.04
2124	100.00%	1.55	0.04
2125	100.00%	1.55	0.04
2126	100.00%	1.55	0.03
2127	100.00%	1.55	0.03
2128	100.00%	1.55	0.03
2129	100.00%	1.55	0.03
2130	100.00%	1.55	0.03
2131	100.00%	1.55	0.03
2132	100.00%	1.55	0.03
2133	100.00%	1.55	0.03
2134	100.00%	1.55	0.03
2135	100.00%	1.55	0.03
2136	100.00%	1.55	0.03
2137	100.00%	1.55	0.02
2138	100.00%	1.55	0.02
2139	100.00%	1.55	0.02
2140	100.00%	1.55	0.02
2141	100.00%	1.55	0.02
2142	100.00%	1.55	0.02
2143	100.00%	1.55	0.02
2144	100.00%	1.55	0.02
2145	100.00%	1.55	0.02
2146	100.00%	1.55	0.02
2147	100.00%	1.55	0.02

HABITAT EQUIVALENCY ANALYSIS (HEA) CALCULATIONS AND RESULTS FOR SALVORS, INC. CASE

2205	100.00%	1.55	0.00
2206	100.00%	1.55	0.00
2207	100.00%	1.55	0.00
2208	100.00%	1.55	0.00
2209	100.00%	1.55	0.00
2210	100.00%	1.55	0.00
2211	100.00%	1.55	0.00
2212	100.00%	1.55	0.00
2213	100.00%	1.55	0.00
2214	100.00%	1.55	0.00
2215	100.00%	1.55	0.00
2216	100.00%	1.55	0.00
2217	100.00%	1.55	0.00
2218	100.00%	1.55	0.00
2219	100.00%	1.55	0.00
2220	100.00%	1.55	0.00
2221	100.00%	1.55	0.00
2222	100.00%	1.55	0.00
2223	100.00%	1.55	0.00
2224	100.00%	1.55	0.00
2225	100.00%	1.55	0.00
2226	100.00%	1.55	0.00
2227	100.00%	1.55	0.00
2228	100.00%	1.55	0.00
2229	100.00%	1.55	0.00
2230	100.00%	1.55	0.00
2231	100.00%	1.55	0.00
2232	100.00%	1.55	0.00
2233	100.00%	1.55	0.00
2234	100.00%	1.55	0.00
2235	100.00%	1.55	0.00
2236	100.00%	1.55	0.00
2237	100.00%	1.55	0.00
2238	100.00%	1.55	0.00
2239	100.00%	1.55	0.00
2240	100.00%	1.55	0.00
2241	100.00%	1.55	0.00
2242	100.00%	1.55	0.00
2243	100.00%	1.55	0.00
2244	100.00%	1.55	0.00
2245	100.00%	1.55	0.00
2246	100.00%	1.55	0.00
2247	100.00%	1.55	0.00
2248	100.00%	1.55	0.00
2249	100.00%	1.55	0.00
2250	100.00%	1.55	0.00
2251	100.00%	1.55	0.00
2252	100.00%	1.55	0.00
2253	100.00%	1.55	0.00
2254	100.00%	1.55	0.00
2255	100.00%	1.55	0.00
2256	100.00%	1.55	0.00
2257	100.00%	1.55	0.00
2258	100.00%	1.55	0.00
2259	100.00%	1.55	0.00
2260	100.00%	1.55	0.00
2261	100.00%	1.55	0.00

HABITAT EQUIVALENCY ANALYSIS (HEA) CALCULATIONS AND RESULTS FOR SALVORS, INC. CASE

2148	100.00%	1.55	0.02
2149	100.00%	1.55	0.02
2150	100.00%	1.55	0.02
2151	100.00%	1.55	0.02
2152	100.00%	1.55	0.02
2153	100.00%	1.55	0.02
2154	100.00%	1.55	0.01
2155	100.00%	1.55	0.01
2156	100.00%	1.55	0.01
2157	100.00%	1.55	0.01
2158	100.00%	1.55	0.01
2159	100.00%	1.55	0.01
2160	100.00%	1.55	0.01
2161	100.00%	1.55	0.01
2162	100.00%	1.55	0.01
2163	100.00%	1.55	0.01
2164	100.00%	1.55	0.01
2165	100.00%	1.55	0.01
2166	100.00%	1.55	0.01
2167	100.00%	1.55	0.01
2168	100.00%	1.55	0.01
2169	100.00%	1.55	0.01
2170	100.00%	1.55	0.01
2171	100.00%	1.55	0.01
2172	100.00%	1.55	0.01
2173	100.00%	1.55	0.01
2174	100.00%	1.55	0.01
2175	100.00%	1.55	0.01
2176	100.00%	1.55	0.01
2177	100.00%	1.55	0.01
2178	100.00%	1.55	0.01
2179	100.00%	1.55	0.01
2180	100.00%	1.55	0.01
2181	100.00%	1.55	0.01
2182	100.00%	1.55	0.01
2183	100.00%	1.55	0.01
2184	100.00%	1.55	0.01
2185	100.00%	1.55	0.01
2186	100.00%	1.55	0.01
2187	100.00%	1.55	0.01
2188	100.00%	1.55	0.01
2189	100.00%	1.55	0.01
2190	100.00%	1.55	0.01
2191	100.00%	1.55	0.01
2192	100.00%	1.55	0.00
2193	100.00%	1.55	0.00
2194	100.00%	1.55	0.00
2195	100.00%	1.55	0.00
2196	100.00%	1.55	0.00
2197	100.00%	1.55	0.00
2198	100.00%	1.55	0.00
2199	100.00%	1.55	0.00
2200	100.00%	1.55	0.00
2201	100.00%	1.55	0.00
2202	100.00%	1.55	0.00
2203	100.00%	1.55	0.00
2204	100.00%	1.55	0.00

HABITAT EQUIVALENCY ANALYSIS (HEA) CALCULATIONS AND RESULTS FOR SALVORS, INC. CASE

2262	100.00%	1.55	0.00
2263	100.00%	1.55	0.00
2264	100.00%	1.55	0.00
2265	100.00%	1.55	0.00
2266	100.00%	1.55	0.00
2267	100.00%	1.55	0.00
2268	100.00%	1.55	0.00
2269	100.00%	1.55	0.00
2270	100.00%	1.55	0.00
2271	100.00%	1.55	0.00
2272	100.00%	1.55	0.00
2273	100.00%	1.55	0.00
2274	100.00%	1.55	0.00
2275	100.00%	1.55	0.00
2276	100.00%	1.55	0.00
2277	100.00%	1.55	0.00
2278	100.00%	1.55	0.00
2279	100.00%	1.55	0.00
2280	100.00%	1.55	0.00
2281	100.00%	1.55	0.00
2282	100.00%	1.55	0.00
2283	100.00%	1.55	0.00
2284	100.00%	1.55	0.00
2285	100.00%	1.55	0.00
2286	100.00%	1.55	0.00
2287	100.00%	1.55	0.00
2288	100.00%	1.55	0.00
2289	100.00%	1.55	0.00
2290	100.00%	1.55	0.00
2291	100.00%	1.55	0.00
2292	100.00%	1.55	0.00
2293	100.00%	1.55	0.00
2294	100.00%	1.55	0.00
2295	100.00%	1.55	0.00
2296	100.00%	1.55	0.00
2297	100.00%	1.55	0.00
2298	100.00%	1.55	0.00
2299	100.00%	1.55	0.00
2300	100.00%	1.55	0.00
Total Discounted Acre-Years of Services Provided by Comp. Habitat Rest. Project			**44.08**

Scale of Compensatory Seagrass Restoration Project:	
Total Discounted Acre-Years of Resource Services Lost Due to Injury:	44.08
Total Discounted Acre-Years of Resource Services Provided by Restored Seagrass Habitat:	44.08
Total Acres of Seagrass Habitat to be Restored as Compensation for Injury:	1.55

ATTACHMENT B

ESTIMATED COSTS FOR SALVORS, INC. CASE ASSOCIATED WITH COMPENSATORY RESTORATION AND MONITORING

Compensatory Restoration Project:	
Type of compensatory habitat project	Thalassia Prop Scars
Area of compensatory habitat project	1.55
Average width of typical prop scar (m)	0.50
Spacing between planting units (m)	1.00
Linear meters of compensatory restoration project	12,579.6
Planting units required for restoration project	12,580.0
Project size relative to Lignumvitae proposal	2.52
Project size relative to GL Cost Baseline	0.75

Labor and Materials Cost Assumptions:	
Average weighted hourly loaded labor rate	$38.28
Average annual increase in labor costs (based on ECI)	3.00%
Average annual increase in materials cost (based on CPIU)	2.98%

Boat Cost Assumptions:	
Cost per day of primary dive platform (approx. 19')	$121
Cost per day of shallow draft work boat (approx. 16')	$77
Fuel Cost Per Boat Per Day	$28

Travel/Per Diem Cost Assumptions:

Est. mileage from contractor location to restoration site (one way)	90
Reimbursable Travel Costs Per Mile	$0.31

Per Diem costs for Florida Keys (per person per day)

	Lodging	M&IE	Total
December 15 - April 30	$164	$38	$202
May 1 - December 14	$114	$38	$152

ATTACHMENT B

ESTIMATED COSTS FOR SALVORS, INC. CASE ASSOCIATED WITH COMPENSATORY RESTORATION AND MONITORING

Stage 1: Secure Aerial Photos	
Labor:	
Total contract direct labor hours	4.0
Total direct labor cost	$153
Materials/Other Costs:	
Subcontract for aerial flight & vertical photos	$5,000
Total Cost for Securing Aerial Photos ($1996)	**$5,153**
Total Cost for Securing Aerial Photos (Adj. to $1998)	**$5,465**

Stage 2: Prepare Map and Groundtruth Sites	
Number of boat/onsite days required	8.0
Number of people traveling to perform task	2
Labor Costs:	
tal contract direct labor hours	189.0
tal direct contract labor cost	$7,236
Travel Costs:	
Total per diem costs	$3,232
Reimbursable (mileage) costs	$112
Total travel costs	$3,344
Boat Rental Costs:	
Costs for dive platform	$971
Costs for shallow draft boat	$616
Boat fuel costs	$448
Total boat costs	$2,035
Materials/Other Costs:	
Aerial photo copies	$881
Total Costs to Prepare Map/Groundtruth Sites ($1996)	**$13,495**
Total Costs to Prepare Map/Groundtruth Site (Adjusted to $1998)	**$14,314**

ATTACHMENT B

ESTIMATED COSTS FOR SALVORS, INC. CASE ASSOCIATED WITH COMPENSATORY RESTORATION AND MONITORING

Stage 3: Collection, Preparation & Installation of Planting Units	
Number of boat/onsite days required	17.0
Number of people traveling to perform task	5
Labor Costs:	
Total contract direct labor hours	680.0
Total direct contract labor cost	$26,033
Travel Costs:	
Total per diem costs	$15,045
Reimbursable (mileage) costs	$279
Total travel costs	$15,324
Boat Rental Costs:	
Costs for dive platform	$2,064
Costs for shallow draft boat	$1,308
Boat fuel costs	$952
Total boat costs	$4,324
Materials/Other Costs:	
Peat Pots	$1,258
Fertilizer (Initial, at time of planting)	$87
Total Materials Costs	$1,345
Costs for Initial Seagrass Preparation/Planting ($1996)	$47,027
Costs for One Remedial Planting (30% of Initial) ($1996)	$14,108
Total Costs - Initial Plus Remedial Planting ($1996)	$61,134
Costs for Initial Preparation/Planting (Adj. to $1998)	$49,882
Costs for One Remedial Planting (Adj. to $1998)	$14,965
Total Costs - Initial + Remedial Planting (Adj. to $1998)	**$64,846**

ATTACHMENT B

ESTIMATED COSTS FOR SALVORS, INC. CASE ASSOCIATED WITH COMPENSATORY RESTORATION AND MONITORING

Stage 4: Seagrass Transplant Monitoring (Plus Fertilization)	
Cost Per Monitoring Event (all costs in 1996 dollars):	
Number of boat/onsite days required for monitoring	8.0
Number of people traveling to perform monitoring tasks	4
Labor Costs Associated with Monitoring:	
Labor hours associated with on-site monitoring activities	256.0
Labor hours - monitoring report preparation (1st report)	176.0
Labor hrs - monitoring report prep. (all subsequent reports)	48.0
Total direct contract labor cost (first monitoring event)	$16,539
Total direct contract labor cost (all subsequent events)	$11,638
Travel Costs Associated with Monitoring:	
Total per diem costs	dependent on event (time of year)
Reimbursable (mileage) costs	$223
al travel costs	dependent on event (time of year)
Boat Rental Costs Associated with Monitoring:	
Costs for dive platform	$971
Costs for shallow draft boat	$616
Boat fuel costs	$448
Total boat costs	$2,035
Cost Per Event for Fertilization of Planting Units (P.U.'s): (Done Concurrently with 1st Year of Monitoring Events)	
Number of boat/onsite days required for fertilization of P.U.'s	3.0
Number of people traveling required for fertilization of P.U.'s	2
Labor Costs Associated with Fertilization of P.U.'s:	
Total contract direct labor hours	48.0
Total direct labor cost	$1,838
Travel Costs Associated with Fertilization of P.U.'s:	
Total per diem costs	$912
mbursable (mileage) costs	$0

ATTACHMENT B

ESTIMATED COSTS FOR SALVORS, INC. CASE ASSOCIATED WITH COMPENSATORY RESTORATION AND MONITORING

Total travel costs	$912
Boat Rental Costs Associated with Fertilization of P.U.'s:	
Costs for dive platform	$364
Costs for shallow draft boat	$231
Boat fuel costs	$168
Total boat costs	$763
Materials/Other Costs Associated with Fertilization of P.U.'s:	
Fertilizer	$87
Total Materials Costs	$87
Total Costs Per Fertilization Event ($1996)	$3,600

Total Costs for Monitoring Events (Adjusted for Inflation):

Monitoring Event	Year	Total Labor Costs Associated with Monitoring	Total Boat Costs Assoc. w/Monitoring	Total Travel Costs Assoc. w/Monitoring	Fertilization Costs	Total Costs (Adj. for Infl.)
1st year, 1st event	1998	$17,546	$2,158	$5,395	$3,818	$28,917
1st year, 2nd event	1998	$12,347	$2,158	$5,395	$3,818	$23,718
1st year, 3rd event	1999	$12,718	$2,222	$5,556	$3,932	$24,428
2nd year, 1st event	1999	$12,718	$2,222	$5,556	$0	$20,496
2nd year, 2nd event	2000	$13,099	$2,289	$5,721	$0	$21,109
3rd year, 1st event	2000	$13,099	$2,289	$5,721	$0	$21,109
3rd year, 2nd event	2001	$13,492	$2,357	$5,892	$0	$21,741
4th year, 1st event	2001	$13,492	$2,357	$5,892	$0	$21,741
4th year, 2nd event	2002	$13,897	$2,427	$6,067	$0	$22,391
					Total	**$205,650**

Summary of Restoration/Monitoring Costs:

Stage/Task	Total Costs
Stage 1: Secure Aerial Photos	$5,465
Stage 2: Prepare Map and Groundtruth Sites	$14,314
Stage 3: Collection, Preparation & Installation of Planting Units	$64,846
Stage 4: Seagrass Transplant Monitoring (Plus Fertilization)	$205,650
Contractor Profit (10%)	$29,028
NOAA Restoration Oversight/Supervision Costs	$17,650
NEPA Compliance/Permitting Costs	$14,695
Total Restoration/Monitoring Costs	**$351,648**